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THE 2008 OSU EXTENSION AGENTS' HANDBOOK OF INSECT, PLANT DISEASE, AND WEED CONTROL

Prepared by
Cooperative Extension Service
Division of Agricultural Sciences and Natural Resources
Oklahoma State University
Stillwater, Oklahoma

January, 2008

The OSU Extension Agents' Handbook of Insect, Plant Disease and Weed Control is revised and published annually to provide extension, research, and other professional workers, dealers, applicators, distributors, formulators, and manufacturers the most up-to-date information available on the selection, application, and safe and proper use of agricultural chemicals.

Information, in addition to that given here, on the control of insects, plant diseases, and weeds with chemicals as well as by other methods is available in Fact Sheets and other bulletins and circulars which are published by the Division of Agricultural Sciences and Natural Resources of Oklahoma State University.

Suggested uses of specific pesticides are based on information on the manufacturer's label and performance of a limited number of experimental trials. Because environmental conditions and methods of application by growers may vary widely, suggested use does not imply that performance of the chemical will always conform to the safety and pest control standards indicated by experimental data.

Rates of application and waiting periods (the interval from application to time of harvest) are based upon a tolerance for residues of the chemical established by the Environmental Protection Agency. Applying chemicals in excess of the suggested dosage or shortening the waiting period from application to harvest may result in residues on the crop in excess of the tolerance and is illegal according to federal and state pesticide regulations.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

The pesticide information presented in this publication was current with federal and state regulations at the time of printing. The user is responsible for determining that the intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label directions.

Copies of the Extension Agents' Handbook may be ordered at a cost of $30.00 from University Mailing Services, Publishing and Printing East, OSU, Stillwater, Oklahoma 74078. Make payment to the OSU Cooperative Extension Service.

SAFE USE OF PESTICIDES

Safe use of pesticides is more important than ever. There is increasing public concern over pesticides and their use. Pesticide applicators are facing increased legal pressure. Personal safety and the safety of others associated with pesticide use is a major issue. Environmental issues such as ground water contamination by pesticides, endangered species, and waste pesticide disposal are receiving major attention. Pesticide applicators must be familiar with these issues and with the laws and regulations controlling pesticide use to be able to safely and legally use pesticides today. The following information provides important information on pesticide laws, safe use of pesticides, pesticide waste and container disposal and poison control information.

OKLAHOMA PESTICIDE LAW

Pesticide Registration

The Oklahoma Pesticide Law requires the registration of all pesticides distributed, sold or offered for sale within the state. Each pesticide product must be registered annually with the Plant Industry and Consumer Services Division of the Oklahoma Department of Agriculture, Food & Forestry. This law also provides for the sampling and chemical analysis of pesticides distributed, sold or offered for sale in the state. Under the Pesticide Law it is also unlawful to distribute, sell or use any registered pesticide in a manner inconsistent with its labeling.

The ODAFF maintains a web site for listing products registered for sale within the state. The address is: http://kellysolutions.com/ok/.

PESTICIDE CERTIFICATION

Oklahoma Pesticide Applicator's Law

The Oklahoma Combined Pesticide Law & Rules provides for the regulation of the use and application of pesticides in Oklahoma. It is enforced by the Plant Industry and Consumer Services Division of Oklahoma Department of Agriculture, Food & Forestry.

Classification of Pesticides

The Environmental Protection Agency is directed by federal law to classify all pesticides for either "general use" or "restricted use." Pesticides classified for general use may be purchased by the general public and applied according to the label directions. Pesticides classified for restricted use may be purchased and applied only by certified applicators or individuals working under the direct supervision of a certified applicator. A pesticide product is considered to be a restricted use product when its label contains the following statement:

Restricted Use Pesticide

For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification.

Classes and Categories of Certified Applicators

Private Applicator - This class includes any person who uses or supervises the use of any restricted pesticide for purposes of producing any agricultural commodity on property owned or rented by the person or his employer or, if applied without compensation other than trading of personal services between producers or agricultural commodities, on the property of another person. Private applicators are farmers, ranchers, growers, etc. Private applicators must be certified in Category 7c-Fumigation to be able to purchase and/or use any fumigant in Oklahoma.

Commercial Applicator - This class includes any person who engages in the commercial application of pesticides. Commercial application means the advertising of services, recommendation for use, the preparation for application and physical act of application of a pesticide for hire or compensation.

Noncommercial Applicator - This class includes any person, other than a commercial or private applicator, who uses or supervises the use of a restricted use pesticide under the supervision of a person who owns or manages the property. Noncommercial applicator also means government employees in the discharge of official duties. Noncommercial applicators are certified to use restricted use pesticides in the same manner as required for commercial applicators.

Service Technicians - This class includes any person who works for a commercial or noncommercial applicator and applies pesticides as long as the person is not the certified applicator. Simply put, this is the person "at the end of the gun."

Categories of Commercial and Noncommercial Applicators

(1a) Agricultural Plant Pest Control - This category includes applicators using or supervising the application of pesticides to agricultural crops, agricultural grassland, and noncrop agricultural land. This category does not include the production of trees for any purpose.

(1b) Agricultural Animal Pest Control - This category includes applicators applying pesticides to animals, including those in feedlots, sale barns, egg production facilities and the animal holding facilities themselves. This excludes Doctors of Veterinary Medicine applying pesticides as drugs or medication during the course of the normal practice.

(2) Forest Pest Control - This category includes the application of pesticides in nurseries, forest seed production areas, trees grown for the production of forestry products, and other forest areas.

(3a) Ornamental and Turf Pest Control Outdoor - This category includes the application of pesticides within residential or business areas to lawns, ornamental trees and shrubs, including park areas, golf courses, other recreational areas, greenhouses, and plant nurseries, except as defined under licensed categories 2, 7, and 8.

(3b) Interiorscape - The indoor application of pesticides within residential or business structures to trees, shrubs, flowers and other horticultural plants except as defined under licensed category 3c.

(3c) Nursery and Greenhouse - The application of pesticides for maintenance and production of ornamental trees, shrubs, flowers and bedding plants

(4) Seed Treatment - This category includes the application of pesticides to seeds for any purpose.

(5) Aquatic Pest Control - This category includes the application of pesticides to standing or running water in manmade and/or natural impoundments, streams, etc. This excludes public health activities (e.g., mosquito control) and water in totally closed systems.

(6) Right-of-Way - This category includes the application of pesticides for public road maintenance, power line maintenance, railroad right-of-way, storage tank areas, and other similar areas.

(7a) General Pest Control - This category includes the application of pesticides within and immediately adjacent to a structure, except for fumigation activities, control of termites and other wood destroying organisms in or on a structure, control of birds or predatory animals. "Immediately adjacent to a structure" means not further than three (3) feet from the structure. Applications to restaurants are permitted in this category.

(7b) Structural Pest Control - This category includes the application of pesticides for the purpose of controlling termites and other wood destroying organisms, such as wood borers and fungus, in or on a structure.

(7c) Fumigation - This category includes the use of liberated gas within a structure or storage area, to include railcars, ships, etc.

(8) Public Health Pest Control - This category includes the application of pesticides by local, state, federal or other governmental employees or commercial pesticide applicators in public health programs, to include municipal and other area wide mosquito control programs.

(9) Regulatory Pest Control - This category includes the application of pesticides by state, federal or other government employees for the control of designated regulated pests.

(10) Demonstration and Research Pest Control - This category includes persons engaged in the application of pesticides for scientific research or for the purpose of demonstrating pesticide products or methods of application.

(11) Bird and Predatory Animal Control - This category includes the application of pesticides for the control of birds or predatory animals in any area and subject to the rules of the Oklahoma Department of Wildlife Conservation, the Predatory Animal Control Division.

(12) Timber Treating - This category includes the treatment of wood by the impregnation or application of chemical solutions for the purpose of retarding or preventing deterioration or destruction by insects, fungi, bacteria, or other wood destroying organisms.

(13) Metam-Sodium - The application of metam-sodium to sewers for the control of tree roots.

Consultants

Persons who make recommendations of pesticides and do so for hire or compensation shall be commercially licensed in the category in which they consult.

Certification of Applicators

Applicators - "Certified applicator" means any individual who is certified to use or supervise the use of any pesticide which is classified for restricted use. Private Applicators may be certified by obtaining a training packet from University Mailing, OSU, Stillwater, OK 74078 with an order form from their local County Extension Office. Upon receipt of the study packet, the Private Applicator will need to complete the self study test and return the answer sheet and the appropriate license fee to the ODAFF's, Plant Industry and Consumer Services Division. Private Applicator licenses are in effect for five (5) years.

Commercial and noncommercial applicators are certified upon receiving a passing score on the appropriate examinations given by ODAFF. The written examination consists of two parts. Part one contains knowledge requirements common to all categories and part two consists of knowledge requirements specific to a category. A person may take as many different category examinations as desired.

Anyone conducting a fumigation **must** be certified in the 7c - Fumigation Category. This includes farmers and persons fumigating lawns/turf areas. Each person certified in fumigation must take the Fumigation Practical.

Practical examinations are required for applicators in the following categories: 7a – General Pest; 7b – Structural; and 7c - Fumigation. The Structural and General Pest Practicals are conducted at the Pinkston Education Facility at OSU. The fumigation

practical is conducted at the Stored Product, Research and Education Center at OSU. Contact 405.744.5531 for dates of these practicals or visit http//:pestedu.okstate.edu.

Contact the Plant Industry and Consumer Services Division of ODAFF for information on locations for examinations (405-522-5984).

Applicator categories are on a five (5) year recertification sequence. Since an applicator can become certified during any portion of a category's five year period, the applicator is required to recertify when the category is scheduled to recertify. Therefore, an applicator may have to recertify sooner than five years.

Certification may be maintained by either taking the category test at the end of the five (5) year period or by accumulating the appropriate number of Continuing Education Units (CEUs) at the end of the five year period. CEUs are not mandatory.

CEUs are not available for Private Applicators or Service Technicians.

The number of CEUs required per category and the maximum number of CEUs which may be obtained per year for a category are listed in Table 1.

Table 1. Number of CEUs required per category.

Applicator Category/Subcategories		Total in five years	Maximum in any one year
1a	Agricultural Plant	20	10
1b	Agricultural Animal	5	2
2	Forest	10	5
3a	Ornamental and Turf Outdoor	20	10
3b	Interiorscape	10	5
3c	Nursery and Greenhouse	15	7
4	Seed Treatment	5	2
5	Aquatic	5	2
6	Right-of-way	15	7
7a	General Pest	20	10
7b	Structural	20	10
7c	Fumigation	10	5
8	Public Health	15	7
9	Regulatory	10	5
10	Demonstration and Research in applicator category	20	10
11	Bird and Predatory	5	2
12	Timber Treating	5	2
	Aerial	5	2
13	Metam-Sodium	5	2

Table 2 lists the sequence of recertification for the various categories. Certified applicators will need to recertify in their category(ies) by December 31 of the year the category recertifies.

Table 2. Recertification Sequence for Pesticide Certification Categories.

Year	Category	
2008	1a	Agricultural Plant
2008	7b	Structural Pest Control
2008	10	Demonstration and Research
2008		Aerial
2008		Private Applicator
2009	3a	Ornamental and Turf Outdoor
2009	3b	Interiorscape
2009	3c	Nursery and Greenhouse
2009	6	Right-of-Way
2009	7a	General Pest Control
2010	4	Seed Treatment
2010	5	Aquatic
2010	7c	Fumigation
2011	11	Bird and Predatory Animal
2011	12	Timber Treating
2011	13	Metam-Sodium
2012	1b	Agricultural Animal
2012	2	Forestry
2012	8	Public Health
2012		Service Technician

Licensing of Applicators and Pesticide Dealers

Commercial Applicator licenses are issued to the commercial applicator business. Each business location must have a separate license. To qualify for a commercial applicator license each business must have an applicator certified in one or more categories that are appropriate to the type of application business. A fee is charged annually for each category of pesticide application. Each applicant or his agent must furnish evidence of financial responsibility before the license can be issued. This consists of liability insurance protecting persons who may suffer legal damages as a result of the pesticide operations of the applicant. The policy need not apply to damages or injury to agricultural crops, plants, or land being worked upon by the applicant. The amount of liability insurance shall not be less than $50,000 each occurrence, $100,000 aggregate bodily injury liability and not less than $50,000 each occurrence property damage liability. The liability insurance must be maintained at not less than that sum at all times during the license period.

Noncommercial applicators are not subject to the insurance requirement. Noncommercial applicators have a license fee for the issuance or renewal of the noncommercial business license. **No testing or licensing fees are charged to governmental agencies or their employees.** Noncommercial applicators working for non-government agencies/companies do have testing and licensing fees.

All commercial, noncommercial applicator and service technician licenses expire on December 31 of the year of issuance and may be renewed without penalty if a properly completed application is filed not later than January 1 of each year. If the application is not received by that date, a penalty of twice the amount of the renewal fee is charged. After February 1, in addition to the penalty, a re-examination is required.

Service Technician is certified by passing a written examination, completing the application and paying the fee. The service technician certification is good for five (5) years and may be renewed by retesting.

For testing and fee levels see: **http://www.oda.state.ok.us/cps-overviewhome.htm** for exact costs.

Dealers – Pesticide dealers engaged in sale, storage, or distribution of pesticides must have a license issued by the Oklahoma Department of Agriculture, Food & Forestry. This includes dealers of Restricted-Use-Pesticides and dealers of non-restricted use pesticides. This license is issued on application and payment of a fee for each business location engaged in the sale and distribution of pesticides. This license is valid for one year.

Restricted use pesticide dealers must keep accurate records for a period of at least two years at each business location, showing the brand name, EPA registration number, date of sale, person to whom sold, and name of certified applicator if different from the purchaser who will use or supervise the use of each restricted pesticide sold.

Pesticide Record Keeping Requirements

Private applicators are required to keep records of restricted-use pesticide applications. Commercial and non-commercial applicators are required to keep records of all pesticide applications. The items required to be kept are as follows:

(1) Start and stop time of application.
(2) Name of applicator.
(3) Company address.
(4) Name of customer.
(5) Customer address:
(6) Legal description.
  (A) May be a street address when properly marked.
  (B) May be 911 identification.
  (C) SHALL NOT be a Post Office Box number.
(7) Date of application.
(8) Total amount of pesticide used.
(9) Application rate.
(10) Dilution rate for mixing.
(11) Total quantity of pesticide tank mix used:
(12) Trade name of pesticide.
(13) EPA registration number.
(14) Target pest.
(15) Site where the pesticide was applied.
(16) Restricted Entry Interval (REI).
(17) Copy of the pesticide label that is on the container.
(18) Copies of any contracts issued.
(19) Copies of any wood infestation report (WIR) issued.

Dealer Record Keeping Requirements
Dealers are required to keep the following records for each sale of restricted-use pesticides.

1. Complete brand name of the pesticide.
2. EPA registration number of the pesticide.
3. Date the pesticide was sold.
4. Total amount of restricted use pesticide used.
5. Name of the person to whom sold.
6. Name and license or certification number of the private or certified applicator.
7. Other information as required by the Board.

Dealers are required to provide copies of their records to ODAFF inspectors, when requested, within seven (7) working days by mail or in person.

Penalties

Criminal - Any person convicted of violating the Oklahoma Combined Pesticide Law shall be guilty of a misdemeanor and shall be fined not less than $100 and not more than $10,000 or by imprisonment in the county jail for not less than 30 days and not more than one year, or by both fine and imprisonment.

Civil - Civil penalties of not less than $100 and not more than $10,000 may be assessed following a public hearing if the State Board of Agriculture finds any person to be in violation of the Oklahoma Combined Pesticide Law.

Any license can be suspended, canceled, revoked, refused issue or reissue by the State Board of Agriculture after a hearing and opportunity to be heard has been given to the holder of the license.

Regulations

Regulations to the Oklahoma Combined Pesticide Law have been written. These regulations include standards of work performance for termite control service. Consult a complete copy of the Oklahoma Combined Pesticide Law and Rules. Contact the ODAFF for complete details.

Mist Blower Sprayer Regulation

The ODAFF has a regulation regarding the use of mist blower sprayers when used as a hormone type herbicide.

The regulation states no person shall use a mist blower or other type of air blasting or misting equipment for the application of hormone type herbicides within Oklahoma except under the following conditions:

a. Forest nursery and timber production areas where the control of undesirable vegetation with a hormone type herbicide is necessary and the area cannot be covered by any other type of ground application equipment.

b. Range, pasture, and crop areas where control of undesirable vegetation with a hormone type herbicide is necessary and a specific type of terrain feature such as a gully precludes the use of any other type of ground application equipment.

When an application by a mist blower type of equipment is made, the application is subject to the following restrictions:

a. At no time during the application shall the outlet point above horizontal.

b. At no time shall an application be performed in a wind speed over 10 MPH.

c. The person making the application shall keep records required by law.

COLLECTION, PACKAGING AND MAILING OF INSECT, PLANT DISEASE, AND WEED SPECIMENS FOR IDENTIFICATION AND DIAGNOSIS

Correct identification of an insect, plant disease or weed problem is the first step in the process of selecting a control method. If you cannot diagnose the problem yourself, you can obtain assistance from your County Extension Director or the Entomology, Plant Pathology and Agronomy Departments at OSU. The kind of specimens you bring or send to someone for identification is very important. The following information has been assembled to help you select, prepare and send good specimens for identification of insects, plant diseases, weeds, and nematodes.

Insects

It is often extremely difficult to identify an insect that has been collected and then dropped into an envelope and mailed. The insect tends to dry up and break when handled or be destroyed when the envelope goes through the stamp canceling machine.

Most of the insects collected in or around the home, on ornamentals or in the field can be best preserved by putting them in a vial or small container that you have filled with alcohol. Moths and butterflies should not be placed in alcohol, as this will prevent their identification. Ethyl alcohol is commonly used to preserve insects, but rubbing alcohol will suffice if you take or send the specimens as soon as possible. If you mail specimens for identification be certain the lid on the vial or container is fastened securely. Wrap cotton or a similar packing material around the container before wrapping it for mailing.

When sending the insect, include the following information: when and where you collected it; the name of the plant it was feeding on; approximate numbers found and your name and address. If possible, send more than one insect.

Take or send your insect specimen to your OSU Extension Center or to the Oklahoma State University, Entomology Department, 127 Noble Research Center, Stillwater, OK 74078.

Plant Diseases

For an accurate diagnosis of plant disease or soil nematode problems, adequate samples must arrive at the diagnostic laboratory in the best possible condition. Careful collection, packaging, and mailing procedures greatly increase the ability of the diagnostic laboratory in solving your plant disease problem. The following procedures are for handling plant disease specimens.

Collection of Plant Disease Sample:

1. Collect the whole plant if feasible. Above-ground symptoms may result from root problems. If wilting, yellowing, or dwarfing is involved, a soil sample for nematode analysis should be included.

2. Collect several plants showing various stages of disease including healthy plants if available.

3. Trees or woody shrubs: Plants with cankers or galls - send the entire infected area and include some young developing gall area. In most cases it is best to send in young, newly infected tissue. Difficulty in diagnosis is increased when a specimen has been dead for some time.

Plants with wilts or blights - send in newly affected branches or twigs. If possible, these branches should be alive, showing typical disease symptoms (vascular discoloration).

4. Foliar diseases - select leaves showing the range of symptoms from early to late stages of infection. Also include a few healthy leaves.

5. Fruit disease problems - select representative specimens showing early and intermediate stages of infection. Don't send specimens in advanced stages of decay.

6. For plants with diseased fleshy organs (bulbs, corms, stolons, etc.) select fairly young diseased specimens.

7. For more information on the use of the diagnostic laboratory see OSU Fact Sheet No. 7612 Plant Disease Diagnostic Services.

Nematode Samples:

1. Take samples from the suspected damaged area plus samples from an adjacent, apparently normal area. Highest nematode populations are usually found associated with plants which exhibit disease symptoms, but are not yet severely affected. These plants are usually found in the periphery of the damaged area. Do not take samples from areas where plants are dead.

2. Samples should be taken at a depth of 1-12 inches depending upon the type of plant and the area of root concentration. Samples should include both roots and associated soil.

3. If possible, nematode samples should be taken from moist soil. Dry soil conditions adversely affect the recovery and evaluation of nematode populations.

4. To get a more accurate reading of the nematode populations of a given area, it is a good procedure to take several samples over the area, mix the samples thoroughly, and take a composite sample of the resulting mixture. Several composite samples taken by the above method may be necessary for a large field. A soil sample of one pint is generally adequate for analysis. Samples should be stored at a cool temperature until shipment. Never allow samples to become overheated, frozen or dry. Immediately after collection, the sample should be placed in a polyethylene bag to prevent drying. Samples should not be exposed to the sun or left in a closed automobile on a hot day.

Packaging and Mailing:

Specimens should be sent to the Diagnostic Laboratory through your County Extension Director's Office. If this is not possible, then enclose plant specimens and soil samples in non-vented polyethylene bags (cellophane, or wax paper can be used if plastic bags are not available). Do not add water. Small leaves or twigs may be sent in a large padded envelope. Larger specimens should be wrapped and placed in a crushproof box or mailing tube. A letter describing the plant problems should be included (see below) along with the specimen. The package should be securely fastened then addressed to:

Plant Disease Diagnostic Laboratory
119 Noble Research Center
Oklahoma State University
Stillwater, Oklahoma 74078

Please include a return address on the package as well as on the letter. There is a $10 fee to help defray the expense of laboratory operations.

Information Needed With the Specimen:

A letter should be either enclosed with the specimen or attached to it. This letter of information should include a completed plant disease diagnostic laboratory data sheet (if available). If not, please include the following:

1. Grower's name and address.
2. Sender's name and address.
3. Name of plant and variety.
4. Type of symptoms.
5. Chemicals used on or near crop.
6. What crop preceded this planting?

In many cases correct disease identification and control recommendations are dependent upon the descriptive information provided by the grower.

Weeds And Other Plants

1. Collect a representative sample with at least 5 sets of mature leaves, flowers and/or fruit. Include a part or the entire underground portion along with the top. This is particularly important with weeds, grasses and grass like plants.
2. Press the specimen between several thicknesses of newspaper weighted down with books or other weight. Take care to spread out the leaves and flowers on the paper before pressing. Fruit or large seed pods should not be pressed. We recommend that the plant be allowed to dry completely before you send it in. Fresh plants usually decay before arrival.

Specimens should be taken to your County Extension Director for assistance in identification.

Ability to identify a specimen is dependent upon the condition of specimen and the accuracy of the information furnished.

CONTRIBUTORS TO THE HANDBOOK

Primary contacts for the various sections of the guide are listed below.
We encourage anyone having questions or suggestions for improvements of a section to contact the individual(s) responsible for that section.

EQUIPMENT	Vacant
INTEGRATED PEST MANAGEMENT COORDINGATOR	Dr. Tom Royer 127 Noble Research Center Stillwater, OK 74078 405/744-9406
PESTICIDE COORDINATOR	Dr. Jim Criswell 127 Noble Research Center Stillwater, OK 74078 405/744-5527
STATE DEPARTMENT OF AGRICULTURE, FOOD AND FORESTRY Pesticide Registration	Vacant 2800 N. Lincoln Blvd Oklahoma City, OK 73105 405/522/6728
Pesticide Applicator Testing, Certification, and Licensing	Vacant 2800 N. Lincoln Blvd. Oklahoma City, OK 73105 405/522-5993
LIVESTOCK	
Insects	Justin Talley 127 Noble Research Center Stillwater, OK 74078 405/744-9420
HORSES	
Insects	Justin Talley 127 Noble Research Center Stillwater, OK 74078 405/744-9420
PETS	
Insects	Justin Talley 127 Noble Research Center Stillwater, OK 74078 405/744-9420
RIGHT-OF-WAY	
Weeds	Doug Montgomery Turf Center, OSU Stillwater, OK 74078 405/624-7538
AQUATIC	
Weeds	Dr. Marley Beem 008C Ag Hall, OSU Stillwater, OK 74078 405/744-9636
ALFALFA	
Insects	Dr. Phil Mulder 127 Noble Research Center Stillwater, OK 74078 405/744-9413
Weeds	Dr. Case Medlin 279 Ag Hall, OSU Stillwater, OK 74078 405/744-9588
Diseases	Vacant
CORN	
Insects	Vacant
Weeds	Rick Kochenower Oklahoma Panhandle Research and Extension Center Rt.1 Box 86M Goodwell, OK 73939-9705 580/349-5441
Diseases	Vacant
COTTON	
Insects	Vacant
Weeds	Dr. J.C. Banks Irrigation Research Station Rt. 1 Box 15A Altus, OK 73521 405/482-3459
Defloiants/Desicants	Dr. J.C. Banks Irrigation Research Station Rt. 1 Box 15A Altus, OK 73521 405/482-3459
Diseases	Vacant
PASTURE AND RANGE	
Insects	Vacant
Weeds	Dr. Case Medlin 279 Ag Hall, OSU Stillwater, OK 74078 405/744-9588
Brush	Dr. Case Medlin 279 Ag Hall, OSU Stillwater, OK 74078 405/744-9588

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Insects	Dr. Phil Mulder 127 Noble Research Center Stillwater, OK 74078 405/744-9413
Weeds	Dr. Case Medlin 279 Ag Hall, OSU Stillwater, OK 74078 405/744-9588
Diseases	Dr. John Damicone 127 Noble Research Center Stillwater, OK 74078 405/744-9962
STORED GRAIN	
Insects	Vacant
SORGHUM	
Insects	Vacant
Weeds	Rick Kochenower Oklahoma Panhandle Research and Extension Center Rt.1 Box 86M Goodwell, OK 73939-9705 580/349-5441
Diseases	Vacant
SOYBEANS	
Insects	Dr. Phil Mulder 127 Noble Research Center Stillwater, OK 74078 405/744-9413
Weeds	Dr. Case Medlin 279 Ag Hall, OSU Stillwater, OK 74078 405/744-9588
Diseases	Vacant
VETCH	
Insects	Dr. Phil Mulder 127 Noble Research Center Stillwater, OK 74078 405/744-9413
APPLES, PEACHES, PEARS & PECANS	
Insects	Dr. Phil Mulder 127 Noble Research Center Stillwater, OK 74078 405/744-9413
Weeds	Dr. Eric Stafne 360 Ag Hall Stillwater, OK 74078 405/744-5409
Diseases/Commercial	Dr. Damon Smith 127 Noble Research Center Stillwater, OK 74078 405/744-9960
Diseases/ Home	Jennifer Olson 127 Noble Research Center Stillwater, OK 74078 405/744-9784
SMALL GRAINS	
Insects	Dr. Tom Royer 127 Noble Research Center Stillwater, OK 74078 405/744-9406
Weeds	Dr. Case Medlin 279 Ag Hall, OSU Stillwater, OK 74078 405/744-9588
Diseases	Dr. Bob Hunger 127 Noble Research Center Stillwater, OK 74078 405/744-9958
HOUSEHOLD PESTS	
Insects	Dr. Brad Kard 127 Noble Research Center Stillwater, OK 74078 405/744-2142
TREES, SHRUBS & FLOWERS	
Insects/Commercial	Eric Rebek 127 Noble Research Ctr Stillwater, OK 74078 405/744-4846
Insects/Home	Eric Rebek 127 Noble Research Ctr Stillwater, OK 74078 405/744-4846
Weeds	Dr. Janet Cole Horticulture Dept., OSU Stillwater, OK 74078 405/744-5414
Weeds (Christmas Trees)	Damon Smith 127 Noble Research Ctr Stillwater, OK 74078 405/744-9960
Diseases/Commercial	Jennifer Olson 127 Noble Research Center Stillwater, OK 74078 405/744-9784
Diseases/Home	Jennifer Olson 127 Noble Research Center Stillwater, OK 74078 405/744-9784
TURF	
Insects	Eric Rebek 127 Noble Research Ctr Stillwater, OK 74078 405/744-4846
Weeds	Dr. Dennis Martin 356 Ag Hall, OSU Stillwater, OK 74078 405/744-5419
Diseases	Dr. Damon Smith 127 Noble Research Center Stillwater, OK 74078 405/744-9960

CONTRIBUTORS TO THE HANDBOOK

Primary contacts for the various sections of the guide are listed below.
We encourage anyone having questions or suggestions for improvements of a section to contact the individual(s) responsible for that section.

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Diseases/Commercial	Damon Smith 127 Noble Research Ctr Stillwater, OK 74078 405/744-9960
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COMMERCIAL VEGETABLES

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Weeds	Dr. Lynn Brandenberger 339 Ag Hall, OSU Stillwater, OK 74078 405/744-5408
Diseases	Dr. John Damicone 127 Noble Research Center Stillwater, OK 74078 405/744-9962

GREENHOUSE

Insects	Vacant
Horticulture	Dr. Mike Schnelle Horticulture Dept., OSU Stillwater, OK 74078 405/744-5414
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PESTICIDE SAFETY TIPS
SAFETY IN HANDLING PESTICIDES

Pesticides by their very nature are poisonous to people, other animals, and sometimes plants. A poisonous or toxic compound becomes dangerous when it is improperly or carelessly used. Poisonous compounds may be used safely when used at concentrations, rates, and with methods of application for which they are recommended.

When the following steps are observed, misuse will seldom if ever occur:

- Properly identify the pest problem and determine what pesticide to use. Seek an expert's advice if in doubt.

- Apply the recommended material according to the labeled instructions.

- Store pesticides in their original labeled containers in a locked storage area out of the reach of children, pets and livestock.

- Triple or pressure rinse pesticide containers immediately after emptying. Pour rinsate into sprayer to apply to labeled site.

- Dispose of clean, empty containers promptly by either recycling or placing in landfills.

- Have an anti-back siphoning device attached to all outlets which fill any spray tank. These can be either mechanical or air gaps. **Do not** place hoses into any spray tank.

- **Do not** mix/load or clean sprayers near any well. Fill or clean sprayers down slope and at least 50 feet from any well to prevent possible contamination of well.

General Precautions

- Read the manufacturer's label carefully and completely, paying particular attention to the precautions and antidotes.

- Wear clean protective clothing and equipment as specified on the label. If the label does not specify certain protective clothing, wear a long sleeved shirt and trousers made of a closely woven fabric and shoes and socks. Use unlined rubber gloves when handling concentrate pesticides and when mixing and loading pesticides or in any other situation when the hands may be exposed to concentrate or dilute pesticides. Rubber gloves should not be used when working with some fumigant pesticides. Follow label directions regarding the use of gloves when working with fumigants.

- Keep protective clothing, gloves, and respirators clean and in good repair.

- Have eye wash/flush immediately available when working with pesticides.

- Remove clothes after using poisonous chemicals and bathe with plenty of soap and water. Wash work clothes before using again. (See section on Cleaning Pesticide-Contaminated Clothing that follows).

- Do not eat, drink, or smoke while handling or applying pesticides.

- Avoid ingesting or inhaling pesticides.

- Avoid skin contact with concentrate or dilute pesticides.

- Make a habit of washing your hands often. Be sure to wash your hands before eating, drinking, or smoking.

- If concentrates or dilute pesticides are spilled on the skin or clothing, remove the clothing at once and wash the skin thoroughly with soap and water.

- Always mix pesticides in an open area where ventilation is adequate; never mix pesticides in an enclosed area.

- Use only recommended materials at recommended rates and by recommended methods of application. Never use a pesticide for a purpose not specifically stated on the label.

- Notify nearby beekeepers before applying insecticide.

- Never use sprayers with leaking hoses or connections. Keep application equipment in good repair.

- Never use the hands and arms to stir pesticides or to reach into a container of pesticides to retrieve tools or other items dropped into them.

- Never allow drift onto neighboring fields, especially pasture and forage crops or fields containing produce ready to harvest. Remove pets and livestock from areas to be treated.

- Never spray directly into the wind or overhead.

- When application equipment is not being used, keep it in an area where children and livestock cannot get to it. Wash spray equipment after each use to avoid hazardous accumulation.

- Never contaminate fish ponds, streams, or lakes.

- Collect wash water when cleaning up spray equipment using a catch basin or sump. Use the wash water as diluent for sprays.

- Store pesticides in the original labeled containers away from food, feed, seed, fertilizers, or medicine, and out of reach of children, pets, and livestock. Use a storage area that can be locked.

- Never guess what is in the pesticide container. If the label has been damaged or removed, discard the entire container with its contents.

- Dispose of empty containers promptly by either recycling or in landfills.

- Call a doctor or get the patient to a hospital immediately if the symptoms of poisoning occur during or shortly after spraying or dusting. Carry the pesticide label or labeled container with you.

- Spray crews regularly using cholinesterase inhibiting pesticides should receive cholinesterase tests before spraying begins and at 10-day intervals thereafter.

- If you plan to apply any of the more toxic pesticides make sure that your physician knows the types of compounds you are using, the effects of and treatments for poisoning by these pesticides, and also has access to the drugs needed in an emergency. If your physician should provide you with a supply of atropine tablets for organic phosphorus poisoning, do not take them before definite symptoms occur. If you ever take atropine tablets, call your physician as soon afterwards as possible. Any person who is ill enough to receive a single dose of atropine should be kept under medical observation for 24 hours, because atropine may produce only temporary relief of symptoms in what may prove to be a serious case of poisoning. Keep atropine tablets away from children.

- Call your Poison Control Centers for detailed information on antidotes, etc. A listing of Oklahoma Poison Control Centers is given in this section.

- Airplane pilots applying pesticides should avoid mixing or loading operations. If they cannot be avoided, they should take special care to avoid exposure.

Cleaning Pesticide-Contaminated Clothing

- Keep clothing contaminated with pesticides separated from regular family laundry.

- Discard clothing saturated with highly toxic pesticides.

- Pre-rinse clothing by: 1) presoaking in a suitable container; or 2) hose down outdoors.

- Washing clothes. Agitate in an automatic washer; hot water (140°F), full water level and normal wash cycle (12 min). Do not use cold water.

- If clothing is heavily contaminated, rewash one or two more times.

- Rinse washing machine thoroughly after laundering contaminated clothing by running through a complete cycle.

- Most laundry detergents (phosphate, carbonate or heavy-duty liquid) will remove pesticides from fabric.

- Line dry if possible, because sunlight will aid in breaking down pesticide residues.

PESTICIDE INFORMATION DIRECTORY

Emergency Information (Bold)

This directory is intended for use by persons who need assistance with general and emergency pesticide-related information. We hope that it will prove useful to you in directing you to the proper government and industry sources.

The directory is divided into EMERGENCY and GENERAL INFORMATION. The blank lines are provided to list local phone numbers for these sources. Take the time to fill in the blanks with the local numbers. It might save a life as well as save time and inconvenience. Keep a copy of this directory near your phone or in your service vehicle.

Emergency Information

POISONINGS for treatment.	**If poisoned, have someone take you immediately to your nearest emergency room with the container or the label of the container.**	
Oklahoma Poison Information Center	**Oklahoma Poison Control Center Children's Memorial Hospital P.O. Box 26307 Oklahoma City, OK 73126**	**1-800-222-1222**
SPILLS Accidents and other related emergencies	CHEMTREC (for assistance) Chemical Transportation Emergency Center Industry assistance with clean up procedures, etc.	1-800/424-9300
SPILLS **Into water**	NATIONAL RESPONSE CENTER Reporting spills to comply with EPA regulations and the Clean Water Act.	1-800/424-8802
MEDICAL INFORMATION	**National Pesticide Telecommunications Network 24-hour medical consultation available on pesticide poisoning information.**	**1-800/858-7378**
FOR ASSISTANCE WITH SPILLS AND EMERGENCIES **Take time to jot down local emergency numbers in the space provided.**	**State Police** **Fire Department** **Ambulance**	_____ _____ _____
For assistance in handling and meeting state reporting requirements for pesticide related spills.	Waste Management Service Department of Environmental Quality Consumer Protection Services Division Oklahoma State Department of Agriculture **Oklahoma Department of Agriculture, Food & Forestry For pesticide spills and other emergencies**	405/702-6222 405/521-3864 **405/990-4253**
DISPOSAL INFORMATION	**Oklahoma State Department of Agriculture Consumer Protection Services Division 2800 N. Lincoln Blvd. Oklahoma City, OK 73105**	**405/521-3864**

PESTICIDE INFORMATION DIRECTORY

Emergency Information (Bold)

GENERAL INFORMATION Except license or permit status and regulatory information.	Your local Cooperative Extension Service Office Pesticide Coordinator Okla. State Univ. Department of Entomology Stillwater, OK 74078	_____ 405/744-5531
REGULATORY INFORMATION Including permit, license and insurance information	Oklahoma State Department of Agriculture Consumer Protection Services Division 2800 N. Lincoln Blvd. Oklahoma City, OK 73105-4298	405/521-3864
INFORMATION ON PESTICIDES, TOXICOLOGY AND	National Pesticide Telecommunications Center (EPA Pesticide Information Clearinghouse) Operates from 8:30 a.m. to 6:30 p.m. Central Time http://ace.orst.edu/info/nptn	1-800/858-7378 1-541-737-0761 Fax
FEDERAL REGULATIONS		
POISONOUS MUSHROOM IDENTIFICATION	Dr. K. E. Conway Okla. State Univ. Dept. of Plant Pathology	405/744-5643 405/372-3667 (home)
ANIMAL TOXICOLOGY HOTLINE	Animal Poison Control Center Information and advice with known or suspected cases of poisoning or chemical contamination in animals	888/426-4435 (24 hours/day) (7 days/week)
EPA ENDANGERED SPECIES	County Bulletins	1-800-447-3813 www.epa.gov.espp
EPA RCRA & SUPERFUND INDUSTRY ASSISTANCE HOTLINE	Resource Conservation and Recovery Act and Superfund regulations assistance for those affected by these regulations, you may call for assistance with interpretation and compliance. EPA Small Business Hotline	1-800/424-9346 1-800/368-5888
RESPIRATOR INFORMATION	For assistance in selecting and use of protective equipment (primarily respirators) and assistance in obtaining equipment in emergencies	www.cdq.gov/niosh/repinfo.html
DEPT OF ENVIRONMENTAL QUALITY HOTLINE	DEQ 800 number is for reporting spills and complaints	1-800/522-0206
ANIMAL DAMAGE CONTROL	State and Federal Wildlife Services 2800 N. Lincoln Blvd. Oklahoma City, OK 73105	405/521-4039
ODWC GAME DIVISION	Oklahoma Department of Wildlife Conservation Game, animal and bird damage to crops	405/521-2739
EPA REGION 6 Pesticide Personnel	Worker Protection (Jerry Oglesby) Certification & Training (Jerry Oglesby) State Project Officer (Jerry Collins) Endangered Species (Elizabeth Reyes) Enforcement (Judith Powers) Ground Water (Jerry Collins)	214/665-7563 214/665-7563 214/665-7562 214/665-3163 214/665-8166 214/665-7562

WORKER PROTECTION STANDARDS FOR AGRICULTURAL PESTICIDES AND RE-ENTRY TIMES

The Environmental Protection Agency has established certain occupational safety and health standards for farm workers performing hand labor operations in fields after ground (other than those incorporated into the soil), aerial or other type of application of pesticides. To accomplish this EPA has established re-entry times for agricultural pesticides in order to protect the health of workers in the field. In 1987, EPA made extensive revisions in worker protection standards for agricultural pesticides.

Definitions

The term "**re-entry time**" means the period of time immediately following the application of a pesticide to a field when unprotected workers should not enter.

The term "**farm worker**" or "**worker**" means any person or persons engaged in agricultural hand labor in the field.

The term "**field**" means any treated land area or part thereof, upon which one or more pesticides are used for agricultural purposes.

The term "**protective clothing**" means
at least a hat or other suitable head covering, a long sleeved shirt and long legged trousers or a coverall type garment (all of closely woven fabric covering the body, including arms and legs), shoes and socks.

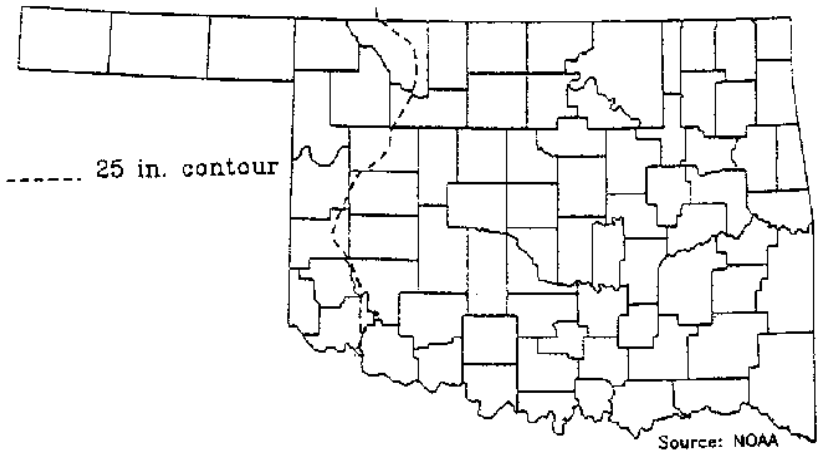
General Requirements

On August 21, 1992, EPA published its final rule on its Worker Protection Standard (WPS).

There are two categories under WPS. The first is "Handlers." Handlers are persons who in some aspect work with pesticides. This includes mixers/loaders, applicators, persons who clean or maintain sprayers or spray tractors, scouts, etc. The second group is workers. Workers do not have any job assignments dealing with pesticides. They are generally considered to be field workers such as hoe hands, irrigation pipe movers, debudders in greenhouses, etc.

Most pesticides have a minimum of a 12-hour Restricted-Entry-Interval (REI); however, some "low risk" pesticides have a four (4) hour REI. The 4-hour REI pesticides are primarily the biological pesticides. The maximum REI is 48 hours except for certain organophosphorus insecticides applied in areas which receive less than 25 inches of rain per year. The approximate area in Oklahoma is shown in Figure 1. During this time, workers cannot enter the treated field until four hours after application and then only with the personal protective equipment (PPE) as required for application of the pesticide.

Figure 1. Approximate line of 25 inches of rainfall per year in Oklahoma.



Warnings

When workers are expected to be working in a field treated or to be treated with a pesticide, appropriate and timely warning to such workers shall be given. The warning may be given orally and/or by posting warning signs at the usual points of entrance to the field, and/or on bulletin boards at points where the workers usually assemble for instructions. Where any person has reason to believe that a farm worker is unable to read, he shall give the farm worker oral warning and make reasonable effort to ensure understanding of such warning. When required, warnings shall be given in appropriate languages other than the English language. Oral warnings should be given in such a manner as to inform workers of the areas or fields which should not be entered without protective clothing, the period of time the area or field should be vacated and actions to take in case of accidental exposure. (Taken from Code of Federal Regulations, Title 40, Part 170).

Certain pesticides have re-entry times on their labels for certain crops or sites. These have been placed on the label by the manufacturer. Check the labels for specific instructions. When no re-entry time is given, a general rule to follow is wait until sprays have dried and dusts have settled.

TOXICITY OF PESTICIDES

Signal words are required by labeling regulations to indicate the relative hazards of the pesticide in each container. The signal words used on pesticide labels and the relative toxicity indicated by the signal word are listed below. Additional information on pesticide toxicity may be found in OSU Extension Fact Sheet 7457. The acute oral and acute dermal toxicity for some common pesticides are also listed. For a comparison of toxicities, the LD_{50} of table salt is 3,320 mg/kg while aspirin is 1,200 mg/kg.

Acute Toxicity Measures and Warnings
Categories of Acute Toxicity

Categories	Signal Word Required on the Label	LD_{50} Oral mg/kg	LD_{50} Dermal mg/kg	LC_{50} Inhalation mg/1	Probe Oral Lethal Dose for 150 lb person
Highly Toxic	DANGER POISON skull and crossbones	0-50	0-200	0-2,000	A few drops to a teaspoonful.
II Moderately Toxic	WARNING	50+ - 500	200+ -	2,000+ -	Over one teaspoonful
	2,000	20,000	to one ounce.		
III Slightly Toxic	CAUTION	500+ - 5,000	2,000+ - 20,000	—	Over one ounce to one pint or one pound.
IV Relatively Non-Toxic	CAUTION	5,000+	20,000+	---	Over one pint or one pound.

Fish and Avian Toxicity

Many MSDS' provide fish and avian toxicity information. The applicator needs to be aware the toxicity scale for fish and birds are not the same toxicity scale used for determining Signal Words nor those for rodents. The scales for fish and birds are at a much lower level or said another way most pesticides are toxic at much lower levels to fish and/or birds.

Toxicity is the ability to harm an organism. To compare the toxicities of pesticides, the median lethal dose (LD_{50}) and the median lethal concentration (LC_{50}) are often used. The LD_{50} is the dose of a chemical needed to kill 50% of a population of a particular test animal. It is measured in milligrams of the chemical over kilograms of body weight of the test animal (mg/kg). The LC_{50} is similar, but it is a measure of the concentration of a pesticide in air or water needed to kill 50% of the test population within a certain time period, usually 24 or 96 hours. The LC_{50} is normally measured in milligrams of chemical over liters of air or water (mg/l).

Fish toxicities are measured in LC_{50}. Acute toxicity tests are usually conducted on fry (small, fingerling fish) or eggs for 24 to 96 hours. MSDS' will often provide several fish toxicities. These often include a top feeding fish such as a bluegill and a bottom feeding fish such as a catfish. The reason for this is that the pesticide may remain near the surface and affect fish in that area or the pesticide may go to the bottom and be in the sediment. Thus, when reading fish LC_{50}'s the applicator needs to be aware of the time, type and size of fish used in the toxicity test.

The table below provides toxicity levels for fish. Note that the categories for toxicity are different than those used for Signal Words.

Fish Toxicity

Classification	Level	96 hr LC_{50} (ppm)
I	Super Toxic	<0.01
II	Extremely Toxic	0.01 to 0.1
III	Highly Toxic	0.1 to 1.0
IV	Moderately Toxic	1.0 to 10
V	Slightly Toxic	10 to 100
VI	Practically Non-Toxic	>100

Avian Toxicity

Sensitivity to toxicants varies greatly from species to species, even within the same genus. Toxicity figures for albino rats are often poor indicators of pesticide effects on birds. Most bird toxicity tests are conducted with ring-necked pheasant, northern bobwhite quail, Japanese quail and the mallard duck. Avian toxicity will be listed as LD_{50} and most often presented as acute oral toxicity.

Toxicity with birds is difficult to measure. Acute oral toxicity is the easiest to measure and is what is most reported as a reference. However, pesticides can affect birds in many different ways without killing the bird. This includes reducing their food supply by insecticides killing their food source, the pesticide reducing the number of eggs laid or the percent of eggs that hatch, the pesticide affecting the bird's behavior in such a way that the bird cannot hide as well from predators and thus is killed by predators and many other sub lethal avenues.

The age of the birds tested can affect the $LD_{50.}$ Like other organisms, younger and older members are usually more susceptible to the toxicant. Also, most granular pesticides can pose a greater risk due to their uptake directly into the bird's gut. The table below provides the "signal words" for avian toxicity.

Bird Toxicity

Classification	Toxicity Level	LD_{50} (mg/kg)
I	Very Highly Toxic	<10
II	Highly Toxic	10 to 50
III	Moderately Toxic	51 to 500
IV	Slightly Toxic	501 to 2,000
V	Practically Non-Toxic	>2,000

INSECTICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
abamectin	Avid, Ascend, Zephyr	Mauget, Syngenta,	650	>2,000
acephate	Acecap, Orthene	Whitmire		
	Payload, Pinpoint			
	Velocity	Valent	980	>10,250
acequinocyl	Shuttle	Arysta	>5000	>2001
acetamiprid	Assail, Intruder, others	Cerexagri, DuPont, Nippon	886	>2000
aldicarb	Temik	Aventis	1	20
allethrin	(Many)	MGK	480	11200
amitraz	Mitac, others	Aventis	800	>200
azadirachtin	Aza-Direct, Ecozin, other	Agridyne, AMVAC, Gowan	>5000	>2000
azinphos-methyl	Guthion	Bayer	37365	150-220
Bacillus thuringiensis	Deliver, Dipel, Javelin, o	Certis, Valent, Mycogen, others	>5000	>2000
Bacillus thuringiensis, spp. Israelensis	Gnatrol	Valent	>5,000	>2,000
Beauveria bassiana	Naturalis	Troy Biosciences		
bendiocarb	Ficam, Dycarb	Mallinckrodt	179	>1,000
benzofuroline	Resmethrin	Fairfield American	>2,500	>3,000
beta-cyfluthrin	Cylence Ultra	Bayer	960	>2,000
bifenazate	Acramite	Chemtura	>5000	>2,000
bifenthrin	Capture, Talstar, Onyx, C	FMC	375	>2,000
boric acid	Roach Prufe	-	3500	>10,000
buprofezin	Applaud, Courier, Talas	Nichino America, SePRO	>5000	>2000
carbaryl	Sevin	Aventis	246-283	4000
carbofuran	Furadan	FMC, Bayer	11	10200
carbosulfan	Advantage	Wilbur Ellis	209	>2,000
chinomethionat	Morestan	Bayer	-	-
chlorethoxyfos	Fortress	Amvac	44-124	>2,000
chlorfenapyr	Phantom, Pylon	BASF, OHP	560	>2000
chloropicrin	Chloropic	Great Lakes Chem. Co.	250	-
chlorpyrifos	Dursban, Lorsban, Durap	Dow AgroSciences, Whitmire	96-270	2000
chlorpyrifos-methyl	Reldan	Gustafson	1,000-3,700	>3,700
clofentezine	Apollo, Ovation	Makhteshim Agan, Scotts	>5000	>2400
clothianidin	Arena, Celero, Poncho	Arysta, Gustafson	4,000	5,000
clothianidin	Poncho	Gustafson	>2000	>4000
coumaphos	Co-Ral	Bayer	140	860
cyfluthrin	Baythroid, Tempo, Other	Bayer, Olympic	826	>2,000
cypermethrin	Ammo, others	FMC, UAP	250	>2,000
cyprodinil	Vanguard	Univar USA Inc.	>2000	>2000
cyromazine	Citation, Larvadex, Triga	Syngenta, Metrex Research	3,387	3,100
DDT	-	canceled	113	2510
deltamethrin	Decis, DeltaGard, Suspen	Bayer	129	2000
diazinon	Diazinon, Spectracide,			
	others	Syngenta	300-400	3600
dichlorvos	DDVP, Vapona,			
	Brigade	AMVAC	80	105-107
dicofol	Kelthane	Dow AgroSciences	570-595	2,000-5,000
dicrotophos	Bidrin	AMVAC	17-22	224
dienochlor	Pentac	Bayer	3,160	>3,160
diflubenzuron	Adept, Dimilin	Uniroyal	>4,640	>10,000
dimethoate	Cygon, Dimate	Agriliance, UAP, Helena	500	>2000

INSECTICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
dinotefuran	Safari	Valent	2,804	>2000
disulfoton	Di-Syston	Bayer	4	10
dodecanol	Isomate	Pacific	>5000	>2000
d-Phenothrin	Summithrin	Sanachem	>10,000	>10,000
emamectin benzoate	Denim, Proclaim	Syngenta	2,950	>2000
endosulfan	Thiodan	Hi-Yield	160	359
endosulfan	Thiodan, Phaser	FMC, Makhteshim Agan	160	359
esfenvalerate	Asana	DuPont	458	>2,000
ethion	Commando	Boehringer Ingelheim Vetmedica	208	838
etoxazole	TetraSan, Zeal	Valent	>5000	>2000
famphur	Warbex, Famophos	BASF	40	1,460
fenbutatin-oxide	Vendex	DuPont	2,631	>2,000
fenoxycarb	Awards, Logic, Preclude	Syngenta	>5000	>2000
fenpropathrin	Tame, Danitol	Sumitomo, Valent	71-164	>2,000
fenpyroximate	Akari, Fujimite	SePRO, Nichino America	7,193	>4000
fenthion	Spot-On,Tiguvon	Bayer	250	1,000
fenvalerate	Belmark, Tribute, Ectrin	BASF, Boehringer	451	>5,000
fiponil	Ceasefire, Regent, Termi	Bayer, BASF	>5000	>2000
flumetsulam	Python Magnum	Y-Tex	5,000	2,000
fluvalinate	Mavrik, Yardex	Zoecon	261-282	20,000
fonofos	Dyfonate	Syngenta	8-17.5	25
gamma-Cyhalothrin	Proaxis	Tenkoz, Inc.	79	632
halofenozide	Mach 2	RohMid L.L.C.	>5,000	>2,000
Heterorhabditis megidis	Nemasys	Becker Underwood		
hexythiazox	Hexygon	Gowan	>5000	>5000
hydromethylnon	Amdro, Combat, Subterf	BASF	1,131	>2,000
hydroprene	Gen Trol	Wellmark	>34,000	5,100
imidacloprid	Admire, Marathion,Prem	Bayer, Gutasfon		
indoxacarb	Avaunt, Steward	Du Pont	1,867	>5000
isazofos	Triumph	Syngenta	40-60	>3,100
isofenphos	Amaze, Pryfon	Bayer	20	162
kinoprene	Enstar	Zoecon	4,950	9,000
lambda-cyhalothrin	Commodore, Demand, O	Syngenta	79	632
lindane	Lindane, others	Gustafson, others	200	2,000
malathion	Cythion, Malathion	Cheminova, Helena	2,800	4,100
metaldehyde	Deadline	Amvac	283	>5000
methidathion	Supracide	Gowan	25-44	1,546
methiocarb	Mesurol	Gowan	-	-
methomyl	Lannate	DuPont	17	5,000
methoprene	Altosid, Precor, others	Zoecon, Syngenta	>34,600	>3,000
methoxfendozide	Intrepid	Dow AgroSciences	>5000	>2000
methyl bromide	(Many)	(Many)	214	-
naled	Dibrom, Trumpet	UAP,AMVAC	376	1,100
neem oil	Triact	OHP	4,200	2,000
nicotine	(Many)	(Many)	55	-
novaluron	Diamond	Chemtura	>5000	>2000
orthoboric acid	Niban	Nisus	>5000	>2000
oxamyl	Vydate	DuPont	37	2,960
oxydemeton-methyl	Meta-Systox-R	Gowan	48-61	112-152
oxytetracycline calcium	Mycoshield	Nufarm	>5000	>2000

INSECTICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
parathion-methyl	Methyl Parathion	Cheminova	25	482
permethrin	Ambush, Atroban, others	Sygenta, Schering-Plough, Others	2,215	>2,000
permethrin	Swine Guard	Y-Tex	5,050	5,050
phorate	Thimet, GX-118	BASF	4-Feb	6
phosmet	Imidan, Prolate	Gowan, Wellmark	147-316	>4,640
phosphoric acid	Foray	Drummond	1,530	2,740
piperonyl butoxide	(Many)	(Many)	>7,500	-
pirimiphos methyl	Actellic, Dominator other	Syngenta, Schering-Ploug	>2,000	>4,592
porpargite	Ornamite	Chemtura	>5000	>5000
potassium salts	M-Pede	Dow AgroSciences	>5000	>2000
profenofos	Curacron	Syngenta	358	277
propargite	Omite, Comite	Uniroyal	4,029	2,940
propetamphos	Catalyst	Zoecon	119	2,825
propoxur	Baygon, others	Bayer, others	-	-
pymetrozine	Endeavor, Fulfill	Syngenta	>5000	>2000
pyrethrin	(Many)	Penick	1,500	>1,800
pyridaben	Pyramite, Sanmite	BASF	820-1350	>2000
pyridazione	Nexter	BASF	1,930	>2000
pyriproxyfen	Distance	Valent	>5,000	>2,000
rotenone	(Many)	Penick	3 50	940
Ryania speciosa				
plant extract	Ryania	Agrisystems	1,200	-
sodium hypochlorite	Esteem	Ecolab		
spinosad	Elector, Spin Tor	Elanco, Dow AgroSciences	5,000	5,000
Spinosyn A+D	Tracer, Conserve	Dow AgroSciences	5,000	5,000
spiromesifen	Oberon	Bayer	>2000	>2000
sulfotepp	Bladafum	Bayer	10	65
sulfur	Microthiol, Thiodex	Cerexagri	>2,000	2,000
sulprofos	Bolstar	Bayer	150	820
tebufenozide	Confirm	Rohm and Haas Co.	>5,000	>5,000
tebupirimphos	Aztec	Bayer	132	>2,000
tefluthrin	Force	Syngenta	-	-
temephos	Tempo	BASF	7,102	2,189
terbufos	Counter	BASF	29-34	900-1,425
tetrachlorvinphos	Rabon, Gardona	DuPont	4,000-5,000	>2,500
tetramethrin	Duracide	Endura S.P.A.	>5,000	-
thiamethoxam	Actara, Cruiser, Others	Syngenta	>5000	>2000
thiodicarb	Larvin	Aventis	166	>2,000
tralomethrin	Scout, Saga	Aventis	1,250	>2,000
trichlorfon	Dylox,Neguvon	Bayer	250	>2,100
zeta-cypermethrin	Fury, Mustang	FMC	>2,000	>4,000

INSECTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Abate	temephos	Clarke	2,189	
Acecap	acephate	Creative Sales, Inc.	1,030	10,250
Acramite	bifenazate	Chemtura USA	>5000	>5000
Actara	thiamethoxam	Syngenta	>5000	>2000
Actellic	pirimiphos methyl	Syngenta, others	>2,000	>4,592
Adept	diflubenzuron	Uniroyal	>4,640	>10,000
Adios	carbaryl	BASF	246	-
Admire	imidacloprid	Bayer	4,143-4870	>2,000
Advantage	carbosulfan	Wilbur Ellis	209	>2,000
Agree	Bacillus thuringiensis	Syngenta	-	-
Agri-Mek	abamectin	Syngenta	300	>1800
Akari	fenpyroximate	SePRO	7,193	>4000
Altosid	methoprene	Syngenta	>34,600	>3,000
Amaze	isofenphos	Bayer	20	162
Ambush	permethrin	Syngenta, Gowan	430-4,000	>2,000
Amdro	hydramethylnon	BASF	1,131	>2,000
Ammo	cypermethrin	FMC, UAP	250	>2,000
Apollo	clofentezine	Makhteshim Agan	>5000	>2400
Applaud	buprofezin	Nichino America	>5000	>2000
Arena	clothianidin	Arvesta	4,000	5,000
Asana	esfenvalerate	DuPont	458	>2,000
Ascend	abamectin	Mauget, Syngenta, Whitmire	650	>2,000
Assail	acetamiprid	Cerexagri	886	>2000
Astro	permethrin	FMC	430-4,000	>2,000
Atroban	permethrin	Schering-Plough Animal Health	>5,050	>5,050
Avaunt	indoxacarb	Du Pont	1,867	>5000
Avid	abamectin	MDS Ag Vet	650	>2,000
Awards	fenoxycarb	Syngenta	>5000	>2000
Aza-Direct	azadirachtin	Gowan	>5000	>2000
Azatin XL	azadirachtin	Thermo Trilogy Corp.	>5,000	>2,000
Aztec	Tebupirimphos	Bayer	132	>2,000
Baygon	propoxur	Bayer	-	-
Baythroid	cyfluthrin	Bayer	826	>2,000
Belmark	fenvalerate	BASF	451	>5,000
Bidrin	dicrotophos	AMVAC	17-22	224
Biobit	Bacillus thuringiensis	Abbott	-	-
Bladafum	sulfotepp	Bayer	10	65
Bolstar	sulprofos	Bayer	150	820
Boss	permethrin	Schering-Plough Animal Health	2,215	>2,000
Brigade	dichlorvos	Sudarshan India Ltd.	50	300
Brute	permethrin	Y-Tex	>5050	>5050
Capture	bifenthrin	FMC	375	>2,000
Catalyst	propetamophos	Zoecon	119	2,825
Catron	permethrin	Boehringer Ingelheim Vetmedica	>5,050	>5,050
Ceasefire	fiponil	Bayer	>5000	>2000
Celero	clothianidin	Arvesta	3,900	>5000
Centric	thiamethoxam	Syngenta	>5000	>2000
Chloropic	chloropicrin	Great Lakes Chem. Co.	250	-
Citation	cyromazine	Syngenta	3,387	3,100
Combat	hydromethylnon	BASF	1,131	>5,000

INSECTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Comite	propargite	Uniroyal	4,029	2,940
Commando	ethion	Boehringer Ingelheim Vetmedica	208	838
Commodore	lambda-cyhalothrin	Syngenta	79	632
Confirm	tebufenozide	Dow AgroSciences	>5,000	>5,000
Conserve	spinosyn A+D	Dow AgroSciences	5,000	5,000
Co-Ral	coumaphos	Bayer	140	860
Counter	terbufos	BASF	29-34	900-1,425
Courier	buprofezin	Nichino America	>5000	>2000
Cruiser	thiamethoxam	Syngenta	5,523	>2000
Curacron	profenofos	Syngenta	358	472
Cygon	dimethoate	BASF	235	400
Cylence Ultra	beta-cyfluthrin	Bayer	960	>2,000
Cymbush	cypermethrin	FMC, Syngenta	250	>2,000
Cynoff	cypermethrin	FMC	-	-
Cythion	malathion	UAP	2,800	4,100
Danitol	fenpropathrin	Valent	71-164	>2,000
DDVP	dichlorvos	AMVAC	80	105-107
Deadline	metaldehyde	Amvac	283	>5000
Decathlon	cyfluthrin	Olympic	>5000	>2000
Decis	Deltamethrin	Aventis	129	-
Deckem	permethrin	Fearing Division	6,000	2,000
Deliver	Bacillus thuringiensis	Certis	>5000	>2000
DeltaDust	deltamethrin	Bayer	>5050	>5050
DeltaGard	Deltamethrin	Aventis	129	-
Demand	lambda-cyhalothrin	Syngenta	68	664
Demon	cypermethrin	Syngenta	250	>2,000
Denim	emamectin benzoate	Syngenta	2,950	>2000
Design	Bacillus thuringiensis	Syngenta	-	-
Diamond	novaluron	Chemtura USA	>5000	>2000
Diazinon, others	diazinon	Syngenta	300-400	3,600
Dibrom	naled	UAP, AMVAC	376	1,100
Dimate	dimethoate	Agriliance	500	>2000
Dimethoate	dimethoate	UAP, Helena	235	400
Dimilin	diflubenzuron	Uniroyal	>4,640	>10,000
Dipel	Bacillus thuringiensis	Valent	-	-
Discus	cyfluthrin	OHP	>5000	>5100
Distance	pyriproxyfen	Valent	>5,000	>2,000
Di-Syston	disulfoton	Bayer	4	10
Dominator	pirimiphos-methyl	Schering-Plough Animal Health	>2000	>4592
Double Barrel	lambda cyhalothrin + primiph	Schering-Plough Animal Health		
Dragnet	Permethrin	FMC	430-4,000	>2,000
Drione	pyrethrins	Bayer	>5000	>2000
Duracide	tetramethrin	Endura S.P.A.	>5,000	-
Duraplex	chlorpyrifos	Whitmire Micro-Gen Research	630	>2000
Durasect	permethrin	Pfizer	2,215	>2,000
Dursban	chlorpyrifos	Dow AgroSciences	96-270	2,000
Dycarb	bendiocarb	Mallinckrodt	179	>1,000
Dyfonate	fonofos	Syngenta	8-17.5	25
Dylox	trichlorfon	Bayer	250	>2,100
Ecozin	azadirachtin	Amvac	>5050	>5050

INSECTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Ectiban	permethrin	Durvet	2,215	>2,000
Elector	spinosad	Elanco	5,000	5,000
Endeavor	pymetrozine	Syngenta	>5000	>2000
Enstar	kinoprene	Zoecon	4,950	9,000
Esteem	sodium hypochlorite	Ecolab		
Ethion	ethion	FMC, others	21-191	838
Extinguish	hydromethylnon	Wellmark	>5000	>2000
Famophos	famphur	BASF	40	1,460
Flagship 25	thiamethoxam	Syngenta	>5000	>2000
Flee	Permethrin	FMC	430-4,000	>2,000
Foray	phosphoric acid	Drummond	1,530	2,740
Force	tefluthrin	Syngenta	969-1,213	>2,000
Fortress	chlorethoxyfos	AMVAC	1.8-4.8	12.5-18.5
Fujimite	fenpyroximate	Nichino America	810	>5000
Fulfill	pymetrozine	Syngenta	>5,000	>2,000
Furadan	carbofuran	FMC, Bayer	11	10,200
Fury	zeta-cypermethrin	FMC	>2,000	>4,000
Fyfanon	malathion	Cheminova	5,500	>2000
Gardona	tetrachlorvinphos	DuPont	4,000-5,000	>2,500
GardStar	permethrin	Y-Tex	1,790	>5000
Gaucho	Imidacloprid	Gustafson	4,350	>5,050
Gen Trol	hydroprene	Wellmark	>34,000	5,100
Gnatrol	Bacillus thuringiensis spp. Israelensis	Valent	>5,000	>2,000
Grubex	imidacloprid	Scotts-sierra	>4820	>2000
Guthion	azinphosmethyl	Bayer	37,365	150-220
GX-118	phorate	BASF	37,291	6
Herculex	Bacillus thuringiensis	Mycogen	>5000	>2000
Hexygon	hexythiazox	Gowan	>5000	>5000
Imidan	phosmet	Gowan	147-316	>4,640
Intrepid	methoxfendozide	Dow Agrosciences	>5000	>2000
Intruder	acetamiprid	Aventis	1,064	>2000
Isomate	dodecanol	Pacific	>5000	>2000
Javelin	Bacillus thuringiensis	Syngenta	-	-
Justice	spinosad	Dow Agrosciences	>5000	>2000
Karate	lambda-cyhalothrin	Syngenta	68	664
Kelthane	dicofol	Dow AgroSciences	570-595	2,000-5,000
Kicker	pyrethrins	Bayer	4,500	>2000
Killmaster	chlorpyrifos	Dow AgroSciences	96-270	2,000
Lannate	methomyl	DuPont	17	5,000
Larvadex	cyromazine	Novartis	5,010	>2010
Larvin	thiodicarb	Aventis	166	>2,000
Lepinox	Bacillus thuringiensis	Certis	>5000	>2000
Leverage	imidacloprid	Bayer	200	>5000
Lindane	lindane	Gustafson, others	200	2,000
Logic	fenoxycarb	Syngenta	16,800	>2,000
Lorsban	chlorpyrifos	Dow AgroSciences	96-270	2,000
Lysoff	fenpropathrin	Bayer	255	-
Mach	halofenozide	RhoMid	>5,000	>2,000
Malathion	malathion	BASF	2,800	4,100

INSECTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Marathon	imidacloprid	OHP	>4870	>2000
Marlate	methoxychlor	Kincaid	6,000	6,000
Mavrik	fluvalinate	Zoecon	261-282	20,000
Max Con	cypermethrin	Johnson, S.C. & Son	173	>2,000
Merit	Imidacloprid	Agridyne Tech	4,143-4,870	>2,000
Mesurol	methiocarb	Gowan	-	-
Metaldehyde	metaldehyde	Many	283	-
Meta-Systox-R	oxydemeton-methyl	Gowan	48-61	112-152
Methoprene	methoprene	Syngenta	>34,600	>3,000
Methoxychlor	methoxychlor	Drexel	6,000	6,000
Methyl Parathion	phosphoric acid	Cheminova	25	482
Microthiol Special	sulfur	Cerexagri	>2,000	2,000
Mitac, others	amitraz	NOR-AM, others	800	>200
Monitor	methamidaphos	Bayer	20	110
Morestan	chinomethionat	Bayer	-	-
M-Pede	potassium salts	Dow AgroSciences	>5000	>2000
MSR	oxydemeton-methyl	Gowan	>138	>359
Mustang	zeta-cypermethrin	FMC	157	>5000
Mycoshield	oxytetracycline calcium	Nufarm	>5000	>2000
Naturalis	Beauveria bassiana	Troy Biosciences		
Navigator	chlorpyrifos	Gharda USA	444	>2000
Neem	azadirachtin	Agridyne Tech.	>5,000	>2,000
Neguvon	trichlorfon	Bayer	250	>2,100
Nemasys	Heterorhabditis megidis	Becker Underwood		
Nexter	pyridazione	BASF	1,930	>2000
Niban	orthoboric acid	Nisus	>5000	>2000
Novodor	Bacillus thuringiensis	Valent	>5000	>2500
Oberon	spiromesifen	Bayer	>2000	>2000
Omite	propargite	Uniroyal	4,029	2,940
Onyx	bifenthrin	FMC	153	>2000
Ornamite	porpargite	Chemtura	>5000	>5000
Ornazin	azadirachtin	Amvac	>5050	>5050
Orthene	acephate	Valent	980	>10,250
Ovation	clofentezine	Scotts	>5000	>2400
Pageant	chlorpyrifos	Dow AgroSciences	96-270	2,000
Patriot	diazinon	Boehringer Ingelheim Vetmedica	1,250	2,020
Payload	acephate	Valent	980	>10,250
Pedestal	novaluron	Chemtura USA	>5000	>2000
Penncap-M	parathion methyl	Elf Atochem N.A.	50	491
Pentac	dienochlor	Syngenta	3,160	>3,160
Permectrin	permethrin	Boehringer Ingelheim Vetmedica	3,800	
Perm-UP	permethrin	United Phosphorus	1,030	>2000
Pestab	lambda cyhalothrin	Surrender	79	632
Petcor	methoprene	Wellmark	>34000	>2100
Phantom	chlorfenapyr	BASF	560	>2000
Phaser	endosulfan	Aventis	160	359
Pinpoint	acephate	Valent	980	>10,250
Poncho	clothianidin	Gustafson	>2000	>4000
Pounce	permethrin	FMC	430-4,000	>2,000
Preclude	fenoxycarb	Syngenta	16,800	>2,000

INSECTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Precor, others	methoprene	Zoecon, Syngenta	>34,600	>3,000
Prelude	permethrin	Syngenta	430-4,000	>2,000
Premise	imadacloprid	Bayer	609	>2000
Proaxis	gamma-Cyhalothrin	Tenkoz, Inc.	79	632
ProBuild	cypermethrin	Syngenta	173	>2000
Proclaim	avermectin	Syngenta	1,516	>2000
Prolate	phosmet	Wellmark	362	>2100
Provado	Imidacloprid	Bayer	4,134-4870	>2,000
Pryfon	isofenphos	Bayer	20	162
Pyganic	pyrethrins	Mclaughlin Gormley King	>2000	>2000
Pylon	chlorfenapyr	OHP	560	>2000
Pynamin	allethrin	Sumitomo Chemical	1,100	685
Pyramite	pyridaben	BASF	820-1350	>2000
Pyrenone	piperonyl butoxide	Aventis	>7,500	-
Python Magnum	flumetsulam	Y-Tex	5,000	2,000
Rabon	tetrachlorvinphos	DuPont	4,000-5,000	>2,500
Regent	fipronil	BASF	275	841
Reldan	chlorpyrifos-methyl	Gustafson	1,000-3,700	>3,700
Resmethrin	benzofuroline	Fairfield American	>2,500	>3,000
Roach Prufe	boric acid	-	350	>940
Rotenone	Rotenone	(Many)	-	-
Ryania	Ryania speciosa plant extract	Agrisystems	1,200	-
Safari	dinotefuran	Valent	2,804	>2000
Saga	Tralomethrin	Aventis	1,250	>2,000
Sanmite	pyridaben	BASF	1,930	>2000
Scimitar	lambda-cyhalothrin	Syngenta	68	664
Scout	tralomethrin	Aventis	1,250	>2,000
Sevin	carbaryl	Aventis	246-283	4,000
Shuttle	acequinocyl	Arvesta	>5000	>2001
Sluggo	phosphoric acid	Lawn And Garden Products, Inc.	>5000	>5000
Spectracide	diazinon	-	-	-
Spin Tor	spinosad	Dow AgroSciences	5,000	5,000
Spot-On	fenthion	Bayer	250	1,000
Steward	indoxacarb	Du Pont	3,619	> 5000
Subterfuge	hydramethyinon	BASF	>5000	>4000
Success	spinosad	Dow AgroSciences	>5000	>5000
Summithrin	d-Phenothrin	Sanachem	>10,000	>10,000
Supracide	methidathion	Gowan	25-44	1,546
Suspend	deltamethrin	Bayer	>15,000	>10,000
Swine Guard	permethrin	Y-Tex	1,790	>5,000
Tactic	lambda-cyhalothrin	UAP - Loveland	79	632
Talstar	bifenthrin	FMC	375	>2,000
Talus	buprofezin	SePRO	>5,000	>2,000
Tame	fenpropathrin	Sumitomo	71-164	>2,000
Temik	aldicarb	Aventis	1	20
Tempo	cyfluthrin	Bayer	826	>2,000
Termidor	fipronil	Aventis	97	>2,000
Terminator Optimizer	deltamethrin	Hi-Yield	43	>2000
TetraSan	etoxazole	Valent	>5000	>2000
Thimet	phorate	BASF	37,291	6

INSECTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Thiodan	endosulfan	Hi-Yield	160	359
Thiodann	endosulfan	FMC	160	359
Thionex	endosulfan	Makhteshim Agan	41	>2000
Thuricide	Bacillus thuringiensis	American Brand	>5000	>2000
Tiguvon	fenthion	Bayer	250	1,000
Tracer	Spinosyn A+D	Dow AgroSciences	5,000	5,000
Triact	neem oil	OHP	4,200	2,000
Tribute	fenvalerate	Aventis	451	>5,000
Triguard	cyromazine	Metrex Research Corporation	3,387	3,100
Trimax	imidacloprid	Bayer CropScience	4,350	> 5,050
TriStar	acetamiprid	Nippon Soda Co., Ltd.	79	632
Triumph	isazofos	Syngenta	40-60	>3,100
Trumpet	naled	Amvac Chemical Corp.	191	1,100
Vanguard	cyprodinil	Univar USA Inc.	>2000	>2000
Vapona	dichlorvos	AMVAC	80	105 - 107
Varsity	abamectin	Syngenta	300	>1800
Velocity	acephate	Valent	980	>10,250
Vendex	fenbutatin-oxide	DuPont	2,631	>2,000
Vydate	oxamyl	DuPont	37	2,960
Warbex	famphur	BASF	40	1,460
Warrior	lambda-cyhalothrin	Syngenta	68	664
Xentari	Bacillus thuringiensis	Valent	>5000	>2000
Yardex	Fluvalinate	Zoecon	261-282	20,000
Yieldgard	Bacillus thuringiensis	Monsanto	>5000	>2000
Zeal	etoxazole	Valent	>5000	>2000
Zephyr	abamectin	Syngenta	300	1,800

FUNGICIDES AND NEMATODES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
aldicarb	Temik	Bayer	1	>2000
anilazine	Dyrene	Bayer	>5,000	>5,000
azoxystrobin	Abound, Heritage, Quadris	Syngenta	>500	>4,000
Bacillus subtilis	Kodiak	Gustafson	-	-
bordeaux mixture	Bordelesa	-	100	1,000
boscalid	Endura	BASF	>2000	>2000
captan	Captan, Orthocide	Helena, Drexel	9,000	-
carbofuran	Furadan	FMC	11	10,200
carboxin	Vitavax	Helena	3,820	>8,000
carboxin + captan	Enhance	Helena	3,820	>8,000
carboxin + lindane + maneb	Enhance Plus	Helena	3,820	>8,000
chloroneb	Terraneb, Nu-Flow D	Kincaid Enterprises	>5,000	>5,000
chorothalonil	Daconil, Bravo, Thalonil	Syngenta, Griffin	>10,000	>10,000
copper complex	Phyton 27	Source Tech. Bio.	4,500	-
copper hydroxide	Champion, Kocide	Nufarm, Griffin	846	>2000
copper salts of fatty & rosin acids	TENNCOP	Tennesse Chem.	10,000	-
copper salts of fatty/rosin acids	Camelot	SePRO	4000	>2000
copper sulfate	TOP COP, others	Stoller Inc	472	-
cymoxanil	Curzate	DuPont	1,100	>3,000
cyprodinil	Switch	Syngenta	>5000	>2000
dicloran, DCNA	Botran	Gowan	>5,000	-
difenoconazole	Dividend	Syngenta	1,453	2,010
dimethomorph	Acrobat, Stature	BASF, SePro	3,900	>2,000
dinocap	Karathane	Dow AgroSciences	980	9,400
dithiocarbamate	Polyram, others	BASF, others	-	-
dodemorph	Milban	BASF	4,180	>4,000
dodine	Cyprex	BASF	1,000	>1,500
duosan	Duosan	Grace Sierra	10,200	8,000
1,3-dichlorpropene	DD, Telone	Dow AgroSciences	224	333
ethoprop	Mocap	Aventis	62	2
etradiazol, ETMT	Terrazole, Koban, Truban	Uniroyal, Mallinckrodt	1,077	1,366
etridiazole	Terramaster	Crompton	1600	3600
famoxadone	Tanos	Dupont	960	>2000
fenamidone	Reason	Bayer	>5000	>5000
fenamiphos	Nemacur	Bayer	3	200
fenarimol	Rubigan	Dow AgroSciences	2,500	4,500
fenbuconazole	Indar	Dow AgroSciences	>2,000	>5,000
fenhexamid	Decree	SePRO	>5000	>5000
fenpropimorph + Kresoxim-methyl	Ensign	BASF	3,515	>4,000
ferbam	Ferbam, Carbamate	UBC	>17,000	-
fluazinam	Omega	Syngenta	>5000	>2000
fludioxonil	Maxim, Medallion, Warden	Syngenta, Agriliance	>5,000	>2,000
flutolanil	Artisan, Contrast, Moncut	Nichino, Gowan, Scotts	>5000	>5000
formetanate hydrochloride	Carzol	Aventis	21	>10,200
fosetyl-Al	Aliette	Aventis	5,800	>2,000
gliocladium virens	Soil Gard	Thermo Trilogy	-	-
imazalil	Fecundal, Flo-Pro,			
iprodione	Chipco 26019, Roval	Bayer	>4,400	>2,000

FUNGICIDES AND NEMATODES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
kresoxim-methyl	Sovran	BASF	>5000	>2000
mancozeb	Dithane, Gavel, Manzate, others	Cerexagri, Dow AgroScience	100	>8000
maneb	Maneb 80, Manex	Cerexagri	7,990	>5,000
maneb+lindane	DB-Green	AGSCO Inc.	-	-
manganese	Manzate	Griffin	>5000	>2000
mefenoxam	Ridomil, Subdue,	Syngenta, Nufarm	2868	>2000
metalaxyl	Apron, Ridomil, Subdue,	Syngenta	669	>3,100
metam-potassium	Kpam	Amvac	630	>1000
metam-sodium	Vapam	AMVAC	1,891	>3,074
methyl bromide	MBC	Hendrix & Dail	100	
methyl isothiocyanate	Vorlex	Aventis	489	1,243
myclobutanil	Eagle, Nova	Dow AgroSciences	1,600	>5,000
neem oil	Triact	OHP	>5000	mild sensation
oxamyl	Vydate L, Oxamyl	DuPont	5	2,960
oxycarboxin	Plantvax	Uniroyal	2,000	>16,000
paclobutrazol	Protect	AgroDragon	5,346	>1,000
pentachloronitrobenzene	PCNB, Terraclor	Gustafson, Chemtura	>5000	>20000
petroleum distillate	Sunspray	Sunoco		
piperalin	Pipron	Dow AgroSciences	2,500	-
potassium bicarbonate	Kaligreen	Arysta	3358	
propamocarb	Banol, Previcur-N	Aventis	2,000-8,500	>3,000
propiconazole	Bumper, Stratego, Tilt	Makhteshim Agan, Dow, Syg	972	>5000
pyraclostrobin	Cabrio, Headline, Pristine	BASF	>500	>4000
pyrimethanil	Scala	Bayer	>5000	>5000
quinoxyfen	Quintec	Dow AgroScience	>2000	>2000
quintozene, PCNB	Terraclor, Defend	Uniroyal, Cleary	1,700-5,000	2,000-4,000
refined petroleum distillate	UltraFine	Mycogen		
sovran	Cygnus	BASF	>5,000	>2,000
Streptomyces griseoviridis	Mycostop	Verdera Oy		
streptomycin sulfate	Agri-mycin, Agri-Step, others	Nufarm, Merks, others	>5000	>2000
sulfur	That F, Kocide F, others	Griffin, Sygenta, Buckman	17,000	-
TCMTB	Busan	Buckman	1,590	-
tebuconazole	Elite, Folicur, others	Bayer, Gustafson	3,766-3,710	>2,011
terbufos	Counter	BASF	29-34	900-1,425
thiabendazole	Mertect 340-F	Syngenta	3,100	-
thiophanate	Thiophanate, 3336	Fulon Chem. Ind., Cleary	>15,000	>15,000
thiophanate-methyl	Fungo, Topsin M, Domain	Cerexagri, Regal, others	7,500	-
thiophanate-methyl + ethazol	Banrot	Mallinckrodt	5,000	2,000
thiram	ProtectorD	Bayer	1000	>5000
thiram	ProtectorD, Thiram	Trace Chemicals, UCB	1000	>5000
triademefon	Bayleton, Strike	Bayer	1,000	>2,000
triadimenol	Baytan 30	Bayer	700	>5,000
Trichoderma harzianum	Plantshield, Rootshield	Bioworks	practically non-toxic	
trifloxystrobin	Flint	Bayer	>4,000	>2,000
triflumizole	Procure	Chemtura	2230	>2000
triforine	Funginex, Triforine	BASF, Valent	>16,000	>10,000
triphenyltin hydroxide	DuTer, Super Tin	Griffin	156	1,600
zinc+ mancozeb+ dinocap	Dikar	Dow AgroSciences	8,000	8,000
ziram	Ziram	UCB Agrochemicals	1,400	>6,000

FUNGICIDES AND NEMATODES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Abound	Azoxystrobin	Syngenta	>500	>4,000
Acrobat	dimethomorph	BASF	3,900	>2,000
Agri-mycin	streptomycin sulfate	Nufarm	>5000	>2000
Agri-strep	streptomycin sulfate	Merk, MDS Ag Vet	9,000	-
Alamo	propiconazole	Syngenta	669	>3,100
Aliette	fosetyl-Al	Aventis	5,800	>2,000
Allegiance	metalaxyl	Gustafson	669	>3,100
Amistar	azoxystrobin	Syngenta	>2000	>5000
Anchor	-	Pure Gro Co.	-	-
Apron	metalaxyl	Syngenta	669	>3,100
Artisan	flutolanil	Nichino America	>5000	>5000
Banner	propiconazole	Syngenta	1,517	>4,000
Banol	propamocarb	Aventis	2,000-8,500	>3,000
Banrot	thiophanate-methyl + ethazol	Mallinckrodt	5,000	2,000
Bayleton	triademefon	Bayer	1,000	>2,000
Baytan 30	triadimenol	Bayer	700	>5,000
-	bordeaux mixture	-	100	1,000
Bean Guard	captan	Trace C	9,000	
Botran	dicloran, DCNA	Gowan Co.	>5,000	-
Bravo	chorothalonil	Sygenta	>10,000	>10,000
Bumper	propiconazole	Makhteshim Agan	972	>5000
Busan	TCMTB	Buckman	1,590	-
Cabrio	pyraclostrobin	BASF	>2000	>2000
Camelot	copper salts	SePRO	4,000	>2000
Captan	captan	Helena	9,000	-
Carbamate	ferbam	UBC	>17,000	-
Carzol	formetanate hydrochloride	Aventis	21	>10,200
Champion	copper hydroxide	Nufarm	846	>2000
Chipco 26019	iprodione	Aventis	>4,400	>2,000
Cleary’s 3336	thiophanate	Cleary	>6,000	>2,000
Compass	iprodione + thiophate -methyl	Scotts	-	-
Contrast	flutolanil	Scotts	>5000	>5000
Counter	terbufos	BASF	29-34	900-1,425
Cuprofix Disprss	mancozeb	Cerexagri	100	>8000
Curzate	cymoxanil	DuPont	1,100	>3,000
Cygnus	sovran	BASF	>5,000	>2,000
Cyprex	dodine	BASF	1,000	>1,500
Daconil	chorothalonil	Sygenta	>10,000	>10,000
DB-Green	maneb+lindane	AGSCO Inc.	-	-
DD	1,3-dichlorpropene	Dow AgroSciences	224	333
Decree	fenhexamid	SePRO	>5000	>5000
Defend	PCNB	Cleary	>5,000	>5,000
Dikar	zinc+mancozeb+dinocap	Dow AgroSciences	8,000	8,000
Dithane	mancozeb	Rohm and Haas	>5000	>5000
Dithane M-45, 80-DF	mancozeb	Dow AgroSciences	11,200	>15,000
Dividend	difenoconazole	Syngenta	1,453	2,010
Duosan	duosan	Grace Sierra	10,200	8,000
DuTer	triphenyltin hydroxide	Griffin	156	1,600
Dynasty	azoxystrobin	Syngenta	>5000	>5000
Dyrene	anilazine	Bayer	>5,000	>5,000

FUNGICIDES AND NEMATODES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Eagle	mycobutanil	Dow AgroSciences	1,600	>5,000
Elite	tebuconazole	Bayer	4,000	>5,000
Enchance +	carboxin +lindane + maneb	-	3,820	>4,000
Endeavour	propiconazole + tebuconazole	Bayer	-	-
Endura	boscalid	BASF	>2000	>2000
Enhance	carboxin + captan	-	3,820	>8,000
Ensign	fenpropimorph+kresoxin -methyl	BASF	3,515	>4,000
Equus	chlorothalonil	Griffin	>5000	>2000
Exotherm 20	chlorothalonil	Value Garden Supply	4,200	20,000
Fecundal	imazalil	Janssen	-	-
Ferbam	ferbam	FMC	>17,000	-
Flint	trifloxystrobin	Bayer	>4,000	>2,000
Flo Pro RTU	imazalil	Gustafson	227-343	4,200-4,880
Folicur	tebuconazole	Bayer	3,766-3,710	>2,011
Fore	mancozeb	Dow AgroSciences	>11,200	>15,000
Funginex	triforine	BASF	>16,000	>10,000
Fungo	thiophanate-methyl	Mallinckrodt	7,500	-
Furadan	carbofuran	FMC	11	10,200
Gavel	mancozeb	Dow AgroScience	>5000	>5000
Germate Plus	carboxin+diazinon lindane	Trace Chemicals	88	1,000
Headline	pyraclostrobin	BASF	>500	>4000
Heritage	azoxystrobin	Syngenta	>500	>4,000
Indar	fenbuconazole	Dow AgroSciences	>2,000	>5,000
Inline	dichloropropene	Dow AgroScience	>100	907
Kaligreen	potassium bicarbonate	Arysta	3,358	
Karathane	dinocap	Dow AgroSciences	980	9,400
Koban	etradiazol, ETMT	Uniroyal, Mallinckrodt	1,077	1,366
Kocide	copper hydroxide	Griffin	1,000	-
Kocide F	sulfur	Griffin	17,000	-
Kodiak	Bacillus subtilis	Gustafson	-	-
Kpam	metam-potassium	Amvac	630	>1000
Kumulus	sulfur	Many	-	-
Mancozeb	dithiocarbamate	DuPont	11,000	>15,000
Maneb 80	maneb	Cerexagri	7,990	>5,000
Manex	maneb	Crystal	7,990	>5,000
Mankocide	copper hydroxide +mancozeb	Griffin	-	-
Manzate	manganese	Griffin	>5000	>2000
Manzate 200	mancozeb	Griffin	11,200	>15,000
Maxim, Medallion	fludioxonil	Syngenta	>5,000	>2,000
MBC	methyl bromide	Hendrix & Dail	100	
Medalion	fludioxonil	Syngenta	>5000	>2000
Mertect 340-F	thiabendazole	Sygenta	3,100	-
Microthiol	sulfur	-	-	-
Milban	dodemorph	BASF	4,180	>4,000
Mocap	ethoprop	Aventis	62	2

FUNGICIDES AND NEMATODES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Moncut	flutolanil	Gowan Co.	10,000	>5,000
Montero	flutolanil +propiconazole	Syngenta	10,000	-
Mycostop	Streptomyces griseoviridis	Verdera Oy		
Nemacur	fenamiphos	Bayer	3	200
Nova	myclobutanil	Dow AgroSciences	1,600	>5,000
Nu-Flow D	chloroneb	Kincaid Enterprises	>5,000	>5,000
Nu-Zone	imazalil	Wilbur-Ellis	227-343	4,200-4,880
Omega	fluazinam	Syngenta	>5000	>2000
Orbit	propiconazole	Syngenta	1,517	>4,000
Orthocide	captan	Syngenta, Valent	9,000	-
Oxamyl	oxamyl	DuPont	5	2,960
PCNB	pentachloronitrobenzene	Gustafson	>5000	>20000
Penncozeb	mancozeb	DuPont, Dow AgroSciences	11,200	>15,000
Pentathlon	mancozeb	BASF	7,990	>5000
Phyton 27	copper complex	Source Tech. Bio.	4,500	-
Pipron	piperalin	Dow AgroSciences	2,500	-
Plantshield	Trichoderma harzianum	Bioworks	practically non-toxic	
Plantvax	oxycarboxin	Uniroyal	2,000	>16,000
Polyram	metriam	UAP - Loveland	>5000	>2000
Prevail	PCNB+carboxin +metalaxyl	Trace Chemicals	669	2,000
Previcur-N	propamocarb	Aventis	2,000-8,500	>3,000
Pristine	pyraclostrobin	Advance Chemicals Ltd.	>2000	>2000
Procure	triflumizole	Chemtura	2,230	>2000
PropiMax	propiconazole	Dow AgroScience	972	>5,000
Protect	paclobutrazol	AgroDragon	5,346	>1,000
ProtectorD	thiram	Bayer	1,000	>5000
Quadris	azoxystrobin	Syngenta	>500	>4,000
Quilt	azoxystrobin	Syngenta	>5,000	>2,000
Quintec	quinoxyfen	Dow AgroScience	>2000	>2000
Rainsheild	mancozeb	Dow AgroScience	>5000	>5000
Raxil-Thiram	tebuconazole	Gustafson	3,910	>2020
Reason	fenamidone	Bayer	>5000	>5000
Ridomil	mefenoxam	Syngenta	2,868	>2000
Ridomil	metalaxyl	Sygenta	669	>3,100
Rival Pak	captan	Gustafon	9,000	
Ronilan	vinclozolin	BASF	>10,000	-
Rootshield	Trichoderma harzianum	Bioworks	practically non-toxic	
Rovral	iprodione	Aventis	4,400	>2,000
Rubigan	fenarimol	Dow AgroSciences	2,500	4,500
Scala	pyrimethanil	Bayer	>5000	>5000
Soil Gard	gliocladium virens	Thermo Trilogy	-	-
Sovran	kresoxim-methyl	BASF	>5000	>2000
SoyGard	azoxystrobin	Bayer	>5000	>2000
Spectro	Alligae, Cygnus	BASF	>5,000	>2,000
Stature	dimethomorph	SePRO	3,453	>2000
Stratego	propiconazole	Bayer+C45	4,757	>5050
Strepol	streptomycin sulfate	Nufarm	500	600
Strepromycin	streptomycin sulfate	Nufarm	>10000	400
Strike	triadimefon	Bayer	700	>5,000

FUNGICIDES AND NEMATODES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Subdue	metalaxyl	Syngenta	669	>3,100
Subdue Maxx	mefenoxam	Syngenta	2,084	2,020
Sunspray	petroleum distillate	Sunoco		
Super Tin	triphenyltin hydroxide	Griffin	156	1,600
Switch	cyprodinil	Syngenta	>5000	>2000
Systec	thiophanate-methyl	Regal	>5,000	>2,000
Systhane	myclobutanil	Dow AgroScience	2,090	>5000
Tanos	famoxadone	Dupont	960	>2000
Telone	1,3-dichlorpropene	Dow AgroSciences	224	333
Telone	dichloropropene	Dow AgroScience	300	333
Temik	aldicarb	Bayer	8	>2000
Temik	aldicarb	Aventis	1	20
Tenncop	copper salts of fatty & rosin acids	Tennessee Chem.	10,000	
Terraclor	pentachloronitrobenzene	Chemtura	5,000	>5000
Terraclor	quintozene, PCNB	Uniroyal	1,700-5,000	2,000-4,000
Terraguard	triflumazole	Universal Chemicals	1,057	5,000
Terramaster	etridiazole	Crompton	1,600	3,600
Terraneb	chloroneb	Kincaid Enterprises	>5,000	>5,000
Terrazole	etradiazol, ETMT	Uniroyal, Mallinckrodt	1,077	1,366
Thalonil	chlorothalonil	Forward International	>10,000	>10,000
That F	sulfur	Griffin	17,000	-
Thiolux	sulfur	Syngenta	>5000	>2000
Thiophanate	thiophanate-methyl	Makhteshim Agan	>5000	>2000
Thiram	thiram	UCB Agrochemicals	1,000	>5,000
Tilt	propiconazole	Syngenta	1,517	>4,000
TOP COP, others	copper sulfate	Stoller Inc.	472	-
Topsin	thiophanate-methyl	Cerexagri	>5000	>2000
Topsin M	thiophanate-methyl	Cerexagri	7,500	-
TPTH	triphenyltin hydroxide	Griffin	156	1,600
Triact	neem oil	OHP	>5000	mild sensation
Triforine	triforine	Valent	>16,000	>10,000
Truban	etradiazol, ETMT	Mallinckrodt	1,077	1,366
UltraFine	refined petroleum distillate	Mycogen Corporation		
UltraFlourish	mefenoxam	Nufarm	>3.6	>2020
Vapam	metam-sodium	Amvac	1,891	>3,074
Vitavax	carboxin	Helena	3,820	>8,000
Vorlex	methyl isothiocyanate	Aventis	489	1,243
Vydate L	oxamyl	DuPont	5	2,960
Warden	fludioxonil	Agriliance	>5000	>2000
Ziram	ziram	UCB Agrochemicals	1,400	>6,000

HERBICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
2,4-D	(MANY)	Dow AgroSciences, Others	699	-
2,4-D + trichlopyr	Crossbow	Dow AgroSciences	1,000	>5000
2,4-D + triclopyr + cylralid	Weed-B-Gone	UAP		
2,4-DB	Butoxone, Butyrac,	Aceto, Albaugh	700	
acetochlor	Degree Xtra, Harness, Others	Monsanto, Dow AgroSciences	2,148	4,166
acifluorfen	Blazer	BASF	1,540	>3,680
acifluorfen+bentazone	Storm	BASF	>2,200	2,000
alachlor	Intrro, Lasso	Monsanto	1,782	>5000
alachlor+atrazine	Bullet	Monsanto	930-1,350	-
ametryn	Evik 80	Syngenta	1,950	-
imazamox	Beyond, Rapor	BASF	>5000	>4000
imazapic	Plateau	BASF	>5000	>5000
asulam	Asulox, Aatrex, others	Sygenta, Helena, others	>5,000	>2,000
atrazine+2,4-D	Shotgun	Platt Chemical Co.	1,780	-
atrazine+dicamba	Marksman	BASF	-	-
benefin	Balan	Dow AgroSciences	>10,000	-
bensulide	Betasan, Prefar,	PBI Gordon, others	360	
bentazon	Basagran, Prompt	BASF, Micro Flo	2,063	-
bromocil	Hyvar-X, Urox	DuPont, Hopkins	5,200	-
bromoxynil	Buctril, Bronate	Bayer, Makhteshim	260	>2,000
butylate	Sutan	Syngenta	3,500-5,431	>4,640
carfentrazone-ethyl	Aim	FMC	4,077	>4000
chlorimuron	Classic	DuPont	>4,000	>2,000
chlorimuron + thifensulfuron	Synchrony	DuPont	>5,000	>2,000
chloroxuron	Tenoran	Syngenta	3,700	>10,000
chlorsulfuron	Corsair, Glean	Riverdale, DuPont	5,000	>2000
chlorsulfuron + metsulfuron	Finesse	DuPont	>5,000	>2,000
cinmethylin	Argold, Cinch	DuPont	4,553	>2,000
clethodim	Envoy, Select	Valent	3,160	>5000
clomazone	Command	FMC	2,077	2,000
clopyralid	Reclaim, Transline, others	Dow AgroSciences	>5,000	>2,000
cloransulam-methyl	First Rate, Frontrow	Dow AgroSciences	2,000	>2,000
copper	Cutrine	Applied Biochemists	680	700
copper sulfate	Basicop	Griffin	472	-
cyanazine	Bladex	DuPont	288	>2,000
cycloate	Ro-Neet	Syngenta	2,000-4,100	-
DCPA	Dacthal	ISK	>5,000	>2,000
sodium chlorate	Defol	Drexel	5,600	500
dibutalin	Amex	CFPI	12,600	10,200
dicamba	Banvel, Rave, others	Syngenta, Micro Flo, Nufarm, etc.	1,707	>2,000
dicamba+glyphosate	Fallowmaster	Monsanto	4,000	>5,000
dichlobenil	Casoron	Uniroyal	>3,160	1,350
dichlorophenoxyacetic acid	Curtail	Dow AgroSciences	3,730	>4000
dichloropicolinic acid	Trupower Selective	Nufarm		
dichloroprop	Seritox	Bayer	925-1,470	>4,000
diclofop-methyl	Hoelon, Illoxam	Bayer	512	>5,000
diclosulam	Strongarm	Dow AgroSciences	>5000	>2000

HERBICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
diethatyl ethyl	Antor	BFC	2,300	-
difenzoquat	Avenge	BASF	863	>2,028
diglycolamine salt	Clarity	BASF	3,512	>2000
dimethenamid	Frontier, Gardsman Max	Syngenta, BASF	2,400	>2,000
dimethipin	Harvade	Uniroyal	1,180	8,000
dinitramine	Cobex	Wacker-Chemie	3,000	6,800
diquat	Diquat, Reglone, Reward	Syngenta	215-235	>400
disodium methanearsonate	DSMA, Ansar, Bueno,	ISK	1,585	4,204
dithiopyr	Dimension	Monsanto	>5,000	>5,000
diuron	Direx, Karmex	Griffin, DuPont	6,100	>5000
diuron + thidiazuron	Ginstar	Bayer	>5,000	>5,000
DPX - 5300 + 6316	Matrix	DuPont	>5,000	>2,000
endothall	Aquathol, Endothal,	Cerex Agri	51	-
EPTC	Eptam, Eradicane	Syngenta	1,630	-
ethalfluralin	Sonalan, Curbit	Dow AgroSciences, Platte	>10,000	-
ethephon	Ethephon, Prep	Makhteshim, Bayer	>5000	>2000
ethephon + AMADS	Cotton Quick	Griffin L.L.C.	3,030	1,560
ethephon + cyclanamide	Finish	Bayer	-	-
ethofumesate	Prograss	Bayer	6,400	>1,400
etofenprox	Primo	RPG	>42,880	>2,140
fenac	Fenatrol	Bayer	1,780	>3,160
fenarimol	Rubigan 50W	Dow AgroSciences	2,500	-
fenoxaprop	Fusion	Syngenta	3,154	>2000
fenoxaprop	Puma	Bayer	3,250	>2000
fenoxaprop-ethyl	Acclaim, Bugle, Excel,	Bayer	2,565	>2,000
fenoxaprop-p-ethyl	Silverado	Bayer	3,040	>2,000
fenoxycarb	Award	Syngenta	>5000	>2000
fluazifop	Fusilade DX	Syngenta	>5000	>2000
fluazifop+fenoxaprop	Fusion	Syngenta	2,000	2,000
fluazifop-butyl	Fusilade	Syngenta	2,712	>2,420
flucarbazone-sodium	Everest	Arysta	>5000	>2000
flufenacet	Axiom, Define, Epic	Bayer	2,347	>2000
flumaioxazin	Valor	Valent	>5000	>2000
flumetsulam	Broadstrike, Python,	Dow AgroSciences	>5,000	>2,000
fluometuron	Cotoran	Syngenta, DuPont	8,900	>10,000
fluorochloridone	Racer	Syngenta	-	-
fluridone	Sonar	Dow AgroSciences	>10,000	-
fluroxypr-meptyl + picloram	Surmount	Dow AgroSciences	3,738	>2000
fluroxypyr-meptyl	Spotlight	Dow AgroSciences	3,738	>2000
fomesafen	Reflex	Syngenta	1,858	-
fomesafen sodium salt	FlexStar	Syngenta	>3863	>2000
foramsulfuron	Equip, Option, Others	Bayer, Agriliance	4,756	>5000
fosamine ammonium	Kernite	DuPont	>5,000	-
fumiclorac-penyl ester	Resource	Sumitomo	>2,500	>5,620
gallery + oryzalin	Snapshot	Dow AgroSciences	>10,000	-
gallery + trifluralin	Snapshot 2.5TG	Dow AgroSciences	>10,000	-
glufosinate	Rely	Bayer	2,000	1,620
glufosinate-ammonium	Finale, Ignite, Liberty	Bayer	3,570	>2000
glyphosate	Accord, Aquamaster, Roundup, oth	Dow AgroSciences, Monsanto, others	>5000	>5000

HERBICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
glyphosate trimesium	Touchdown	Syngenta	750	>2,000
glyphosate+2,4-D +Am Sulfate	Campaign	Monsanto	-	5,000
halosulfuron	Manage, Permit	Monsanto	1,287	>5,000
halosulfuron-methyl	Permit, Yukon	Gowan, Monsanto	2,606	>5000
haloxyfop-methyl	Verdict	Dow AgroSciences	2,179	3,536
hexazinone	Velpar	DuPont	1,690	5,278
imazameth	Cadre	BASF	>5,000	>5,000
imazamethabenz	Assert	BASF	>5,000	>2,000
imazapyr	Arsenal	BASF	>5,000	>2,148
imazaquin	Scepter, Squadron	BASF	5,000	2,000
imazethapyr	Lightning, Pursuit	BASF	>5000	>2000
imazethapyr + dicamba	Resolve	BASF	>5,000	>2,000
2,4-D, 2,4-DP, dicamba	TurfEster	PBI Gordon	2,154	>2000
isoxaben	Gallery, Portrait	Dow AgroSciences	>10,000	-
isoxaflutole	Balance	Bayer	>5,000	>2,000
lactofen	Cobra	Valent	2,600	2,000
linuron	Lorox	DuPont	4,000	-
MCPA	(Many)	BASF, others	1,160	>4,000
MCPA + MCPP + dicamba	ENCORE	PBI Gordon		
MCPP	Mecomec	PBI Gordon		
mecoprop	MCPP	Bayer	1,166	>4,000
mefluidide	Embark	PBI Gordon	>4,000	>4,000
mepiquat chloride	Mepex, Pix	Griffin, BASF	464	>5000
mesosulfuron-methyl	Osprey	Bayer	>2000	>2000
mesotrione	Callisto, Probe, others	Syngenta	>5000	>5000
methyl sulfanilylcarbamate	Asulam	UAP - Loveland	>5000	>2000
metolachlor	Dual	Syngenta	2,780	>10,000
metribuzin	Contrast, Lexone, Sencor	Bayer, DuPont	1,100-2,300	>20,000
metsulfuron	Manor	Riverdale Chemical	>5000	>2000
metsulfuron-methyl	Ally, Escort	DuPont	>5,000	>2,000
monosodium methanearsonate	MSMA	UAP - Loveland	1,738	>2000
napropamide	Devrinol	Syngenta	>500	-
naptalam	Alanap	Uniroyal	8,200	-
nicosulfuron	Accent, Solicam, Steadfast	DuPont, Sygenta	>5,000	>2,000
oryzalin	Surflan	Dow AgroSciences	>10,000	-
oxadiazon	Ronstar	Bayer	>5,000	>2,000
oxyfluorfen	Goal	Dow AgroSciences	>5,000	>10,000
paclobutrazol	Predict	Syngenta	5,346	>1000
paraquat	Gramoxone, Cyclone	Syngenta, UAP	150	-
pelargonic acid	Scythe	Dow AgroSciences	>5000	>2000
pendimethalin	AquaCap, Pendulum, others	BASF, Lescon, others	>5000	>5000
phenmedipham	Spin-Aid	Bayer	>8,000	>4,000
picloram	Grazon, Tordon	Dow AgroSciences	2,598	>2000
clopyralid + flumetsulam	Hornet WPG	Dow AgroSciences	>5000	>5000
primisulfuron	Beacon	Syngenta	>5,050	>2,010
primisulfuron-methyl	Spirit	Dow AgroSciences	>5050	>2020
prodiamine	Barricade	Syngenta	>5,000	>2,000
profluralin	Tolban	Syngenta	1,808	>10,000
prometon	Pramitol	Syngenta	2,980	>2,000

HERBICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
prometryn	Caparol	Syngenta	5,235	>3,100
pronamide	Kerb	Dow AgroSciences	8,350	3,160
propachlor	Ramrod	Monsanto	500-1,700	-
propanil	DCPA	Dow AgroSciences	>2500	>5000
propoxycarbazone-sodium	Olympus	Bayer	>2000	>2000
prosulfuron	Peak	Syngenta	4,360	>2,020
pyrazon	Pyramin	BASF	3,030	2,500
pyridate	Tough, Lentagran	Syngenta	2,000	3,400
pyrithiobac-sodium	Staple	DuPont	4,000	>2,000
quinclorac	Drive, Paramount	BASF	2,200	>2000
quizalofop	Assure	DuPont	1,210	-
quizalofop P-ethyl	Assure II	DuPont	5,900	>2000
rimsulfuron	TranXit	Griffin	>5000	>2000
sethoxydim	Poast	BASF	2,676-3,125	-
siduron	Tupersan	DuPont	>7,500	-
simazine	Caliber 90, Princep	Syngenta	>5000	>2000
s-metachlor	Dual II Magnum, Pennant	Syngenta	2,675	>2020
sodium chlorate	Sodium Chlorate	J.R.Simplot	4,950	500
diflufenzopyr-sodium+dicamba+	Celebrity, Overdrive	BASF	2,000	>2000
sulfentrazone	Authority	DuPont	2,855	>2000
sulfosate	Touchdown	Syngenta	750	>200
sulfosulfuron	Maverick, Outrider	Monsanto	>5,000	>5,000
tebuthiuron	Graslan, Spike	Dow AgroSciences	644	-
terbacil	Sinbar	DuPont	5,000-7,500	-
thidiazuron	Ginstar	Bayer	>5000	>4000
thifensulfuron + rimsulfuron	Basis	DuPont	>5,000	>2,000
thifensulfuron + tribenuron	Harmony Extra	DuPont	>5,000	>2,000
thifensulfuron-methyl	Pinnacle	DuPont	>5,000	-
tralkoxydim	Achieve	Syngenta	934-1,324	-
triallate	Far-go, Avadex	Monsanto	395	>2,000
triasulfuron	Amber	Syngenta	>5,000	>2,000
triasulfuron + dicamba	Rave	Syngenta	>5,000	>2,000
tribenuron methyl	Express	DuPont	>5,000	>2,000
tribufos	DEF, Folex	Bayer, Amvac	570	4
triclopyr	Confront, Remedy, others	Dow AgroSciences	2,164	>2000
triclopyr +2,4-D	Crossbow	Dow AgroSciences	-	-
tridiphane	Tandem	Dow AgroSciences	1,743	3,536
triflurlin	Treflan	Dow AgroSciences	>10,000	-
triisopropanolamine	Momentum	Lesco	1,750	>5000
vernolate	Vernam	Syngenta	1,800-1,900	10,000

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
2,4-D	(MANY)	Dow AgroSciences	699	-
AAtrex, others	atrazine	Syngenta	1,780	-
Accent	nicosulfuron	DuPont	>5,000	>2,000
Acclaim	fenoxaprop-ethyl	Aventis	3,040	>2,000
Accord	glyphosate	Dow AgroSciences	>5000	>5000
Achieve	tralkoxydim	Syngenta	934-1,324	-
Aim	carfentrazone-ethyl	FMC	4,077	>4000
Alanap	naptalam	Uniroyal	8,200	-
Ally	metsulfuron	DuPont	>5,000	>2,000
Amber	triasulfuron	Syngenta	>5,000	>2,000
Amex	dibutalin	CFPI	12,600	10,200
Ansar	disodium methanearsonate	ISK	1,585-2,267	3,150-4,204
AquaCap	pendimethalin	BASF	>5000	>5000
Aquamaster	glyphosate	Monsanto	>5000	>5000
Aquathol	endothall	Cerexagri	51	-
Argold	cinmethylin	DuPont	4,553	>2,000
Arsenal	imazapyr	BASF	>5,000	>2,148
Assert	imazamethabenz	BASF	>5,000	>2,000
Assure	quizalofop	DuPont	1,210	-
Assure II	quizalofop P-ethyl	Du Pont	5,900	>2000
Asulam	methyl sulfanilylcarbamate	UAP - Loveland	>5000	>2000
Asulox	asulam	Aventis	>5,000	>2,000
Authority	sulfentrazone	Du Pont	2,855	>2000
Avadex	triallate	Monsanto	395	-
Avail	methoprene	Purina Mills	>34000	>5050
Avenge	difenzoquat	BASF	863	>2,028
Award	fenoxycarb	Syngenta	>5000	>2000
Axiom	flufenacet	Bayer	2,347	>2000
Backdraft	glyphosate	BASF	>5000	>5000
Balan	benefin	Dow AgroSciences	>10,000	-
Balance	isoxaflutole	Aventis	>5,000	>2,000
Banvel	dicamba	Syngenta	1,707	>2,000
Banvel	dimethylamine salt	Micro Flo	2,629	>2000
Barricade	prodiamine	Syngenta	>5,000	>2,000
Basagran	bentazon	BASF	2,063	-
Basicop	copper sulfate	Griffin	472	-
Basis	thifensulfuron + rimsulfuron	DuPont	>5,000	>2,000
Beacon	primisulfuron	Syngenta	>5,050	>2,010
Bensulide	bensulide	PBI Gordon	360	
Bensumec	bensulide	Syngenta	271-1,470	-
Betasan	bensulide	Syngenta, Uniroyal	271-1,470	-
Beyond	imazamox	BASF	>5000	>4000
Bicep	atrazine+metolachlor	Syngenta	2,780	>1,000
Bladex	cyanazine	DuPont	288	>2,000
Blazer	acifluorfen	BASF	1,540	>3,680
Broadstrike	flumetsulam	Dow AgroSciences	>5,000	>2,000
Brominal	bromoxynil	Aventis	400	3,660
Bronate	bromoxynil	Aventis	260	>2,000
Buctril	bromoxynil	Aventis	260	>2,000

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Bueno	disodium methanearsonate	ISK	1,585-2,267	3,150-4,204
Bugle	fenoxaprop-ethyl	Aventis	6,400	>1,400
Bullet	alachlor+atrazine	Monsanto	930-1,350	-
Butoxone	2,4-DB	Cedar Chem.	700	-
Butyrac	2,4-DB	Albaugh	>2,000	>10,000
Cadre	imazameth	BASF	>5,000	>5,000
Caliber 90	simazine	Syngenta	>5000	>2000
Callisto	mesotrione	Syngenta	>5000	>5000
Camix	mesotrione	Syngenta	>5000	>5000
Campaign	glyphosate+2,4-D+Am sulfate	Monsanto	5,000	5,000
Canopy	chlorimuron+metribuzin	DuPont	1,500-1,600	2,000
Caparol	prometryn	Syngenta	5,235	>3,100
Caparol	prometryn	Syngenta	>5000	>2000
Casoron	dichlobenil	Uniroyal	>3,160	1,350
Celebrity	sodium salt	BASF	2,000	>2000
Cinch	cinmethylin	DuPont	4,553	>2,000
Clarity	diglycolamine salt	BASF	3,512	>2000
Classic	chlorimuron	DuPont	>4,000	>2,000
Cobra	lactofen	Valent	59,600	2,000
Cobra	lactofen	Valent	2,600	>2000
Command	clomazone	FMC	2,077	2,000
Conclude	sodium salt	BASF	1,470	>2000
Confront	triclopyr	Dow AgroSciences	2,164	>2000
Contrast	metribuzin	Bayer	1,100-2,300	>20,000
Corsair	chlorsulfuron	Riverdale	5,000	>2000
Cotoran	fluometuron	Syngenta	8,900	>10,000
Cotoran/Meturon	fluometuron	Du Pont	1,841	>2020
Cotton Quik	ethophon + AMADS	Griffin L.L.C.	3,030	1,560
Crossbow	2,4-D + triclopyr	UAP - Loveland	1,000	>5000
Crossbow	triclopyr + 2,4-D	Dow AgroSciences	-	-
Curbit	ethalfluralin	Dow AgroSciences	>10,000	-
Cutrine	copper	Applied Biochemists	680	700
Cyclone	Paraquat	Syngenta	150	-
Daconate	disodium methanearsonate	ISK	1,585-2,267	3,150-4,204
Dacthal	DCPA	ISK	>5,000	>2,000
DCPA	propanil	Dow AgroSciences	>2500	>5000
DEF	tribufos	Bayer	570	355
Define	flufenacet	Bayer	1,365	>5000
Defol	sodium chlorate	Drexel	5,600	500
Degree Xtra	acetochlor	Monsanto	2,148	4,166
Devrinol	napropamide	Syngenta	>500	-
Dimension	dithiopyr	Monsanto	>5,000	>5,000
Diquat	diquat	Syngenta	215-235	>400
Direx	diuron	Griffin	6,100	>5000
Dissolve	2,4-D	Nufarm	699	
Distinct	sodium salt	BASF	>1800	>5000
Drive	quinclorac	BASF	2,200	>2000
DSMA	disodium methanearsonate	ISK	1,585-2,267	3,150-4,204
Dual	metolachlor	Syngenta	2,780	>10,000
Dual II Magnum	metachlor	Syngenta	2,675	>2020

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Embark	mefluidide	PBI Gordon	>4,000	>4,000
ENCORE	2,4-D + MCPA + Dicamba	PBI Gordon		
Envoy	clethodim	Valent	3,160	>5000
Epic	flufenacet	Bayer	1,136	>5000
Eptam	EPTC	Syngenta	1,630	-
Equip	foramsulfuron	Bayer	4,756	>5000
Eradicane	EPTC	Syngenta	1,630	-
Escort	metsulfuron-methyl	DuPont	>5,000	>2,000
Ethephon	ethephon	Makhteshim Agan	>5000	>2000
Everest	flucarbazone-sodium	Arysta	>5000	>2000
Evik 80	ametryn	Syngenta	1,950	-
Exceed	primisulfuron+prosulfuron	Syngenta	-	-
Excel	fenoxaprop-ethyl	Aventis	3,040	>2,000
Expert	atrazine	Syngenta	2,000	>5000
Express	tribenuron methyl	DuPont	>5,000	>2,000
Fallowmaster	dicamba+glyphosate	Monsanto	4,000	>5,000
Far-go	triallate	Monsanto	395	-
Fenatrol	fenac	Aventis	1,780	>3,160
Field Master	acetochlor	Monsanto	3,105	>5000
Finale	glufosinate-ammonium	Bayer	3,570	>2000
Finesse	chlorsulfuron+metsulfuron	DuPont	>5,000	>2,000
Finish	ethephon + cyclanamide	Aventis	-	-
First Rate	cloransulam-methyl	Dow AgroSciences	>2,000	-
FlexStar	fomesafen sodium salt	Syngenta	>3863	>2000
Folex	tribufos	Amvac	570	4
Frontier	dimethenamid	Syngenta	2,400	>2,000
Frontrow	cloransulam-methyl	Dow AgroSciences	>5000	>2000
Fultime	acetochlor	Dow AgroSciences	>5000	>2.5
Furore	fenoxaprop-ethyl	Aventis	2,565	>2,000
Fusilade	fluazifop-butyl	Syngenta	2,712	>2,420
Fusilade DX	fluazifop	Syngenta	>5000	>2000
Fusion	fenoxaprop	Syngenta	3,154	>2000
Fusion	fluaziflop+fenoxaprop	Syngenta	2,000	2,000
Gallery	isoxaben	Dow AgroSciences	>10,000	-
Garlon	triclopyr	Dow AgroSciences	2,140	-
Ginstar	thidiazuron	Bayer	>5000	>4000
Glean	chlorsulfuron	DuPont	3,053	>2,000
Glpro	glyphosate	Albaugh	>5,000	>5,000
GlyStar	glyphosate	Dow AgroSciences	>5,000	>5,000
Goal	oxyfluorfen	Dow AgroSciences	>5,000	>10,000
Goal	oxyfluorfen	Dow AgroSciences	2,985	>4000
Gramoxone	paraquat	Syngenta	150	-
Graslan	tebuthiuron	Dow AgroSciences	644	-
Grazon	picloram	Dow AgroSciences	8,200	4,000
Grazon	picloram	Dow AgroSciences	2,598	>2000
Guardsman Max	dimethenamid	BASF	<2000	>4000
HarmonyExtra	thifensulfuron+tribenuron	DuPont	>5,000	>2,000
Harness Plus	acetochlor	Monsanto	2,953	3,667
Harvade	dimethipin	Uniroyal	1,180	8,000
Hoelon	diclofop-methyl	Aventis	512	>5,000

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Honcho	glyphosate	Monsanto	>5000	>5000
Hornet WPG	potassium salt	Dow AgroSciences	>5000	>5000
Horsepower	dimethylamine salt	Nufarm	500	2,000
Hydrothol	endothall	Cerexagri	51	-
Hyvar-X	bromocil	DuPont, Hopkins	5,200	-
Ignite	glufosinate-ammonium	Bayer	2,170	1,400
Illoxan	diclofop-methyl	Bayer	2,176	5,000
Image	bromoxynil+ioxynil+	BASF		
Intrro	alachlor	Monsanto	1,782	>5000
Karmex	diuron	DuPont	3,400	2,000
Kerb	pronamide	Dow AgroSciences	8,350	3,160
Krenite	fosamine-ammonium	DuPont	>5,000	-
Laddok	atrazine+bentazone	BASF	3,840	>4,000
LAF	MCPP + 2,4-D + dicambra			
Landmaster	2,4-D+glyphosate	Monsanto	3,860	>6,366
Lariet	alachlor+atrazine	Monsanto	4,400	>5,000
Lasso	alachlor	Monsanto	930-1,350	-
Lexone	metribuzin	Bayer, DuPont	1,100-2,300	>20,000
Liberty	glufosinate-ammonium	Bayer	2,170	1,400
Lightning	imazethapyr	BASF	>5000	>2000
Lontrel	clopyralid	Dow AgroSciences	>5,000	>2,000
Lorox	linuron	DuPont	4,000	-
Lumax	mesotrione	Syngenta	>5050	>5050
Magnum	s-metholachlor	Syngenta	3,425	>2,000
Manage	halsulfuron	Monsanto	1,287	>5,000
Manor	metsulfuron	Riverdale	>5000	>2000
Marksman	atrazine + dicamba	BASF	-	-
Matrix	DPX - 5300 + 6316	DuPont	>5,000	>2,000
Maverick	sulfosulfuron	Monsanto	>5,000	>5,000
MCPA	(Many)	BASF	1,160	>4,000
MCPP	mecoprop	Aventis	1,166	>4,000
Mecomec	MCPP	PBI Gordon		
mecoprop-P	-	-	-	
Mepex	mepiquat chloride	Griffin	6.95 mL/mg	>5000
Millenium Ultra	2,4-D + dicamba + clopyralid	Nufarm		
Momentum	triisopropanolamine	Lesco	1,750	>5000
Moxy	atrazine	Agriliance	3,600	>2000
MSMA	monosodium acid	UAP - Loveland	1,738	>2000
MSMA	monosodium methanearsonate	UAP, Drexel	700	-
Northstar	dicamba	Syngenta	2,932	>2020
Olympus	propoxycarbazone-sodium	Bayer	>2000	>2000
Option	foramsulfuron	Agriliance	3,881	>5000
Osprey	mesosulfuron-methyl	Bayer	>2000	>2000
Oust	sulfometuron methyl	DuPont	>5,000	-
Outlook	dimethenamid	BASF	695	>5.6
Outrider	sulfosulfuron	Monsanto	>5000	>5000
Overdrive	sodium salt of diflufenzopyr	BASF	>1800	>5000
Paramount	quinclorac	BASF	4,120	>2,000
Pasturegard	triclopyr	Dow AgroSciences	630	>5,000
Peak	prosulfuron	Syngenta	4,360	>2,020

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Pendulum	pendimethalin	BASF	>5000	>5000
Pennant Magnum	metachlor	Syngenta		
Permit	halosulfuron	Monsanto	1,287	>5,000
Permit	halosulfuron-methyl	Gowan	1,287	>5000
Pinnacle	thifensulfuron	DuPont	>5,000	>2,000
Pix	mepiquat chloride	BASF	464	-
Pix	mepiquat chloride	BASF	>5000	>2000
Plateau	imazapic	BASF	>5000	>5000
Poast	sethoxydim	BASF	2,676-3,125	-
Portrait	isoxaben	Green Light	5,000	5,000
Pramitol	prometon	Syngenta	2,980	>2,000
Predict	paclobutrazol	Syngenta	5,346	>1000
Prefar	bensulide	Syngenta, Uniroyal	271-1,470	-
Pre-M	pendimethalin	Lesco	>5000	>5000
Prep	ethephon	Aventis	4,229	-
PreSan	bensulide	PBI Gordon	360	
Primo	etofenprox	RPG	>42,880	>2,140
Princep	simazine	Syngenta	>5,000	>3,100
Prisim	clethodim	Valent	3,160	>5000
Probe	methazole	Syngenta	2,501	>12,500
Prograss	ethofumesate	Aventis	6,400	>1,400
Prompt	bentazon	Micro Flo	3,840	>4000
Propel	dimethenamid	Rosen's	695	>2000
Propendi	pendimethalin	Anderson's	>5,000	>5,000
Prosecutor	glyphosate	Lesco	>5000	>5000
Protect T/O	mancozeb	Cleary Chemical Corp.	>5,000	>5,000
Prowl	pendimethalin	BASF	3,956	>2,200
Puma	fenoxaprop	Bayer	3,250	>2000
Pursuit	imazethapyr	BASF	>5,000	>2,000
Pyramin	pyrazon	BASF	3,030	>2,500
Python	flumetsulam	DuPont	<5,000	<2,000
Racer	fluorochloridone	Syngenta	-	-
Ramrod	propachlor	Monsanto	500-1,700	-
Raptor	imazamox	BASF	>5000	>4000
Rave	dicamba	Syngenta	4,551	>2000
Rave	triasulfuron +dicamba	Syngenta	>5,000	>2,000
Razor	glyphosate	Riverdale	>5000	>5000
ReadyMaster ATZ	atrazine	Monsanto	1,600	>10000
Reclaim	clopyralid	Dow AgroSciences	>5,000	>2,000
Reclaim	clopyralid	Dow AgroSciences	>5000	>5000
Redeem	triclopyr	Dow AgroSciences	1,521	>2000
Reflex	fomesafen	Syngenta	1,858	-
Reglone	diquat	Syngenta	215-235	>400
Rely	glufosinate	Aventis	2,000	1,620
Remedy	triclopyr	Dow AgroSciences	2,140	-
Remedy	triclopyr	Dow AgroSciences	1,581	>2000
Resolve	imazethapyr + dicamba	BASF	>5,000	>2,000
Resource	flumiclorac pentyl ester	Sumitomo Chemical	>2,500	>5,620
Revolover	foramsulfuron	Bayer	>5000	>5000
Reward	diquat dibromide	Syngenta	600	260

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Rhonox	MCPA	Nufarm Americas Inc.	1,160	>2,000
Rodeo	glyphosate	Monsanto	5,000	2,000
Ro-Neet	cycloate	Syngenta	2,000-4,100	-
Ronstar	oxadiazon	Aventis	>5,000	>2,000
Roundup	glyphosate	Monsanto	5,000	>5,000
RT Master	glyphosate	Monsanto	>5000	>5000
Sabre	2,4-D	-	699	-
Scepter	imazaquin	BASF	5,000	2,000
Scythe	pelargonic acid	Dow AgroSciences	>5000	>2000
Select	clethodim	Valent	3,610	>2,921
Sencor	metribuzin	Bayer, DuPont	1,100-2,300	>20,000
Sequence	glyphosate	Syngenta	>5000	>5000
Seritox	dichloroprop	Aventis	925-1,470	>4,000
Shotgun	atrazine	UAP - Loveland	>5000	>2000
Silverado	fenoxaprop-p-ethyl	Aventis	>5,000	>2,000
Sinbar	terbacil	DuPont	5,000-7,500	-
Snapshot	Gallery + oryzalin	Dow AgroSciences	>10,000	-
Snapshot 2.5TG	Gallery + trifluralin	Dow AgroSciences	>10,000	-
Sodium Chlorate	sodium chlorate	J.R. Simplot	4,950	500
Sodium Chlorate	sodium chlorate	Simplot	4,950	500
Solicam	norflurazon	Syngenta	>8,000	>20,000
Sonalan	ethalfluralin	Dow AgroSciences	>10,000	-
Sonar	fluridone	Dow AgroSciences	>10,000	-
Speed Zone	MCPA	PBI Gordon	>5000	>2000
Spike	tebuthiuron	Dow AgroSciences	644	-
Spike	tebuthiuron	Dow AgroSciences	>2000	>2000
Spin-Aid	phenmedipham	Aventis	>8,000	>4,000
Spirit	primisulfuron-methyl	Dow AgroSciences	>5050	>2020
Spotlight	fluroxypyr	Dow AgroSciences	3,738	>2000
Squadron	imazaquin	BASF	>5000	>2000
Staple	pyrithiobac-sodium	Dupont	4,000	>2,000
Starfire	paraquat	Syngenta	283	2,000
Steadfast	nicosulfuron	Du Pont	>5000	>2000
Stinger	clopyralid	Dow AgroSciences	>5,000	>2,000
Storm	aciflourine+bentazone	BASF	>2,200	>2,000
Strongarm	diclosulam	Dow AgroSciences	>5000	>2000
Super Boll	ethephon	Aventis	4,229	-
Surefire	paraquat dichloride	UAP - Loveland	594	84
Surflan	oryzalin	Dow AgroSciences	>10,000	-
Surmount	fluroxypr-meptyl	Dow AgroSciences	3,738	>2000
Surpass	acetochlor	Dow AgroSciences	1,426	>2240
Sutan	butylate	Syngenta	3,500-5,431	>4,640
Synchrony	chlorimuron +thifensulfuron	DuPont	>5,000	>2,000
Systhane	myclobutanil	Dow AgroSciences	1,600	>5,000
Tandem	tridiphane	Dow AgroSciences	1,743	3,536
Team	benefin + trifluralin	Dow AgroSciences	>7,000	-
Tenoran	chloroxuron	Syngenta	3,700	>10,000
Tolban	profluralin	Syngenta	1,808	>10,000
Top Notch	acetochlor	Dow AgroSciences	2,148	4,166

HERBICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50	ACUTE DERMAL LD 50
Tordon	picloram	Dow AgroSciences	8,200	4,000
Tordon	picloram	Dow AgroSciences	>5000	>5000
Touchdown	glyphosate trimesium	Syngenta	750	>200
Tough	pyridate	Syngenta	2,000	3,400
Transline	clopyralid	Dow AgroSciences	>5,000	>2,000
TranXit	rimsulfuron	Griffin	>5000	>2000
Treflan	trifluralin	Dow AgroSciences	>10,000	-
Triamine	dimethylamine salt	Riverdale	2,300	>2000
Trimec	2,4-D+dicamba +mecoprop	-	-	-
Triplet	dimethylamine salt	Nufarm	>500	>2000
Tripower Selective	dicamba	BASF	2,629	>2000
Trupower Selective	2,4-D + dicamba + clopyralid	Nufarm		
Tupersan	siduron	DuPont	>7,500	-
TurfEster	2,4-D + dicamba + 2,4-DP	PBI Gordon	2,154	>2000
Turflon	triclopyr	Dow AgroSciences	2,140	-
Urox	bromocil	DuPont, Hopkins	5,200	-
Valor	flumaioxazin	Valent	>5000	>2000
Vanquish	dicamba	Syngenta	2,629	>2,000
Velpar	hexazinone	DuPont	1,690	5,278
Velpar DF	hexazinone	Du Pont	1,310	>5000
Verdict	haloxyfop-methyl	Dow AgroSciences	2,179	3,536
Vernam	vernolate	Syngenta	1,800-1,900	10,000
Weedar	2,4-D	CFPI AGRO, Nufarm	949	-
Weed-B-Gone	2,4-D + triclopyr + clyralid			
Weedgrass Preventer	bensulide	Anderson's	360	
Weedmaster	2,4-D + dicamba	BASF	-	-
Weedmaster	dimethylamine salt	BASF	1,150	>2000
Whip	fenoxaprop-ethyl	Aventis	2,565	>2,000
XL 2G	benefin + oryzalin	Helena Chemical Co.	>7,000	-
Yukon	halosulfuron-methyl	Monsanto	2,606	>5000
Zorial	norflurazon	Syngenta	>8,000	>20,000

RODENTICIDES BY COMMON NAME

COMMON NAME	TRADE NAME	MAJOR PRODUCER	ACUTE ORAL LD 50
alpha-chlorohydrin	Epibloc	-	-
brodifacom	Talon, Havoc	Syngenta	50
bromadiolone	Maki, Contrac	Chempar, Bell Labs	1
chlorophacinone	Rozol	Chempar	21
cholecalciferol	Quintox	Bell Labs	-
coumafuryl	Fumarin, Fumasol	Aventis	25
diphacinone	Ramik, Promar	Syngenta	2
-	Rodent Cake	Bell Labs	2
-	Kill-Ko Rat Killer	Rigo	2
pindone	Pival	Montomco	280
warfarin	Warfarin	Bell Labs	3
warfarin + sulfaquinoxaline	Warfarin Q, Prolin	Bell Labs, Hopkins	3

RODENTICIDES BY TRADE NAME

TRADE NAME	COMMON NAME	MAJOR PRODUCER	ACUTE ORAL LD 50
Contrac	bromadiolone	Chempar, Bell Labs	1
Epibloc	alpha-chlorohydrin	-	-
Fumarin	coumafuryl	Aventis	25
Fumasol	coumafuryl	Aventis	25
Havoc	brodifacom	Syngenta	50
Kill-Ko Rat Killer	diphacinone	Rigo	2
Maki	bromadiolone	Chempar, Bell Labs	1
Pival	pindone	Montomco	280
Proline	warfarin + sulfaquinoxaline	Bell Labs, Hopkins	3
Promar	diphacinone	Syngenta	2
Quintox	cholecalciferol	Bell Labs	-
Ramik	diphacinone	Syngenta	2
Rodent Cake	diphacinone	Bell Labs	2
Rozol	chlorophacinone	Chempar	21
Talon	brodifacom	Syngenta	50
Warfarin	warfarin	Bell Labs	3
Warfarin Q	warfarin + sulfaquinoxaline	Bell Labs, Hopkins	3

HERBICIDE MODE OF ACTION TABLE

WSSA GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
1	Inhibition of acetyl CoA carboxylase (ACCase)	Aryloxyphenoxy-propionate 'FOPs'	clodinafop-propargyl cyhalofop-butyl diclofop-methyl fenoxaprop-P-ethyl fluazifop-P-butyl haloxyfop-R-methyl propaquizafop quizalofop-P-ethyl
1		Cyclohexanedione 'DIMs'	alloxydim butroxydim clethodim cycloxydim profoxydim sethoxydim tepraloxydin tralkoxydim
1		Phenylpyrazoline 'DEN'	pinoxaden
2	Inhibition of acetolactate synthase ALS (acetohydroxyacid synthase AHAS)	Sulfonylurea	amidosulfuron azimsulfuron bensulfuron-methyl chlorimuron-ethyl chlorsulfuron cinosulfuron cyclosulfamuron ethametsulfuron-methyl ethoxysulfuron flazasulfuron flupyrsulfuron-methyl-Na foramsulfuron halosulfuron-methyl imazosulfuron iodosulfuron mesosulfuron metsulfuron-methyl nicosulfuron oxasulfuron primisulfuron-methyl prosulfuron pyrazosulfuron-ethyl rimsulfuron sulfometuron-methyl sulfosulfuron thifensulfuron-methyl triasulfuron tribenuron-methyl trifloxysulfuron triflusulfuron-methyl tritosulfuron
2		Imidazolinone	imazapic imazamethabenz-methyl imazamox imazapyr imazaquin imazethapyr

HERBICIDE MODE OF ACTION TABLE

WSSA GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
2		Triazolopyrimidine	cloransulam-methyl diclosulam florasulam flumetsulam metosulam penoxsulam
2		Pyrimidinyl(thio)benzoate	bispyribac-Na pyribenzoxim pyriftalid pyrithiobac-Na pyriminobac-methyl
2		Sulfonylaminocarbonyl-triazolinone	flucarbazone-Na propoxycarbazone-Na
3	Microtubule assembly inhibition	Dinitroaniline	benefin = benfluralin butralin dinitramine ethalfluralin oryzalin pendimethalin trifluralin
3		Phosphoroamidate	amiprophos-methyl butamiphos
3		Pyridine	dithiopyr thiazopyr
3		Benzamide	propyzamide = pronamide tebutam
3		Benzoic acid	DCPA = chlorthal-dimethyl
4	Action like indole acetic acid (synthetic auxins)	Phenoxy-carboxylic-acid	clomeprop 2,4-D 2,4-DB dichlorprop = 2,4-DP MCPA MCPB mecoprop = MCPP = CMPP
4		Benzoic acid	chloramben dicamba TBA
4		Pyridine carboxylic acid	clopyralid fluroxypyr picloram triclopyr
4		Quinoline carboxylic acid	quinclorac (also group L) quinmerac
4		Other	benazolin-ethyl

HERBICIDE MODE OF ACTION TABLE

WSSA GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
5	Inhibition of photosynthesis at photosystem II	Triazine	ametryne atrazine cyanazine desmetryne dimethametryne prometon prometryne propazine simazine simetryne terbumeton terbuthylazine terbutryne trietazine
5		Triazinone	hexazinone metamitron metribuzin
5		Triazolinone	amicarbazone
5		Uracil	bromacil lenacil terbacil
5		Pyridazinone	pyrazon = chloridazon
5		Phenyl-carbamate	desmedipham phenmedipham
6	Inhibition of photosynthesis at photosystem II	Nitrile	bromofenoxim bromoxynil ioxynil
6		Benzothiadiazinone	bentazon
6		Phenyl-pyridazine	pyridate pyridafol
7	Inhibition of photosynthesis at photosystem II	Urea	chlorobromuron chlorotoluron chloroxuron dimefuron diuron ethidimuron fenuron fluometuron (see F3) isoproturon isouron linuron methabenzthiazuron metobromuron metoxuron monolinuron neburon siduron tebuthiuron
7		Amide	propanil pentanochlor

HERBICIDE MODE OF ACTION TABLE

WSSA GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
8	Inhibition of lipid synthesis - not ACCase inhibition	Thiocarbamate	butylate cycloate dimepiperate EPTC esprocarb molinate orbencarb pebulate prosulfocarb thiobencarb = benthiocarb tiocarbazil triallate vernolate
8		Phosphorodithioate	bensulide
8		Benzofuran	benfuresate ethofumesate
9	Inhibition of EPSP synthase	Glycine	glyphosate sulfosate
10	Inhibition of glutamine synthetase	Phosphinic acid	glufosinate-ammonium bialaphos = bilanaphos
11	Bleaching: Inhibition of carotenoid biosynthesis (unknown target)	Triazole	amitrole (in vivo inhibition of lycopene cyclase)
12	Bleaching: Inhibition of carotenoid biosynthesis at the phytoene desaturase step (PDS)	Pyridazinone	norflurazon
12		Pyridinecarboxamide	diflufenican picolinafen
12		Other	beflubutamid fluridone flurochloridone flurtamone
13		Isoxazolidinone	clomazone
13		Urea	fluometuron (see C2)
13		Diphenylether	aclonifen
14	Inhibition of protoporphyrinogen oxidase (PPO)	Diphenylether	acifluorfen-Na bifenox chlomethoxyfen fluoroglycofen-ethyl fomesafen halosafen lactofen oxyfluorfen
14		Phenylpyrazole	fluazolate pyraflufen-ethyl
14		N-phenylphthalimide	cinidon-ethyl flumioxazin flumiclorac-pentyl
14		Thiadiazole	fluthiacet-methyl thidiazimin

HERBICIDE MODE OF ACTION TABLE

WSSA GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
14		Oxadiazole	oxadiazon oxadiargyl
14		Triazolinone	azafenidin carfentrazone-ethyl sulfentrazone
14		Oxazolidinedione	Pentoxazone
14		Pyrimidindione	benzfendizone butafenacil
14		Other	pyraclonil profluazol flufenpyr-ethyl
15	Inhibition of VLCFAs (see Remarks) (Inhibition of cell division)	Chloroacetamide	acetochlor alachlor butachlor
15			dimethachlor dimethanamid metazachlor metolachlor pethoxamid
15			pretilachlor propachlor propisochlor thenylchlor
15		Acetamide	diphenamid napropamide naproanilide
15		Oxyacetamide	flufenacet mefenacet
15		Tetrazolinone	fentrazamide
15		Other	anilofos cafenstrole piperophos
17		Organoarsenical	DSMA MSMA
18	Inhibition of DHP (dihydropteroate) synthase	Carbamate	asulam
19	Inhibition of auxin transport	Phthalamate Semicarbazone	naptalam diflufenzopyr-Na
20	Inhibition of cell wall (cellulose) synthesis	Nitrile	dichlobenil chlorthiamid
21		Benzamide	isoxaben
21		Triazolocarboxamide	flupoxam
22	Photosystem-I-electron diversion	Bipyridylium	diquat paraquat
23	Inhibition of mitosis / microtubule organisation	Carbamate	chlorpropham propham carbetamide
24	Uncoupling (Membrane disruption)	Dinitrophenol	DNOC dinoseb dinoterb

HERBICIDE MODE OF ACTION TABLE

WSSA GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
25	Unknown Note: While the mode of action of herbicides in Group Z is unknown it is likely that they differ in mode of action between themselves and from other groups.	Arylaminopropionic acid	Flamprop-M-methyl /-isopropyl
26		Quinoline carboxylic acid	quinclorac (for monocots) (also group O)
26		Chloro-Carbonic-acid	TCA dalapon flupropanate
26		Pyrazolium	difenzoquat
27	Bleaching: Inhibition of 4-hydroxyphenyl-pyruvate-dioxygenase (4-HPPD)	Triketone	mesotrione sulcotrione
27		Isoxazole	isoxachlortole isoxaflutole
27		Pyrazole	benzofenap pyrazolynate pyrazoxyfen
27		Other	Benzobicyclon
27		Other	bromobutide (chloro)-flurenol
27			Cinmethylin
27			Cumyluron
27			Dazomet
27			dymron = daimuron methyl-dimuron= methyl-dymron etobenzanid fosamine indanofan metam oxaziclomefone oleic acid
27			pelargonic acid pyributicarb

INSECTICIDES MODE OF ACTION TABLE

IRAC GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
1A	Acetylcholine esterase inhibitors	Carbamates	Aldicarb, Alanycarb, Bendiocarb, Benfuracarb, Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Trimethacarb, XMC, Xylylcarb
1A		Triazemate	Triazemate
1B		Organophosphates	Acephate, Azamethiphos, Azinphos-ethyl, Azinphos-methyl, Cadusafos, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Cyanophos, Demeton-S-methyl, Diazinon, Dichlorvos/ DDVP, Dicrotophos, Dimethoate, Dimethylvinphos, Disulfoton, EPN, Ethion, Ethoprophos, Famphur, Fenamiphos, Fenitrothion, Fenthion, Fosthiazate, Heptenophos, Isofenphos, Isopropyl O-methoxyaminothio=phosphoryl) salicylate, Isoxathion, Malathion, Mecarbam, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenthoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos-, ethyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirimfos, Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion

INSECTICIDES MODE OF ACTION TABLE

IRAC GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
2A	GABA-gated chloride channel antagonists	Cyclodiene organochlorines	Chlordane, Endosulfan, gamma-HCH (Lindane)
2B		Phenylpyrazoles (Fiproles)	Ethiprole, Fipronil
3	Sodium channel modulators	DDT	DDT
3		Methoxychlor	Methoxychlor
3		Pyrethroids	Acrinathrin, Allethrin, d-cis-trans Allethrin, d-trans Allethrin, Bifenthrin, Bioallethrin, Bioallethrin S-cylclopentenyl , Bioresmethrin, Cycloprothrin, Cyfluthrin, beta-Cyfluthrin, Cyhalothrin, lambda-Cyhalothrin, gamma-Cyhalothrin, Cypermethrin, alpha-Cypermethrin, beta-Cypermethrin, theta-cypermethrin, zeta-Cypermethrin, Cyphenothrin , (1R)-trans- isomers], Deltamethrin, Empenthrin , (EZ)- (1R)- isomers], Esfenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, tau-Fluvalinate, Halfenprox, Imiprothrin, Permethrin, Phenothrin [(1R)-trans-isomer], Prallethrin, Resmethrin, RU 15525, Silafluofen, Tefluthrin, Tetramethrin, Tetramethrin [(1R)-isomers], Tralomethrin, Transfluthrin, ZXI 8901
3		Pyrethrins	Pyrethrins (pyrethrum)
4A	Nicotinic Acetylcholine receptor agonists / antagonists	Neonicotinoids	Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiacloprid, Thiamethoxam
4B		Nicotine	Nicotine
4C		Bensultap	Bensultap
4C		Cartap hydrochloride	Cartap hydrochloride
4C		Nereistoxin analogues	Thiocyclam, Thiosultap-sodium
5	Nicotinic Acetylcholine receptor agonists (allosteric) (not group 4)	Spinosyns	Spinosad
6	Chloride channel activators	Avermectins, Milbemycins	Abamectin, Emamectin benzoate, Milbemectin
7A	Juvenile hormone mimics	Juvenile hormone analogues	Hydroprene, Kinoprene, Methoprene
7B		Fenoxycarb	Fenoxycarb
7C		Pyriproxyfen	Pyriproxyfen

INSECTICIDES MODE OF ACTION TABLE

IRAC GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
8A	Compounds of unknown or non-specific mode of action (fumigants)	Alkyl halides	Methyl bromide and other alkyl halides
8B		Chloropicrin	Chloropicrin
8C		Sulfuryl fluoride	Sulfuryl fluoride
9A	Compounds of unknown or non-specific mode of action (selective feeding blockers)	Cryolite	Cryolite
9B		Pymetrozine	Pymetrozine
9C		Flonicamid	Flonicamid
10A	Compounds of unknown or non-specific mode of action (mite growth inhibitors)	Clofentezine	Clofentezine
10A		Hexythiazox	Hexythiazox
10B		Etoxazole	Etoxazole
11A1	Microbial disruptors of insect midgut membranes (includes transgenic crops expressing Bacillus thuringiensis toxins)	B.t. subsp. israelensis	Bacillus thuringiensis subsp. Israelensis
11A2		B. sphaericus	Bacillus sphaericus
11B1		B.t. subsp. Aizawai	Bacillus thuringiensis subsp. Aizawai
11B2		B.t. subsp. kurstaki	Bacillus thuringiensis subsp. Kurstaki
11C		B.t. subsp. tenebrionis	Bacillus thuringiensis subsp. Tenebrionis
12A	Inhibitors of oxidative phosphorylation, disruptors of ATP formation (inhibitors of ATP synthase)	Diafenthiuron	Diafenthiuron
12B		Organotin miticides	Azocyclotin, Cyhexatin, Fenbutatin oxide
12C		Propargite	Propargite
12C		Tetradifon	Tetradifon
13	Uncouplers of oxidative phosphorylation via disruption of proton gradient	Chlorfenapyr	Chlorfenapyr
13		DNOC	DNOC
15	Inhibitors of chitin biosynthesis, type 0, Lepidopteran	Benzoylureas	Bistrifluron, Chlofluazuron, Diflubenzuron, Flucycloxuron, Flufenoxuron, Hexaflumuron, Lufenuron, Novaluron, Noviflumuron, Teflubenzuron, Triflumuron
16	Inhibitors of chitin biosynthesis, type 1, Homopteran	Buprofezin	Buprofezin
17	Moulting disruptor, Dipteran	Cyromazine	Cyromazine

INSECTICIDES MODE OF ACTION TABLE

IRAC GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
18A	Ecdysone agonists / moulting disruptors	Diacylhydrazines	Chromafenozide, Halofenozide, Methoxyfenozide, Tebufenozide
18B		Azadirachtin	Azadirachtin
19	Octopaminergic agonists	Amitraz	Amitraz
20A	Mitochondrial complex III electron transport inhibitors (Coupling site II)	Hydramethylnon	Hydramethylnon
20B		Acequinocyl	Acequinocyl
20C		Fluacrypyrim	Fluacrypyrim
21	Mitochondrial complex I electron transport inhibitors	METI acaricides	Fenazaquin, , Fenpyroximate, Pyrimidifen, Pyridaben, Tebufenpyrad, Tolfenpyrad
21		Rotenone	Rotenone
22	Voltage-dependent sodium channel blockers	Indoxacarb	Indoxacarb
23	Inhibitors of lipid synthesis	Tetronic acid derivatives	Spirodiclofen, Spiromesifen
24A	Mitochondrial complex IV electron transport inhibitors	Aluminium phosphide	Aluminium phosphide
24B		Cyanide	Cyanide
24C		Phosphine	Phosphine
25	Neuronal inhibitors (unknown mode of action)	Bifenazate	Bifenazate
26	Aconitase inhibitors	Fluoroacetate	Fluoroacetate
27A	Synergists	P450-dependent monooxygenase inhibitors	Piperonyl butoxide
27B		Esterase inhibitors	Tribufos (DEF)
28	Ryanodine receptor modulators	Flubendiamide	Flubendiamide
UNA	Compounds with unknown mode of action[2]	Benzoximate	Benzoximate
UNB		Chinomethionat	Chinomethionat
UNC		Dicofol	Dicofol
UND		Pyridalyl	Pyridalyl
NSA	Miscellaneous non-specific (multi-site) inhibitors[3]	Borax	Borax
NSB		Tartar emetic	Tartar emetic

FUNGICIDES MODE OF ACTION TABLE

FRAC GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
1	Mitosis and cell division	benzimidazoles	thiabendazole
1		thiophanates	thiophanate-methyl
2	Respiration		iprodione vinclozolin
3	Sterol synethesis	imidazoles	Imazilil
3		piperazines	Triforine
3		pyrimidines	Fenarimol
3		triazoles	bitertanol cyproconazole difenoconazole fenbuconazole flusilazole ipconazole metconazole myclobutanil propiconazole prothioconazole tebuconazole tetraconazole triadimefon triadimenol triticonazole
4	Nucleic acid synethesis	acylalanines	metalaxyl metalaxyl-M (=mefenoxam)
7	Respiration		boscalid carboxin flutolanil
9	Protein synthesis		cyprodinil
11	Respiration	methoxyacrylates	azoxystrobin picoxystrobin
11		methoxy-carbamates	pyraclostrobin
11		oximino acetates	kresoxim-methyl trifloxystrobin
11		oxazolidine-diones	famoxadone
11		dihydro-dioxazines	fluoxastrobin
11		imidazolinones	fenamidone
12	Signaling		fludioxonil
13	Signaling		quinoxyfen
14	Lipids and membranes		chloroneb dicloran quintozene (PCNB)
14		1,2,4-thiadiazoles	etridiazole
17	Sterol synthesis		fenhexamid

FUNGICIDES MODE OF ACTION TABLE

FRAC GROUP	MODE OF ACTION	CHEMICAL FAMILY (GROUP)	ACTIVE INGREDIENTS
19	Cell wall synthesis	peptidyl pyrimidine nucleoside	polyoxin
21	Respiration	cyanoimidazole	cyazofamid
22	Cell division		zoxamide
24	Protein synthesis		kasugamycin
25	Protein synthesis		streptomycin
27	Unkown		cymoxanil
28	Cell membrane permeability		propamocarb
29	Respiration	2,6-dinitro-anilines	fluazinam
30	Respiration	tri phenyl tin compounds	fentin hydroxide
33	Unkown	ethyl phosphonates	fosetyl-Al
33			phophorous acid and salts
40	Cell wall synthesis	cinnamic acid amides	dimethomorph
40		mandelic acid amides	mandipropamid
41	Protein synthesis		oxytetracycline
P	Host plant defense induction	benzo-thiadiazole BTH	acibenzolar-S-methyl
M	Multi-site contact activity	inorganic	copper
		inorganic	sulphur
		dithiocarbamates and relatives	ferbam mancozeb maeb metiram thiram ziram
		phthalimides	captan
		chloronitriles (phthalonitriles)	chlorothalonil
		guanidines	dodine
NC	Not classified	diverse	mineral oils, organic oils, potassium bicarbonate

PESTICIDE COMPATIBILITY

What chemicals can be safely used together? Pesticide compatibility can be defined as "when two or more chemicals can be mixed without affecting each other's properties." Involved in the mixing of pesticides are other related problems such as (1) the possible decrease in effectiveness of one or more materials against various pests; (2) the increase or decrease in breakdown of one of the materials; or (3) the increase in phytotoxicity, i.e., injury or burn to the plant.

Information is provided on many labels by the manufacturer or formulator of a product regarding its mixing with other materials. The information and mixing instructions should be followed to minimize compatibility problems.

TANK MIXES OF PESTICIDES

Often pesticides are applied in mixes to save the time and the expense of applying the products separately. Many labels do not give directions for tank mixing with other products. The question is often raised about the legality of mixing two or more pesticides without appropriate directions on the label.

EPA issued a Pesticide Regulation notice on July 3, 1973, addressed to the question of tank mixes. This notice recognized the fact that various tank mixes had been tested and recommended by agricultural experiment stations, state Departments of Agriculture, or were common agricultural practices, but directions for tank mixing did not appear on the appropriate labels.

EPA has ruled that such uses are not inconsistent with the label provided the following criteria are met:

•The crop or site of application must appear on each label of the products being mixed.

•The application rate for each product must not exceed that prescribed by the label.

•The label on one or more of the products does not explicitly instruct against such mixture.

The applicator assumes the liability and risk in applying tank mixes when instructions are not specifically given on the label.

•Read the labels carefully for all products before mixing.

•Do a small scale "jar test" for compatibility as follows:

Place one pint of carrier-water or liquid fertilizer in a quart jar. Add each pesticide or premix of pesticide in water, one at a time and shake well with each addition. Use each product in the same proportion to carrier as it will be in the actual tank mix.

Unless labels indicate otherwise, add pesticides in this order: first wettable granules or powder, followed by flowables, emulsifiable concentrates, water solubles and their recommended companion surfactants. When adjuvants to facilitate tank mixing are used, they should be added first to the carrier-water or liquid fertilizer.

Invert the jar 10 times, then inspect the mixture immediately and again after standing quietly for 30 minutes. If a uniform mix cannot be made or if nondispersible oil, sludge or clumps of solids form, the mixture is incompatible and should not be used. Minor separation after 30 minutes, with sludge or clumps and which remixes readily with 10 jar inversions is tolerable if field spray tank agitation is good and keeps the combination mixed.

•When tank mixing in volume, put two-thirds of the carrier in the tank first. Then add pesticides one by one, with wettable powders first. Agitate for thorough mixing after each addition, before pouring in the next. Finish filling tank with carrier.

•Keep agitation going at all times on the way to the field, during application and during stops for any reason. Empty the tank preferably on the day of mixing. Do not allow mixture to stand overnight without agitation. Check labels for temperature and humidity data as they affect mixing or delay in use.

•When using new combinations, test the tank mixtures on small areas before large scale use.

MISUSE OF PESTICIDES

It is a violation of the law to use any pesticide in a manner inconsistent with its labeling. To protect yourself, be certain the pesticide is labeled for use on the plant, crop, animal or site intended for application. Do not use rates of application that exceed those given on the label. Don't ignore the harvest intervals, grazing restrictions, or re-entry intervals. Follow the instructions for use of protective clothing and devices and for storage and disposal of pesticide wastes including containers.

The 1978 amendments to the Federal Pesticide Law provide further definition of "use inconsistent with labeling." According to these amendments, it will not be "use inconsistent with labeling" to: apply a pesticide at a dosage, concentration or frequency less than that specified on the labeling. In Oklahoma, however, prior approval must be obtained from the Oklahoma Department of Agriculture, Food & Forestry before use of a pesticide at a concentration, dosage or frequency less than specified on the labeling.

PESTICIDE TOXICITY TO BEES

Efficient production of many crops depends on pollination by honey bees and some other insects. Without the help of these pollinators, we would not have some of our fruit, vegetable, forage, and seed crops. One of the serious side effects of pesticide applications has been the loss of many pollinators each year. Because of the importance of these insects, make every effort to use pesticides so that they will cause the least amount of injury to pollinators. This requires detailed knowledge of pesticide toxicity to bees, timing of application in relation to bee activity in crops, least hazardous method of application, and cooperation among growers, applicators and beekeepers.

Toxicity of pesticides to honey bees

Many pesticides are highly toxic to honey bees and other beneficial insects. The farmer, the beekeeper and the pesticide applicator should cooperate closely to keep losses of beneficial insects to a minimum. To protect these insects, it is essential to use only the safest of the recommended materials. The groupings on the following tables show the relative toxicity of many pesticides to honey bees as determined by laboratory and field tests.

How to use hazardous pesticides around honey bees

The kind and amount of pesticide used is important. Use the proper dosage of the safest material that will give good pest control. Read the label and follow the approved local, state and federal recommendation.

Identify the location of any hives near the field being treated. When using materials hazardous to bees, notify beekeepers so they can protect their bees.

With few exceptions, dusts are more hazardous to honey bees than sprays.

Generally, application by airplane is more hazardous to bees than by ground equipment.

Treating large areas and repeating applications may cause greater bee losses.

Avoid leaving puddles when the sprayer is emptied or cleaned. Large numbers of bees often visit such puddles for drinking water.

Time of application is important and depends on bloom period and attractiveness of crop. Treatments when bees are foraging in the field are usually the most hazardous. Treatments over colonies in hot weather, when bees are clustering on the outside, may cause severe losses. Treatments during the night and early morning before bees are foraging are the safest.

Treating a nonblooming crop with a hazardous material when cover crops, weeds, or wild flowers are in bloom in the field or close by may cause heavy bee losses. Drift of pesticides to neighboring fields attractive to bees also may cause losses.

Location of bees is important. Colonies located in fields being treated may sustain more losses than colonies outside the treated area at the edge or away from the field. Colonies moved into a field after treatment may escape damage. Farmers and applicators must make a special effort to protect bees to insure the continued availability of this important insect.

Precautions for beekeepers

Choose apiary sites as far away as practical from where pesticides will be applied.

Place your name, address and phone number on your hives so that you can be contacted by concerned parties.

When selecting a site get permission from the farmer and determine the pesticide schedules your apiary may be exposed to.

Selection, Operation, Adjustment and Care of Spray Equipment

Preparation of Spray Equipment

Before any pesticide can be sprayed accurately, the volume of liquid discharged per acre must be determined under field conditions. Gallons per acre applied depends on (1) nozzle orifice size, (2) pressure at the nozzle, (3) sprayer ground speed, (4) nozzle spacing and (5) viscosity of the liquid being sprayed. A variation of any factor will vary the application rate.

Preparation of a sprayer for calibration should include the following management and maintenance operations or steps:

_ Select an operating speed that can be maintained to suit the field surface and crop condition.

_ Select nozzle sizes that deliver the desired flow rate at the selected ground speed.

_ Select tips that deliver the desired droplet size range. To reduce drift to sensitive plants, apply herbicides with low pressure (under 40 psig) and larger droplet size. PSIG is pounds per square inch as read from a pressure gauge. Use high pressure (60 psi or more) for small drops to get penetration and more complete coverage of crop foliage with insecticides and fungicides.

_ Remove and clean all nozzle tips and screens. Use an old toothbrush or a wood toothpick as they will not damage shape or size of orifice. Do not use a pocket knife or wire on tips. Remove and clean suction strainer screen.

_ Add clean water to the supply tank; start pump and flush hoses and boom.

_ Reassemble all screens and tips. Make sure that all tips are the correct size and type for the desired spray pattern. Check all connections for leaks. Check the sprayer at field pressure for uniform flow from all nozzles, using a calibrated cup or flow meter.

_ Adjust the pressure relief valve to about 15 PSI above the spraying pressure. Slowly open the agitation line control valve until the gauge pressure drops to the desired spraying level. All pump output that is not discharged through the spray nozzle recirculates through the venturi jet agitators or the relief valve. One jet agitator is usually sufficient for tanks up to 100-gallon capacity; use two in larger tanks.

Sprayers

Most field sprayers use hydraulic pressure nozzles ranging from low-to high-pressure. Sprayers are mounted, pull-type, or self-propelled. Basic components are tank, pump, pressure regulator and gauge, agitator, hoses, valves and fittings, and nozzles. Figures 1 and 2 show the two most common types of sprayer systems, roller pump and centrifugal pump systems.

Roller Pump Sprayers

Roller pumps are constant volume so the plumbing pressures are controlled by a pressure relief valve or regulator, which bypasses excess flow back to the tank, Figure 1. The sprayer nozzle design determines the primary flow required while the tank agitation and future wear (pump slippage) factors provide the secondary pump flow requirement. Roller pumps must be carefully sized to avoid excess fluid recycling. A hand control valve allows operator adjustment of agitation flow. A strainer is used ahead of the pump to protect against damage; a second strainer after the pump filters smaller particles that may plug nozzle orifices.

Centrifugal Pump Sprayers

Centrifugal pumps generate flow and pressure by centrifugal force by creating a low pressure at the center and a high pressure at the outer edge of the pump impeller wheel. Since it operates on a pressure differential basis to generate flow, it is not a close tolerance device and requires no strainer between tank and pump inlet. A down stream strainer is used to protect nozzles. Figure 2 shows the strainer at the outlet of the pump; it could also be placed between the bypass or agitation line control valve and the throttling valve to reduce the volume of material that it handles, as the bypass line handles all flow not required by the boom nozzles.

For more detailed information on sprayers or components, see OSU Fact Sheets:
No. 1215 - Selecting the Proper Nozzle Type and Size for Low Pressure Ground Sprayers
No. 1216 - Calibrating a Low Pressure Sprayer
No. 1217 - The Low-Pressure Ground Sprayer
No. 1218 - Pumps for Low Pressure Ground Sprayers.

Figure 1. Roller Pump Spraying System

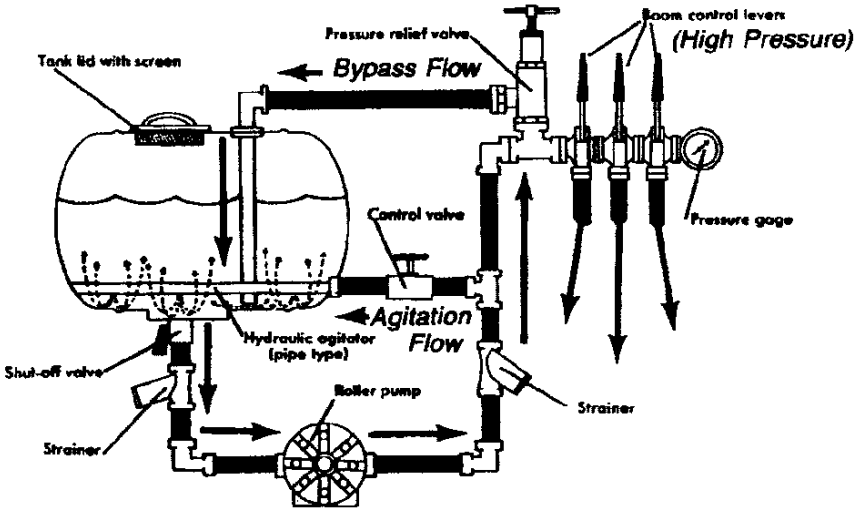
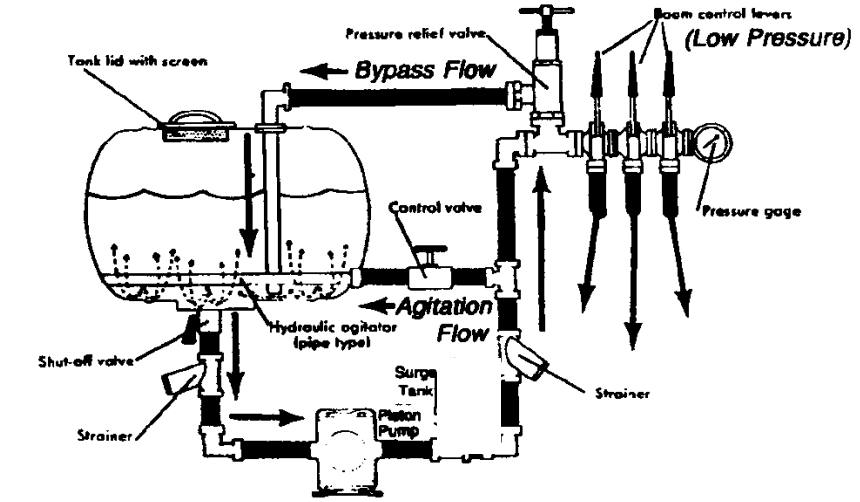


Figure 2. Centrifugal Pump Spraying System



Tanks

Factors to consider in sprayer tanks are size, resistance to chemical corrosion, and ease of filling and cleaning. A tank should be: (1) large enough that it does not require frequent refilling; (2) easy to fill and clean; (3) shaped suitably for mounting and effective agitation; (4) corrosion-resistant; (5) designed with adequate openings for pump and agitation connections.

Volume levels should be clearly marked on the tank. If the tank is not transparent, it should have a protected sight gauge, with a bottom safety shutoff valve, for determining fluid level. The top opening cover should be well sealed but large enough to allow easy cleaning. A bottom drain should allow the tank to be emptied completely. Tanks should be made from fiberglass, cross-linked polyethylene, or stainless steel.

Pumps

Roller, piston, or centrifugal sprayer pumps supply pressure and constant flow to nozzles, agitation to the supply tank, and must be corrosion resistant. Table 1 summarizes pump design characteristics.

Roller Pumps

Roller pumps, Figure 3, are low cost, easy to repair, positive displacement self-priming pumps that operate well at direct drive PTO speeds. They can be selected with a range of capacities ranging from 5 to 30 GPM for farm or field sprayers. They are capable of operating at pressures of 150 to 300 psig.

Table 1. Characteristics of Common Agricultural Pumps

	Roller	Centrifugal	Piston
Materials handled	Emulsions, non-abrasives	Any liquid	Any liquid
Relative Price	Low	Medium	High
Durability	Wear reduces pressure and flow	Long life	Long life
Pressure ranges (PSI)	0-300	0-60	0-1000
Operating speed (RPM)	300-1000	2000-4500	600-1800
Flow rates (GPM)	3-30	3-120	3-60
Advantages	Low cost, easy to service, PTO speed operation, easy to prime	Handles all liquid materials, high volume, long life	High pressure, wear resistant, handles all liquid materials, self priming, ground driven
Disadvantages	Short life if material is abrasive, relative low volume, not self-priming	Low pressure, not self-priming, needs drive speedup, or hydraulic drive	High cost, needs surge tank

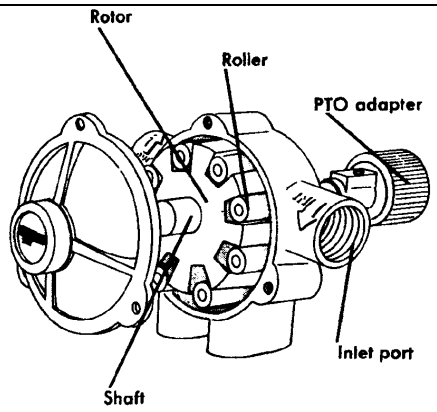


Figure 3. Typical Roller Pump (Cutaway)

Nylon or teflon rollers provide the best chemical resistance, rubber rollers are suitable for water and wettable powder slurries at pressures under 100 psig. Polypropyline rollers are superior to nylon or rubber.

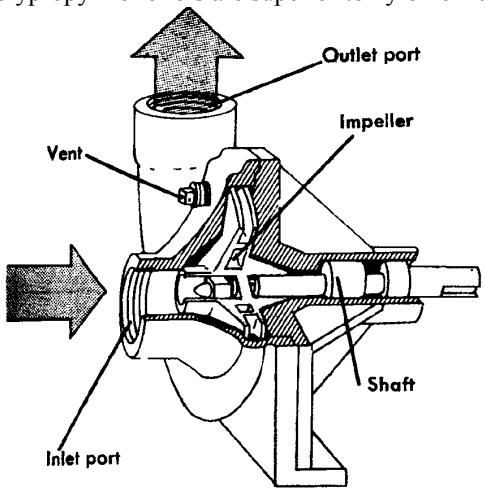


Figure 4. Typical Centrifugal Pump (Cutaway)

Centrifugal Pumps

Single stage centrifugal pumps, Figure 4, are the most popular pumps for low-pressure sprayers. They are simply constructed, durable, and can readily handle wettable powders and mildly abrasive materials. Handling capacities of 30 to 150 GPM with pressures of 30-40 psig to 70 psig at 3,000-4,500 RPM can deliver lower volumes at pressures up to 150 psig. Multistage pumps can provide high pressure at lower speed while maintaining high flow rates but are much more expensive than single stage pumps. Drive options are speed up gear box or belt drives from PTO or high speed hydraulic motors driven by tractor hydraulic systems.

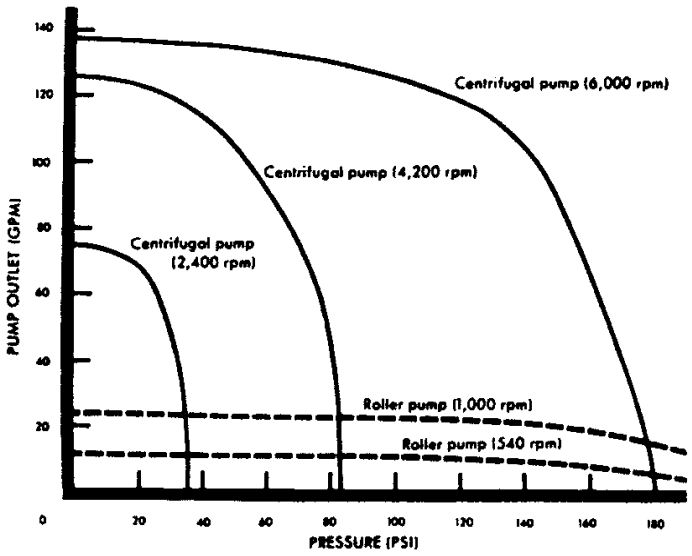


Figure 5.Comparative Pump Performance Curves

Pump Performance

Comparative performance of roller versus hydraulic pumps is illustrated in Figure 5. Roller pumps are constant volume devices across wide pressure range while centrifugal pump capacity varies directly with pressure.

Pump Capacity

Pumps must have sufficient capacity to supply all nozzles, provide hydraulic tank agitation, and offset wear and piping friction.

Sprayer capacity is determined by multiplying gallons per minute (GPM) output of one nozzle by the number of nozzles. If a nozzle has an output of 0.7 GPM and the boom has 20 nozzles, total sprayer output is 20 x 0.7 = 14 GPM. If 8 GPM are recycled for agitation and 30 percent capacity is allowed for wear and slippage, the pump capacity must be (14+8) x 1.30 = 28.6 or approximately 30 GPM.

The amount of pump capacity required for hydraulic agitation depends on the type of agitation used. For a submerged pipe agitator, allow 5 GPM per 100 gal. or 15 GPM for a 300 gal. tank. A venturi jet agitator requires 2-4 GPM per 100 gal.

Pump Maintenance and Care

Deterioration during storage can consume more of the useful pump life than actual spraying use. After each use, thoroughly clean the entire plumbing system to remove all dirt and chemical residue, before storage.

If the sprayer *has no rubber parts* (gaskets, diaphragms, hoses, or pump rollers) a small volume of motor oil (for example: SAE 10W40) should be run through the pump after the final flushing to leave a protective coating on the inside of the pump and plumbing. In sprayers *with rubber components*, use automotive antifreeze with a rust inhibitor as a coating to protect against corrosion and freezing; antifreeze can be used in all types of sprayers.

Agitation Sprayers

Agitation requirements depend on the formulation of the chemical. Soluble liquids and powders do not require special agitation in solution. Emulsions, wettable powders, and liquid and dry flowables may separate if not continuously agitated. Separation causes the pesticide spray concentration to vary greatly, resulting in uneven control.

Mechanical agitators are propellers or paddles shaft mounted near the bottom of the tank operated at 100 to 200 RPM, generally used in tanks over 500 gal. when the primary material is a wettable powder, or on sprayers equipped with piston pumps.

Hydraulic agitation, commonly used in low pressure ground and aircraft sprayers involves discharging part of the pump output from the pressure side of the pump (*not* from the pressure relief by-pass) through tube openings along the tank bottom or through special venturi injector agitator nozzles.

A flow of 5 GPM per 100 gal. for orifice jet agitators or 2 to 4 GPM per 100 gal. for venturi jet agitator nozzles is adequate.

Hoses

Hoses must be (1) properly sized, (2) flexible, (3) durable, and (4) resistant to sunlight, ozone, oil, chemicals, and general abuse such as twisting, pulling, shock load or "hydraulic hammer," and vibration. Suitable materials are ethylene vinyl acetate (EVA) and ethylene propylene dione monomer (EPDM).

Peak pressures occur as the sprayer shuts off; sprayer hoses and fittings must be kept in good condition to prevent ruptures and personnel injury. Suction hoses must be airtight, noncollapsible, short as possible, and have the same I.D. as the pump intake. Collapsed suction hoses restrict flow and "starve" or cavitate a pump, damaging seals and impellers.

The lines between pressure gauge and nozzles should be as straight and short as possible, with minimum restrictions. Proper line sizes vary with sprayer size and capacity. Fluid velocities of 5 to 7 feet per second should be maintained throughout the system so that the pesticide will not settle out and clog the system. If lines are too small, excessive pressure drops will occur. Suggested hose sizes for various pump flow rates are listed in Table 2.

Table 2. Hose Sizes

Pump Output (GPM)	Suction*	Pressure
0 to 6	0.75"	0.5"
6 to 12	0.75	0.625
12 to 25	1.00	0.75
25 to 50	1.25	1.00
50 to 100	1.50	1.25

* or pump suction inlet diameter

Strainers

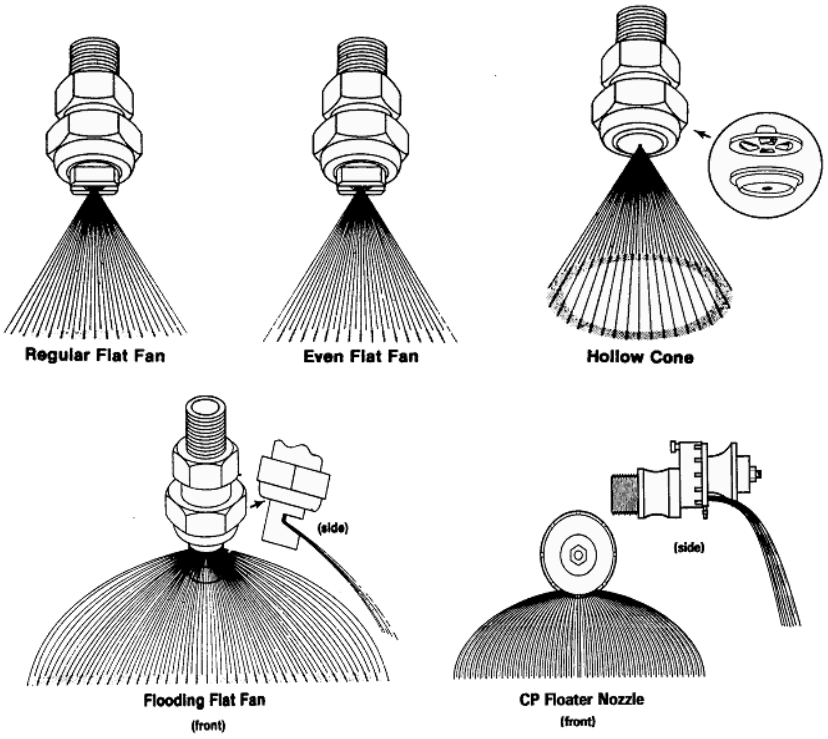
Strainers are classified by mesh numbers which indicated the number of openings per square inch. Strainers with high mesh numbers have smaller openings than strainers with low mesh numbers; 50-mesh strainers catch smaller particles than 20-mesh strainers. A 16- to 20-mesh tank-filler strainer should be used.

Sprayers equipped with roller pumps need a 40- to 50-mesh suction line strainer between the tank and pump to prevent rust, scale or other material from damaging the pump. Suction-line strainers are not recommended for centrifugal pumps as restriction of the suction line causes loss of pressure control and possible pump damage; if a suction-line strainer is used, it should be no smaller than 20-mesh, be cleaned frequently, and have an effective straining area several times larger than the cross-section area of the suction line. A 50-mesh line strainer should be located on the pressure side of the pump to protect spray and agitation nozzles.

Nozzle strainers (50-100 mesh) are used at flow rates less than 1 GPM. For nozzle flow rates above 1 GPM, nozzle strainers are usually not needed if a line strainer is used.

Nozzles

Nozzle selection is one of the most important pesticide application decisions. The nozzle type determines volume and uniformity of the applied spray, the target surface coverage, and the amount of drift. Each nozzle type has specific characteristics designed for specific uses. Figure 6 illustrates the common spray nozzle patterns.



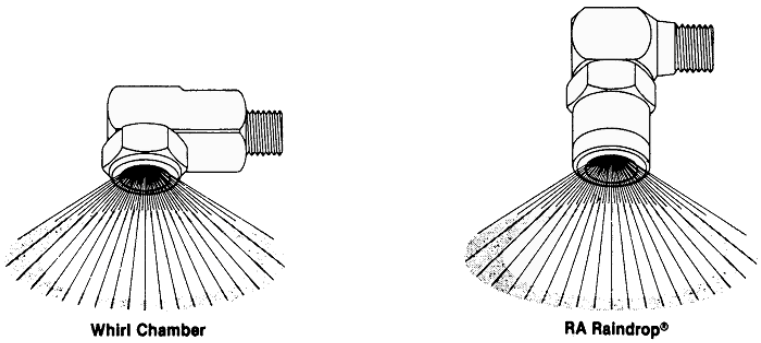


Figure 6. Nozzle Spray Patterns

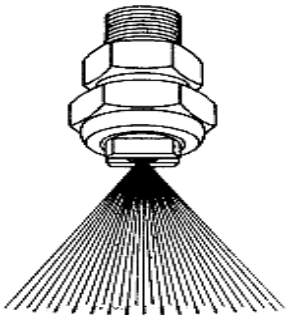
Nozzle Types

1) **Regular flat-fan nozzles** produce a flat oval spray pattern with tapered edges. They are available in spray-fan angles of 65, 73, 80 and 110 degrees and are usually spaced 20 inches apart at a height above ground of 10-23 inches, depending on nozzle spray angle. Nozzle heights for the various angles are shown in Table 3.

Table 3.Flat Fan Nozzle Heights (20" Spacing)

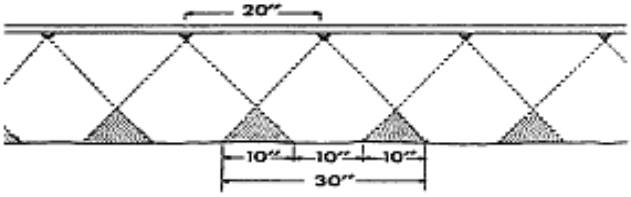
Spray Angle (degrees)	Nozzle Height (inches)
65	21-23
73	20-22
80	17-19
100	10-12

The normal pressure range of 15 to 30 PSI for regular flat-fan nozzles produces medium to coarse drops that drift less than finer drops produced at pressures above 40 PSI. The outer edges of flat-fan nozzle spray patterns have reduced volumes so adjacent nozzle patterns along the boom must be overlapped 30 to 50% to obtain uniform coverage, Figure 7. The regular flat-fan nozzle is used for broadcast herbicide.



Regulator Flat Fan

Flat Fan Spray Overlap (50%)



Flooding Nozzle Spray Overlap (100%)

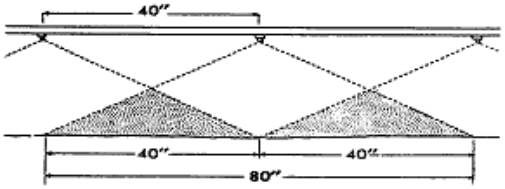


Figure 7.Boom Nozzle Spray Pattern
Overlap Based on Nozzle Type, Nozzle Spacing, and Boom Height.

2) **Even flat-fan nozzles** apply uniform coverage across the entire width of the spray pattern; these nozzles are used for banding chemicals over the row at pressures of 15 to 30 PSI. Band widths are controlled by nozzle height, Table 4 and Figures 8, 9 & 10.

Table 4.Even Flat-Fan Nozzle Heights

Band Width (inches)	Nozzle Height (inches)	
	80 degree	95 degree
8	5	4
10	6	5
12	7	6
14	8	7

3) **Flooding flat-fan nozzles** produce a wide-angle flat-fan pattern used for herbicides or herbicide and liquid fertilizer mixtures, usually at nozzle spacings of 40 inches and from 10 to 25 PSI for maximum effectiveness, drift control, and spray pattern width variation. The pattern is not as uniform as regular flat-fan tips so this nozzle is usually mounted to obtain double coverage or 100% overlap. Flooding nozzles are mounted to spray straight down, straight back, or in between. The most uniform coverage is obtained with the spray at about a 45° angle, Figure 8.

Flooding Nozzle Operating Positions

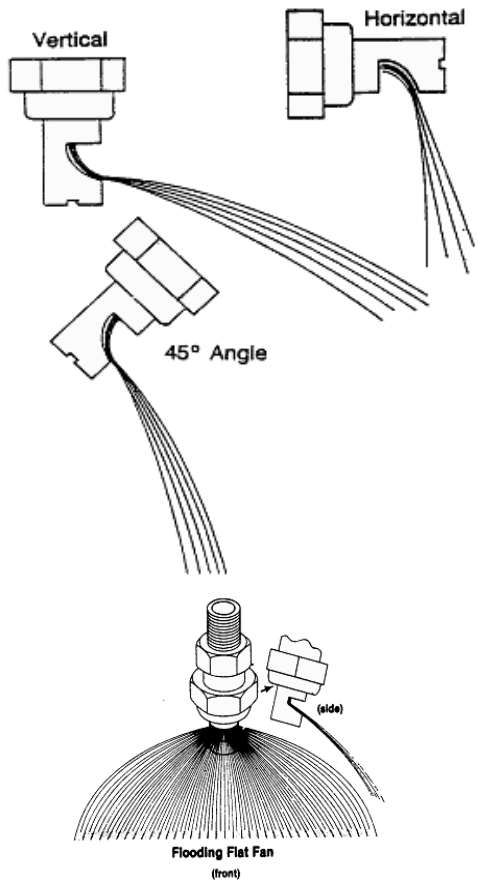


Figure 8. Flood Nozzle Angles

4) **Cone nozzles** are used primarily for plant foliage penetration to get effective insect or disease control, Figure 9.

Pressures of 40 to 80 PSI produce small droplets that penetrate plant canopies and more effectively cover the underside of the leaves than other nozzle types. These nozzles are used on aircraft at lower pressures because of core and orifice sizing options. They should not be used for broadcasting herbicides where drift is a problem.

Solid-cone nozzles produce a uniform distribution throughout the pattern; *hollow-cone* nozzles concentrate the spray around the pattern edge.

Two designs of hollow-cone nozzles are the Whirljet (Spraying Systems) and the Raindrop (Delavan). The Whirljet nozzle produces a fan angle of up to 140 degrees with pressures of 5 to 20 PSI and is used primarily on herbicide incorporation. Raindrop nozzles produce large droplets at pressures of 20 to 60 PSI. The "RA" Raindrop nozzle is used for herbicide incorporation, and the "RD" Raindrop nozzle for foliar spraying. When used for broadcast, Raindrop nozzles should be rotated 30 to 45 degrees from horizontal for best distribution.

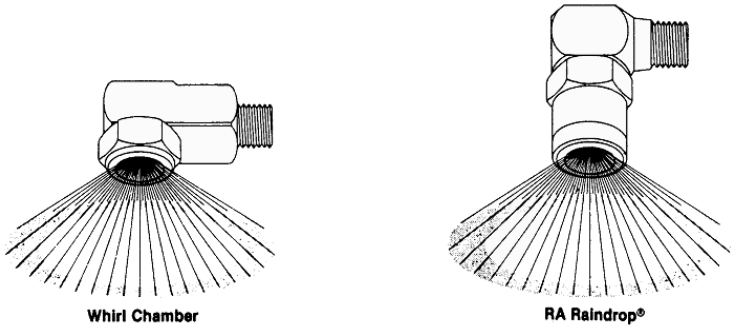


Figure 9. Whirljet and Raindrop Cone Nozzles

5) **CP nozzles (floater, tractor and aerial).** CP multi-port spray deflector nozzles are available in three designs. *Aerial* nozzles with a 30 or 90 degree deflector and four orifice sizes provide droplet size change over a volume range of 1 to 12 gpa. *Ground sprayer* nozzles have six orifices (TK1-TK10) for low volume spraying. *Floater* nozzles have eight orifices (TK5-TK60) for high volumes. Both ground nozzles have a fixed spray deflector. Horizontal nozzle spray orientation is about 45 degrees from horizontal. Quick volume change with orifice change plus shut-off is their major advantage.

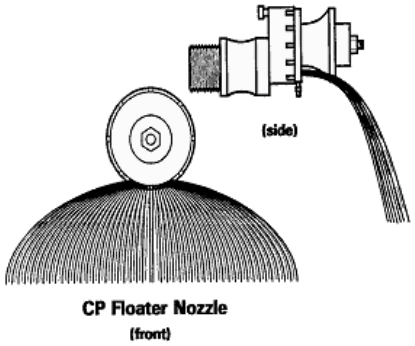


Figure 10. CP Nozzle

6) **Broadcast (boomless, cluster or pasture) nozzles** are used for wide swath work of 30 feet or more where a boom sprayer is impractical. These nozzles may be single nozzles or clusters, Figure 10. Spray droplet sizes vary and coverage is not uniform. Spray patterns are greatly affected by wind; these *nozzles are not suitable for precision application or where drift may cause damage*.

Broadcast nozzles produce small droplets immediately under the nozzle, but extremely large droplets may be deposited near the outer edge and at intermediate points in the swath. Broadcast nozzles are sometimes added to the end of spray booms to extend effective widths of booms where precision or full coverage is needed, such as fencerows, roadsides, and rough terrain where booms will not work.

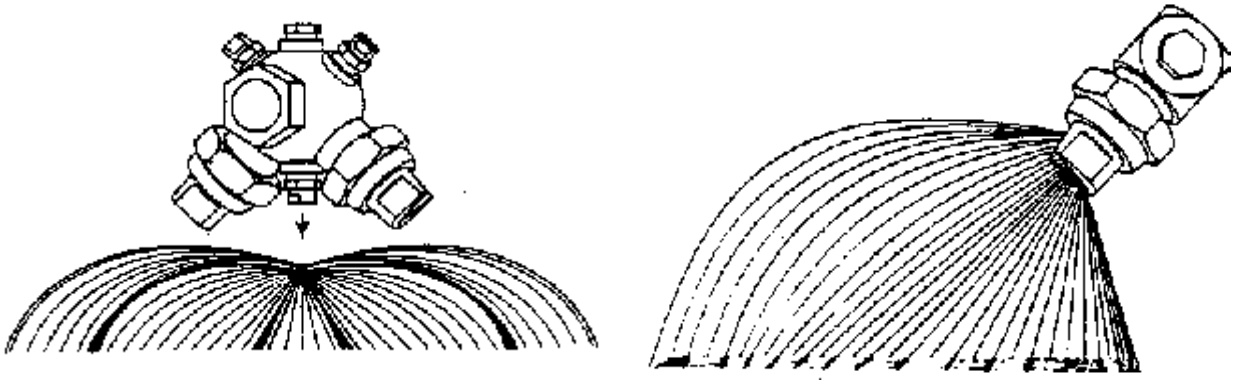


Figure 10. Broadcast (boomless, cluster or pasture) nozzles.Figure 10.Broadcast (off-center or right-of-way) nozzle.

Check and clean suction, line, and nozzle strainers every 3-5 days. Partially plugged strainers create pressure drops, may reduce the nozzle flow rates, and can cause pump damage. To minimize clogged strainers, use clean or filtered water.

Nozzle orifices are precisely machined to close tolerances. Use a wooden toothpick or toothbrush to clean clogged nozzles. Cleaning with metal objects may damage the orifice and drastically affect the nozzle's output and pattern.

Tank Cleaning

To remove residues of oil-based herbicides, such as esters of 2-4 D, rinse the sprayer with one gallon of kerosene or diesel fuel (not gasoline) to 25 gallons of water.

After flushing with the oil-water mixture or for cleaning other types of chemicals, fill the tank about half full with water and add one pound of biodegradable household detergent for every 50 gallons of water in the tank. Circulate the detergent solution through the sprayer for a few minutes (including the upper part of the tank walls) and then flush it all out through the boom. Then fill the tank ¼ to ½ full of a water-ammonia solution, one quart of household ammonia to 25 gallons of water. Circulate the water-ammonia solution through the sprayer for a few minutes, pumping a small amount of spray out through the nozzles. Allow the remainder of the solution to stand at least 6 hours, then pump it out through the nozzles. Remove the nozzles and strainers, and flush the system twice with clean water.

For disposal, rinse water can be sprayed on a field that is cleared for that pesticide.

If the sprayer is to be stored for a period of time, add antifreeze or rust inhibitor to a small amount of water and pump it through the sprayer. This will help prevent rust and corrosion inside the pump and plumbing. Store the sprayer in a dry building.

For certain pesticides, the label provides specific cleaning directions. Read the label to ensure that the sprayer is properly cleaned. Not properly cleaning a sprayer can lead to damage of crops treated later with other pesticides.

Calibrating a Low Pressure Sprayer

Calibration is the process of adjusting spray equipment to uniformly apply the desired rate of chemical. Proper procedure for calibrating a sprayer involves: (1) selecting the correct nozzle type and tip size; (2) setting correct nozzle spacing, orientation and height; (3) adjusting boom pressure until the nozzle's output is correct; (4) maintaining the proper ground speed. Three variables affect calibration:

Nozzle Flow Rate - The nozzle *flow rate* varies with the orifice and swirl plate sizes, and the nozzle pressure. Installing nozzles with larger or smaller orifices (and/or swirl plates) is the most efficient way to change the sprayer's output. Changes in nozzle pressure is only used to make small increases or decreases in sprayer output due to nozzle wear or minor changes in application rates. A 4-fold pressure increase is required to double nozzle flow. To increase from .28 GPM at 20 PSI to .56 GPM, 80 PSI pressure is required, Figure 11.

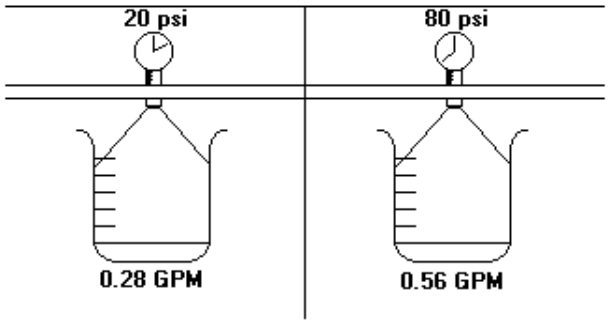


Figure 11. In order to double the output of an orifice the pressure must be increased four times.

Ground Speed - Spray application rates vary *inversely* with the ground speed. Doubling ground speed reduces gallons per acre (GPA) by half. A sprayer calibrated at 4 MPH but operated at 3 MPH, oversprays by 33%, significantly increasing chemical costs and crop damage potential.

Sprayed Width Per Nozzle - The effective width sprayed per nozzle also affects the spray application rate. Doubling the effective spraying width per nozzle decreases the gallons per acre (GPA) by half. If the sprayer is applying 20 GPA on 20-inch spacings, a change to 40-inch spacings decreases the rate to 10 GPA.

Precalibration Checks

Before calibration, service the entire sprayer and check for uniform nozzle output and pattern.

Servicing - Clean all lines and strainers, making sure strainers are the correct size for the nozzle tip and chemical formulation. Inspect all hoses and hose clamps for aging, damage or leaks. Check the pressure gauge for proper operation, pressure, and zero gauge reading when pump is off. Repeatability is as important as gauge accuracy. *Check the gauge against an accurate gauge at least annually.*

Nozzle Output and Pattern - Install the correct nozzle tips, then check for uniformity of nozzle output, spray angles, spacing and height by operating the sprayer with clean water at field pressure. Catch a timed sample from each nozzle to see whether all nozzles flow evenly. Replace nozzle tips that vary more than + or - 5% from the output of the average of all nozzles; also check fan angle and spray patterns of all nozzles.

To determine if a spray pattern is uniform or the boom is at the proper height, spray water on a warm dry paved road or parking lot and observe the drying pattern. If the pattern is not uniform, some strips will dry slower or faster than others.

Measuring Ground Speed

To apply pesticides accurately, ground speed must be uniform. Field conditions such as surface roughness, softness, soil moisture and slopes affect ground speed and application rates. Tractor speedometers and tachometers are not a good measure of ground speed as wheel slippage and changes in tire size can result in errors of 15-25% or more. To maintain a constant ground speed, use a sprayer speedometer run off a nondriven wheel; these are available from spray equipment manufacturers for $100-$250. Sprayer monitors can also be set to accurately measure ground speed.

An alternate method for establishing constant ground speeds is to measure and record (calibrate) the speed of the sprayer at several throttle and gear settings in the field to be sprayed. (Stake out 200 feet for speeds up to 10 mph, and 300 feet or more for speeds above 10 mph. For each engine throttle and gear setting used, record the travel time between stakes in each direction with the sprayer at least half full of clean water using a running start. Average the two times and use the following equation or Table 5 to determine ground speed:

$$\text{Speed (MPH)} = \frac{D \times 60}{T \times 88}$$

where: "D" is the measured distance between stakes, "T" is *average* travel time *in seconds* between stakes, "60" = seconds, "88" = feet (1.0 MPH = 88 feet in 60 seconds).

Table 5. Ground Speed vs. Distance Traveled

Ground Speed (MPH)	3	4	5	6	7	8	9	10
Time to travel 200 feet (sec)	45		342723			19171514		
Time to travel 300 feet (sec)	68		514134			29262320		

Ground Sprayer Calibration Process

The actual calibration of a field sprayer involves three important factors to determine if:

1. Correct nozzle specifications (tips, height, spacing, and orientation) are being used.
2. The sprayer is applying the correct GPA of chemical.
3. Nozzle volumes are uniform.

Determining Sprayer Output One of the most effective methods for checking sprayer volume is the *nozzle output method*, which is done with the sprayer stationary. To use this method the sprayer output in GPM, ground speed (MPH), and spray width per nozzle must be determined as follows:

1. GPM - Operate the sprayer with water at the correct pressure. Use a calibrated measuring cup or bottle showing liquid ounces) and a stop watch or a watch with sweep second hand or digital seconds. Collect the output of each nozzle in the container for 1 minute. Determining the average number of ounces per minute (OPM) of output *for each nozzle*, then compute the GPM/nozzle using Equation 1 below.

2. MPH - Select the ground speed, normally 3-8 MPH, at which the sprayer is to be operated.

3. WIDTH - Determine the sprayed width per nozzle (W), in inches. For broadcast spraying, "W" equals the distance between nozzles. For band spraying, "W" equals row spacing or band width divided by the number of nozzles per row or band.

Once these three values are known, the sprayer's output in gallons per acre (GPA) can be calculated using Equation 2:

$$GPM = \frac{OPM}{128 \text{ oz/gal}} \qquad \text{(Eq. 1)}$$

$$GPA = \frac{GPM \times 5940}{MPH \times W} \qquad \text{(Eq. 2)}$$

where: "GPM" - nozzle output determined in Eq. 1;
"GPA" - sprayer's output in gallons per acre;
" "5940" is a constant;
"MPH" - ground speed selected in Step 2;
"W" - sprayed width (in inches) per nozzle from Step 3.

Example: What is the application rate, GPA, for a sprayer set up to broadcast herbicides with regular flat fan nozzles spaced 20 inches on center. Ground speed = 5 MPH. The average output per nozzle - 54 OPM.

$$GPM = \frac{54 \text{ OPM}}{128 \text{ oz/gal}} = 0.42$$

$$GPA = \frac{0.42 \times 5940}{5 \times 20} = \frac{2500}{100} = 25$$

Under these conditions the sprayer will apply 25 GPA. If this is not the application rate desired, one or more conditions must be changed. Small changes can be made by increasing or decreasing the nozzle pressure, within recommended operating pressure range limitations of the nozzle type. Larger changes should be made by changing ground speed or switching to larger or smaller nozzle tips.

Calculating Application Rates

Two calibration methods are listed for use with broadcast and band treatments.

Row or Band Method

1. For *broadcast spray* applications use nozzle spacings for "W"; for *band* applications use band widths. Use Table 6 to select the calibration distance.
2. From Step 1, Table 6, stake the distance in the field to be sprayed. Clock the number of seconds the partially filled sprayer takes to cover this distance with the gear and throttle setting (RPM) selected for spraying. Make several runs over the distance and average the time it takes. Record the throttle setting and gear used.

Table 6. Row Width vs. Calibration Distance

Row or Band Width or Nozzle Spacing

inches	**48**	**40**	**38**	**36**	**34**	**3230**
Calibration Distance (ft) 85	102	107	113	120	128	136

Row or Band Width or Nozzle Spacing

inches	**28**	**24**	**20**	**18**	**16**	**1410**
Calibration Distance (ft) 146	170	204	227	255	292	408

3. With the sprayer stationary, engage the power take-off and set the RPM at the spraying setting. Set the sprayer at the recommended nozzle pressure.
   Broadcast: Collect the spray from several nozzles; check each for the time recorded in Step 2.
   Average the output. The average number of *ounces*
   collected per nozzle *equals* the number of *gallons per acre per nozzle.*
   Banding: Collect the spray from all nozzles used to spray the band (i.e., two nozzles per band) collect the total from the two nozzles); the amount collected in *ounces equals gallons per acre* (GPA) *per band*.
4. Multiply GPA per nozzle or per band times the number of nozzles per bands per sprayer swatch to obtain total GPA for the sprayer.
5. Divide your tank capacity by the GPA determined in Step 4 to find the number of acres per tank.
6. Multiply the recommended rate per acre by the number of acres per tank (Step 5) to find how much chemical to add to the tank.

Tank Volume Method

1. Measure off one-eighth mile (660 feet or 40 rods) in the field to be sprayed.
2. Start with the *tank full* of clean water. Spray the test run of one-eighth mile, using the spray pressure and tractor speed that will be used in actual spraying. Record the throttle and gear setting used.
3. Refill the tank, carefully measuring the amount of water required. Repeat and average two passes for "gallons used."
4. Broadcast application calculation:
   $$GPA = \frac{\text{Gallons Used} \times 66}{\text{Feet of Spray Swath Width}}$$
5. Band application calculation:
   $$GPA = \frac{\text{Gallons Used} \times 66}{\text{Band Width (inches)} \times \text{No. Bands}}$$
6. Divide capacity of spray tank by the GPA (Steps 4 or 5) to find the number of acres per tank.
7. Multiply the recommended chemical rate per acre by the number of acres per tank (Step 6) to determine how much chemical to add to the tank.

Calibration of Fertilizer Distributors and Granular Pesticide Applicators

- Measure and stake 100 ft in the field.
- Drive equipment in the field with all soil tools working to achieve normal speed with normal wheel slippage for the 100 measured ft while collecting the fertilizer or pesticide for one row (or a specific width of coverage). Compare the quantity collected to the quantities in Tables 7 and 8 under the row width (or coverage width) to determine the application rate in lbs/A.

Table 7. Fertilizer Rate Table

Rate	Pounds per 100 foot of row				
lbs/A	24-in row	30-in row	36-in row	42-in row	48-in row
100	0.5 lb	0.6 lb	0.7 lb	0.8 lb	0.9 lb
200	0.9	1.1	1.4	1.6	1.8
300	1.4	1.7	2.1	2.4	2.8
400	1.8	2.2	2.8	3.2	3.7
500	2.3	2.8	3.4	4.0	4.6
600	2.8	3.4	4.1	4.8	5.5
700	3.2	3.9	4.8	5.6	6.4
800	3.7	4.5	5.5	6.4	7.3
900	4.1	5.1	6.2	7.2	8.3
1000	4.6	5.6	6.9	8.0	9.2
1100	5.1	6.2	7.6	8.8	10.1
1200	5.5	6.7	8.3	9.6	11.0
1300	6.0	7.3	9.0	10.4	11.9
1400	6.4	8.0	9.6	11.2	12.6
1500	6.9	8.6	10.3	12.1	13.8

Table 8. Granular Pesticide Rate Table

Rate	Grams per 100 feet of row				
lbs/A	24-in row	30-in row	36-in row	42-in row	48-in row
5	10 gm	13 gm	16 gm	18 gm	21 gm
6	13	16	19	22	25
7	15	18	22	26	29
8	17	21	25	29	33
9	19	23	28	33	38
10	21	26	31	36	42
12	25	31	37	44	50
15	31	39	47	55	62
20	42	52	62	73	83
25	52	65	78	91	104
30	63	78	93	109	125
40	83	104	125	146	167
50	104	130	156	182	208
60	125	156	187	218	250
75	156	195	234	273	312

Calculation of Spray Percentage

Pesticide rates are expressed as a percent spray solution, i.e., 0.5% spray. When determining the quantity of pesticide needed to make a certain percent spray solution the following information is needed: (1) the percent active ingredient (AI) of the pesticide, (2) the number of gallons of spray, and (3) the percent spray solution desired.

To figure the amount of a *wettable powder* (WP) required for a given percent of spray mixture, multiply the percent spray solution wanted by 8.33 (lbs/gal of water) times the number of gallons of spray, divided by the percent of AI. (Use 8.0 lb/gal of water to simplify math; this changes final answers by 4%).

Example: How much 50% WP should be added to 100 gal of water for a 0.5% spray solution?

$\frac{0.5\% \times 8 \times 100}{50\%}$ = 8 lb of 50% WP per 100 gal

For an *emulsifiable concentrate* (EC) multiply the percent spray solution wanted by 8.0 lbs/gal times the number of gallons of spray, divided by the pounds of active ingredient (AI) x 100.

Example: How much EC at 4 lb of AI per gallon is needed for 50 gal of 0.5% spray solution?

$\frac{0.5\% \times 8 \times 50}{4 \times 100}$ = 0.5 gal or 2 qt of EC per 50 gal

Spray mixing and sprayer calibration require the use of measuring equipment. In collecting spray from nozzles and measuring liquid concentrates, use a container marked in ounces. For weighing wettable powders, use a small scale (10-lb capacity) marked in pounds and ounces.

Warning!: Any liquid or powder pesticide volume measuring equipment should not be used for any other purpose. Measuring containers should be labeled "FOR PESTICIDE USE ONLY."

PESTICIDE DILUTION CHARTS

Table 9. Dilution chart for pesticide concentrates for various rates of application per acre.

Pesticide Concentrate	Amount concentrate needed to apply the following amounts of active ingredients (AI) per acre: 0.125 lb	0.25 lb	0.5 lb	0.75 lb	1 lb
Dust					
1% Dust	12.5 lb	25 lb	50 lb	75 lb	100 lb
5% Dust	2.5 lb	5 lb	10 lb	15 lb	20 lb
10% Dust	1.25 lb	2.5 lb	5 lb	7.5 lb	10 lb
Wettable Powders					
25% WP	0.50 lb	1 lb	2 lb	3 lb	4 lb
40% WP	0.33 lb	0.66 lb	1.25 lb	1.9 lb	2.25 lb
50% WP	0.25 lb	0.50 lb	1 lb	1.5 lb	2 lb
75% WP	0.17 lb	0.33 lb	0.66 lb	1 lb	1.33 lb
Emulsifiable Concentrates					
10-12% EC=1 lb AI/gal	1 pt	1 qt	2 qt	3 qt	1 gal
15-20% EC=1.5 lb AI/gal	0.33 pt	0.66 pt	1.33 qt	2 qt	2.66 qt
21-25% EC=2 lb AI/gal	0.50 pt	1 pt	1 qt	3 pt	2 qt
40-45% EC=4 lb AI/gal	0.25 pt	0.50 pt	1 pt	1.5 pt	1 pt
40-57% EC=5 lb AI/gal	0.20 pt	0.40 pt	0.80 pt	1.20 pt	1.60 pt
58-67% EC=6 lb AI/gal	0.17 pt	0.33 pt	0.66 pt	1 pt	1.33 pt
72-80% EC=8 lb AI/gal	0.125 pt	0.25 pt	0.50 pt	0.75 pt	1 pt

Table 10. Dilution chart for pesticide concentrates for various percentages of mixture.

Concentrate	Amount concentrate needed for 100 gal of water to mix the following percentages of actual ingredient Percentage 0.25%	0.5%	1%	2%	5%
Wettable Powders					
25% WP	8 lb	16 lb	32 lb	64 lb	160 lb
50%	4 lb	8 lb	16 lb	32 lb	80 lb
75% WP	2.66 lb	5.33 lb	10.66 lb	21.33 lb	53.33 lb
Emulsifiable Concentrates					
1 lb AI/gal	2 gal	4 gal	8 gal	16 gal	40 gal
1.5 lb AI/gal	1.3 gal	2.7 gal	5.3 gal	10.7 gal	27 gal
2 lb AI/gal	1 gal	2 gal	4 gal	8 gal	20 gal
4 lb AI/gal	0.5 gal	1 gal	2 gal	4 gal	10 gal

Table 11. Dry weight wettable powders.

1 gal	5 gal	100 gal
0.16 oz	0.8 oz	1 lb
0.32 oz	1.6 oz	2 lb
0.5 oz	2.4 oz	3 lb
0.64 oz	3.2 oz	4 lb
0.8 oz	4 oz	5 lb
1.6 oz	8 oz	10 lb
3.2 oz	16 oz	20 lb

Table 12. Mist blower dilution tables, quantity of emulsifiable concentrate (EC) needed to make a 25X concentrate.

If amount per 100 gal for a high volume Spray is:	Use this amount in a mist blower 25 gal	10 gal	2 gal	1 gal
1 pt	6.25 pt	2.5 pt	8 fl oz	4 fl oz
1 qt	6.25 qt	5 pt	1 pt	8 fl oz
2 qt	3.13 gal	5 qt	1 qt	1 pt
1 gal	6.25 gal	2.5 gal	2 qt	1 qt

Reducing Drift

There are two major reasons why drift should not be allowed from pesticide applications. *First*, the drifting chemical can cause damage to other property, including crops, trees, pasture, as well as contamination of air, water, or soil, and injury to personnel and livestock and if the chemical leaves the target area, effectiveness within the target area is reduced. *Second*, it is illegal for pesticides to drift to non-target sites In Oklahoma, the primary cause is excessive wind.

Several factors cause drift; the cause is not always obvious. Minimizing drift requires a good understanding of these factors and how they relate to each application.

What is Spray Drift?

Spray particle drift is that portion of the spray material that moves off the target area in liquid droplet form during the spraying operation. Liquid particle drift is easier to understand as you can see swirls of mist moved by the wind as a ground or aerial sprayer crosses a field. Pesticide spray can drift great distances from the target area and damage susceptible species.

Major factors affecting drift are droplet size, wind, droplet release height, climatic conditions, and size of area treated (cumulative), Table 13.

Table 13. Drift Factors.

Factor	Less Drift	More Drift
Droplet fall rate		
Droplet size	larger	smaller
Pressure	lower	higher
Orifice size	larger	smaller
Humidity	higher	lower
Wind speed	lower	higher
Release height	lower	higher
Air stability	less stable	more stable (inversion)
Size of treated area (Less total spray)	smaller	larger

Droplet Size

Droplet size is probably the most important drift factor. Research indicates that droplets with diameters in the 200 to 250 micron range give the best combination of application versus drift reduction control. A droplet 800 microns in diameter is approximately the size of a typewriter period. If droplets are too large, the total volume of effective spray material required becomes unreasonable. Droplets under 50 microns float on air currents and have a hard time settling to the target. A droplet with twice the diameter of another has *8 times* the *volume* or mass and *4 times* the *surface*. A smaller droplet will *drift 4-8 times farther* than one twice the diameter.

Broadcast herbicide sprays may contain a droplet size range from 10 to 2,000 microns. Fortunately, if the sprayer is used properly, droplets under 150 microns are a very small percentage of total volume and drift damage is minimal.

Factors used to control the droplet size range on ground sprayers are nozzle (1) pressures, (2) size and (3) type. (*Nozzle orientation* to high velocity airstreams is important on *aircraft sprayers*.) Increasing the pressure reduces the droplet size for a given nozzle.

Generally, pressure should be below 30 PSI at the boom. *Larger nozzle orifices* give bigger droplets. For ground rigs, use at least 5-10 GPA. Nozzle types also affect droplet size on ground sprayers. *Hollow cone* nozzles give the finest spray droplets and the greatest drift. *Flat fan* nozzles, particularly the wider angle types, are next. *Flooding flat fan* or reflector type nozzles at pressures of 10 to 20 PSI give desirable droplet size ranges for minimum drift using ground sprayers.

Thickening agents are beneficial for increasing droplet size and reducing drift, and are recommended for applications where drift may be a problem. Be sure to read the label carefully and use the recommended mixture to keep the sprayer from plugging.

Droplet size has been changed to very fine, fine, medium, coarse, very coarse, and extremely coarse. Nozzles will be identified by either these levels or the volume median diameter droplet the nozzle produces at a set pressure.

Table **SYZ** provides a comparison of droplet sizes for these criteria.

Table 14. Nozzle Classification

	Symbol	VMD	Color	Size Comparison
Very Fine	VF	<150	Red	Human Hair
Fine	F	150-250	Orange	Sewing Thread
Medium	M	250-350	Yellow	Toothbrush bristle
Coarse	C	350-450	Blue	Staple
Very Coarse	VC	450-500	Green	
Extremely Coarse	XC	>550	White	Paper clip

Wind Velocity and Directions

When a spray nozzle discharges liquid into air at initial velocities up to 120 ft/sec or 80 MPH (approximately 40-45 PSI pressure), a wide range of droplet sizes is produced. Larger drops are slowed by air resistance but go directly to the target. Smaller drops are slowed so much by air resistance within a few inches that they "float" to the ground at a constant speed. The smaller the drop the slower it falls. Drops under 150 microns may take from 8 seconds to several minutes to fall 10-12 ft (See Tables 15 and 16). Smaller droplets (10-100 microns) can be carried several hundred feet to several miles horizontally by wind. If the sprayer releases a large number of small droplets in the airstream, susceptible species directly in the wind path of hormone sprays like 2,4-D can receive extensive damage. Be aware of susceptible species in the area, particularly those downwind from the target area. Harmful drift will move farther across open areas than it will through dense foliage.

Even with extreme precautions, it is not advisable to use hormone type sprays in a *ground sprayer* in winds *over 8 mph* or an *aircraft sprayer* in winds *over 5 mph.*

Table 15. Spray Droplet Fall Time and Distance Traveled from Discharge Position vs. VMD and Wind Speed.

S = (H x U) / Vs

S = VDM mass position downwind from the drop position (in meters)
H = drop height (in meters)
U = mean wind speed (in meters per second)
Vs = droplet sedimentation velocity (in meters per second)

U=10 mph = 4.47 m/s 5 mph = 2.2352 m/s 3 mph = 1.34112 m/s H=10 ft = 3.048 m

Droplet Size VMD (microns)	Sedimentation Velocity m/s	10 ft. Fall Time in Still Air	Distance Droplet Travels (ft.) from Release Point during 10-ft. Fall to Center of Peak Deposit; Wind @ 3 mph	5 mph	10 mph
50	0.244	40.9	54.9	91.4	182.9
100	0.886	11.3	15.1	25.2	50.5
200	2.314	4.3	5.8	9.7	19.3
300	3.775	2.7	3.6	5.9	11.8
400	5.350	1.9	2.5	4.2	8.4
500	6.828	1.5	2.0	3.3	6.6

Reference: Quantick, H.R. (1985) Aviation in Crop Protection, Pollution and Insect Control. London: *Collins Professional and Technical Books.*

Table 16. Spray Droplet Fall Time, Distance Traveled and Final Droplet Diameter for Non-Volatile Spray* for Various Discharge Heights and Wind Speeds @ 86°F and 50 percent RH.

Initial Droplet Diameter (microns)	Release height (feet)	Diameter at Impact (microns)	Distance Traveled (feet)	Time to Impact (seconds)	Diameter at Impact (microns)	Distance Traveled (feet)	Time to Impact (seconds)
		5 mph wind			10 mph wind		
50	10	16	2587	397.3	16	5255	400.0
100	10	31	348	58.9	31	750	62.7
150	10	121	54	8.5	121	106	8.1
200	10	186	38	5.7	186	70	5.2
300	10	293	20	3.0	292	41	3.1
400	10	396	14	2.1	395	30	2.3
500	10	496	12	2.0	496	24	1.9
1000	10	998	6	1.2	998	12	1.1
50	15	16	4271	603.2	16	8629	611.1
100	15	31	753	114.4	31	1563	116.1
150	15	101	91	13.1	99	185	13.2
200	15	179	57	8.0	179	109	7.5
300	15	289	32	4.4	289	64	4.5
400	15	393	23	3.2	393	46	3.4
500	15	495	19	2.6	495	37	2.6
1000	15	998	9	1.6	997	20	1.6
50	20	16	6049	816.1	16	>10,000	>700.0
100	20	31	1191	165.8	31	2442	170.4
150	20	48	150	22.5	47	327	24.5
200	20	172	76	10.0	169	155	10.3
300	20	286	44	5.8	285	87	5.8
400	20	391	32	4.3	391	63	4.2
500	20	493	25	3.5	493	51	3.4
1000	20	997	13	2.1	997	26	2.0

***Note:** 2gpa of water containing 0.5 lb/ac non-volatile chemical.

The significant point from Table 17 is that spray droplets below 200 microns are quite susceptible to drifting well out of the target area due to evaporation. In the near future, spray nozzles will be classified based on the spray droplet range for each nozzle type and size. This quantifying data will help aerial applicators in minimizing drift.

Reference: Table values based on computations from the Spray Drift Task Force's Ag Drift Model.

Climatic Factors

Temperature and relative humidity are interrelated in affecting droplet evaporation rate. Evaporation is much more pronounced when water is the carrier than for drops containing an evaporative oil film. As shown in Table 16, a 100-micron water droplet can evaporate to 31 microns at a relative humidity of 50% during a 10 ft fall. A 50-micron droplet falling 5 ft can evaporate to less than half that size in temperatures of 85°F and 20% relative humidity, and be carried several hundred feet off target in a 5 mph wind.

Large droplets can evaporate and reduce in size fast enough to travel considerable distances before reaching the ground. The evaporation rate increases as the temperature increases and relative humidity decreases. For every 20°F rise in air temperature, air relative humidity (RH) decreases by half; 60°F air at 80% RH when warmed to 80°F will be 40% RH. To minimize the effect of evaporation, try to spray when the temperature is under 75°F and the relative humidity is over 70%, i.e., early morning.

Drift damage often occurs from spraying during a temperature inversion, a condition where the air temperature increases with height above the ground. Inversions, stable air conditions with no air turbulence for mixing, are caused by cooling of air close to the soil surface from radiation during the night, leaving a layer of warm air above. Dead calms late at night or early in the morning are often accompanied by temperature inversions.

Under normal climatic conditions air temperature decreases with increased elevation. This is called the *standard lapse rate.* Warmer air near the ground rises and vigorous air mixing occurs as wind currents move horizontally. These conditions are desirable for spraying in low wind conditions. Larger spray droplets fall through the mildly turbulent air and hit the target. Finer droplets, particularly those under 50 microns, evaporate and are carried aloft where they become greatly diffused and degraded by photo decomposition, Table 16.

Avoid spraying when an inversion exists and surface air is not mixing. Droplets under 200 microns in size do tend to be suspended in the inversion layer and partially evaporate; they "hang" in the air and can drift tremendous distances before reaching the ground. During extreme inversions, symptoms of hormone spray damage have been found 50 miles from the target area.

Size of Treated Area

The larger the treated area, the greater the potential volume of pesticide that drifts off the target area. For this reason, air and ground applicators should take all possible precautions to minimize drift. Aerial applicators often treat several thousands of acres in one block. While the volume drifting outside the target area is not directly proportional to the area sprayed, it does increase. A single error or a combination of mistakes can cause extensive damage to susceptible species great distances from the target area.

Measurements

The following pages include methods, tables, figures, and abbreviations used to compute measurements of speed, area, and volumes, related to pesticide applications. Some information is included for general use with no examples of specific application. Other discussion will be made of procedures, such as computing field measurements.

Computing Field Measurement

To compute the area of a field or farm, you must know the lengths of the different sides in whatever unit of measure you are using. For small plots, feet or yard dimensions may be most convenient. For larger areas, rods (16½ ft), chains (66 ft), or miles can be used.

The area of a rectangular field is found by multiplying the length by the width. If a field is 20 rods wide and 60 rods long, it contains 1,200 sq rods. The same field would measure 330 ft wide by 900 ft long and contain 326,700 sq ft (7.5 acres), or 5 chains wide by 15 chains and contain 75 sq chains.

The number of acres in a field is determined by dividing the number of square units by the number of square units per acre, as illustrated below.

(1) $\text{Acres} = \frac{\text{Area in sq ft}}{43{,}560}$

(2) $\text{Acres} = \frac{\text{Area in sq yd}}{4{,}840}$

(3) $\text{Acres} = \frac{\text{Area in sq rods}}{160}$

(4) $\text{Acres} = \frac{\text{Area in sq chains}}{10}$

(5) Acres = Area in sq miles x 640

Measuring

Make measurements in a straight line and keep an accurate record of all distances as well as corners and odd-shaped boundaries. Make a rough sketch of the field before you start, if possible, or as you go along. Label each side as soon as it is measured. A surveyor's chain (66 ft) is a good unit of measure on field size or larger tracts. The number of square chains in an area, divided by 10, gives the number of acres. To measure large areas, two people should each carry a tally. One stake is placed at the start. The leading person sets a stake at each 66-foot interval measured off by the chain. The rear person gathers up the stakes. When the rear person has gathered up 10 stakes, the distance covered by the front person is 10 chains.

Fields of Different Shapes

Rectangular or square-shaped fields are the easiest to measure. Find the area by multiplying the length times the width, Figure 18.

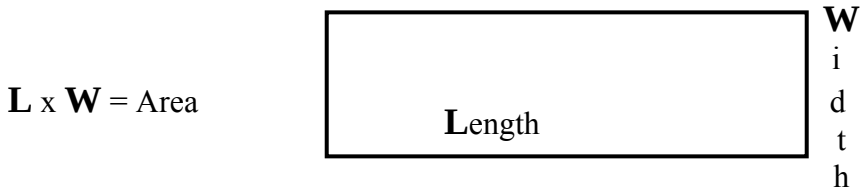
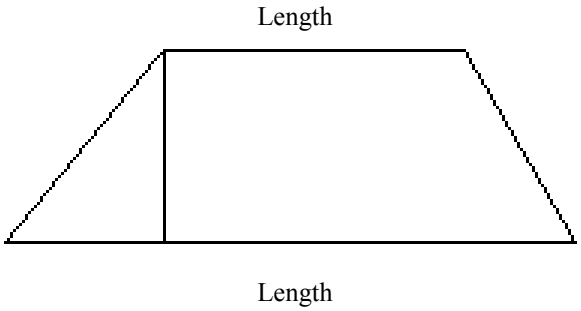


Figure 18. Rectangular Areas

A trapezoid is a figure of four sides having two, and only two, sides parallel. It is figured the same as the rectangular field, except that you use the average of the two parallel sides for the length value, Figure 19.



Area = ½ (Length + Length) Height

Figure 19. Trapezoidal Area

Right triangle fields are three-sided fields having one square corner. To find the area, figure as if it were one-half of a rectangle. Thus, one-half of the length (base) multiplied by the width (height) will give you the area, Figure 20.

Area = ½ (H x B)

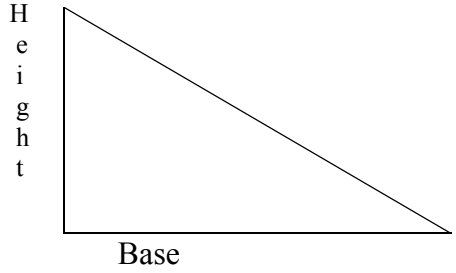


Figure 20. Right Triangle Areas

Other triangular fields not having a square corner can be figured the same as the right triangle, but the height must be measured square (at right angles) from the base line. Thus, one-half the height times the base gives the area (Figure 21).

Area = ½ H x B

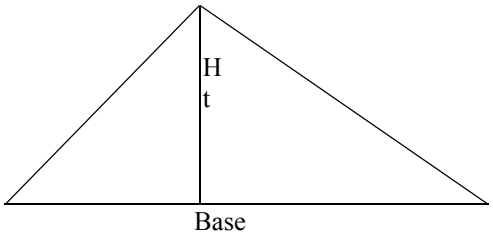
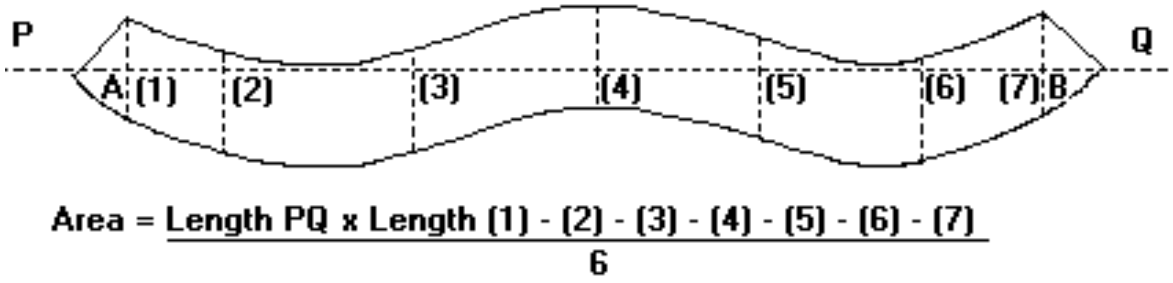


Figure 21. Obtuse Triangle Areas

Uneven multi-sided fields those with more than four sides or with four unequal sides can usually be measured by using one or more of the methods already discussed. The trick is to divide the fields into triangles, rectangles, or other shapes that can be easily measured. A good rule is to measure from one corner to an opposite corner, dividing the field into more easily measured plots. Find the area of each of the new plots by using the formula for rectangles, triangles, or trapezoids. Some examples of how fields may be divided for easier measurement, are shown in Figure 22.

Figure 22. Irregular Straight Sided Areas

Curved boundaries. Where contour farming is practical, field measurement becomes somewhat more complicated. The best method is to measure off a straight base line near the center of the field. At equal distances take a number of measurements of the field width. Make these measurements square across (at right angles) to the base line. Find the average of these width lines and multiply this average by the length of the base line. This gives the area of the field. If the base line does not meet the ends of the field square (at right angles), you will have to figure the area of the small triangles A and B separately, Figure 23.



$$\text{Area} = \frac{\text{Length PQ x Length (1) - (2) - (3) - (4) - (5) - (6) - (7)}}{6}$$

Figure 23. Curved Sided Areas

When fields are curved too much for a straight base line to be drawn as above, do this: Measure a base line down the center of the field or as near the center as practical. Let it curve as the field curves. At equal distances, measure the width of the field. Make these measurements as square across the base line as possible; then use the same method of figuring the area as used with the straight line base shown in Figure 23.

Tables 17-19 are provided for use in measuring or converting volumes or weights of materials.

Table 17. Measuring

Weights and Measures Factors

Volume = (diameter) x 0.7854 x height (for circular bin)
Volume = length x width x height (for rectangular bin)
Capacity of bin in bushel is volume in cu ft x 0.8
1 bushel = 1.25 cu ft
1 cu ft = 0.8 bushel
1 cu ft dry shelled corn = 44.8 lb
1 cu ft soybeans = 48 lb
1 cu ft wheat = 48 lb
1 cu ft = 1,728 cu in
1 cu ft = 7.48 gal
1 gal = 231 cu in
1 cu yd = 27 cu ft
0.43 lb per sq in = column of water 1 ft high
1 lb per sq in = column of water 2.31 ft or 27.72 inches high

Tractor Speeds

MPH = $\frac{0.682 \times \text{length of run (ft)}}{\text{time (sec)}}$

Time required in seconds to travel			
Speeds in MPH	**100'**	**200'**	**300'**
3.0	23	45	68
3.5	20	39	58
4.0	17	34	51
4.5	15	30	45
5.0	14	27	41
6.0	11	23	34
7.0	9.7	19	29
7.5	9.0	18	27
8.0	8.5	17	26
9.0	7.6	15	23
10.0	6.8	13.6	20.5

Field Measurement

No. Rows per acre	30"	36"	38"	40"	48"
	LENGTH OF ROWS IN FEET				
1	17,242	14,520	13,756	13,068	10,890
2	8,712	7,260	6,878	6,534	5,445
3	5,808	4,840	4,585	4,360	3,630
4	4,356	3,630	3,438	3,267	2,722
5	3,484	2,904	2,751	2,614	2,178
6	2,904	2,420	2,293	2,178	1,815
7	2,489	2,074	1,966	1,866	1,555
8	2,178	1,815	1,720	1,634	1,361
9	1,936	1,613	1,529	1,452	1,210
10	1,742	1,452	1,376	1,307	1,089
12	1,452	1,210	1,147	1,090	907
14	1,244	1,037	984	934	777
16	1,089	907	861	817	680
18	968	806	765	726	605
20	871	726	689	654	544
30	580	484	459	436	363
40	435	364	345	328	272
50	348	290	276	262	217
60	290	242	230	218	181
70	249	207	197	186	155
80	217	181	172	163	136
90	193	161	153	145	121
100	174	145	137	131	108

Table 18. Standard Measurements

Measure of Length (Linear Measure)

4 inches = 1 hand
9 inches = 1 span
12 inches = 1 foot
3 feet = 1 yard
6 feet = 1 fathom
5½ yards = 16½ feet
16½ yards = 1 rod or 11 poles
40 poles = 1 furlong
8 furlongs = 1 mile
5,280 feet = 1,760 yards
5,280 feet = 320 rods
5,280 feet = 1 mile
3 miles = 1 league

Measure of Surface (Area)
144 square inches = 1 square foot
9 square feet = 1 square yard
30¼ square yards = 1 square rod
160 square rods = 1 acre
43,560 square feet = 1 acre
640 square acres = 1 square mile
36 square miles = 1 township

Surveyor's Measure
792 inches = 1 chain
1 link = 7.92 inches
25 links = 1 rod
4 rods = 1 Gunther's chain
1 Gunther's chain = 66 feet
10 square chains = 160 square rods
10 square chains = 1 acre
640 acres = 1 square mile
80 chains square = 1 square mile

Troy Weight
24 grains = 1 pennyweight
20 pennyweight = 1 ounce
16 ounces = 1 pound

Cubic Measure
1,728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard
2,150.42 cubic inches = 1 standard bushel
231 cubic inches = 1 standard gallon (liquid)
1 cubic foot = 0.80 of a bushel
128 cubic feet = 1 cord (wood)
7.48 gallons = 1 cubic foot
1 bushel = 1.25 cubic feet

Dry Measure
2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel

Table 19. Units of Measure

Fluid Measure		Units of Measure	
English Measure	English to Metric Conversion	English Measure	English to Metric Conversion
0.17 fl oz=1 tsp 0.5 fl oz=1 tbsp=3 tsp 1 fl oz=2 tbsp=1/8 c 16 fl oz = 0.48 L 1 fl oz=29.57 cc 8 fl oz=1 c=0.5 pt 1 c=16 tbsp 16 fl oz=2 c=1 pt 32 fl oz=2 pt=1 qt 128 fl oz=4 qt=1 gal	1 tsp=5 ml=5 cc 1 tbsp=15 ml=15 cc 1 c=240 ml 1 r =16.5 ft 1 gal=3.8 L 1 gal=8.3 lb=3764.9 g	1 ft=12 in 1 yd=3 ft 1 mi=1760 yd=5280 ft 1 mi=1.61 km=1610 m	1 in=25.4 mm=2.54 cm 1 ft=0.305 m=30.5 cm 1 yd=0.914 m

Units of Measure		Units of Weight	
English Measure	English to Metric Conversion	English Measure	English to Metric Conversion
1 sq ft = 144 sq in 1 sq yd = 9 sq ft 1 A = 4840 sq yd = 43560 sq ft 1 A = 0.4 ha = 4046.24 sq m	1 sq in = 6.45 sq cm 1 sq ft = 929 sq cm 1 sq yd = 0.836 sq m 1 long ton = 1016 kg	16 oz = 1 lb 1 ton = 2000 lb 1 long ton = 2240 lb	1 oz = 28.35 g 1 lb = 453.6 g 1 ton = 907.2 kg

Approximate Conversion from U.S. to Metric to Metric to U.S.

When you know:		You can find:	If you multiply by:
Length	inches	millimeters	25
	feet	centimeters	30
	yards	meters	0.9
	miles	kilometers	1.6
	meters	yards	1.1
	kilometers	miles	0.6
Area	square inches	square centimeters	6.5
	square feet	square meters	0.09
	square yards	square meters	0.8
	square miles	square kilometers	2.6
	square centimeters	square inches	0.16
	square meters	square yards	1.2
	square kilometers	square miles	0.4
Liquid Volume	ounces	milliliters	30
	pints	liters	0.47
	quarts	liters	0.95
	gallons	liters	3.8
	liters	pints	2.1
	liters	quarts	1.06
	liters	gallons	0.26
Weight	ounces	grams	28
	pounds	kilograms	0.45
	short tons	metric tons	0.9
	grams	ounces	0.035
	kilograms	pounds	2.2

Temperature	degrees Fahrenheit	degrees Celsius (centigrade)5/9 (after subtracting 32)
degrees Celsius	degrees Fahrenheit	9/5 (then add 32)

ABBREVIATIONS

foot	ft	hundredweight	cwt
feet	ft	bushel	bu
inch(es)	in	acre	A
yard(s)	yd	ounce(s) per hundredweight	oz/cwt
mile(s)	mi	pound(s) per acre	lb/A
rod(s)	r	gallon(s) per acre	gal/A
square inch(es)	sq in	milligram per kilogram	mg/kg
square foot or feet	sq ft	parts per million	ppm
square yard(s)	sq yd	ounce(s) per head	oz/hd
square mile(s)	sq mi	quart(s) per head	qt/hd
square rod(s)	sq r	lethal dose	LD
cubic inch(es)	cu in	active ingredient	AI
cubic foot or feet	cu ft	fahrenheit	□F
cubic yard(s)	cu yd	celsius	□C
cubic centimeters	cc	ultra low volume	ULV
teaspoon(s)	tsp	liquid concentrate	LC
tablespoon(s)	tbs	granules	G
cup(s)	c	flowable	F
pint(s)	pt	emulsifiable	E
quart(s)	qt	emulsifiable liquid	EL
gallon(s)	gal	emulsifiable concentrate	EC
fluid ounce(s)	fl oz	emulsifiable solution	ES
milliliter(s)	ml	wettable powder	WP
liter(s)	l	wettable dust	WD
grains	gr	wettable	W
gram(s)	g	dust	D
kilogram(s)	kg	liquid solution	LS
ounce(s)	oz	millimeter(s)	mm
pound(s)	lb	centimeter(s)	cm
meter(s)	m	kilometer(s)	km
hectare(s)	ha		

Chemigation Requirements

In 1987, the Environmental Protection Agency (EPA) finalized their Label Improvement Program (LIP) for chemigation. All products approved for chemigation will be labeled regarding the types of irrigation systems through which they may be applied. Labels on products not approved for chemigation will bear the statement "Do Not Apply This Product Through Any Type of Irrigation System."

Labels will also contain general information regarding nonuniformity of application, sources of information about calibration, supply tank dilution and agitation, and the time of irrigation cycle during which the chemical should be applied. Some chemical labels will also include recommendations regarding the amount of water to be applied during chemigation operations. The label will enumerate what the applicator must do to warn the public when chemicals are applied to sensitive areas or areas open to the public. The new EPA regulations also require that a knowledgeable person monitor the application of chemicals so that the application can be terminated when unfavorable weather conditions, such as heavy rain or high winds, develop. Any chemical approval for chemigation will also have the following verbatim statements on the label:

1. "The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow."

The components must be constructed of corrosion resistant materials. The drainage water from the low pressure drain must be vented a minimum of 20 ft from the water supply and directed away from it. The positioning of the backflow prevention devices must be between the point of chemical injection into the irrigation pipeline and the irrigation water supply (Figure 27).
A variance to this requirement has been granted by the EPA in which a "gooseneck" pipe loop with a vacuum breaker at the apex is an
acceptable alternative backflow prevention device. The apex of the loop must be at least 24 inches higher than the highest point of discharge in the sprinkler or emitter system (Figure 28).

Another approved backflow prevention device is an air gap. An air gap exists when water from the water supply is discharged from a pipe into an open, non-pressurized container with the discharge pipe at least two pipe diameters or one inch, whichever is greater, above the maximum tank water level. Chemical injection then takes place between the tank and the irrigation machine (Figure 29).

2. "The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump."

This check valve must be constructed of chemical resistant material and should have a minimum opening pressure of 10 psi. This valve is optional if the check valve in Item 2 has a minimum opening pressure of 10 psi.

3. "The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down."

This valve is normally held closed by a spring and is opened only when the injection pump is operating. The valve must be placed in the suction line between the supply tank and the injection pump. If it is placed in the pressure line between the injection pump and the point of chemical injection into the irrigation pipeline, the pressure line could rupture in the event the valve should fail to open when the injection pump starts (Figure 27.)

4. "The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops."

The interlock insures that the injection pump will not operate unless the irrigation pump is running. On electric powered irrigation pumps this is done by powering the injection pump motor control from the switched side of the irrigation pump motor controller (Figure 30). For internal combustion engine powered irrigation pumps, the injection pump can be belt driven from the irrigation pump propeller shaft (Figure 31).

5. "The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected."

The uniformity of chemical application will be only as good as the uniformity of application of the irrigation water. The minimum acceptable coefficient of uniformity for chemical application should be 80%. The shut off should be set to stop the irrigation pump when the irrigation system pressure drops below a level at which the minimum acceptable level of uniformity can be maintained. Your irrigation equipment supplier can advise you as to the minimum pressure requirement needed for your system to maintain proper uniformity.

6. "Systems must use a metering pump, such as a positive displacement injection pump (for example, a diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock."

The EPA regulations require an injection pump be used to apply toxic chemicals through all sprinkler and drip irrigation systems.
It is recommended, but not required, that a metering pump be used on continuously moving (center pivot or lateral move) irrigation machines. An EPA variance permits the use of venturi injection devices in place of injection pumps. The chemical injection line to the venturi must be equipped with a check valve, and because the minimum opening pressure of this valve will be less than 10 psi in order for the venturi to function, the chemical line must also be equipped with a normally closed valve. The normally closed valve may be activated by either an electric solenoid coil interlocked with the irrigation pump motor, or hydraulically activated by water pressure within the irrigation pipeline.

7. “Do not apply when wind speed favors drift beyond the area intended for treatment.”
The system must be monitored by a knowledgeable person to insure that weather conditions do not deteriorate, adversely affecting uniformity and causing the chemical to drift out of the target area. Some authorities recommend that application cease when wind speeds reach 10 to 12 mph for continuously moving sprinkler systems, and at 7 to 8 mph for stationary systems. Chemigation safety equipment requirements are reviewed and updated periodically as the available technology changes. As new, more effective devices are developed further variances to these requirements may be permitted.

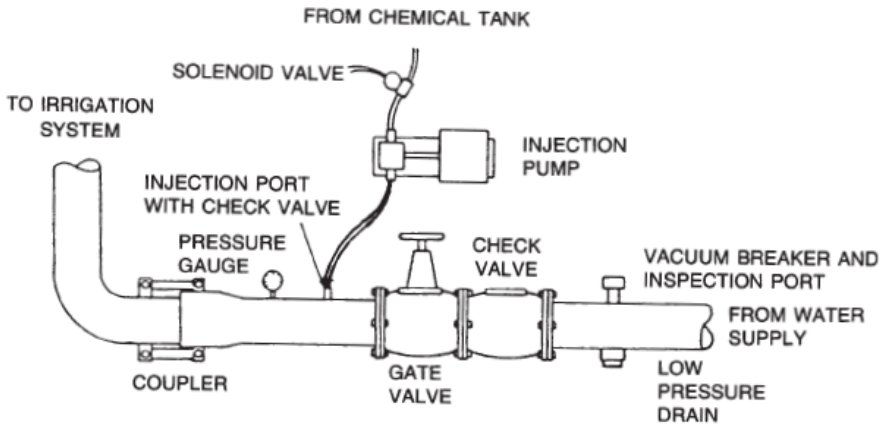


Figure 27: Backflow prevention device using check valve with vacuum relief and low pressure drain.

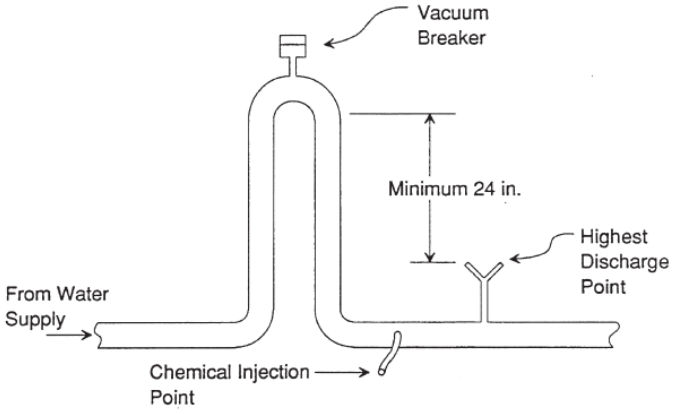


Figure 28. Gooseneck Pipe Loop Backflow Preventer

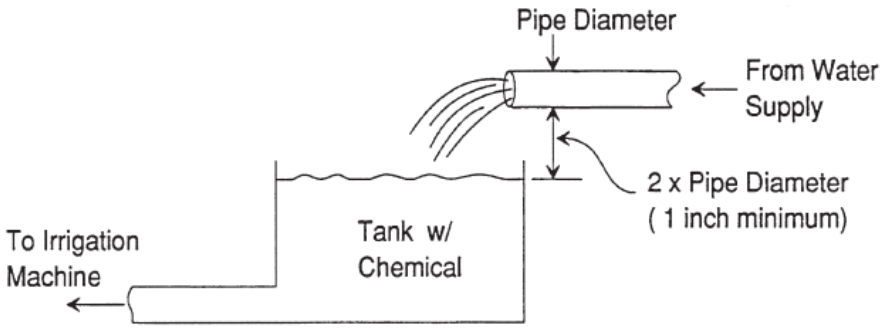


Figure 29. Air Gap Backflow Preventer

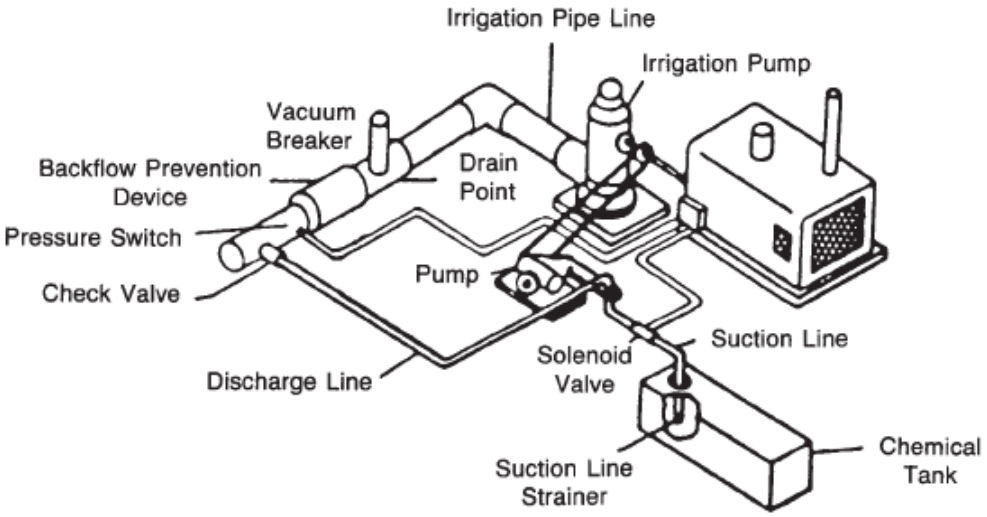


Figure 30. Safety devices for injection of chemicals in irrigation systems using a belt driven injection pump and engine power units.

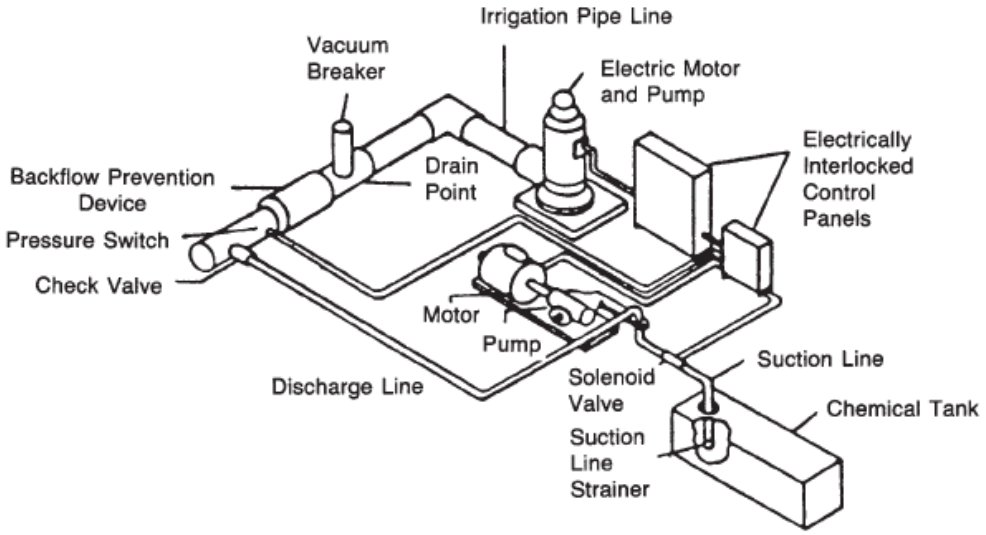


Figure 31. Safety devices for injection of chemicals into irrigation systems having electric power.

Your local County Cooperative Extension Service can offer further information on chemigation. However, the chemical label is the law regarding application of chemicals. It is the responsibility of the applicator to insure the law is obeyed.

SUGGESTIONS FOR FLY CONTROL AROUND FARM PREMISES
RESIDUAL FLY SPRAYS

TYPE OF BUILDING	INSECTICIDE AND DILUTION	NOTES AND PRECAUTIONS
Dairy Barns	Malathion 57% EC	Apply as coarse spray to walls, ceilings and other surfaces. Do not contaminate feed or water. Follow label directions.
	Cyfluthrin 24.3% EC	Apply a coarse spray to walls, ceilings and other surfaces. Do not spray animals, food or water. Follow label directions.
	Lambda-Cyhalothrin -10.0% WP	Ready to use packets. Follow instructions.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos+ 5.3% dichlorvos) .	Apply to coarse spray to ceilings, walls and other surfaces. Follow label directions.
	Rabon 50 WP (50% tetrachlorvinphos WP)	Apply to coarse spray to ceilings, walls and other surfaces. Follow label directions.
	Elector (2.5% spinosad)	Apply to coarse spray to ceilings, walls and other surfaces. Follow label directions
	GRENADE ER (9.7% Lambdacyhalothrin)	Do Not make applications in areas where animals are present in the facility. Allow treated surfaces to completely dry before restocking the facility.
	Prozap Fly Killer D (36% Naled [Dibrom])	For increased residual control, concentrate spray application to walls, beams, rafters and around windows, doorways and other fly resting areas.
	Quickbayt Disposable Fly Bait Strip (0.5% Imidacloprid + 0.1% (Z)-9 Tricosene[Attractant])	Place bait strips in areas inaccessible to animals. 1 bait strip/250 sq ft
	Quickbayt Fly Bait ***Paint-on Application*** (0.5% Imidacloprid + 0.1% (Z)-9 Tricosene[Attractant])	Mix 1.5 oz bait with 1 fl oz warm water (3 lbs bait in 1 quart water) and stir thoroughly. Let stand for about 15 minutes until a paste consistency suitable for painting has formed. Apply the paste with a brush to surfaces where flies rest, avoiding surfaces that are dusty.
	Blue Streak Fly Bait (1% Methomyl + 0.025% (Z)-9 Tricosene[Attractant])	As a dry bait: Scatter on floors, walkways, etc., throughout operation but away from animals. Apply heavy (about 1/4 lb. per 500 to 1000 sq. ft.) until flies are suppressed. Wear rubber gloves when applying baits. Do not allow workers on treated floors without shoes. Do not allow animals to come in contact with baits.
	Prelude (25.6% permethrin)	Apply as a spray or spot treatment to walls and ceilings as a residual surface treatment. DO NOT treat manure or apply directly to animals.
	Formulations of Permethrin – EC and WP formulations. There are many containing permethrin with many brand names or trade names. A few trade names are Atroban, Ectiban, Insectaban, Insectrin, GardStar, Hard Hitter, Permectrin II, and many others. Read labels carefully to determine the concentration according to label instructions.	

SUGGESTIONS FOR FLY CONTROL AROUND FARM PREMISES
RESIDUAL FLY SPRAYS (CONT'D)

TYPE OF BUILDING	INSECTICIDE AND DILUTION	NOTES AND PRECAUTIONS
Milk rooms	Cyfluthrin 24.3% EC	Avoid contaminating milk or milk processing in equipment.
	CT-75 Aerosol (0.7% Pyrethrins + 5% PBO)	Cover milking utensils and milk to prevent contamination from spray and dead or falling insects.
	Prozap Insect Guard (18.6% Dichlorvos)	DO NOT contaminate milk or milking equipment.
	Prozap LD-44Z (0.5% Pyrethrins + 4.0% PBO)	Cover milking utensils and milk to prevent contamination from spray and dead or falling insects.
	Quickbayt Bait *Bait Station Application* (0.5% Imidacloprid + 0.1% (Z)-9 Tricosene[Attractant])	Place in any fly bait station. Use 1 bait station to cover approximately 250 sq ft, and add up to 1.5 oz of bait per station. Secure bait stations at least 4 feet above the ground.
	Quikstrike Fly Strip (1% Nithiazine)	In enclosed structures or sites with low to moderate house fly populations, use 1 strip per 300 ft^2. In open structures or sites with high house fly populations, use 1 strip per 100-150 ft^2.
	Check label of any products before using in milk rooms.	
Poultry Houses A. Caged layers		
	Lambda-Cyhalothrin - 10.0% WP	Ready to use packets. Follow instructions.
	Rabon + Vapona (Ravap) (23% tertrachlorvinphos + 5.7%dichlorvos)	Follow label directions.
	Rabon 50 WP (tetrachlorvinphos 50% WP)	Follow label directions.
	Dichlorvos EC (Vapona) 40.2%	Apply to indoor surfaces. Do not contaminate feed or water. Follow label directions.
	Elector (2.5% spinosad)	Do not apply when poultry animals are present. Follow label directions.
	Quickbayt Fly Bait *Scatter Application* (0.5% Imidacloprid + 0.1% (Z)-9 Tricosene[Attractant])	**For use in walkways.** Scatter the bait directly from the container onto dry level surfaces so that the individual granules lie near each other without forming small piles.
	GoldenMalrin (1.1% Methomyl + 0.049% (Z)-9 Tricosene[Attractant])	**For use in walkways.** Follow label directions when applying.
	Archer (1.3 % pyriproxyfen) Insect Growth Regulator	Treat bird cages only after removal of animals.
	Permethrins - WP and EC formulations: Many formulations includes: Atroban, Ectiban, Insecctaban, Insectrin, GardStar, Hard Hitter, Permectrin II, and other trade or brand names	Follow label instructions as to rate, method of application, etc

SUGGESTIONS FOR FLY CONTROL AROUND FARM PREMISES
RESIDUAL FLY SPRAYS (CONT'D)

TYPE OF BUILDING	INSECTICIDE AND DILUTION	NOTES AND PRECAUTIONS
Poultry Houses (cont'd)		
B. Poultry on Litter		
	Lambda-Cyhalothrin - 10.0% WP	Ready-to-use packets. Follow instructions.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.7% dichlorvos)	Follow label directions
	Demand CS (9.7% Lambda-cyhalothrin)	Apply to floor area and DO NOT apply when poultry animals are present. Reapply after each growout or sanitization procedure when labeled pests are an issue.
	Permethrins - WP and EC formulations: includes Atroban, Ectiban, Insectaban, Insectrin, GardStar, Hard Hitter, Permectrin, Synergized DeLice or possibly others.	Follow label instructions as to rate, method of application, etc.
Other Farm Buildings		
	Naled (Dibrom) 60% EC	Spray surfaces. Do not contaminate feed or water. Follow label directions.
	Dichlorvos (Vapona) 40.2% EC	Spray surfaces. Do not contaminate feed or water. Follow label directions.
	Lambda-Cyhalothrin - 10.0% WP	Ready-to-use packets. Follow instructions.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.7% dichlorvos)	Spray surfaces. Do not contaminate feed or water. Follow label directions.
	Rabon 50 WP (tetrachlorvinphos 50% WP)	Spray surfaces. Do not contaminate feed or water. Follow label directions.
	Elector (2.5% spinosad)	Spray fly-inhabiting surfaces in animal premises to the point of runoff. Use approx. 1 gal. of spray per 500 to 1,000 sq. ft. Repeat as needed, but not more often than once per week. Spray in early morning when flies are resting. Lactating and non-lactating dairy and beef cattle may be present at time of premise treatment; horses not intended for human consumption may be present during premise treatment. Do not use in poultry, swine, or sheep facilities when animals are present; allow surfaces to dry completely before readmitting animals.
	Tempo Dust (1% Cyfluthrin)	Do not make applications of Dust when animals are present in area of facility to be treated. Do not apply directly to animal feedstuffs or watering equipment.
	Tempo 20 WP (20% Cyfluthrin)	Apply as a general surface and/or a crack and crevice spray.
	Tempo SC Ultra Premise Spray (11.8% Beta-cyfluthrin)	Different application rates are required for specific surfaces. Follow label directions regarding the different application rates.
	Dryzon (50% Diazinon WP)	Remove animals from buildings or corrals prior to treatment and keep animals out until dry. **Do not apply** in dairy barns, milk rooms and poultry houses. Apply 1 gal. of residual spray as an overall spray at the rate of 1 gal. per 350 to 750 square feet to ceilings and walls of livestock sheds, calf barns, hog barns, loafing sheds and other farm buildings.

SUGGESTIONS FOR FLY CONTROL AROUND FARM PREMISES
RESIDUAL FLY SPRAYS (CONT'D)

TYPE OF BUILDING	INSECTICIDE AND DILUTION	NOTES AND PRECAUTIONS
Other Farm Buildings (cont'd)	**Permethrins** - WP and EC formulations: Many formulations such as: Atroban, Ectiban, Insectaban, Insectrin, GardStar, Hard Hitter, Permectrin II, and many others.	Follow label instructions as to rate, method of application, etc.

FEEDLOTS AND OUTSIDE PREMISES: most of the insecticides listed for use inside premises can be used for fly control in and around feed lots. Please read labels carefully. Insecticides can be applied to walls, floors, posts etc. where flies rest on the outside of buildings. Wettable powder formulations (WP) usually give longer residual concentrations than emulsifiable concentrate formulations (EC) when applied to bare wood or concrete blocks or floors.

SPACE SPRAYS FROM MIST BLOWERS, FOGGERS OR AUTOMATIC MIST SYSTEMS

Several insecticides have formulations that can be applied by portable mist sprayers, fogging machines or automatic overhead mist systems where a mist is released at pre-timed intervals. Not all formulations that can be used in portable mist sprayers can be used in the automatic overhead mist so **READ THE LABEL CAREFULLY**.

Space sprays generally kill only the adult flies present at the time of application although some of the permethrin products provide some residual control. Consult the **LABEL** to determine how often they can be applied. Some of the materials applied in the automatic mist sprayers can be applied daily if needed. Space sprays are most effective when combined with other fly control procedures, <u>especially</u> good sanitation in removing the materials in which fly larvae develop. For best results, space sprays should be applied inside with the doors and windows closed. With some materials, animals can be present when space sprays are applied, but the sprays should not be aimed directly on the animals or the feed or water, **CHECK LABEL**. Most products are not cleared for use in milking rooms or parlors. If you have an overhead automatic mist system in a milking room or parlor, be sure to use only the products recommended for that system in milk rooms.

BAITS: Several insecticides have dry bait formulations for use in controlling house flies and other filth flies. Baits will not aid in the control of stable flies. Baits will aid in the control of house flies, but will not control flies without good sanitation and the use of some other control practices. Place baits in areas where flies congregate, but try to keep them from areas where children, birds or animals may frequently contact them. Do not contaminate feed or water with baits. Some bait can be painted onto surfaces but read the **LABEL** to be sure the proper application is followed with particular attention to statements concerning discoloration of certain surfaces.

BIOLOGICAL CONTROL AGENTS: The use of parasitic wasps and predatory insects for use in the biological control of house flies has been proven effective when used in an integrated system. Research has indicated that some species of parasitic wasps have been very successful in controlling house flies in confined poultry houses in the east and in California. Research on the use of parasitic insects for the control of house flies around feedlots in Kansas and Nebraska has shown that they are not as successful in controlling house flies under those conditions. Parasitic wasps will not control house fly and stable fly populations without proper management of waste water, manure, spilled feed and weeds around the barns or feedlot. A number of companies are selling parasitic wasps for control of house flies and stable flies but I am not aware that these organisms have been studied in Oklahoma. Many times the parasitic wasps raised in colony situations do not do well when introduced into stressful climatic conditions. If you are considering using biological control agents for fly control, you should be aware that the parasitic wasps you are purchasing may not survive under Oklahoma conditions, and you must be willing to implement extensive waste management practices to reduce fly populations as much as possible. The purchase and use of parasitic wasps for fly control without a total commitment to good sanitation will not only be expensive, but will likely not be successful. Proper application of biological control agents should be stressed and ask the company to provide a species list of which organisms they plan on releasing.

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn flies, face flies and stable flies, etc. Early May to frost	Altosid Premix (methoprene)	Feed Additive (IGR)	Begin use in the spring before horn flies appear on cattle and continue feeding until cold weather restricts horn fly activity. Mix with feed or minerals at the rate recommended on the label.
Most will aid in control horse flies and mosquitoes.	Rabon Oral Larvicide Premix (7.76% tetrachlorvinphos)	Feed Additive	Prepare feed according to label directions.
	Rabon Oral Larvicide (97.3% tetrachlorvinphos)	Feed Additive	Prepare feed according to label directions.
	Co-Ral Fly and Tick Spray 6.15% (coumaphos)	Spray Mix according to label directions	Spray to complete wetness. Do not spray less than 10 days apart. READ LABEL
	Co-Ral 11.6% ELI[r] (coumaphos)	Restricted-Use Pesticide See footnote.	Purchased and applied by certified applicator only.
	Rabon 50 WP 50% (tetrachlorvinphos)	Spray	Mix according to dilution table on the label.
	Del-Phos Emulsifiable Liquid (phosmet)	Spray	At the 1:200 dilution rate, mix 1 gallon of DEL-PHOS Insecticide with 50 gallons of water and stir thoroughly. Apply the fresh mixture as a coarse spray, taking care to wet the skin, not just the hair. Do not apply to the point of runoff. For cattle, do not apply within 3 days of slaughter.
	Prolate/Lintox-HD (11.75% phosmet)	Spray	Mix 1 qt. of Prolate/Lintox-HD in 50 gal. of water. Apply fresh mixture as a coarse spray, taking care to wet skin, not just hair. **Do not apply to point of run-off. Do not allow spray to drift. Do not treat sick, convalescent, stressed, or animals less than 3 months old.**
	Paramite L.A. (11.75% phosmet)	Spray	Mix 1 gal. of PARAMITE L.A. in 200 gal. of water. **Do not treat** non-lactating dairy cattle within 28 days of freshening. If freshening should occur within the 28 day period after treatment, that milk must not be used as human food.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.3% dichlorvos)	Spray Mix according to label directions	Follow all label directions.
	Elector 2.46% (spinosad)	Spray	Follow all label directions.

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn flies, face flies, stable flies etc cont.	**PERMETHRIN PRODUCTS**		
	There are many different formulations and trade names containing permethrin. Some are listed below but the list is not at all inclusive.	Always follow the label directions for the product being used.	
	Permethrin formulations:		
	Atroban 42.5 % EC	Spray	Follow label directions.
	Atroban 11 % EC	Spray	Follow label directions.
	Ectiban 5.7% EC	Spray	Follow label directions.
	Insectiban 5.7% EC	Spray	Follow label directions.
	Permectrin II 10%EC	Spray	Follow label directions.
	GardStar 40% EC	Spray	Follow label directions.
	Catron IV 0.5%	Aerosol	Spray according to label directions.
	Pour-On Formulations **Permethrin** formulations:		
	Atroban DeLice 1%	Ready-to Use	Apply according to label directions.
	Ectiban DeLice 1% + 1%PBO	Ready-to Use	Follow label directions.
	Permectrin CDS 7.4%	Ready-to Use	Follow label directions.
	Permethrin 1%	Ready-to Use	Follow label directions.
	Boss 5.0 %	Ready-to Use	Pour labeled amount along back and down face.
	Ultra Boss 5% + 5% PBO	Ready-to Use	Follow label directions.
	Brute 10%	Ready-to Use	Apply 15cc per 1000 lbs. down mid-line of back.
	Exit 1%	Ready To Use	Pour along back line and down face. Apply 1/2 fl oz per 100 lbs body weight of animal, up to a maximum of 5 fl oz for any one animal.
	Back Side (1% permethrin)	Ready To Use	Pour along back and down face. Apply 1/2 fl oz (15 cc) per 100 lbs body weight of animal, up to a maximum of 5 fl oz for any one animal. Follow all label directions.
	Back Side Plus (1% permethrin + 1% PBO)	Ready To Use	Follow label directions.
	Durasect (1% permethrin)	Ready To Use	Follow label directions.
	Durasect II (5% permethrin + 0.10% pyrethrins + 1% PBO)	Ready To Use	Follow label directions.

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn flies, face flies, stable flies etc cont.	Other formulations		
	Cylence (1% cyfluthrin)	Ready-to Use	Apply the required amount of ready-to-use solution directly along the top of the back and top of head of the animal.
	Saber (1% lambdacyhalothrin)	Ready-to Use	Follow label directions.
	Elector 2.46% (spinosad)	Ready-to-Use	Follow label directions.
	Cydectin (moxidectin)	Ready-to-Use	Apply directly to the hair and healthy skin in a narrow strip extending along the top of the back from the withers to the tailhead.
	Ivomec Eprinex (5 mg eprinomectin/mL)	Ready-to-Use	Follow label directions.
	Ivomec (5 mg ivermectin/mL)	Ready-to-Use	Cattle must not be treated within 48 days of slaughter for human consumption.
	There are many other products containing ivermectin under different trade names that aid in the control of horn flies.		
	Dectomax (5 mg doramectin /mL)	Ready-to-Use	Cattle must not be slaughtered for human consumption within 45 days of treatment.
Horn Flies and Face Flies (cont'd) (Ear tags do not provide much control of stable flies, horse flies or mosquitoes.)	**Ear Tags:** **Organophosphate Tags**: **X-Terminator** **Optimizer** (18% to 21.4 % diazinon)	Two per head.	Follow label instructions for all ear tags.
	Co-Ral Plus (20% coumaphos + 20%diazinon)	Two per head	
	Patriot (40% diazinon)	Two per head.	
	New Z Diazinon Ear Tag (18% diazinon + 2% PBO)	Two per head.	PBO = Piperonyl Butoxide. A material that increases the effectiveness of some pyrethrin and pyrethroid insecticides.
	Warrior **(**30%diazinon + 10%chlorpyrifos)	Two per head	
	Dominator **(**20% pirimiphos-methyl)	Two per Head	

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn Flies and Face Flies (cont'd)	**Pyrethroid Tags**:		Follow Label Directions for all Ear Tags.
	Dekem (8% permethrin)	Two per head.	
	Atroban Extra, Super Deckem II, GardStar Plus, New Z Permethrin (10% permethrin)	Two per head.	
	Ectrin (8.6% fenvalerate)	Two per head.	
	Combination Ear Tags with Pyrethroids:		PBO = Piperonyl Butoxide. A material that increases the effectiveness of some pyrethrin and pyrethroid insecticides.
	Max Con (7% cypermethrin + 5% chlorpyrifos + 3.5% PBO)	Two per head.	
	Double Barrel VP (6.8% Lambda-cyhalothrin + 14% Pirimiphos methyl)	Two per head	
	Cylence Ultra (8.0% cyfluthrin + 20% PBO)	Two per head.	
	Saber Extra (10%lambda-cyhalothrin +13% PBO	Two per head.	
	PYthon (10% zetacypermethrin +20% PBO)	Two per head.	
	Python Magnum, a larger tag (10% zetacypermethrin +20% PBO)	One tag per animal.	
	Cyclodiene Tags:		
	Avenger (30% Endosulfan)	Two per head	

NOTICE CONCERNING HORN FLY RESISTANCE

Horn fly populations throughout Oklahoma have developed a degree of resistance to most of the insecticides used in the tags. For best results, in most areas, it is recommended that tags containing pyrethroid compounds are alternated with those that contain organophosphate ear tags at least every two years. If less than four to five weeks of satisfactory control is achieved with any type of tag it would be best to switch to tags containing a different class of insecticide. It is also recommended that other types of labeled insecticides be used occasionally such as sprays, pour-ons, dust bags or back oilers. In any case try to use an insecticide that is in a different class that the one used last.

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn Flies Face Flies, stable flies etc. (cont'd)	**BACKRUBBER OR OILER APPLICATIONS:** The insecticide formulations listed below should be mixed as directed on the label and used in homemade or commercial backrubbers. Backrubbers are most effective when they are placed in a forced-use situation such as gateways, doors or alleyways. They should be installed so that all animals use them once a day. If backrubbers cannot be installed in a forced-use situation they should be placed in areas where animals frequently loaf. To be effective, backrubbers must be maintained and filled frequently. Use only No. 2 diesel fuel or an approved backrubber oil to mix insecticides for backrubbers. DO NOT USE FRESH OR USED MOTOR OILS.		
	Co-Ral 11.6% ELI[r] (coumaphos)	Restricted-Use Pesticide	See footnote.
	Col-Ral Fly and Tick Spray 6.15% (coumaphos)	Backrubbers only.	Follow label directions.
	Malathion 57% EC	Backrubber.	Follow label directions.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.7% dichlorvos)	Backrubber.	Follow label directions.
	Prolate/Lintox-HD (11.75% phosmet)	Backrubber	Follow label directions.
	Paramite L.A. (11.75% phosmet)	Backrubber	Mix 1 gal. of PARAMITE L.A. in 50 gal. of water.
	Pyrethroid Compounds		
	Permethrin: Ectiban 5.7% EC	Backrubbers.	Follow label directions.
	Gardstar 40% EC Permectrin II 10% EC Permectrin CDS 7.4% Brute 10% Many other formulations can be used in back oilers	Backrubbers. Backrubbers.	Follow label directions. Follow label directions.
	DUSTS FOR USE IN DUST BAGS OR DIRECT APPLICATION: The dust formulations listed below can be used in dust bags. Dust bags work best if they are placed in situations where animals must use them or where animals will often use them. Many dust formulations can also be applied directly to the animal. FOLLOW LABEL DIRECTIONS CAREFULLY TO DETERMINE PROPER USE. Co-Ral 1% Dust coumaphos; 3% Rabon Livestock Dust tetrachlorvinphos; Permectrin Fly and Louse Dust 0.25% permethrin; Insectrin Dust 0.25% permethrin ; Python dust 0.075% Zeta-cypermethrin + 0.150% PBO. There are likely several other similar dust formulations sold under other names. Check label instructions before using these dusts in dust bags.		

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Lice October through Spring	Co-Ral Fly and Tick Spray 6.15% (coumaphos)	Spray	Spray to complete wetness. Do not spray less than 10 days apart. READ LABEL
	Co-Ral 11.6% ELI[r] (coumaphos)	Restricted-Use Pesticide	Purchased and applied by certified applicator only.
	Rabon 50% WP (tetrachlorvinphos)	Spray	Mix according to dilution table on label and used as directed.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.7% dichlorvos)	Spray	Treatment interval not less than 10 days. No waiting period.
	Spinosad (2.46% spinosad)	Spray	Follow label directions.
	Tactik (12.5% amitraz)	Spray	Penetrate spray to skin until run-off. Pay particular attention to legs, udder, tail regions, head, ears, shoulder area and neck.
	Del-Phos Emulsifiable Liquid (phosmet)	Spray	At the 1:150 dilution rate, mix 1 gallon of DEL-PHOS Insecticide with 150 gallons of water and stir thoroughly. Apply the fresh mixture as a coarse spray, taking care to wet the skin, not just the hair. Do not apply to the point of runoff. For cattle, do not apply within 3 days of slaughter.
	Prolate/Lintox-HD (11.75% phosmet)	Spray	Mix 1 qt. of Prolate/Lintox-HD in 38 gal. of water. Apply fresh mixture as a coarse spray, taking care to wet skin, not just hair. **Do not apply to point of run-off. Do not allow spray to drift. Do not treat sick, convalescent, stressed, or animals less than 3 months old.**
	Paramite L.A. (11.75% phosmet)	Spray	Mix 1 qt. of PARAMITE L.A. in 38 gal. of water. **Do not treat** non-lactating dairy cattle within 28 days of freshening. If freshening should occur within the 28 day period after treatment, that milk must not be used as human food.

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
	PERMETHRIN and RELATED PRODUCTS		
	Atroban 42.5 %	Spray	Follow label directions.
	Atroban 11 % EC	Spray	
	Ectiban 5.7% EC	Spray	Follow label directions.
	Insectaban 5.7%EC	Spray	Follow label directions.
	Permectrin II 10%EC	Spray	
	GardStar 40% EC	Spray	Follow label directions.
	Pour-On Formulations		
	Atroban DeLice 1%	Ready-to Use Pour-on	Follow label directions.
	Brute 10%		
	Durasect II 5.0%	Ready-to Use Pour-on	Follow label directions.
	Ectiban DeLice 1% + 1%PBO	Ready-to Use Pour-on	
	Permectrin CDS 7.4%		
	Permethrin 1%	Ready-to Use Pour-on	Follow label directions.
	Boss 5.0%	Ready--to Use Pour-on	
	Ultra Boss 5.0% +PBO 5.05		
	Cylence (cyfluthrin) 1%	Ready-to Use Pour-on	Follow label directions.
	Saber (lambdacyhalothrin} 1%	Ready to Use Pour-on	Follow label directions.
	Exit 1% permethrin	Ready-to Use	Follow label directions.
Gulf Coast tick, April through June and Spinose ear tick, spring and summer (Both of these tick species occur mostly in and around the ear or head. Very small amount of pour-on formulations work very well for up to three weeks).	Spinosad (2.46% spinosad)	Ready-to Use pour-on	Follow label directions.
	Ivermectin 1% (Ivomec)	Injectable	Follow directions. Do not use within 35 days of slaughter, injectable or 48 days, pour-on.
	Ivermectin (Ivomec) 1 ml/22 lb body weight Pour on formulation.	Pour-on	
	Cydectin (5 mg moxidectin/ml)	Pour-on	Apply directly to the hair and healthy skin in a narrow strip extending along the top of the back from the withers to the tailhead. Follow all label directions. Should be administered by subcutaneous injection under the loose skin in front of or behind the shoulder. Follow all label instructions.
	Cydectin (10 mg moxidectin/ml)	Injectable	Cattle must not be slaughtered for human consumption within 45 days of treatment. Should be administered in front of or behind shoulder. Follow all label instructions.
	Dectomax (5 mg doramectin /mL)	Pour-on	Follow all label directions.
	Dectomax (10 mg doramectin /mL)	Injectable	Materials used in backrubber and dust bags will also aid in control of lice.
	IVOMEC EPRINEX (5 mg eprinomectin/mL)	Pour-on	

Ear Tags: Many of the ear tags listed for control of horn flies will also control or assist in the control of lice. Read the labels before purchasing ear tags for lice control to be sure they are labeled for lice control. **Dust formulations**: Many of the dust formulations listed under fly control will also control biting and sucking lice. Most can be used as a direct application to the animal or in dust bags.

BEEF CATTLE AND NONLACTATING DAIRY CATTLE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Ticks: Lone Star Tick and American dog tick from April through June.	Co-Ral Fly and Tick Spray 6.15% (coumaphos)	Spray	Spray to complete wetness. Do not spray less than 10 days apart. Do not apply to sick, convalescent or stressed livestock or to animals less than 3 months old. READ LABEL
Winter tick and deer tick from November through March.	Co-Ral 11.6% ELI[r] (coumaphos)	Restricted-Use Pesticide	Purchased and applied by certified applicator only.
	Rabon 50% WP (tetrachlorvinphos)	Use a 0.5% spray	Mix according to dilution table on label and used as directed.
	Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.3% dichlorvos)	Use 0.5 to 1 gal spray per animal.	Treatment interval not less than 10 days. Follow Label Directions.
	Prolate/Lintox-HD (11.75% phosmet)	Spray	Follow Label Directions.
	Tactik (12.5% amitraz)	Spray	Apply up to 2 gals. of spray for a fully grown animal. Penetrate spray to skin until run-off. Pay particular attention to legs, udder, tail regions, head, ears, shoulder area and neck. **Do not use on horses.**
	Del-Phos Emulsifiable Liquid (phosmet)	Spray	Follow label directions.
	PARAMITE L.A. (11.75% phosmet)	Spray	Follow label directions.
Gulf Coast tick, April through June and Spinose ear tick, spring and summer (Both of these tick species occur mostly in and around the ear or head. Very small amount of pour-on formulations work very well for up to three weeks).	**PERMETHRIN and RELATED PRODUCTS**		
	Atroban 42.5 %	Spray	Follow label directions.
	Atroban 11 % EC	Spray	Follow label directions.
	Ectiban 5.7% EC	Spray	Follow label directions.
	Permectrin II 10%EC	Spray	Follow label directions.
	Catron IV 0.5% permethrin specifically for spinose ear ticks	Spray	Follow label directions.
	GardStar 40% EC	Spray	Follow label directions.
	Pour-On Formulations		
	Brute 10%	Ready-to Use Pour-on	Follow label directions.
	Permectrin CDS 7.4%	Ready-to Use Pour-on	Follow label directions.
Ear Tags: Most of the ear tags listed in the horn fly control section will control or prevent infestation with Gulf Coast Ticks or Spinose Ear Ticks, but the pyrethroid tags are the most effective. In order to be most effective, tags should be placed in each ear by mid-March to prevent initial infestation. Select ear tags based on label instructions for control of these ear ticks. Remember, ear tags will not control lone star or winter ticks that are all over the body.			

A.I.= Active Ingredient

[r]= Restricted Use Pesticide

Footnote: The formulations of Co-Ral 11.6% ELI is classified as a **RESTRICTED USE PESTICIDES**. As such, they can only be purchased and used by Certified Applicators or used by persons under the direct supervision of a Certified Applicator.

Additional information may be found in:

Beef Cattle Parasite Control, EPP - 7000

Common Ticks of Oklahoma and Tick Borne Diseases, EPP - 7001

DAIRY CATTLE
ECTOPARASITE CONTROL SUGGESTIONS

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn flies, face flies, stable flies and aid in control of horse flies mosquitoes etc. (April to frost)	Co-Ral Fly and Tick Spray 6.15 % (coumaphos)	Spray. Mix according to label directions.	Follow Label Directions.
	Ravap 23% + 5.7% (tetrachlorvinphos +dichlorvos)	Spray	Follow Label Directions
Biting and sucking lice. (Winter and early spring)	Elector (2.46% spinosad)	Spray	Follow Label Directions
	Taktic (12.5% amitraz)	Spray	Follow Label Directions
Ticks (Some spring and early summer, some winter and early spring).	Super II Dairy & Farm Spray (0.05% pyrethrins + 0.10% PBO + 0.49% dichlorvos)	Spray	Follow Label Directions
	SK-Surekill (0.05% pyrethrins + 0.10% PBO + 0.465% dichlorvos)	Spray	Follow Label Directions
	Permethrin:	Several formulations. Use as a spray.	
	Atroban 11% EC		Follow Label Directions.
	Atroban 42.5%	Spray	Follow Label Directions.
	Ectiban 5.7% EC	Spray	Follow Label Directions.
	Insectaban 5.7% EC	Spray	Follow Label Directions.
	Permectrin II 10% EC	Spray	Follow Label Directions.
	Permectrin CDS (7.4% permethrin + 7.4% PBO)	Spray	Follow Label Directions..
	GardStar 40%	Spray	Follow Label Directions.
	PYRETHRIN PLUS (0.1% pyrethrins + 1% PBO)	Spray	Follow Label Directions.
	Pour- On Formulations	**Pour-on Formulations**	
	Atroban (1% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Boss (5% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Ultra Boss (5.0% permethrin+ 5.0% PBO)	Ready-to-use pour-on	Follow Label Directions.
	Atroban DeLice (15% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Brute (10% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Ectiban DeLice (1% permethrin+ 1% PBO)	Ready-to-use pour-on	Follow Label Directions
	Permectrin S (1% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Permectrin Pour-on (1% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Cylence (1% cyfluthrin)	Ready-to-use pour-on	Follow Label Directions.
	Back Side (1% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Back Side Plus (1% permethrin + 1% PBO)	Ready-to-use pour-on	Follow Label Directions.
	Durasect (1% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Durasect II (1% permethrin + 0.10% pyrethrins + 1% PBO)	Ready-to-use pour-on	Follow Label Directions.
	Exit (1% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Prozap (0.125% permethrin)	Ready-to-use pour-on	Follow Label Directions.
	Cydectin (5 mg moxidectin/ml)	Ready-to-use pour-on	Follow Label Directions.
	Ivomec Eprinex (5 mg eprinomectin/ml)	Ready-to-use pour-on	Follow Label Directions
	Elector (2.46% spinosad)		PBO=Piperonyl Butoxide, a material that increases the effectiveness of most pyrethrin and pyrethroid insecticides.

DAIRY CATTLE
ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I. (Common Name)	METHOD	COMMENTS
Horn flies, Face Flies and aid in control of ticks in the ears and lice if used in the winter.	**EAR TAGS:** **Ectrin** (8.0% fenvalerate) **Avenger** (30% Endosulfan) **Atroban Extra** **PYthon** **GardStar Plus** **Super Deckem II** **New Z Permethrin** (8-10% permethrin in the above tags) **PYthon Magnum** (10% Zetacypermethrin + 20% PBO) **Max-Con** (7% cypermethrin +5% Chlorpyrifos + 13% PBO) **Cylence Ultra** (8% cyfluthrin + 20% PBO)	Apply two tags per head preferably in late April or early May.	Follow Label Directions for Application.
Horn flies, lice and some ticks.	**MATERIALS FOR USE IN BACKRUBBERS AND OILERS.** Co-Ral Fly and Tick Spray (6.15 % coumaphos) Rabon + Vapona (Ravap) (23% tetrachlorvinphos + 5.7% dichlorvos) Many of the permethrin spray and pour-on formulations listed above can also be used in backrubbers. **DUSTS FOR USE IN DUST BAGS OR DIRECT APPLICATION TO THE ANIMAL.** Co-ral 1% Dust (1% coumaphos) Rabon 3% Dust (3% tetrachlorvinphos) Permectrin Fly and Louse Dust (0.25% permethrin) Insectrin Dust (0.25% permethrin) Python dust (0.075% zeta-cypermethrin+0.15% PBO) Ectiban D (0.25% permethrin) Prozap Cylence (0.165% cyfluthrin)	 Use in a Back rubber or oiler. Use in a Back rubber or oiler. Use in a Back rubber or oiler. **Dust Bags**	 Follow Mixing Directions on Label. Follow Mixing Directions on Label. Follow Mixing Directions on Label. PBO= Piperonyl Butoxide a material that increases the effectiveness of most pyrethrin and pyrethroid insecticides. **Follow Label Carefully Before Applying Dusts Directly to Animals**.

HORSE ECTOPARASITE CONTROL SUGGESTIONS

PESTS AND TIME OF TREATMENT	INSECTICIDE : Trade Name %Concentration A.I.* (Common Name)	METHOD	COMMENTS
Horn flies, face flies, stable flies and aid in control of mosquitoes horse flies, deer flies, black flies etc. (spring-summer)	Co-Ral Fly and Tick Spray 6.15% (coumaphos)	Spray	Follow label Directions.
	Co-Ral 11.6% ELI (coumaphos)	Restricted-Use-Pesticide	See footnote.
	Endure 35WP (Esfenvalerate 35%)	Spray	Do not apply when feed is present.
Fly Control in Horse Facilities (These products are to be applied in horse facilities only and not on the animal)	QuickBayt (imidacloprid 0.5%)	Bait	Scatter bait directly from container onto dry level surfaces so individual granules lie near each other without forming piles. Or place in any commercial bait station. Or mix 1.5 oz. bait with 1 fl. oz. warm water and stir to create a paste; apply with brush to surfaces where flies rest. Bait should be inaccessible to food-producing animals, children, and pets.
	Elector Bait (0.5% spinosad)	Bait	Follow label directions.
	Permectrin II 10% (permethrin)	Spray	Follow label Directions.
	Atroban 42.5% EC (permethrin)	Spray	Follow label Directions.
Ticks (spring-summer)	Co-Ral Fly and Tick Spray 6.15% (coumaphos)	Spray	Follow label Directions
Winter tick and Black-legged tick (Oct.-Jan.)	GardStar 40% EC (permethrin)	Spray	Follow label Directions.
Lice (winter)	**Ready-to- use Compounds:**	Almost all of these products are **Ready –to-Use Formulation** that are designed to be used as a **Pour-on, Mist spray, or a Wipe-On.**	Always carefully read and follow label directions for these products.
	There are many different Brand Names or formulations of materials containing **PYRETHRIN +PBO** or those containing a formulation of **PERMETHRIN** some with an addition of **PBO.**		**PBO** = Piberonyl Butoxide. A material that increases the effectiveness of some pyrethrin and pyrethroid insecticides.
	Most of these formulations are designed specifically for use on horses and are found in the horse specialty sections of farm or veterinary outlets or veterinarians.		
Bots (larvae in stomach or intestine).	Several Insecticide Formulations for these pests.	See labels or veterinarians.	Several formulations are available. Some are for use only by or upon order of licensed veterinarians; others may be administered by owner. Check product label restrictions on the particular product.
	Check with Veterinarian.		
Bot Fly Eggs (Horse bot flies deposit eggs on the hairs of the legs, nose and jaw of horses in the summer to late fall.)	Check insecticide label. Several insecticide formulations can be used as a wipe on to stimulate the eggs to hatch and kill the larvae before they crawl into the mouth of the horse		

*** A.I.= Active Ingredient.**

Footnote: Co-Ral 11.6% ELI formulation is now classified as a **RESTRICTED USE PESTICIDE**. As such, it can only be purchased and used by Certified Applicators or used by persons under the direct supervision of a Certified Applicator.

OTHER ITEMS: Vaccinate horse as recommended for protection against West Nile Virus and Western Equine Encephalitis Viruses. Vaccinated horses normally need an annual booster shot. Watch for blister beetles in alfalfa hay. See OSU Fact Sheet No. 2072, Blister Beetles and Alfalfa.

SHEEP ECTOPARASITE CONTROL SUGGESTIONS

PESTS AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	METHOD	COMMENTS
Nasal Bots	Ivomec Sheep Drench (0.08%)	Administer orally at a dose of 3 ml per 26 lbs. body wt. Delivers 0.2 mg ivermectin per 1 kg body wt.	For nasal bots: Ready-to-use solution is specifically formulated for use in sheep only. May cause severe reactions in other animals. Do not treat sheep within 11 days of slaughter.
Lice, keds and ticks	INSECTICIDES CONTAINING **PERMETHRIN** as the Active Ingredient.		Follow Label Directions.
In fall or spring after shearing.	Atroban 11% EC	Spray	Follow Label Directions.
	Atroban 42,5 % EC	Spray.	Follow Label Directions.
	GardStar 40% EC	Spray.	Follow Label Directions.
	Permectrin II	Spray.	Follow Label Directions.
	Pour-on formulations:		
	Atroban 1%	Ready-to Use Pour-on	Follow Label Directions.
	Boss 5%	Ready-to Use Pour-on	Follow Label Directions.
	Ultra Boss 5%+ 5% PBO	Ready-to Use Pour-on	Follow Label Directions.
	Permectrin CDS 7.4%+ 7.4% PBO	Ready-to Use Pour-on	Follow Label Directions.
	Peremctrin 1%	Ready-to Use Pour-on	Follow Label Directions.
	Permectrin S 1% + 1% PBO	Ready-to Use Pour-on	Follow Label Directions.
	Dust Formulations		
	Python dust 0.075% (zeta-cypermethrin)	Ready-to Use Dust.	Follow Label Directions.
Scab mites[1] (Psoroptes Mange)	See footnote. Treat under a veterinarian's direction.		

[1] If scabies are suspected in a flock of sheep, this situation should be reported immediately to your county educator or local veterinarian who will notify proper state and federal authorities. Scabies, a condition caused by scab mites, can result in quarantines against Oklahoma sheep if not properly handled. Oklahoma has completed an eradication program and is thought to be free of this pest.

*** A.I.=Active Ingredient**

GOAT ECTOPARASITE CONTROL SUGGESTIONS

PESTS AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	METHOD	COMMENTS
Lice, keds, flies and ticks	INSECTICIDES CONTAINING **PERMETHRIN** as the Active Ingredient.		
Lice and Keds: Late Fall – Spring	Atroban 11 % EC	Spray.	Follow Label Directions.
	Atroban 42.5 % EC	Spray.	Follow Label Directions.
Flies and Ticks: Late Spring – Early Fall	GardStar 40% EC	Spray.	Follow Label Directions.
	Martin's Permethrin 10% Multi-Purpose Insecticide	Spray	Retreatment is required 14-21 days after initial treatment for lice and mites.
	There are many permethrin products available but always check the label to determine if a particular product can be used on goats.		
	Dust Formulations		
	Python dust (0.075% zeta-cypermethrin)	Ready-to Use dust	Follow Label Directions.

*** A.I.= Active Ingredient**

SWINE ECTOPARASITE CONTROL SUGGESTIONS

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	METHOD	COMMENTS
Lice Fall through spring	Co-Ral 11.6% ELI (coumaphos)	Restricted-Use-Pesticide	Purchased and applied by Certified Applicator only.
	Co-Ral Fly and Tick Spray 6.15 % (coumaphos)	Spray	Do not treat sick, convalescent or stressed animals. Do not spray animals for 10 days before or after shipping or weaning or after exposure to contagious or infectious diseases. Do not spray in a confined, non-ventilated area. Do not apply in conjunction with oral drenches or other internal medications, or with natural or synthetic pyrethroids or their synergists, or with other organophosphates or cholinesterase inhibiting drugs, pesticides or chemicals.
	Prolate/Lintox HD 11.75% (phosmet)	Spray	If retreatment is required do not apply until 14 days after initial treatment.
	Rabon 50% WP (tetrachlorvinphos)	Spray	Follow Label Directions.
	Taktic 12.5% EC (amitraz)	Spray	Follow Label Directions.
	Doramectin (Decto Max)	Injectable	Pre-harvest interval is 24 days
	Permethrin and Related **Pyethroid** Materials (a partial listing of many materials available.)		There are many different formulation of these materials sold under many trade names. Read the label carefully to be sure of the material and the label directions.
	Etiban or Insectaban 5.7% EC	Spray	Follow Label Directions
	Atroban 42.5% EC	Spray	Follow Label Directions.
	Atroban 11% EC	Spray	Follow Label Directions.
	GardStar 40%EC	Spray	Follow Label Directions.
	Permectrin II 10% permethrin	Spray	Follow Label Directions.
	SwineGuard 10% permethrin	Ready-to-Use Pour-on	Follow Label Directions
	Taktic 12.5% EC (amitraz) (Not permethrin)	Spray	Follow Label Directions

SWINE ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME OF TREATMENT	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	METHOD	COMMENTS
	Ready to Use Dust formulations: There are several different formulations of dust that can be applied directly to swine. Some of these include formulations of : coumaphos (Co-ral), permethrin and tetrachlorvinphos (Rabon).	Direct Application Dusts	Follow Label Directions.
Mange Mites	Use the following insecticides as listed under lice control. Taktic (amitraz), Phosmet. Permethrin: Atroban, Ectiban, Insectaban, Permectrin.		Follow Label Instructions for manage mite control.
Ticks	Co-Ral Fly and Tick Spray 6.15 % (coumaphos)	Spray	Do not treat sick, convalescent or stressed animals. Do not spray animals for 10 days before or after shipping or weaning or after exposure to contagious or infectious diseases. Do not spray in a confined, non-ventilated area. Do not apply in conjunction with oral drenches or other internal medications, or with natural or synthetic pyrethroids or their synergists, or with other organophosphates or cholinesterase inhibiting drugs, pesticides or chemicals.
Blowflies, Mosquitoes, Fleas and Ticks	Permectrin II 10% permethrin Prolate/Lintox HD 11.75% (phosmet)	Spray Spray	Spray, paint or dip to apply 1 pint per hog, especially around ears. If retreatment is required do not apply until 14 days after initial treatment.

* A.I.=Active Ingredient

POULTRY ECTOPARASITE CONTROL SUGGESTIONS

PESTS	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	COMMENTS	
Bedbugs, Chicken Lice, Fleas, Fowl Ticks, and Mites <u>For direct treatment to birds or poultry facility</u>	Malathion 4% or 5% Dust	Dust or Ready-to-use (RTU)	Apply 1 lb./100 birds by direct application to birds or apply 1 lb./50 sq. ft. of litter and floor space and to nests, roosts and adjacent areas or apply 1 lb. in 18"x12"x3" dust box/30 birds.
	Ectiban, Insectrin, Permectrin (0.25% permethrin Dust)	Dust or RTU	Apply 1 lb./100 birds. Ensure thorough treatment of vent for northern fowl mite control.
	Malathion (Cythion) 25% WP or 5 lbs. a.i. per gal. EC (57%)	Spray	Apply 1 gal./100 birds of 0.5% spray OR apply 1 gal. 1.0% spray/1,000 sq. ft. to litter, walls, ceilings, nests, roosts and adjacent areas. **<u>Do not apply 1.0% spray directly to birds.</u>**
	Permethrin (Ectiban, Permectrin) 5.7% EC	Spray	Apply 1 gal. diluted spray to 100 hens using high pressure. Apply to vent area for best results. A second application may be needed 4 to 12 weeks later.
	Ravap (23.0% stirofos + 5.7% dichlorvos) 28.7% EC	Spray	Apply 1 gal./100 birds. Apply directly to birds. Spray vent and fluff areas from below using high pressure (100 p.s.i. and up) sprays. Wet feathers around vent area for effective control. Do not spray birds more often than once every 14 days. For floor birds, apply 1 to 2 gals. of spray per 1,000 sq. ft. of litter. Spray birds lightly.
	Rabon 50% WP (tetrachlorvinphos)	Apply spray directly to birds, especially vent area.	Follow label directions.
	Permethrin Formulations:	Apply spray directly to birds, especially vent area for all formulations.	
	Ectiban 5.7%		Follow label directions.
	Insectaban 5.7%		
	Atroban 11% EC		
	GardStar 40% EC		
	Permectrin II 10% EC		

POULTRY ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PESTS	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	COMMENTS	
Litter Beetles	Safecide 99.0% (orthoboric acid)	Apply as a dust directly to litter when birds are not present.	Follow label directions.
	Duratrol Darkling Beetle Spray (chlorpyrifos)	- Restricted use pesticide	Follow label directions.
	Tempo SC Ultra (11.8% cyfluthrin)	Spray	Apply as a general surface and/or a crack and crevice spray. Do not make applications when birds are present. Do not make applications to feed, water and feeding and watering equipment.
	Tempo 1% cyfluthrin	Dust	Remove all animals from facility. Apply dust using hand or power dusters or other suitable equipment. Apply uniformly at 0.5 to 1 pound per 1,000 sq. ft. Do not apply to feedstuffs or watering equipment. Repeat treatment as necessary.
	Tempo 20 WP (cyfluthrin)	Spray	Remove all animals from facility. Based on label chart, spray adequate material to adequately cover area but not allow dripping or run-off to occur. Do not apply to feedstuffs or watering equipment. Do not re-apply more frequently than every 10 days.
	Grenade (9.7% lambdacyhalothrin)	Spray	To control litter beetles, apply to walls and floors at cleanout, before reintroduction of animals. To help control flies, apply to fly resting areas, and allow todry before animals are readmitted. Do not make applications when animals are present; do not apply to feedstuffs, water, or watering equipment; do not contaminate food, feed, or water.
	Elector PSP (44.2% spinosad)	Spray	Spray fly-resting surfaces. Do not apply where birds are present. Follow label directions.
	Rabon Beetle Shield (3% tetrachlorvinphos dust)	RTU	Use 4 to 8 oz./100 sq. ft., applied using plunger or rotary type duster.
	Ravap E.C. (23% tetrachlorvinphos + 5.3% dichlorvos)	Spray	Apply 1 gal. of spray per 500 to 1,000 sq. ft. to cover walls, floors, and other sites where beetles congregate.

POULTRY ECTOPARASITE CONTROL SUGGESTIONS (CONT'D)

PESTS	INSECTICIDE: Trade Name % Concentration A.I.* (Common Name)	COMMENTS	
Fly larvae in litter.	Larvadex 1% FAP (cyromazine)	Mix in feed. For use in self-mixers	Mix and feed according to label directions.
	Lavadex 10 TK (cyromazine)	Premix for commercial feeds.	Feed following directions..
	Ravap 23% +5.7% EC Rabon + Vapona (tetrachlorvinphos + dichlorvos)	Spray on litter.	Follow label directions.
Flies	QuickBayt (imidacloprid 0.5%)	Bait	Scatter bait directly from container onto dry level surfaces so individual granules lie near each other without forming piles. Or place in any commercial bait station. Or mix 1.5 oz. bait with 1 fl. oz. warm water and stir to create a paste; apply with brush to surfaces where flies rest. Bait should be inaccessible to food-producing animals, children, and pets.
	QuickBayt Fly Strip	RTU	Use in buildings where animals are kept and where flies are a nuisance.
	Apache, Golden Malrin, Improved Golden Malrin, Blue Streak (1% methomyl)	Bait	Scatter on floors, walkways, etc., throughout house. Apply heavy (about 1/2 - 2 lbs./1,000 sq. ft.) until flies are suppressed. Wear rubber gloves when applying baits. Do not allow workers on treated floors without shoes. Keep pets out of house. Do not contaminate eggs, feed or water. Keep baits away from birds.
	QuikStrike (1.0% nithiazine) fly abatement strips	RTU	Hang one strip per 100 ft.2 or 300 ft.2 depending on fly population in enclosed areas that are protected from rain.
	Elector Bait (0.5% spinosad)	Bait	Apply at rate of 12 to 16 oz. of bait per 2,000 sq. ft. of building Follow label directions.
	Elector PSP (44.2% spinosad)	Spray	Spray fly-resting surfaces. Do not apply where birds are present. Follow label directions.
	Elector (2.46% spinosyn)	Spray	Remove all animals from facility. Spray fly-resting surfaces to point of runoff, using approx. 1 gal. per 500 to 1,000 sq. ft. Repeat as needed, but not more often than once per week. Spray in early morning when flies are resting. Do not use in poultry facilities when animals are present; allow surfaces to dry completely before readmitting animals.
	Atroban, Ectiban, Insectrin, Permectrin (5.7% Permethrin)	Spray	Apply as a residual surface spray to fly resting areas (walls, ceilings, etc.). Do not spray manure or litter. Do not apply directly to poultry. Do not apply in egg storage areas. Apply 5.7% EC undiluted at 4 ozs. per 1000 sq. ft. of surface area or apply diluted WP and EC mixtures at 1 gal./750 sq. ft. Don't apply more than once every 2 weeks.

* A.I. = Active Ingredient

CONTROL OF COMMON AQUATIC WEEDS

Aquatic weed control begins with identification of the problem plant.

Step 1. Determine growth habit of plant:

EMERGENT	- most of plant above water
SUBMERGED	- may have flowers or seeds above water
OPPOSITE LEAVES	
ALTERNATE LEAVES	
WHORLED LEAVES	
FLOATING LEAVES	- leaves float on water
FREE-FLOATING	- duckweed and watermeal
ALGAE	- simple non-vascular plants

Step 2. Locate appropriate growth habit section and identify weed.

Step 3. After identifying plant, determine best treatment from the options listed. Suppliers are given at end of section. If restrictions on water use are listed, then see the restrictions table at the end of this section and the label.

This publication is not intended to be a complete source of information on herbicide applications. Always read and follow the instructions on the label. The **USER** always assumes complete responsibility for effects of herbicide treatments.

Consider non-herbicide treatments listed under Alternative Treatment heading under each weed.

Extension Fact Sheets are available: Aquatic Weed Management – Control Methods (SRAC 360) and Aquatic Weed Management - Herbicides (SRAC 361).

Common Sense in Aquatic Weed Control

The number one cause of rooted weed problems is shallow water. This allows sunlight to strike the bottom and permits rooted plants to sprout and grow.

The number one cause of algae problems in ponds is excess nutrients, especially from cattle, lawns or un-pumped septic systems.

No chemical control is permanent. If conditions are good for weed growth (shallow water, excess nutrients, etc), then weeds will return.

Usually the safest and most effective time to apply herbicides is early spring.

If weed growth is heavy, treat no more than one-fourth of pond and wait 2 weeks before treating subsequent section. To do otherwise, invites a fish kill due to lack of oxygen as weeds decay.

Muddy ponds are difficult to treat chemically because many herbicides bind with clay particles. Do not stir up mud while applying herbicides.

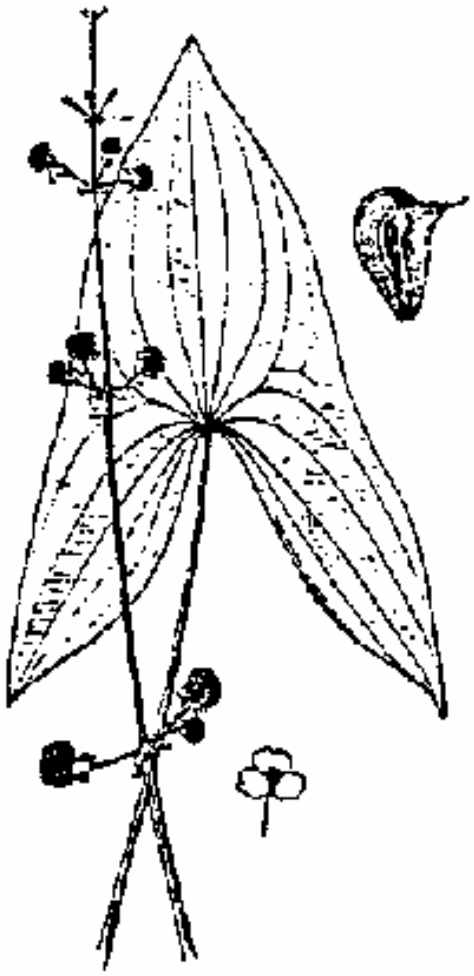
For safe herbicide applications, usually **the volume of the pond must be measured exactly**. Pond owners almost always overestimate pond size, resulting in over-application of herbicide. To calculate pond volume first determine average water depth by dropping a weighted line to the bottom at many locations in the pond. Next pace off perimeter of pond to determine surface acres or see if your county Soil Conservation Service office can determine surface acres from an aerial photograph.

Pond volume = average depth (feet) x surface acres.

One part per million (ppm) equals 2.7 lbs active ingredient per acre foot of water.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

EMERGENT



ARROWHEAD (*Sagittaria* spp.)
Arrowhead shaped leaves.
Three petaled white flowers in whorls of three.
Tuberlike roots are edible - "Duck Potatoes."
Milky sap.

For photos - see websites at the end of this section

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (38.9%) ae liquid	Excellent	$10-20/ surface acre	2 oz per gal water sprayed on plants or 2-4 pt/acre	21 days irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Excellent	$66-115/ surface acre	4.5-7.5 pts/ surface acre	0 days except water intakes, rice	Best results in summer or fall when actively growing. Nonionic surfactant (e.g., Ortho X-77 or Aqua King).
Reward (Diquat)	Good	$65/surface acre	1 gal/ surface acre	human, livestock, irrigation	Nonionic surfactant (e.g., Ortho X-77 or Aqua King).

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

EMERGENT

WATERWILLOW (*Justicia americana*)
Willow-like leaves, opposite attachment.
2-3 feet tall.
Small orchid-like flowers - white with purple spots on lower petal.

For photos - see websites at the end of this section

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (38.9% ae liquid)	Excellent	$10-20/ surface acre	2 oz/gal water sprayed on plants or 2-4 pt/acre	21 days irrigation and domestic	Take steps to reduce spray drift

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

EMERGENT

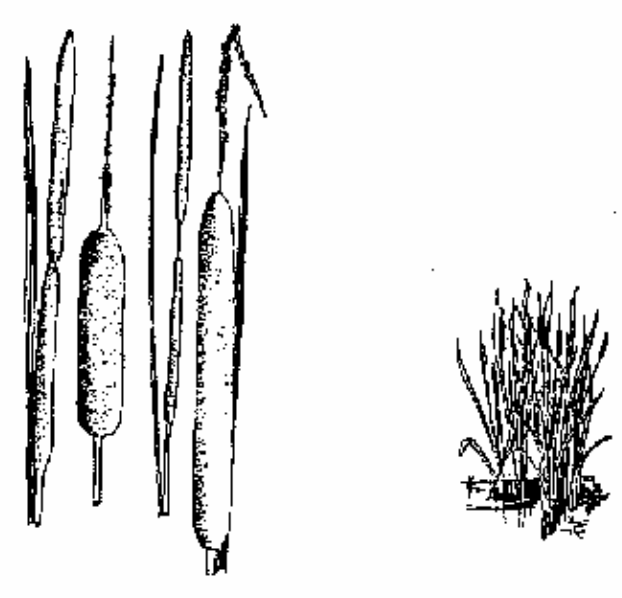
BULLRUSH (*Scirpus* spp.)
Up to 9 feet tall.
Smooth, round, hollow stems.

For photos - see websites at the end of this section

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (38.9% ae liquid)	Excellent	$10-20/ surface acre	2 oz per gal water sprayed on plants or 2-4 pt/acre	21 days irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Excellent	$66-115/ surface acre	4.5-7.5 pts/ surface acre	0 days except water intakes, rice	Best results in summer or fall when actively growing. Nonionic surfactant (e.g., Ortho X-77 or Aqua King).

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

EMERGENT



CATTAILS (*Typha* spp.)

Best herbicide results when 3 feet tall and actively growing. Best to control before seed spikes form.

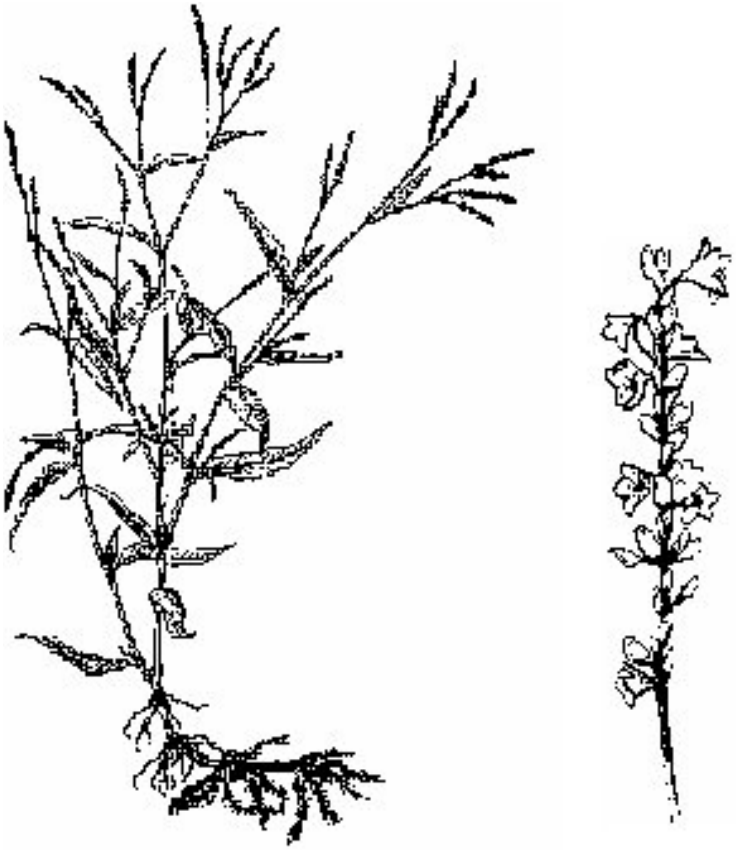
For photos - see websites at the end of this section

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Reward (Diquat)	Good	$65-130/ acre	5 oz/4 gal water sprayed on plants	human, livestock, irrigation	Nonionic surfactant (e.g., Ortho X-77 or Aqua King).
2,4-D (38.9% ae liquid)	Good	$10-20/acre	4 oz/gal of water sprayed on plants or 2-4 pt/acre	21 days, irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Excellent	$66-115/ acre	Boom rate: 4.5-6.0 pt Aquamaster plus surfactant in 3-30 gal water per surface acre. Hand rate: 1 oz Aquamaster plus surfactant per gal water per surface acre.	0 days except water intakes, rice	Best results in summer or fall when actively growing and at or beyond the early to full bloom stage. Nonionic surfactant (e.g., Ortho X-77 or Aqua King).

Alternative Treatments:
Use brush attachment on weed eater - cut and then recut growth before seed spikes form.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

EMERGENT



SMARTWEED (*Polygonum hydropiperoides)* Jointed stems, "tufts" at joints. Leaves alternate.
Flowers pink or white on spike. Up to 3 feet tall.

For photos - see websites at the end of this section

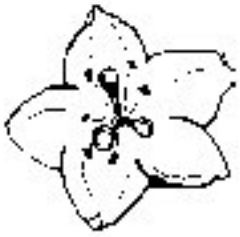
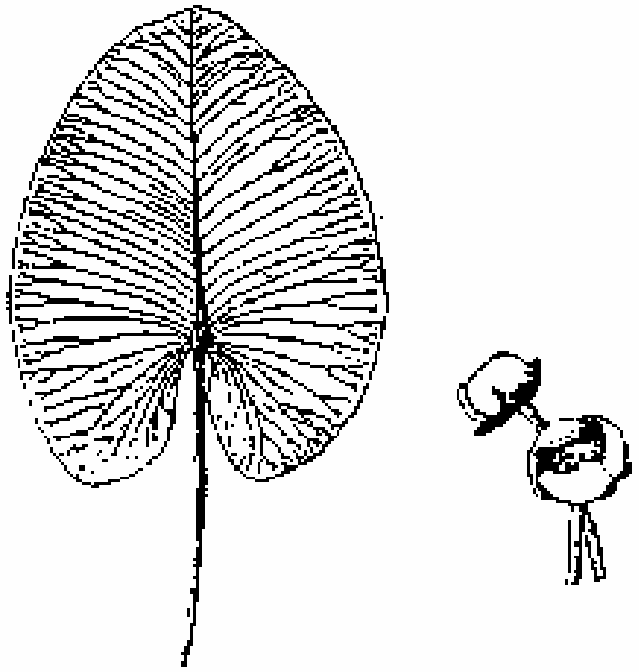


illustration provided by:
IFAS, Center forAquatic Plants
Universitv of Florida. Gainesville. 1993

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (38.9% ae liquid)	Good - Excellent	$10-20/ surface acre	2-4 pts/ surface acre	21 days irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Fair - Excellent	$66-115/ surface acre	4.5-7.5 pts/ surface acre	0 days except water intakes, rice	Nonionic surfactant (e.g., Ortho X-77 or Aqua King).

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

EMERGENT



SPATTERDOCK (*Nuphar luteum*)
Oval heart shaped leaves.
Stem extends to tip of leaf.
Yellow flower often confused with lily or lotus

Herbicide	**Effectiveness**	**Cost (Approximate)**	**Dose (Approximate)**	**Water Use Restrictions - See table at end of section**	**Remarks**
2,4-D (38.9% ae liquid)	Excellent	$10-20/ surface acre	8 oz/5 gal water sprayed on plants or 2-4 pt/acre	21 days irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Good - Excellent	$66-115/ surface acre	Boom rate: 6 pt Aquamaster plus surfactant per 3-30 gal water per surface acre. Hand rate: 1 oz Aquamaster plus surfactant per gal water per surface acre.	0 days except water intakes, rice	Apply when most plants are in full bloom. Best results in summer or fall months. Nonionic surfactant (e.g., Ortho X-77 or Aqua King).
Sonar (fluridone)	Excellent	$235-700/ surface acre	0.5-1.5 quarts/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment only.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

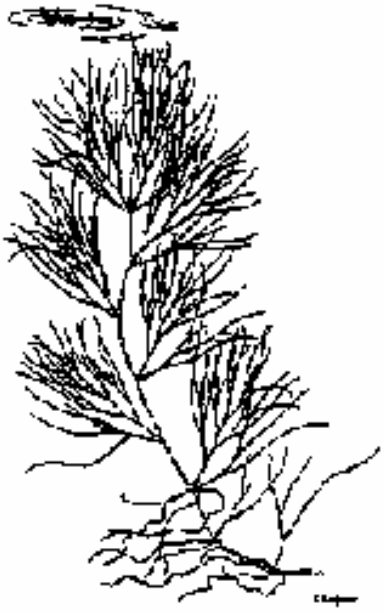
SUBMERSED WITH ALTERNATE LEAF ATTACHMENT

PONDWEEDS (*Potamogeton* spp.)
Long, flexible rooted stems.
Leaves variable.
Also see Pondweed figures in floating leaved section.

For photos - see websites at the end of this section

AMERICAN PONDWEED *(P. nodosus)*

SAGO PONDWEED *(P. pectinatus)*



CURLYLEAF PONDWEED *(P. crispus)*

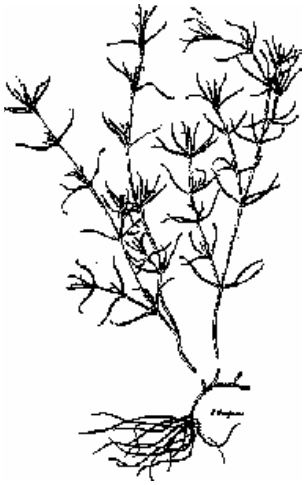
Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Reward (Diquat)	Good	$130/ surface acre	2 gal/ surface acre	human, livestock, irrigation	Do not treat muddy water.
Aquathol K (granular) (endothall)	Excellent	$34-68/ acre foot	27-54 lb/ acre foot	human, livestock, irrigation	Application hazard requires special care
Aquathol K (liquid) (endothall)	Excellent	$18-39/acre foot	0.6-1.3 gal/ acre foot	human, livestock, irrigation	
Sonar (fluridone)	Excellent	$235-700/ surface acre	0.5-1.5 quarts/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment only.

Alternative Treatment:
Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

Water dye: 1 gallon per acre, 3x per year, before leaves grow to surface.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

SUBMERSED WITH OPPOSITE LEAF ATTACHMENT



NAIADS ("Ni-ads")
Small fruits in leaf axils.
Attached to pond bottom.
Can be confused with FILAMENTOUS ALGAE.

For photos - see websites at the end of this section

SOUTHERN NAIAD
(*Najas guadaluponsis*)
Stem up to 2 feet long.

illustration provided by:
IFAS, Center for Aquatic Plants
University of Florida, Gainesville, 1990

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Reward (Diquat)	Excellent	$65/ surface acre	1 gal/ surface acre	human, livestock, irrigation	Do not treat muddy water.
Aquathol K (granular) (endothall)	Excellent	$100/acre foot	80 lb/acre foot	human, livestock, irrigation	Application hazard requires special care
Aquathol K (liquid) (endothall)	Excellent	$9-30/acre foot	large area: 0.3-1.0 gal/ acre foot	human, livestock, irrigation	
2,4-D (ester)	Fair	$50-100/ acre	2.5-5 gal/ acre	21 days irrigation and domestic	Ester is much more toxic to fish but fish kills seldom occur at these doses.
Sonar (fluridone)	Excellent	$235-700/ surface acre	0.5-1.5 quarts/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, hole pond treatment only.

Alternative Treatment:

Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

Water dye: 1 gallon per acre, 3x per year.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

SUBMERSED WITH WHORLED LEAF ATTACHMENT

ELODEA (*Elodea* spp.)
3 leaves per whorl on upper branches.
Warning: Reproduces from fragments.
Up to several feet long.

GIANT EGERIA (*Egeria densa*)
4-6 leaves per whorl on upper branches.
3/4 inch white flowers.
Warning: Reproduces from fragments.
Up to 9 feet long.

For photos - see websites at the end of this section

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Reward (Diquat)	Elodea: Excellent Egeria: Good	$130/surface acre	2 gal/ surface acre	human, livestock, irrigation	Do not treat muddy water.
Sonar (fluridone)	Excellent	$235-700/surface acre	0.5-1.5 pt/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment

Alternative Treatment:

Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

Water dye: 1 gallon per acre, 3x per year.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

SUBMERSED WITH WHORLED LEAF ATTACHMENT

COONTAIL (*Ceratophyllum* spp.)

Threadlike forked leaves without nodules.
Usually without roots.
Can be confused with Chara -- see algae section at end.

For photos - see websites at the end of this section

"teeth" on outside edge

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (liquid)	Good	$50-200/surface acre	2.5-10 gal/ surface acre	21 days irrigation and domestic	
Reward (Diquat)	Excellent	$130/surface acre	2.0 gal/surface acre	human, livestock, irrigation	Do not treat muddy water.
Aquathol K (liquid) (endothall)	Excellent	$18-39/ acre foot	0.6-1.3 gal/acre foot	human, livestock, irrigation	Application hazard requires special care
Aquathol K (granular) (endothall)	Excellent	$68/acre foot	54 lb/acre foot	human, livestock, irrigation	
Sonar (fluridone)	Excellent	$235-700/ surface acre	0.5-1.5 quarts/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment only.

Alternative Treatment:

Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

Water dye: 1 gallon per acre, 3x per year.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

SUBMERSED WITH WHORLED LEAF ATTACHMENT

WATERMILFOIL (*Myriophyllum* spp.)

Fine feather-like leaves.
Rooted to bottom.
Warning: Reproduces by fragments.
For photos - see websites at the end of this section

Leaves rough and stiff.
WATERMILFOIL

Leaves soft, flexible and limp.
EURASIAN WATERMILFOIL

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Aquathol K (granular)	Excellent	$100/acre foot	81 lb/acre foot	human, livestock, irrigation	
Reward (Diquat)	Excellent	$65-130/ surface acre	1-2 gal/ surface acre	human, livestock, irrigation	Do not treat muddy water.
Sonar (fluridone)	Excellent	$235-700/ surface acre	0.5-1.5 quarts surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment only.
2, 4-D (granular)	Excellent	$280 - 560/ surface acre	5 lbs/ 2000 sq ft 100 - 200 lbs/surface area	21 days irrigation and domestic	
2, 4-D (liquid)	Excellent	$50-200/ surface acre	2.5 - 10 gal/ acre	21 days irrigation and domestic	Higher rate for acers with high water exchange

Alternative Treatment:
Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

Water dye: 1 gallon per acre, 3x per year.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

SUBMERSED WITH WHORLED LEAF ATTACHMENT

STONEWARTS

Most with musty-garlic smell.
Most gritty to the touch.
Attached to bottom (no true roots).

(See Under Algae Section)
For photos - see websites at the end of this section

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

FLOATING-LEAVED

CREEPING WATER PRIMROSE (*Ludwigia* spp.)

Bright yellow flowers in summer.
Spongy white "roots" along stem.

For photos - see websites at the end of this section

Leaf shape varies.

Lays flat on water surface, rooted at shore.

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (38.9% ae liquid)	Excellent	$10-20/ surface acre	2 oz/gal water sprayed on plants or 2 -4 pt/acre	21 days irrigation and domestic	Take steps to avoid spray drift
Aquamaster (53.8% glyphosate)	Excellent	$66-115/ surface acre	1-1.3 oz plus surfactant per gal water sprayed on plants.	0 days except water intakes, rice	Apply thoroughly when plants are at or beyond bloom, before fall color change. Nonionic surfactant (e.g., Ortho X-77 or (Aqua King).

Alternative Treatment:

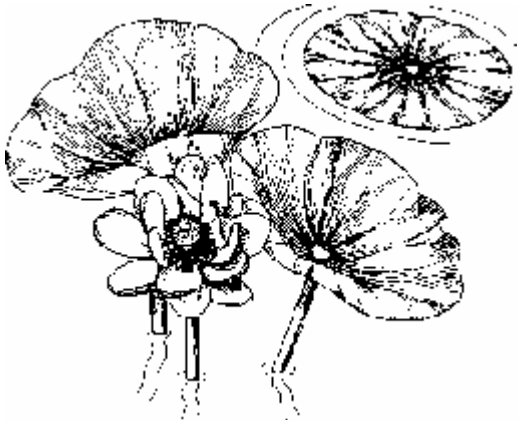
Pull out by hand or drag before plants set seed.

Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

FLOATING-LEAVED

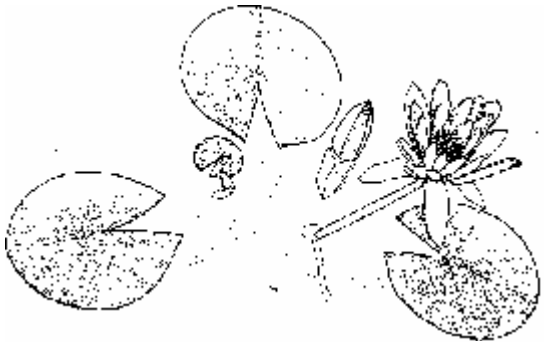
AMERICAN LOTUS (*Nelumbo lutea*)



Large round leaves that extend above water. Completely round leaf with stem attachment in center.

WATER LILY (*Nymphea* spp.)

For photos - see websites at the end of this section



Circular leaves with a slit from edge to center. Often confused with Spatterdock
illustration provided by: IFAS, Center for Aquatic Plants University of Florida, Gainesville, 1990

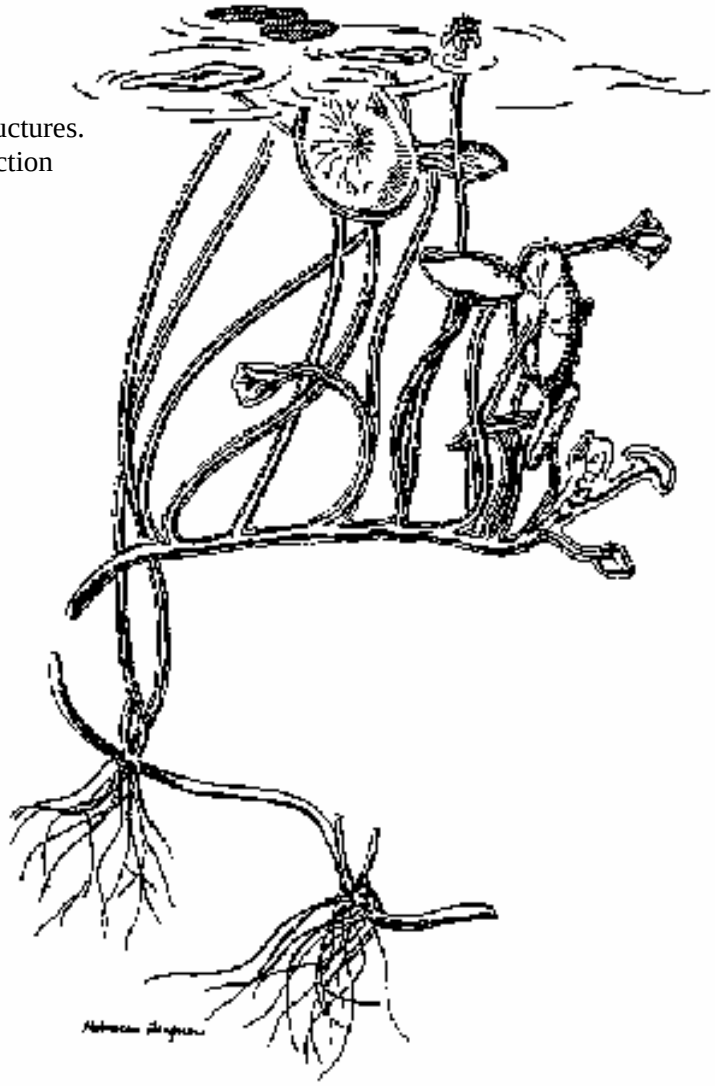
Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions -See table at end of section	Remarks
2,4-D (38.9% ae liquid	Excellent	$45-78/ surface acre	8 oz in 5 gal water sprayed on plants or 2-4 pts/acres	21 days irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Good-Excellent: lotus Poor: lillies	$66-115/ surface acre	Boom rate: 4 pt plus surfactant per 3-30 gal water per surface acre. Hand rate: 1 oz plus surfactant per gal water per surface acre.	0 days except water intakes, rice	Treat when actively growing at or beyond bloom stage. Repeat treatments may be needed to control regrowth from seeds and tubers.
Sonar (fluridone)	Excellent: lillies Fair: lotus	$235-700/surface acre	0.5-1.5 quarts/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment only.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

FLOATING-LEAVED

WATERSHIELD (*Brasenia schreberi*)

Round, floating leaves.
Jelly on young stems, buds and lower leaf structures.
For photos - see websites at the end of this section



Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
2,4-D (liquid)	Excellent	$50-200/ surface acre	2.5-10 gal/ surface acre	21 days irrigation and domestic	Take steps to reduce spray drift
Aquamaster (53.8% glyphosate)	Good	$70-110/ surface acre	4.5-7.5 pts/ surface acre	0 days except water intakes, rice	Spray on leaves. Nonionic surfactant (e.g., Ortho X-77 or Aqua King).
Sonar (fluridone)	Good	$235-700/ surface acre	0.5-1.5 quarts/ surface acre	30 days for irrigation, water intake restrictions	Slow acting, hazard to trees at water's edge, whole pond treatment only.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

FLOATING-LEAVED

PONDWEEDS (*Potamogeton* spp.)
Long, flexible rooted stems.
Leaves variable.
For photos - see websites at the end of this section

AMERICAN PONDWEED
(P. nodosus)

VARIABLE-LEAF PONDWEED
(P. diversifolius)

See Pondweeds under SUBMERSED WITH ALTERNATE LEAF ATTACHMENT

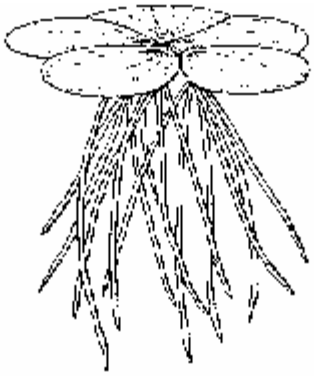
CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

FREE-FLOATING

DUCKWEEDS (*Lemna* spp.)

Specks of green often covering entire pond surface. Major food for ducks. Cattle: no harm from duckweeds. Fish: can lead to low oxygen kill.

LESSER DUCKWEED
4 mm or less.
Single root.



BIG DUCKWEED
Pumpkin seed size.
Cluster of roots.

WATERMEAL
1 mm or less.
Rootless.

Note: If treatment with herbicides is needed, do completely: even spraying duckweeds in damp areas above water level.

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Reward (Diquat)	duckweed: Good watermeal: fair	$110/acre	5 oz in 2-6 gal water sprayed on plants.	1-5 days drinking, irrigation	Nonionic surfactant. Seino to remove plants first. Spray damp shorelines repeat treatment may be needed.
2,4-D (38.9% ae liquid)	duckweed: fair watermeal: fair	$5-10/ surface acre	2-4 pts/acre	21 days	Take steps to reduce spray drift. Seine to remove plants first. Spray damp shorelines. Repeat treatment may be needed.
Sonar (fluridone)	duckweed: Excellent watermeal: Fair-Good	$235-700/ surface acre	0.5-1.5 quarts surface acre	30 days for irrigation, water intake restriction	Slow acting, hazard to trees at water's edge, whole pond treatment only.

Note: Spray all plants including those washed up on shore to prevent rapid regrowth by survivors.

Alternative Treatments:

Use a minnow seine to remove duckweed after the wind has blown it to shore.

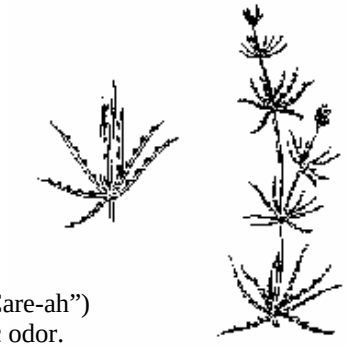
Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. See section on grass carp.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

STONEWARTS

ALGAE-SUBMERSED

Illustration provided by: IFAS, Center for Aquitic Plants University of Florida, Gainesville, 1990



CHARA ("Care-ah")
Musty-garlic odor.
Bristly to the touch.
Often gritty from calcium carbonate.
Also see COONTAIL under Submersed with Whorled Leaf Attachment.

NITELLA
Very similar to Chara.
Lacks nodules seen on "leaves" of Chara.

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Copper Sulfate[1]	Excellent	$2-6/acre foot	See footnote 1 below	None	Corrodes metal. Toxic to sheep.
Cutrine-Plus (liquid) (chelated copper)	Excellent	$31/acre foot	1.2 gal/acre foot	None	Dilute 9:1 with water. Toxic to sheep.
Cutrine-Plus (granular) (chelated copper)	Excellent	$111/ surface acre	60 lb/surface acre	None	Toxic to sheep.
Hydrothol (endothall)	Good	$150-600/ acre	2.5-10 gallons/ acre	7-14 days for most uses	**Application hazard - requires special care**

[1] Safe dose for fish and an effective dose for control of chara/nitella is based on the total alkalinity of the water. OSU irrigation in water test will provide total alkalinity.

If total alkalinity is less than 40 mg/l, then do not use copper sulfate or chelated copper: fish are at risk of copper toxicity. If total alkalinity is between 40 and 200 mg/l, then recommended pounds of copper sulfate per acre foot=(total alkalinity/100) x 2.7. **Note**: It is best to avoid creating hot spots which might harm fish. Apply copper sulfate by placing in a sack and towing behind boat in a crazy spider web pattern. If total alkalinity is more than 200 mg/l, then plain copper sulfate will not be effective. Use chelated copper or add 8 pounds of citric acid per acre foot at the same time. Use the formula above to determine pounds of copper sulfate needed.

Alternative Treatment:
Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp.

Water dye: 1 gallon per acre, 3x per year.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

ALGAE

No Figure

FILAMENTOUS ALGAE
Stringy, hair-like, totally without leaves.
Often in mats floating to surface.
Confused with NAIAD see under submersed with opposite leaves.
For photos - see websites at the end of this section

No Figure

PLANKTONIC ALGAE (Phytoplankton)
A dense green color to water.
Sometimes brown or other colors.

Herbicide	Effectiveness	Cost (Approximate)	Dose (Approximate)	Water Use Restrictions - See table at end of section	Remarks
Copper Sulfate[1] ($CuSO_4$)	Excellent	$2-6/acre foot	Lbs $CuSO_4$ = (total alkalinity/100) x 2.7 per acre foot	None	Corrodes metal. Toxic to sheep.
Cutrine-Plus[1] (liquid) (chelated copper)	Excellent	$16/acre foot	0.6 gal/acre foot	None	Dilute 9:1 with water. Toxic to sheep.
Cutrine-Plus[1] (granular) (chelated copper)	Excellent	$111/ surface acre	60 lb/surface acre	None	Toxic to sheep.
Reward (Diquat)	Good – filamentous Poor - planktonic	$110-220/ surface acre	1-2 gallons/ surface acre	Human, livestock, irrigation	Do not apply to muddy water.
Hydrothol (endothall)	Good – filamentous Good - planktonic	$17-65/ surface acre	2.2-8.6 pints/ surface acre	7-14 days for most uses	**Application hazard – requires special care**

[1] Safe dose for fish and an effective dose for control of algae is based on the total alkalinity of the water. OSU irrigation water test will provide total alkalinity.

If total alkalinity is less than 40 mg/l, then do not use copper sulfate or chelated copper: fish are at risk of copper toxicity.
If total alkalinity is between 40 and 200 mg/l, then recommended pounds of copper sulfate per acre foot=(total alkalinity/100) x 2.7. **Note**: It is best to avoid creating hot spots which might harm fish. Apply copper sulfate by placing in a sack and towing behind boat in a crazy spider web pattern.
If total alkalinity is more than 200 mg/l, then plain copper sulfate will not be effective. Use chelated copper or add 8 pounds of citric acid per acre foot at the same time. Use the formula above to determine pounds of copper sulfate needed.

Alternative Treatment:

For filamentous algae only:
Stock 10 grass carp per vegetated acre. If bass or other predatory fish are present, then 10 inch grass carp should be used. Effects are seen 2 years after stocking. See section on grass carp. Other plants will be eaten before filamentous algae.

For filamentous and planktonic algae:

- Consider reducing nutrients going into pond from cattle by fencing them out. Provide water for cattle with a freeze-proof tank below dam. See SCS Engineering Bulletin No. 210-0-5.

- If cattle must have access, consider Aquashade or similar EPA approved dyes that control algae by reducing light. One gallon per acre of water with 4 foot average depth, 3x per year.

- Heavily polluted stock-watering ponds may call for a livestock water test since nitrates may be at a harmful level.

CONTROL OF COMMON AQUATIC WEEDS (CONT'D)

Grass Carp

Grass carp effects are not usually seen until late in the second year after stocking.

Recreational fishing ponds with less than 25% weed coverage should generally not be stocked with grass carp. To open up shore fishing spots try spot herbicide treatments instead.

They **do not** reproduce in ponds. The concern is that escaped grass carp may breed in rivers and become a problem fish there.

They do tend to escape over spillways, so spillway and drain barriers should be used. For spillways, make short panels that can be moved and linked together like livestock panels. Weld rebar in a horizontal pattern on 1 inch centers.

Do not stock grass carp in ponds managed for ducks since they will eliminate plants preferred by waterfowl.

Do not stock where they might escape into public waters.

Aquatic Herbicide Suppliers

Aquacenter, Inc.
P.O. Box 4877
Greenville, MS 38704
1-800-748-8921 1-800-333-9154

Boatcycle
Box 494
Henderson, TX 75653

Chemical & Turf Specialty Co.
3208 SE I-240
Oklahoma City, OK 73135
405-677-0132

Estes Chemicals, Inc.
9410 East 55th Street
Tulsa, OK 74145
918-234-0560

Estes Chemicals, Inc.
1819 NW 5th Street
Oklahoma City, OK 73016
1-800-234-9795 1-800-850-7274

Southern Aquaculture Supply
P.O. Box 326
Lake Village, AR 71653

Inclusion on this list does not imply endorsement by the Oklahoma Cooperative Extension Service nor does exclusion imply lack of endorsement. Contact author of this section to be added to this list.

General Restrictions on Use of Treated Water (Number of Days)

- Refer to label for actual withdrawal times –

Herbicide	Human			Animal	Irrigation	
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Food Crops
Aquathol K (granular)	7[Z]	0	3	7[Z]	7[Z]	7[Z]
Aquathol K (liquid)	7[Z]	0	3	7[Z]	7[Z]	7[Z]
Copper sulfate	0[C]	0	0	0	0	0
Cutrine Plus (granular)	0	0	0	0	0	0
Cutrine Plus (liquid)	0	0	0	0	0	0
Hydrothol	7-25	0	3	7-25	7-25	7-25
Reward (Diquat)	1-3	0	0	1	1-3	5
2,4-D (granular)	21	0	0	0	21	21
2,4-D (liquid)	21	0	0	0	21	21
Aquamaster	0[A]	0	0	0	0	0[B]
Sonar A.S.	0	0	0	0	30	30
Sonar 5P	0	0	0	0	30	30
Sonar SRP	0	0	0	0	30	30

[A] See label for special restrictions near potable water intakes.
[B] Do not apply to flooded rice fields.
[C] If used for drinking no more than 4.0 ppm should be applied.
[Z] Longer waiting periods required for doses greater than 0.5 ppm, see label

Costs of Aquatic Weed Treatments

Herbicide	Approximate Prices	Approximate Treatment Costs
Aquathol K (liquid)	$130/2.5 gal	$52-520/surface acre
Aquathol K (granular)	$90/40 lbs	$180/1,000/surface acre
Copper sulfate	$30/50 lbs	$1-5/acre ft
Cutrine Plus (liquid)	$25/gal	$25-100/surface acre
Cutrine Plus (granular)	$50/30 lbs	$100/surface acre
Hydrothol (liquid)	$150/2.5 gal	$2-17/acre ft (algae) $40-200/acre ft (rooted plants)
Hydrothol (granular)	$100/40 lbs	$8-30/acre ft (algae) $68-340/acre ft (rooted plants)
Reward	$110/gal	$55-220/surface acre
Aquamaster	$300/2.5 gals	$60-90/surface acre
Sonar (liquid)	$470 /qt	$235-705/surface acre
Sonar (liquid)	$1,300/gal	$160-490/surface acre
Sonar (granular)	$750/40 lb	$190-560/surface acre
2,4-D (liquid)	$50/2.5 gals	$10-50/surface acre
2,4-D (granular)	$70/25 lbs	$280-420/surface acre
Aquashade	$40/gal	$40/acre (3x per year)
Grass Carp 3-6 inches	$2.00-3.00	stock 10 per vegetated acre
10 inches	$5.00-7.00	
Surfactants	$10-20 gal	$1-2/25 gals spray mix

Sources of Information Used

Aquatic Weeds: Their Identification and Methods of Control, Illinois Department of Conservation, Fishery Bull. No. 4, 1988.

Aquatic Plants of Oklahoma. E. N. Nelson and R. W. Couch, Oral Roberts University, 1985.

How To Identify and Control Water Weeds and Algae. J. C. Schmidt, Applied Biochemists, 1987.

Aquatic Weed Management: Herbicides, Southern Regional Aquaculture Center, Publication No. 361.

Aquatic Plant Identification and Herbicide Use Guide. Volume II: Aquatic Plants and Susceptibility to Herbicides. U.S. Army Corps of Engineers Technical Report A-88-9, November, 1988.

Water Plants for Missouri Ponds, Whitley et al., 1990, Missouri Department of Conservation.

TIPS FOR SUCCESSFUL HERBICIDE USE

- USE CLEAN TAP WATER IN SPRAY MIX, NEVER POND WATER.
- USE SURFACTANT THAT IS SPECIFIED ON LABEL.
- APPLY WHEN PLANTS ARE ACTIVELY GROWING AND BEFORE SEEDS FORM.
- **KARMEX** IS NOT APPROVED FOR POND OR LAKE USE. IT KILLS TREES WITH ROOTS IN THE WATER. SAFETY OF FISH FOR HUMAN CONSUMPTION FOLLOWING KARMEX USE IS UNKNOWN.

Photos of Aquatic Weeds

http://aquaplant.tamu.edu

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL

Right-of-way vegetation management is a very important part of the overall roadside maintenance program. The vegetation adjacent to the road surface is a functional part of the road. In addition to mechanical methods, herbicides are used for managing right-of-way vegetation. When used correctly, herbicides can selectively control undesirable weeds and leave nearby beneficial plants unharmed.

This Extension circular summarizes herbicides, rates of application per acre, water carrier rates, timing of application, and important comments for a vegetation management program. These programs include control of johnsongrass, annual grasses and broadleaves, silver bluestem (silver beardgrass), switchgrass, bermudagrass encroachment, aquatic weeds, and suppression of bermudagrass growth and development (growth regulation) along roadside right-of-ways in Oklahoma. With respect to recommended timing of applications, refer to the spray zone map (Figure 1) based on your location within Oklahoma.

Please remember these are only suggestions and the following information is for preliminary planning. There is no substitute for an applicator scouting roadside areas regularly to note the conditions of the desired species, weeds present, and their stage of development. Be sure to follow the manufacturer's directions, not withstanding the information contained in this circular. Read and follow all label directions.

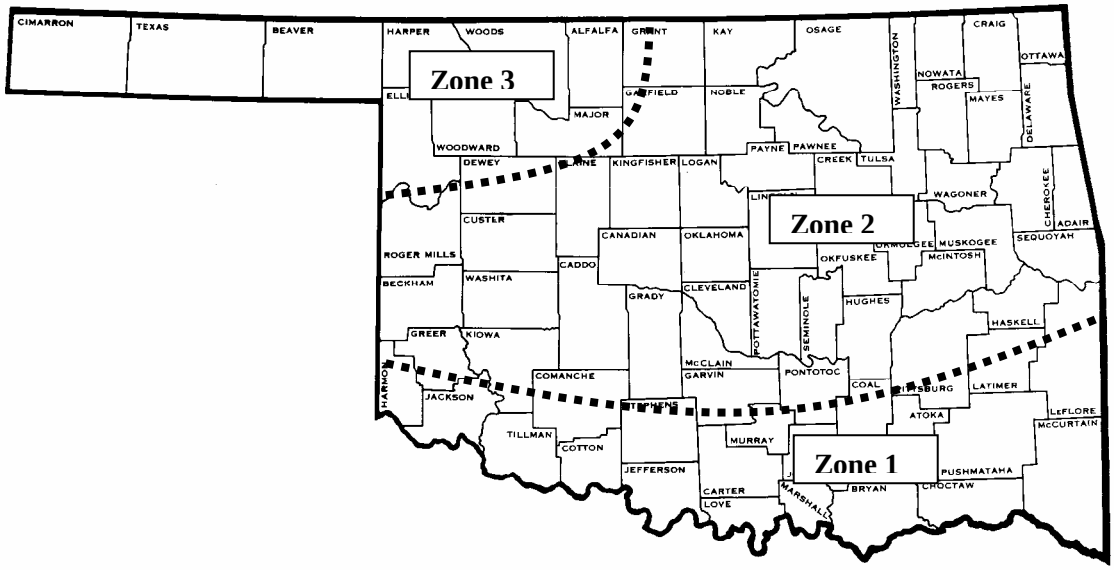


Figure 1. Seasonal herbicide spray zones along Oklahoma roadsides. Seasonal spray zones are based on many factors. Optimize your weed control results by following the recommended treatment dates for your specific zone.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Johnsongrass Control (Postemergence)	Glyphosate + sulfometuron. Apply 16 to 24 fluid ounces of product + 1 ounce of product, respectively in 20 to 40 gallons of water per acre. MOA Group 9.	Zone 1: April 20 - May 31 Zone 2: May 10 - June 15 Zone 3: May 20 - June 30

COMMENTS

1. Application should be made after bermudagrass has broken dormancy and is 100 percent green and actively growing.
2. Add glyphosate to the tank mixture first and then add the sulfometuron.
3. Applications should not be made to areas that have little or no bermudagrass to release. It is recommended that a roadside needs at least 30 percent bermudagrass cover. If not, use a MSMA program until you achieve recommended coverage.
4. Applications should not be made on newly sprigged or seeded areas. This treatment will slow the rate of coverage from sprigs and inhibit seed germination.
5. Do not apply to saturated soils or if rainfall will occur within 2 to 6 hours. Rainfall will wash the glyphosate from the plants and reduce the level of control. Generic glyphosates need to remain on foliage for at least 6 hours before any significant rainfall event.
6. If Roundup Pro Concentrate® is used, apply 13 to 19 fluid ounces of product per acre.
7. Glyphosate rates higher than 16 fluid ounces of product per acre should not be used in the western one-third of Oklahoma.
8. Do not mow roadsides prior to treatment. Wait at least 10 days after treatment before mowing or weed control may be reduced.

Johnsongrass Control (Postemergence)	Glyphosate + Plateau®. Apply 12 to 16 fluid ounces of product + 4 fluid ounces of product per acre, respectively in 20 to 40 gallons of water per acre. MOA Group 9.	Zone 1: April 20 - May 31 Zone 2: May 20 - June 15 Zone 3: May 20 - June 30

COMMENTS

1. Application should be made after bermudagrass has broken dormancy and is 100 percent green and actively growing.
2. Add glyphosate to the tank mixture first and then add the Plateau®.
3. Plateau® is only available through direct purchase from the manufacturer (BASF).
4. Applications should not be made to areas that have little or no bermudagrass to release. It is recommended that a roadside needs at least 30 percent bermudagrass cover. If not, use a MSMA program until you achieve this recommended coverage.
5. Applications should not be made on newly sprigged or seeded areas. This treatment will slow the rate of coverage from sprigs and inhibit seed germination.
6. Do not apply to saturated soils or if rainfall will occur within 2 to 6 hours. Rainfall will wash the glyphosate from the plants and reduce the level of control. Generic glyphosates need at least 6 hours before any significant rainfall event.
7. If Roundup Pro Concentrate® is used, apply 10 to 13 fluid ounces of product per acre.
8. Do not mow roadsides prior to treatment. Wait at least 10 days after treatment before mowing or weed control may be reduced.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Johnsongrass Control (Postemergence)	Glyphosate + Outrider®. Apply 12 to 24 fluid ounces of product + 0.75 to 1.33 ounces of product per acre, respectively in 20 to 40 gallons of water per acre. MOA Group 9.	Zone 1: April 20 - June 30 Zone 2: May 10 - July 30 Zone 3: May 20 - August 15

COMMENTS

1. This treatment will produce less noticeable injury to bermudagrass. It has the greatest level of bermudagrass safety of any of the suggested johnsongrass treatments especially at later applications.
2. Application should be made after bermudagrass has broken dormancy and is 100 percent green and actively growing.
3. Add glyphosate to the tank mixture first and then add the Outrider®.
4. Applications should not be made to areas that have little or no bermudagrass to release. It is recommended that a roadside needs at least 30 percent bermudagrass cover. If not, use a MSMA program until you achieve recommended coverage.
5. Applications should not be made on newly sprigged or seeded areas. This treatment will slow the rate of coverage from sprigs and inhibit germination of seeds.
6. Do not apply to saturated soils or if rainfall will occur within 2 to 6 hours. Rainfall will wash the glyphosate from the plants and reduce the level of control. Generic glyphosates need to remain on foliage for at least 6 hours before any significant rainfall event.
7. If Roundup Pro Concentrate® is used, apply 10 to 19 fluid ounces of product per acre.
8. After mowing wait until johnsongrass has 12 to 24 inches of regrowth before treating. Wait at least 10 days after treatment before mowing or weed control may be reduced.
9. The addition of certain amine-form broadleaf weed control herbicides to this treatment can result in reduced johnsongrass control (antagonism). This is not desirable and one should consult the Outrider® label before tank-mixing.
10. Glyphosate rates higher than 16 fluid ounces of product per acre should not be used in the western one-third of Oklahoma.

Johnsongrass Control (Postemergence)	MSMA. Apply 2 to 3 pounds of active ingredient per acre in 40 gallons of water per acre. MOA Group 17.	Zone 1: April 15 - July 30 Zone 2: May 10 - August 15 Zone 3: May 20 - August 15

COMMENTS

1. Two or three applications per year will be required to control johnsongrass. Treatments should start when johnsongrass reaches 12 to 18 inches in height and retreatments should be made when regrowth is 12 to 18 inches tall (retreatments usually will be made on a 3 to 4 week interval maximum).
2. Preemergence seedling johnsongrass control may be achieved by adding sulfometuron or Outrider® at 1 ounce product per' acre when the first MSMA treatment is made. Do not add sulfometuron or Outrider® to subsequent MSMA treatments.
3. Never apply MSMA to standing water, creeks, rivers, or ponds. Be sure to shut off spray rigs when passing over bridges.
4. MSMA, alone, can be used on newly sprigged or thin roadsides, as MSMA will produce very little injury or slow bermudagrass growth and development.
5. MSMA should not be applied to young bermudagrass seedlings until they have produced stolons from 1 to 3 inches in length.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Winter Annual Grass and Broadleaf Weed Control Using Postemergence Herbicides	Campaign® + ammonium sulfate (AMS). Apply 2 to 4 pints of product per acre + 17 pounds of product per 100 gallons of carrier (AMS is used only with low end rates of Campaign®) in 20 to 40 gallons of water per acre. MOA Group 4 and 9.	Zone 1: February 15 - March 20 Zone 2: February 25 - March 31 Zone 3: March 10 - April 15
COMMENTS 1. Apply to dormant bermudagrass. Applications made to bermudagrass that is beginning to green-up will result in temporary discoloration and slight bermudagrass green-up delay. 2. Campaign® should be applied at a rate of 3 to 4 pints of product per acre alone. Campaign® applied at 2 pints product per acre requires the addition of AMS. The AMS treatment will significantly reduce treatment costs while maintaining acceptable weed control. 3. Targeted weeds must be actively growing and may take 2 to 3 weeks before showing any phytotoxicity symptoms from the herbicides (this is because of the cool temperatures). 4. This product is for the control of emerged weeds only, there is no preemergence control of weeds with this treatment. 5. Precautions should be taken to avoid drift to susceptible nontarget plants. 6. AMS should be mixed thoroughly into the tank first, then add the Campaign®. 7. This treatment needs to be applied before targeted weeds reach 6 inches tall to assure good coverage and control. 8. Roadsides that are infested with musk thistle would benefit from an addition of Overdrive® at 2 ounces per acre. 9. The addition of Milestone VM® at 4 ounces product per acre to this treatment would provide 3 to 5 months of summer annual broadleaf weed control.		
Annual Ryegrass Control Using Postemergence Herbicides	Campaign® + glyphosate + ammonium sulfate (AMS). Apply 2 pints product + 16 fluid ounces of product per acre + 17 pounds of product per 100 gallons of carrier in 20 to 40 gallons of water per acre. MOA Group 4 and 9.	Zone 1: February 15 - March 10 Zone 2: February 20 - March 25 Zone 3: March 5 - April 5.
COMMENTS 1. This treatment should only be substituted for a traditional Campaign® program when annual ryegrass becomes a problem in the clear zone. 2. Annual ryegrass requires higher herbicide rates to achieve successful control. 3. If Roundup Pro Concentrate® is used apply at 13 fluid ounces of product per acre. 4. Apply to dormant bermudagrass. Applications made to bermudagrass that is beginning to green-up will result in temporary discoloration and slight bermudagrass green-up delay. 5. Targeted weeds must be actively growing and may take 2 to 3 weeks before showing any phytotoxicity symptoms from the herbicides (this is because of the cool temperatures). 6. This product is for the control of emerged weeds only, there is no preemergent (residual) control of weeds with this treatment. Milestone VM® at 4 ounces product per acre may be added to this treatment to provide 3 to 5 months of summer annual broadleaf weed control. 7. Precautions should be taken to avoid drift to susceptible nontarget plants. 8. This treatment needs to be applied before targeted weeds reach 6 inches tall to assure good coverage and control.		

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Annual Ryegrass Control Using Postemergence Herbicides	Glyphosate. Apply 32 fluid ounces of product per acre in 20 to 40 gallons of water per acre. MOA Group 9.	Zone 1: February 15 - March 10 Zone 2: February 20 - March 25 Zone 3: March 5 - April 5

COMMENTS

1. This treatment should only be substituted for a traditional Campaign® program when annual ryegrass becomes a problem in the clear zone.
2. Annual ryegrass requires higher herbicide rates to achieve successful control.
3. If Roundup Pro Concentrate® is used apply at 25 fluid ounces of product per acre.
4. Apply to dormant bermudagrass. Applications made to bermudagrass that is beginning to green-up will result in temporary discoloration and slight bermudagrass green-up delay.
5. Targeted weeds must be actively growing and may take 2 to 3 weeks before showing any phytotoxicity symptoms from the herbicides (this is because of the cool temperatures).
6. This product is for the control of emerged weeds only, there is no preemergence control of weeds with this treatment. Milestone VM® at 4 ounces product per acre may be added to this treatment to provide 3 to 5 months of summer annual broadleaf weed control.
7. Precautions should be taken to avoid drift to susceptible nontarget plants.
8. This treatment needs to be applied before targeted weeds reach 6 inches tall to assure good coverage and control.

Early Postemergence and Preemergence Control of Winter and Summer Broadleaf Weeds	Milestone VM® + non-ionic surfactant. Apply 4 ounces of product per acre + 0.25 percent solution in 20 to 40 gallons of water per acre. MOA Group 4.	Zone 1: February 15 - March 10 Zone 2: February 25 - March 31 Zone 3: March 5 - April 5

COMMENTS

1. This treatment can be tank-mixed with any of the Winter Annual Weed Control Treatments to add a residual component.
2. This treatment produces good postemergence control of emerged winter broadleaf weeds and provides 4 to 5 months of residual control of many common summer annual broadleaf weeds.
3. This treatment will provide 40 to 50 percent kochia suppression if applied and activated with rainfall before kochia emerges.
4. A quality non-ionic surfactant should be used that has a minimum of 80 percent active ingredient if used alone.
5. Precautions should be taken to avoid drift to susceptible nontarget plants.
6. This product can provide summer broadleaf weed control from March applications. This reduces potential to damage broadleaf crops that are planted after April or May. It reduces the need for summer applications of Vanquish® to control broadleaf weeds.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Early Postemergence and Preemergence Control of Winter and Summer Broadleaf Weeds	Diuron 80 WDG® + non-ionic surfactant. Apply 3 to 5 pounds product per acre + 0.25 percent solution in 25 to 40 gallons of water per acre. MOA Group 7.	Zone 1, 2, and 3: January 15 – February
COMMENTS 1. Diuron 80 WDG® is used primarily in areas infested with kochia. 2. This recommendation is specific to the Diuron 80 WDG® Loveland Industries product as it is currently labeled for recommended rates. 3. A quality non-ionic surfactant should be used that has a minimum of 80 percent active ingredient if used alone. 4. Application should be made on completely dormant bermudagrass. 5. Applications should never be made to saturated or frozen soils (there is a potential for runoff if application is followed by rain). 6. Regardless of right-of-way width, always leave an untreated buffer zone. 7. Diuron 80 WDG® can be used with imazapyr or glyphosate treatments to provide long-term total vegetation control around signs and guardrails.		
General Broadleaf Weed Control Using Postemergence Herbicides	Vanquish® + non-ionic surfactant. Apply 1 to 2 pints of product per acre + 0.25 percent solution, respectively. In 20 to 40 gallons of water per acre as a broadcast application or 50 to 100 gallons per acre as a handgun or backpack application. MOA Group 4.	Zone 1, 2, and 3: March 15 – June 30
COMMENTS 1. A quality non-ionic surfactant should be used that has a minimum of 80 percent active ingredient. 2. Precautions should be taken to avoid drift to susceptible crops. This herbicide can volatilize at higher air temperatures. 3. One timely application per year should control most broadleaf weeds including kochia. 4. Because of different carrier rates, a single tank mixture should not be used for both broadcast and handgun applications. This could cause a severe over or under application of targeted herbicide rates. 5. Vanquish® should provide good broad spectrum broadleaf weed control, however, refer to label for specific weed species. 6. Better control can be achieved by treating smaller seedlings or early vegetative stage weeds that are no taller than 3 inches. 7. For best results on biennial weeds, applications should be made to rosettes or at the early vegetative stage when plants are no taller than 6 inches. 8. This treatment is also very effective at controlling the state noxious weed, scotch thistle when applied in March through April.		

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Musk Thistle Control Using Postemergence Herbicides	Overdrive® + non-ionic surfactant. Apply 2 to 4 ounces product per acre + 0.25 percent solution. In 20 to 40 gallons of water per acre or 50 to 100 gallons per acre as a handgun or backpack application. MOA Group 4.	Zone 1, 2, and 3: March – May 10
COMMENTS 1. Currently, this is the most economical treatment for controlling musk thistle. 2. Rates less than 4 ounces per acre are made under a 2ee label and is approved for Oklahoma Department of Transportation and pasture use only. The 2ee label must be in possession during the application. Applications at 2 ounces per acre must be made to the rosette stage of growth, poor control will result if applied to bolted (flowered) thistles at this rate. 3. A quality non-ionic surfactant should be used that has a minimum of 80 percent active ingredient if used alone. 4. Due to different carrier rates, a single tank mixture should not be used for both broadcast and handgun applications. This could cause a severe over or under application of targeted rates. 5. Applications should be made to actively growing thistles prior to bolting. 6. Extreme growing conditions such as drought or near freezing temperatures prior to, at, and following time of application may reduce thistle control. 7. Precautions should be taken to avoid drift to susceptible nontarget plants. This herbicide can volatilize at higher air temperatures. 8. By law (Oklahoma Noxious Weed Law), musk thistles must be prevented from flowering statewide. 9. The 2 ounces per acre rate makes an excellent tank-mix partner with Campaign® + AMS at recommended rates to control musk thistle.		
Musk Thistle Control Using Postemergence Herbicides	Transline® + non-ionic surfactant. Apply 6 to 10 fluid ounces of product per acre + 0.25 percent solution. In 20 to 40 gallons of water per acre as a broadcast application or 50 to 100 gallons of water per acre as a handgun or backpack application. MOA Group 4.	Zone 1, 2, and 3: March – May 10
COMMENTS 1. A quality non-ionic surfactant should be used that has a minimum of 80 percent active ingredient. 2. Due to different carrier rates, a single tank mixture should not be used for both broadcast and handgun applications. This could cause a severe over or under application of targeted rates. 3. Applications should be made to actively growing thistles prior to bolting. The lower rate can be used when treating the rosette stage. 4. Extreme growing conditions such as drought or near freezing temperatures prior to, at, and following time of application may reduce thistle control. 5. Precautions should be taken to avoid drift to susceptible nontarget plants. 6. By law (Oklahoma Noxious Weed Law), musk thistles must be prevented from flowering statewide.		

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Scotch Thistle Control Using Postemergence Herbicides	Metsulfuron methyl + non-ionic surfactant. Apply 1 ounce of product per acre + 0.25 percent solution. In 20 to 40 gallons of water per acre broadcast application or 50 to 100 gallons per acre as a handgun or backpack application. MOA Group 2.	Zone 1, 2, and 3: March - April
COMMENTS 1. A quality non-ionic surfactant should be used that has a minimum of 80 percent active ingredient. 2. Due to different carrier rates, a single tank mixture should not be used for both broadcast and handgun applications. This could cause a severe over or under application of targeted rates. 3. Broadcast applications should be made to rosettes that are 6 inches or smaller in diameter. 4. Poor results will occur if applications are made during drought conditions. 5. Refer to label for other susceptible species. 6. Precautions should be taken to avoid drift to susceptible crops, gardens, and nontarget areas. 7. By law (Oklahoma Noxious Weed Law), scotch thistle must be prevented from flowering statewide.		
Silver Bluestem Control Using Postemergence Herbicides	Glyphosate. Apply 24 fluid ounces of product per acre in 20 to 40 gallons of water per acre. MOA Group 9.	Zone 1: April 20 - May 31 Zone 2: May 10 - June 15 Zone 3: May 20 - June 30
COMMENTS 1. Sprayer equipment must be properly calibrated to ensure desirable silver bluestem control and minimize bermudagrass injury. 2. Glyphosate, alone, is used in areas where there is little or no previous history of johnsongrass. In areas where there is a history of johnsongrass, glyphosate plus Outrider®, sulfometuron, or Plateau® should be used. If a summer preemergent is not added to the treatment in areas where there are johnsongrass seeds in the soil, the seeds could germinate and create an even bigger problem than the silver bluestem that was controlled. This is because glyphosate has no soil activity. 3. Do not apply glyphosate if rainfall will occur within 2 to 6 hours. Rainfall will wash the glyphosate off the plants and reduce the level of control. Generic glyphosate products need at least 6 hours before a significant rainfall event. 4. If Roundup Pro Concentrate® is used, apply 19 fluid ounces of product per acre. 5. Do not mow roadsides prior to treatment. Wait at least 10 days after treatment before mowing or weed control may be reduced.		

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Silver Bluestem Control Using Postemergence Herbicides	Glyphosate + sulfometuron. Apply 24 fluid ounces of product + 1 ounce of product per acre, respectively in 20 to 40 gallons of water per acre. MOA Group 9.	Zone 1: April 20 - May 31 Zone 2: May 10 - June 15 Zone 3: May 20 - June 30

COMMENTS

1. Glyphosate + sulfometuron should be used in areas where there is a past history of johnsongrass problems. If the history of an area is not known, then it is best to add the sulfometuron to the glyphosate treatment. The sulfometuron is soil active and will help prevent johnsongrass seeds from emerging.
2. Spray equipment must be properly calibrated to ensure desirable silver bluestem control and minimal bermudagrass injury.
3. Application should be made after bermudagrass has broken dormancy and is green and actively growing.
4. Add the glyphosate to the tank mixture first then add the sulfometuron.
5. Applications should not be made to areas that have little or no bermudagrass to release. It is recommended that a roadside needs at least 30 percent coverage of bermudagrass, if not, use a MSMA program until this is achieved.
6. Applications should not be made on newly sprigged or seeded areas. This treatment will slow the rate of coverage from sprigs and inhibit germination of seeds.
7. Do not apply to saturated soils or if rainfall will occur within 2 to 6 hours. Rainfall will wash the glyphosate from the plants and reduce the level of control. Generic glyphosates need at least 6 hours before a significant rainfall event.
8. Do not mow roadsides prior to treatment. Wait at least 10 days after treatment before mowing or weed control may be reduced.
9. If Roundup Pro Concentrate® is used, apply at 19 fluid ounces of product per acre.
10. This treatment should not be used in the western one-third of Oklahoma. Use glyphosate only treatments to control silver bluestem in western Oklahoma.

Switchgrass Management (Ropewick or Wiper Application)	Glyphosate. Apply 1:2 ratio of herbicide to water. MOA Group 9.	Zone 1, 2, and 3: May - June (followed by mowing).

COMMENTS

1. This treatment is to be selectively applied with either a ropewick or wiper-type applicator.
2. An important component of switchgrass management is timely mowings following application. Switchgrass areas should be mowed approximately 1 month and 3 months after treatment. Mowing should occur when switchgrass regrowth begins producing seed heads.
3. Dense stands of switchgrass will require wiping in 2 directions.
4. Do not wipe bermudagrass with this treatment as severe damage will occur.
5. Do not apply to plants that are drought stressed. Wait for a 1/2 to 1 inch rain before making the application.
6. Do not apply if rainfall will occur within 2 to 6 hours. Rainfall will wash glyphosate from the plants and reduce the level of control. Generic glyphosates need at least 6 hours before any significant rainfall event.
7. Do not use drift control products with this treatment.
8. Equipment used should include polyester over acrylic fiber core ropes or canvas and should be cleaned daily with detergent and water. This will remove wax buildup and allow for an even flow of herbicide across the wiping surface.
9. Applications made to plants noticeably covered with dust will result in reduced control.
10. This treatment followed by timely mowings will take a minimum of 2 years to remove switchgrass from safety areas.
11. Do not mow switchgrass areas prior to treatment.
12. Switchgrass should be wiped as low as possible without wiping the bermudagrass.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
General Brush Control	Tordon K® + Garlon 4 Ultra®. Refer to labeled rates for specific brush species. Apply 50 gallons of water per acre as a broadcast application or a minimum of 100 gallons of water per acre as a handgun application. MOA Group 4.	Zone 1, 2, and 3: May - July (see comments).

COMMENTS

1. This herbicide treatment can volatilize at higher air temperatures.
2. The use of this treatment will cause a very quick brown-out of the brush species in 7 to 14 days. Public acceptance of the treatment should be considered before choosing this treatment.
3. Refer to herbicide labels for susceptible target species. This treatment, applied in early summer to new leaves, should give very good control of most brush species found along Oklahoma roadsides.
4. Handgun applications should be made on a spray-to-wet basis using a minimum of 100 gallons per acre for low-density brush and up to 250 gallons per acre for high-density brush areas.
5. Due to different carrier rates, it is not recommended that a single tank mixture be used for both broadcast and handgun applications. This could cause a severe over or under application of targeted rates.
6. Most brush species are susceptible to this treatment, extreme caution should be used to prevent off-target movement of fine spray particles.
7. Always use a quality drift control additive to reduce the number of fine spray particles. This will help reduce the hazard of off-target drift.
8. Follow label rates for the specific brush species you are targeting.
9. Use extreme caution when treating near any ground water. Leave a buffer zone around all ground water sources.
10. Tordon K® is a restricted use herbicide because of its potential to move to groundwater sources.
11. Brush should not be removed following application for a minimum of 1 month.

General Brush Control	Krenite S® + crop oil. Refer to label for specific brush control rates. Apply a minimum of 100 gallons of water per acre as a handgun application or broadcast application.	Zone 1, 2, and 3: June - October (see comments).

COMMENTS

1. Little or no foliage brown-out will occur after treatment. Leaves will drop off the tree in a normal fashion and the following spring the tree will not produce any new leaves.
2. The addition of a crop oil is critical to aid in absorption of the herbicide through the waxy leaves.
3. Handgun applications should be made on a spray-to-wet basis using a minimum of 100 gallons per acre for low-density brush and up to 250 gallons per acre for high-density brush areas.
4. Refer to herbicide label for susceptible species. This treatment does not produce as broad a spectrum of brush control as Tordon K® + Garlon 4 Ultra®. Identifying problem brush species is very important.
5. Thorough coverage of the entire target plant is necessary for complete control of susceptible species as this treatment has little if any translocation in the treated brush.
6. Do not apply Krenite S® if rainfall will occur anytime during the day of application. The Krenite S® will be washed off the leaves and reduce the level of control.
7. Applications made in October should be made before fall leaf discoloration.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
General Brush Control	Glyphosate—foliar spot treatment only. Apply 1.5 gallons of product per acre in 100 gallons of water per acre—handgun only. MOA Group: 9	Zone 1, 2, and 3: June - October.

COMMENTS

1. Do not make broadcast applications with this treatment. This herbicide treatment will cause severe damage or death of desirable grass understories if applied as a broadcast treatment.
2. This treatment should be applied as a foliar spot treatment using a handgun application only.
3. Apply the herbicide mixture on a spray-to-wet basis.
4. At this rate of application the grass understory will be killed at the base of the spot treatment.
5. Do not apply glyphosate if rainfall will occur within 2 to 6 hours. Rainfall will wash the glyphosate off the plant and reduce the level of control. Generics require 6 hours before they are rainfast.
6. Refer to the herbicide label for susceptible target species.
7. This treatment should only be used on low-density brush areas.
8. If Roundup Pro Concentrate® is used, apply at 1.25 gallons of product per acre.

Brush Control Using Cut Surface Treatments	Glyphosate (cut surface treatments only). Apply 1:1 water to herbicide ratio. MOA Group: 9	Zone 1, 2, and 3: May – September.

COMMENTS

1. All brush manually cut by Oklahoma Department of Transportation crews and not previously treated with a herbicide should receive a cut stump treatment to prevent resprouting.
2. Applications should be made immediately after cutting or as soon as possible. Delay in application of more than 30 minutes may result in reduced performance on hard-to-control species.
3. Apply using a backpack sprayer or squirt bottle.
4. Remove wood chips from the stump before application. It is only necessary to treat the outside 1/3 of the top of the cut stump as this is where the cambium layer is found. The cambium will move the herbicide to the roots. Treat the entire circumference of the cut surface.
5. It would be useful to include an agricultural dye in this treatment to prevent waste and mark treated stumps. Use a water soluble dye with glyphosate and oil soluble dye with Garlon 4 Ultra®.
6. No drift control product should be used with this treatment.
7. The Garlon 4 Ultra® + oil carrier treatment (low volume dormant basal) should be used in the dormant season instead of glyphosate.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Brush Control Using Dormant Basal Stem and Cut Surface Treatments	Garlon 4 Ultra® + oil carrier. Apply 4:1 oil to herbicide ratio (low volume dormant basal and cut surface). Apply 20:1 oil to herbicide ratio (high volume dormant basal only). MOA Group: 4	Zone 1, 2, and 3: Year-round, especially during the dormant season.

COMMENTS

1. Low volume applications are made by lightly spraying the cambium area (outside 1/3 of the top of the cut surface) or entire circumference of the trunk (dormant basal) to the point of wetting but not runoff. This treatment usually requires the additional purchase of very small nozzle tips that will produce a fine spray. This low volume solution is very concentrated, if runoff occurs the expensive herbicide is wasted.
2. High volume applications are made by spraying the entire circumference of the trunk (dormant basal) to the point where the mixture is allowed to runoff and pool at the base of the target for a few seconds. Most backpack or small hand-pump sprayers when purchased have nozzle tips designed to make this type of treatment.
3. High volume (20:1 oil to herbicide) mixtures should not be used for cut surface applications.
4. It is critical that the entire cambium area (cut surface) or entire circumference of the trunk (dormant basal) is treated to ensure complete control no matter what ratio of oil to herbicide is used. Failure to get good coverage will result in possible resprouting.
5. Dormant basal stem treatments should be made to trees with stems 6 inches or less in diameter.
6. Trunks that are 0 to 3 inches in diameter should be treated to a height of 18 inches. Trunks larger than 3 inches in diameter should be treated to a height of 24 inches.
7. The addition of an oil soluble dye may assist in getting the desired coverage from these treatments as well as marking treated areas.
8. Backpack or small hand sprayers would work well for these treatments, but it is important to only use ones that have Viton seals. Garlon 4 Ultra® will cause rubber or pvc seals to leak.
9. Applications may be made up to the edge of water but may not be applied to brush in water.
10. No drift control product should be used with this treatment.
11. This treatment should be mixed with a penetrating oil as a carrier and should never be mixed with water as a carrier.

Bermudagrass Encroachment Control Using Postemergence Herbicides	Imazapyr + non-ionic surfactant. Apply 4 pints of product per acre + 0.5 percent solution, respectively in 40 gallons of water per acre. MOA Group: 2	Zone 1: April 25 – Sept 15 Zone 2: May 10 – Sept 15 Zone 3: May 20 - Sept 15

COMMENTS

1. Application is to be made to 100 percent green and actively growing bermudagrass.
2. This treatment should only be applied once per year.
3. In areas that have not been treated with glyphosate plus a summer preemergence, a herbicide such as sulfometuron or diuron should be added to control weeds that germinate from seed.
4. Do not apply directly to water or wetlands.
5. Do not treat irrigation ditches.
6. Do not apply, drain, or flush equipment on or near desirable trees or other plants; onto areas into which their roots may extend; or locations where the chemical may be washed or moved into contact with their roots or into water features.

SUGGESTED MAINTENANCE PRACTICES FOR ROADSIDE WEED AND BRUSH CONTROL (CONT'D)

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Aquatic Weed Control in Standing or Moving Water *(Cattail, willow, cottonwood)*	Glyphosate (aquatic) + non-ionic surfactant. Apply 1 percent solution + 1 percent solution, respectively in 100 gallons of water per acre—handgun treatment only. MOA Group: 9	Zone 1, 2, and 3: May 15 – August.

COMMENTS

1. A non-ionic aquatic-approved surfactant is critical to the success of this herbicide treatment.
2. If the low end glyphosate rate is used then use the high end non-ionic surfactant rate.
3. Apply with a handgun or backpack sprayer only. This treatment should not be made as a broadcast application as the desirable grass understory may be damaged or destroyed.
4. In dense stands of willow or cattails, good coverage is critical. Plants should be treated from both sides if possible.
5. Plants that have not emerged at the time of treatment will not be controlled and they will require retreatment.
6. Do not apply if rainfall will occur within 2 to 6 hours. Rainfall will wash glyphosate from the plants and reduce control.

ACTIVITY	HERBICIDE(S) AND RATE(S) OF APPLICATION PER ACRE	TIME OF APPLICATION
Aquatic Weed Control in Standing or Moving Water *(Cattail, willow, cottonwood)*	Habitat® + aquatic-approved non-ionic surfactant or methylated seed oil. Apply 1 percent solution + 1 percent solution, respectively in 20 to 100 gallons of water per acre—handgun treatment only. MOA Group: 2	Zone 1, 2, and 3: May - July

COMMENTS

1. This is the best treatment for long-term cattail control.
2. A non-ionic aquatic-approved surfactant or methylated seed oil is critical to the success of this herbicide treatment.
3. When a low volume carrier rate is used target vegetation should receive approximately 70 percent coverage. Low volume applications are made with back-pack sprayers equipped with small fan-type spray tips. The high volume carrier rate is a spray-to-wet application and is typically achieved with larger spray tips and powered handguns.
4. Apply with a handgun or backpack sprayer only. This treatment should not be made as a broadcast application as the desirable grass understory may be damaged or destroyed.
5. Refer to label for restrictions on treating irrigation ditches and in the vicinity of potable water intakes.
6. Plants that have not emerged or are underwater at the time of treatment will not be controlled.
7. This treatment is very slow to produce brown-out of target vegetation, it may take up to 12 weeks for final brown-out. Be patient the final results should be very good through 1 year-after-treatment.

Campaign®, glyphosate + 2,4-D, Monsanto Ag Co
Diuron 80 WDG® , diuron, Loveland Industries, Inc.
Garlon 4 Ultra®, triclopyr, Dow AgroSciences
glyphosate (aquatic), glyphosate, many companies
glyphosate, glyphosate, many companies
Habitat®, imazapyr, BASF
Imazapyr, imazapyr, many companies
Krenite S®, fosamine, E.I. du Pont de Nemours & Co., Inc.
metsulfuron methyl, metsulfuron methyl, many companies
Milestone VM®, aminopyralid, Dow AgroSciences
MSMA, MSMA, many companies
Sulfometuron, sulfometuron, many companies
Outrider®, sulfosulfuron, Monsanto Agricultural Company
Overdrive®, dicamba + diflufenzopyr, BASF
Plateau®, imazapic, BASF
Roundup Pro Concentrate®, glyphosate, Monsanto Agricultural Co
Tordon K®[1], picloram, Dow AgroSciences
Transline®, clopyralid, Dow AgroSciences
Vanquish®, diglycolamine salt of dicamba, Nufarm/Syngenta

[r]Restricted-Use-Pesticide

MOA Group Tables start on page 46 of the handbook.

ALFALFA FORAGE INSECT CONTROL SUGGESTIONS

To protect insect pollinators, do not spray during full bloom. If necessary to control insects for maximum seed production, use insecticides least damaging to pollinators.

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Alfalfa Seed Chalcid June to September	Small wasp. Two to three generations per year.	Proaxis[r] (3)	2.56- 3.84 oz	[1]See footnotes on alfalfa seed chalicid.
Alfalfa Weevil Affects mainly the first cutting. Usually 1 generation per year	Light green to green larvae with white to yellowish-white stripe down back paralleled by 2 faint white stripes on either side. Black head capsule. Skeletonizes leaves, causing an over-all grayish to whitish cast.	Pounce3.2EC[r] (3)	4.0-8.0 oz	Required waiting period before harvest * 0.1 lb active or less - 0 days Above 0.1 lb active - 14 days Lower rates (<0.2 lb AI/A) of permethrin have not been highly effective on heavy weevil populations. Lower rates (0.1) may serve to reduce (not eliminate) feeding under the windrow by moderate weevil populations when used just before (0-3 days) harvest
Note: There are no alfalfa varieties adapted to Oklahoma conditions that are highly resistant to the alfalfa weevil; however, some varieties show tolerance to this pest.		Warrior[r] (3)	2.56-3.84 oz	Do not apply within 1 day of harvest for forage or within 7 days of harvest for hay.
		Baythroid[r] (3)	1.6 -2.8 oz	7 days Note: To enhance resistance management of budworm/bollworm complex in any nearby cotton **do not** apply pyrethroids to alfalfa from mid-May to late July.
		Cobalt[r] (1B + 3)	19-38 oz	See restrictions at end of section.
		Furadan 4F[r] (1A)	1.0-2.0 pt	1.0 pt - 14 days Above 1.0 pt - 28 days.
		Lorsban 4E[r] (1B)	2.0 pt	21 days
		Malathion 5E (1B)	1.5-2.0pt	0 days
		Methyl Parathion[r] (1B)	1.0 pt	15 days. May cause some degree of burn to crop, depending on temperature.
		Methomyl[r] (Lannate) (1A)	3.0 pt	0 days
		Proaxis[r] (3)	2.56-3.84 oz	Do not apply within 1 day of harvest for forage or within 7 days of harvest for hay.
Application Information: Begin when 1.5-2 larvae per stem are found. This will equate to about 40 or more larvae per square foot. See Current Report CR-7177 for a definitive, more precise method indicating when to spray based on the degree-day concept. For ground application, use 10-15 gal of total mix per acre. Use 15-20 gal when plants are rank and dense. For best results, by aircraft use 2 gal; 3 gals or more in heavy foliage.				
Army Cutworm February and March, sometimes to April.	Consumes new growth. Especially damaging to newly planted stands. Economic injury level is 3-4 larvae per sq ft when larvae are 0.5 inch or less in length; 2-3 larvae per sq ft when they are over 0.5 inch in length.	Pounce[r] (3)	2.0-8.0oz	See comments: end of section. These materials may fail under heavy cutworm pressure. See chemical restrictions under alfalfa weevil section.
		Lorsban[r] (1B)	1.0-2.0 pt	See restrictions under alfalfa weevil.
		Baythroid[r] (3)	1.6-2.8 oz	
		Warrior[r] (3)	1.92-3.2 oz	
		Proaxis[r] (3)	1.92-3.2 oz	
		Javelin (11B2)	0.25-1.5 lbs	*Bacillus thuringiensis* (B.t.) 0 day*
		Cobalt[r] (1B + 3)	13-26 oz	See restrictions at end of section.
Blister Beetles Spring and Summer Earliest on record in Oklahoma - May 14. Latest on record in Oklahoma - October 21.	Destroys foliage and flowers. Beetle bodies contain cantharidin, a toxic substance that can be detrimental to livestock, regardless of whether beetles are dead or alive.			Heavy numbers of blister beetles in hay may cause sickness or death to horses. See OSU Fact Sheet EPP-2072 for more information.
		Cobalt[r] (1B + 3)	19-38 oz	See restrictions at end of section.
		Warrior[r] (3)	2.56-3.84 oz	See restrictions under alfalfa weevil
		Proaxis[r] (3)	2.56-3.84 oz	See restrictions under alfalfa weevil.
		Sevin XLR (1A)	0.5-1.0 qt	7 days*

ALFALFA FORAGE INSECT CONTROL SUGGESTIONS (CONT'D)

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Clover Leaf Weevil Spring	Closely resembles Alfalfa Weevil. Full grown larva 0.5 inch long,. green to yellowish green, has pale white stripe down center of back and brown head capsule.	Methyl Parathion[r] (1B) Malathion5EC (1B) Proaxis[r] (3) Warrior[r] (3) Cobalt[r] (1B + 3)	0.5-1.0 pt 1.5 pt 2.56-3.84 oz 2.56-3.84 oz 19-38 oz	See restrictions for other compounds under alfalfa weevil. See restrictions under alfalfa weevil. See restrictions under alfalfa weevil. See restrictions at end of section.
Grasshoppers May to frost	Destroys foliage, usually starting at field borders.	Cobalt[r] (1B + 3) Dimethoate4E (1B) Proaxis[r] (3) Furadan[r] (1A) Malathion (1B) Warrior[r] (3) Lorsban[r] (1B) Baythroid[r] (3)	7-13 oz 0.5-1.0 pt 2.56-3.84 oz 0.25-0.50 pt 1.5-20 pt 2.56-3.84 oz 0.5-1.0 pt 2.0-2.8 oz	See restrictions at end of section. 10 days* See restrictions under alfalfa weevil. 7 days* (only at this rate). See restrictions under alfalfa weevil. 0.5 pt = 7 days* 1.0 pt = 14 days* 7 days*
Leafhoppers and Lygus Bugs Summer months	Small jumping or flying insects. Cause yellowing of leaves.	Cobalt[r] (1B + 3) Dimethoate (1B) Malathion (1B) Sevin 80S (1A) Methomyl[r] (1A) Lorsban[r] (1B) Baythroid[r] (3) Pounce[r] (3) Warrior[r] (3) Baythroid[r] (3) Proaxis[r] (3)	7-13 oz 19-38 oz 0.5-1.0 pt 1.5-2.0 pt 1.25 lb 1.5-3.0 pt 0.5-1.0 pt 0.8-2.8 oz 4.0-8.0 oz 1.92-3.2 oz 0.8-2.8 oz 1.92-3.20 oz	Leafhopper rate only. Plant bug rate only. See restrictions at end of section. Greatest damage by Lygus Bugs is to seed production. To protect pollinators, apply insecticides before bloom. **Malathion and Methomyl are not labeled for leafhoppers.** 0.5 pt= 7 days* 1.0= 14 days * 7 days * For leafhoppers, consider yield potential and stand age before deciding to treat. Recommendations should be based on plant height and number of leafhoppers per 20 sweeps across each 40-acre block of alfalfa. Alfalfa Height (Inches) — Leafhoppers in 20 Sweeps 3 — 4 6 — 10 12+ — 20
Defoliating Caterpillars (Alfalfa Caterpillar, Green Cloverworm, Corn Earworm, Armyworm, Webworms) Summer	See OSU EPP- 7159 for detailed description of each species	Malathion (1B) Methomyl[r] (1A) Sevin 80S (1A) Lorsban[r] (1B) Warrior[r] (3) Mustang MAX[r] (3) Steward SC (22) Cobalt[r] (1B + 3) Baythroid[r] (3) Proaxis[r] (3) Pounce[r] (3) Javelin *(Bacillus thuringensis*) (11B2) Agree (B.t.) (11B2)	2.0 pt 0.75-1.5 pt 1.25-1.625 lb 1.0-2.0 pt 1.92-3.2 oz 2.24-4.0 oz 9.2-11.3 oz 13-38 oz 1.6-2.8 oz 2.56-3.84 oz 2.0-8.0 oz 0.25-1.5 lb 0.5-2.0 lb	Read insecticide label carefully. Specific rates may apply for each or only a few species. Even heavy(5-6/sweep) defoliator infestations may be adequately controlled by simply cutting alfalfa early. Decisions to treat should be based on number of larvae and noticeable damage. For webworms specifically, control is generally poor if worms and/or webs are large. Treat early in outbreaks. Rate varies depending on species. See restrictions at end of section. Use of synthetic pyrethroids are not suggested in cotton-growing areas. See note under alfalfa weevil section. 0 days. * 0 days.*

* Required waiting period before harvest.

ALFALFA FORAGE INSECT CONTROL SUGGESTIONS (CONT'D)

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Pea Aphid Usually early March, April and May	Large green aphid with dark bands at base of each antennal segment. Causes chlorosis and wilting of leaves. Economic injury level is about50 aphids/stem for 10 inch alfalfa, about 100 aphids/stem when alfalfa is 20 inches tall. Usually present over entire plant.	Cobalt[r] (1B + 3) Dimethoate (1B) Furadan[r] (1A) Lorsban[r] (1B) Malathion (1B) Methyl Parathion[r] (1B) Proaxis[r] (3) Methomyl[r] (1A) Pounce[r] (3) Mustang MAX[r] (3) Baythroid[r] (3)	13-26 oz 0.50-1.0 pt 0.50-2.0 pt 1.0-2.0 pt 1.5 pt 0.50-1.0 pt 2.56-3.84pt 1.5-3.0 pt 2.0-8.0 oz 2.24-4.0 oz 1.6-2.8 oz	See restrictions at end of section. Several resistant varieties are available. See Current Report CR-2106 for information on variety insect resistance level and adaptability in Oklahoma.
Blue Alfalfa Aphid Usually early March April and May, but may persist later.	Large green aphid. Similar in appearance to pea aphid, but lacks dark antennal bands at base of each segment. Often found in high numbers on terminals. Heavy infestations may cause severe stunting. Economic injury level is about20 aphids/stem for 10 inch alfalfa, and about 40 aphids/stem when alfalfa is20 inches tall.	Cobalt[r] (1B + 3) Dimethoate (1B) Furadan[r] (1A) Lorsban[r] (1B) Malathion (1B) Methyl Parathion[r] (1B) Proaxis[r] (3) Pounce[r] (3) Warrior (3) Baythroid[r] (3) MustangMAX[r] (3)	13-26 oz 0.50-1.0 pt 0.50-1.0 pt 1.0-2.0 pt 1.5 pt 0.50-1.0 pt 2.56-3.84oz 2.0-8.0 oz 2.56-3.84oz 1.6-2.8 oz 2.24-4.0 oz	See restrictions at end of section. Currently, no well-adapted varieties for Oklahoma exhibit high resistance to the blue alfalfa aphid. See Current Report CR-2106. See chemical restrictions at end of this section.
Spotted Alfalfa Aphid Most common in summer and fall but may occur throughout year	Small tan-colored aphid with black spots in rows over surface of body. May deposit large amounts of honeydew. Plants wilt yellow and die. Economic injury levels are similar to the blue alfalfa aphid (above).	Cobalt[r] (1B + 3) Dimethoate (1B) Lorsban[r] (1B) Malathion (1B) Methyl Parathion[r] (1B) Proaxis[r] (3) Pounce[r] (3) Mustang MAX[r] (3) Warrior[r] (3)	13-26 oz 0.5-1.0 pt 1.0-2.0 pt 1.5 pt 0.50-1.0 pt 2.56-3.84oz 2.0-8.0 oz 2.24-4.0 oz 2.56-3.84oz	Suppression only. See restrictions at end of section. Several well-adapted resistant varieties are available. See Current Report CR-2106. In the fall, even light populations(1-3 aphids/stem) can devastate seedling alfalfa stands. See chemical restrictions at end of this section.
Variegated Cutworm Late April or May	Most common occurrence is on regrowth after first cut. In some years may destroy regrowth for period of 2-3 weeks. Larvae may attain nearly two inches in length. Tan to mottled black in color with distinctive light yellow, diamond shaped markings along the center of the back.	Cobalt[r] (1B + 3) Javelin (11B2) Lorsban[r] (1B) Methomyl[r] (1A) Methyl Parathion[r] (1B) Pounce[r] (3) Baythroid[r] (3) WarriorT[r] (3) Proaxis[r] (3)	13-26 oz 0.25-1.5 lb 1.0-2.0 pt 0.75-3.0 pt 0.50-1.0 pt 2.0-8.0 oz 1.6-2.8 oz 1.92-3.2 oz 1.92-3.2 oz	See restrictions at end of section. If larvae are large control is usually poor. See chemical, restrictions at end of this section.

[r] Restricted-Use-Pesticides

MOA Group Tables start on page 46 of the handbook.

For additional information, see the following:

OSU Extension PSS-2072 - Blister Beetles in Alfalfa
OSU Extension PSS-2097 - Alfalfa Weevil and Its Management in Oklahoma
OSU Extension EPP-7159 - Field Key to Larvae in Alfalfa
OSU Extension EPP-7184 - Alfalfa Aphids in Oklahoma
OSU Extension Current Report CR-7177 - Scouting for the Alfalfa Weevil in Oklahoma
OSU Extension Current Report CR-7179 - Integrated Control of the Alfalfa Weevil

*Required waiting periods before harvest.

ALFALFA FORAGE INSECT CONTROL SUGGESTIONS (CONT'D)

When insecticides are applied to alfalfa that will be grazed or mowed for hay, certain precautions for use of materials must be taken. The following waiting periods from application to grazing or cutting have been established:

[1]**Alfalfa Seed Chalcid —** Control with insecticides is usually unsatisfactory due to persistence of attack and restrictions against using chemicals with long residual effects. To avoid the necessity of spraying for this insect and thereby harming beneficials; alfalfa seed should be produced as early in the season as possible.

All B.t. products — 0 days to harvest, 12 hour re-entry interval.

Baythroid[r] — One application per cutting only, and up to three applications per season. Avoid application of this product in cotton producing areas from mid-May to late July. Do not apply by ground within 25 feet, or by air within 150 feet of any body of water. Increase the buffer zone to 450 feet when ultra-low volume (ULV) application is made. 7 days to harvest.

Cobalt[r] –Do not cut or graze treated alfalfa within 7 days of application of 13 ounces, within 14 days of application of 26 ounces, or within 21 days after application of rates above 26 ounces. Do not make more than 4 applications per season. Do not make a second application of any product containing chlorpyrifos within 10 days of first application.

Furadan[r] — Additional waiting periods, 0.5 pts rate, 7 days; 1 pt, rate, 14 days; above 1 pt rate, 28 days. Do not apply Furadan more than twice per season, or more than once per cutting. Do not use more than 0.5 lb in the second cutting.

Dimethoate — 10 days to harvest.

Lorsban[r] — Do not make more than four applications per year. Tank mixes of 1 pt Lorsban plus .75 pt of Furadan have provided good control of both aphids and alfalfa weevils, while shortening the harvest interval to 14 days. Additional waiting periods; .5 pt rate, 7 days; 1 pt rate, 14 days; above 1 pt rate, 21 days. Do not make more than four applications per year or apply more than once per crop cutting.

Malathion — 0 days for up to 1.5 lbs, 5 days for more than 1.5 lbs.

Methyl Parathion[r] — 15 days to harvest.

Methomyl[r] — 0 days to harvest for hay; 7 days for grazing or feeding to livestock.

Mustang MAX[r] — 3 days to harvest.

Pounce[r] (Permethrin) — Do not apply more than 0.2 lb active per cutting. Do not apply permethrin products in cotton producing areas from mid-May to late July.

Proaxis[r] — Do not apply more than 0.24 pints per acre per cutting. Do not apply more than 0.96 pints per acre per season. Avoid application when bees are actively foraging. This chemical is Gamma-cyhalothrin; if it is used in the same season as lambda-cyhalothrin (Warrior[r]) then read the label carefully for use rate limitations. One day for harvest of forage and 7 days to harvest for hay.

Sevin — 7 days to harvest.

Warrior[r] — Avoid application around bee shelters or when bees may be actively foraging. Do not apply more than 0.03 lb a.i. per acre per cutting or more than 0.12 lb a.i. per acre per season. One day for harvest of forage and 7 days to harvest for hay.

[r] Restricted use pesticides.

This section was not revised in 2007.

ALFALFA WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Alfalfa Herbicides[a]

Herbicide	Broadleaf Weeds															Grass Weeds										
	Black Nightshade	Chickweed	Common Ragweed	Curly Dock	Dandelion	Field Pennycress	Giant Ragweed	Henbit	Kochia	Lambsquarters	Pigweed	Plantain	Shepherdspurse	Smartweed	Wild Mustard	Barnyardgrass	Crabgrass	Cheat	Downy Brome	Fall Panicum	Foxtails	Italian Ryegrass	Volunteer Grain	Yellow Nutsedge	General or Restricted use
PREPLANT TRTS.																									
Balan	0	**8**	0	0	0	0	0	5	7	**9**	**9**	0	0	0	0	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	0	Gen
Eptam	**8**	7	5	0	0	6	0	**9**	6	**9**	**9**	0	7	5	6	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	Gen
Treflan	2	**9**	-	0	0	5	-	6	7	**9**	**9**	-	3	-	3	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	0	Gen
POSTEMERGENCE																									
Buctril	**9**	6	**9**	0	0	**8**	**8**	**8**	6	**9**	**8**	0	**9**	**9**	**8**	0	0	0	0	0	0	0	0	0	Gen
Butyrac 200	2	6	**9**	5	**8**	**9**	**9**	6	6	**8**	**8**	2	**9**	6	**9**	0	0	0	0	0	0	0	0	0	Gen
Gramoxone Extra	**9**	**8**	**9**	0	0	**9**	**9**	**9**	5	**8**	**9**	5	**9**	**9**	**9**	**8**	7	**9**	**9**	**9**	**9**	**9**	6	0	Res
Poast Plus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	0	Gen
Pursuit	**9**	**8**	6	0	0	**8**	7	**8**	**8**	6	**9**	-	**9**	**9**	**9**	6	7	3	3	7	**8**	4	0	5	Gen
Raptor	**9**	**8**	7	0	0	**8**	**8**	**8**	7	**8**	**9**	-	**9**	**8**	**9**	6	7	3	3	7	**8**	4	0	4	Gen
Roundup Original Max	**9**	**9**	9	9	8	**9**	**9**	**9**	**8**	**9**	**9**	9	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen
Select	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	0	Gen
SPOT APPLICATIONS																									
Roundup Original Max[d]	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen
DORMANT SEASON																									
Gramoxone Extra	**9**	**8**	**9**	0	0	**9**	**9**	**9**	5	**8**	**9**	5	**9**	**9**	**9**	**8**	7	**9**	**9**	**9**	**9**	**9**	6	0	Res
Karmex DF	7	6	**8**	-	3	6	-	5	**8**	7	7	-	**9**	7	**8**	7	7	-	-	-	6	-	-	-	Gen
Kerb	6	**8**	5	0	0	5	5	**8**	-	6	6	0	5	5	5	**8**	**8**	**9**	**9**	6	**8**	**9**	**9**	0	Gen
MCPA Amine	6	6	-	-	5	7	-	6	5	6	6	-	7	-	7	0	6	**4**	**4**	5	6	**4**	**6**	-	Gen
Sencor	5	**9**	**8**	6	7	**9**	5	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	6	5	**9**	**9**	6	6	**9**	5	0	Gen
Sinbar	6	**9**	-	5	6	**9**	**9**	**9**	-	-	-	**8**	**9**	**9**	**9**	**9**	-	**9**	**9**	-	-	**9**	**9**	-	Gen
Velpar	6	**9**	-	5	**8**	**9**	**9**	**9**	-	-	-	**8**	**9**	**9**	**9**	**9**	-	**9**	**9**	-	-	**9**	**9**	-	Gen
Velpar AlfaMax	6	**9**	-	-	**8**	**9**	**9**	**9**	**8**	**8**	**8**	**8**	**9**	**9**	**9**	**9**	-	**9**	**9**	-	-	**9**	**9**	-	Gen

[a] Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assume the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions.

[b] Product should not be used as a selective "over-the-top" control application. Only use after alfalfa cutting and prior to reinitiation of alfalfa

[c] Only use over-the-top of Roundup Ready alfalfa varieties.

[d] Treatment will kill most all green plants including alfalfa. Do not treat more than 10% of the total field area at one time.

This section was not revised in 2007.

ALFALFA WEED CONTROL (CONT'D)

Rotational Cropping Restrictions in Months for Alfalfa Herbicides

	Crop							
Herbicide	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Balan	a	a	a	a	a	a	a	a
Buctril	1	1	1	1	1	1	1	1
Butyrac 200	a	a	a	a	a	a	a	a
Eptam	a	a	a	a	a	a	a	a
Glyphosate	0	0	0	0	0	0	0	0
Gramoxone Max	0	0	0	0	0	0	0	0
Karmex DF	24	24	24	24	24	24	24	24
Kerb	12	12	3 to 5[a]	12	12	12	12	12
MCPA Amine	a	a	a	a	a	a	a	a
Poast Plus	0	0	4	0	0	4	0	4
Pursuit	4	b	18.5[c]	18.5	0	18.5	0	4
Raptor	-	40	9	18[d]	0	18	9	4
Sencor	4	-	4	8	-	-	4	4 to 8[a]
Sinbar	12	24	24	24	24	24	24	24
Select	1	1	1	1	1	1	1	1
Treflan	0	0	14	0	0	14	0	14
Velpar	24	24	12[e]	24	24	24	24	24
Velpar AlfaMax	24	24	12[f]	24	24	24	24	24

[a] See labeled.

[b] Only Clearfield or Sumner Canola varieites can be planted the year following a Pursuit application. See label.

[c] Clearfield corn hybrids can be planted anytime. See label.

[d] The restriction is 18 months if at least 15 inches of rainfall has been received since the time of application and

[e] If use rate did not exceed 1 lb/A and if at least 20 inches of rainfall is received. See label.

[f] If use rate is not less than 6.6 acres per unit pack and if at least 20 inches of rainfall is received. See label.

This section was not revised in 2007.

ALFALFA WEED SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Balan DF 70% WSP **PPI applications:** 2.0-2.5 lb /A	**Active Ingredient:** Benefin **Similar Products:** None **MOA:** 3	**PPI.** Apply and incorporate within 3 weeks prior to planting. Must be incorporated within 4 to 8 hours after application. A second incorporation is required for most equipment. Incorporate to a depth of 2 inches running 4-6 mph. Refer to label for incorporation equipment. Apply at a rate of 2.0 lb /A for coarse and medium textured soils. Apply at a rate of 2.5 lb /A for fine textured soils.	**Do not** apply to soils that are wet, cloddy, contain excessive plant residue or that are subject to prolonged periods of flooding as poor weed control or crop injury may result.
Buctril 2.0 lbs. ai per gallon **All applications:** 1-1.5 pts. /A	**Active Ingredient:** Bromoxynil **Similar Products:** Connect 20 WSP Moxy 2E **MOA:** 6	**POST.** Apply in the fall or spring to seedling alfalfa when the majority of the field has a minimum of 4 trifoliate leaves. When stand is uneven and conditions favor leafburn, unacceptable crop injury may occur to plants in the 2 trifoliate or smaller stage of growth. Applications made when temperatures are expected to exceed 70°F at and 3 days following application can result in unacceptable crop injury.	**Do not** apply when crop is under stress. **Do not** cut for feed or graze spring treated crop within 30 days following treatment. **Do not** cut for feed or graze fall or winter treated crop until spring, at least 60 days following treatment. **Do not** exceed 2 pt /A per crop season.
Butyrac 200 2 lb ai per gallon **POST applications.** 1 – 3 qt /A	**Active Ingredient:** 2,4-DB **Similar Products:** 2,4-DB 200 **MOA:** 4	**POST.** Apply to seedling forage legumes and seedling or established alfalfa. For control or suppression of smartweed and curled dock up to 3 inches tall, apply at 3 qt /A. For control of other target weeds, apply at a rate of 1 to 2 qt /A when target weeds are less than 3 inches tall, apply at a rate of 2 to 3 qt /A when greater than 3 inches tall. Use higher rates in dry, low humidity growing areas.	**Do not** graze or feed hay from treated established alfalfa to livestock within 30 days after application. **Do not** graze or feed seedling alfalfa, seedling clover or seedling birdsfoot trefoil within 60 days after application. **Do not** apply when crop is stressed from lack of moisture. **Do not** spray when the temperature exceeds 90°F and/or is predicted to exceed 90°F during the three days following application.
Eptam 7-E 7.0 lbs ai per gallon **PPI applications:** 3.5 pt /A **POST applications:** 2.25 to 3.5 pt /A	**Active Ingredient:** EPTC **Similar Products:** None **MOA:** 8	**PPI.** Apply and incorporate just before planting. **POST (irrigated).** Meter into the irrigation water applied to established stands prior to weed emergence. Use lower rate on very coarse textured soils.	**PPI. Do not** use if a grass or grain nurse crop is to be planted with the legume. **Do not** use if Atrazine was applied within the previous 12 months. **POST (irrigated). Do not** apply within 14 days of harvesting or grazing crop.
Gramoxone Max 3.0 lbs ai per gallon **PRE applications:** 1.7-2.7 pt /A **Dormant Season applications (established stands):** 0.7-1.3 pt /A **POST applications (between-cuttings):** 0.7 pt /A **Dormant Season applications (first-year stands):** 0.5-0.8 pt /A	**Active Ingredients:** Paraquat **Similar Products:** Cyclone Max Gramoxone Extra Gramoxone Super Tres **<u>Rates may vary due to formulation.</u>** **MOA:** 22	**PRE.** Apply prior to emergence of crop. Crop plants emerged at time of application will be killed. **POST (established stands).** Apply during the late fall or winter months after the last fall cutting and before the first spring cutting. **POST (between-cuttings).** Apply immediately after alfalfa has been removed for hay or silage. Foliage present at time of application will be desiccated. Do not apply more than twice during the first growing season. **Dormant Season (first-year stands).**	**Do not** apply through any type of irrigation equipment. **Dormant Season (established stands). Do not** harvest within 60 days of application. **Do not** apply more than once per season. **Do not** apply to crops that are not dormant, or that have broken dormancy as severe crop injury will result. **POST (between-cuttings). Do not** treat more than 5 days after cutting. **Do not** cut or harvest within 30 days of application. **Do not** apply more than twice during the first growing season. **Dormant Season (first-year stands). Do not** harvest within 60 days of application. **Do not** apply to crops that are not dormant, or that have broken dormancy as severe crop injury will result.

This section was not revised in 2007.

ALFALFA WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Karmex DF 80% DF **Dormant Season applications:** 1.5-3.0 lb /A	**Active Ingredients:** Diuron **Similar Products:** Direx 4L **MOA:** 7	**Dormant Season.** Apply before spring growth begins. Treat only stands that have been established for 1 year or more. Apply only when crop is dormant to avoid crop injury.	**Do not** apply to seedling alfalfa nor to alfalfa/grass mixtures. **Do not** apply to crops under stress from disease, insect damage, shallow root penetration, alkali spots, nor to flooded fields as crop injury may result. **Do not** spray on snow covered or frozen ground.
Kerb 50-W^{r} 50% WP **POST applications:** 1.0 to 4.0 lb /A	**Active Ingredients:** Pronamide **Similar Products:** None **MOA:** 15	**POST.** Apply during the fall or winter months prior to weed emergence. Optimum activity occurs when applications are made under cool temperature conditions (55°F or less) and are followed by rainfall or overhead irrigation. Applications should always be made before soil freeze-up. In established stands, application should be made after the last cutting when the weather and soil temperatures are cool. In fall seeded crops, applications should be made after crop has reached the trifoliate leaf stage.	**Do not** use more than 4.0 lb /A per season. **Do not** graze or harvest for forage or dehydration within the following intervals after application: **less than 3.0 lb /A-** 25 days, **3.0 to 4.0 lb /A-** 45 days. **Do not** use as a preplant or preemergence treatment or before the trifoliate leaf stage has developed in new plantings as injury to the crop stand may result.
MCPA Amine 1.0 lbs ai per gallon **POST applications:** 1.0 pt /A	**Active Ingredients:** MCPA **Similar Products:** Chiptox Dagger MCP 2 Sodium MCP 4 Amine Sword **MOA:** 4	**POST.** Apply in the late fall following frosts when crop is dormant. Temperature at time of spraying should be above 40°F.	**Do not** forage or graze dairy or meat animals on treated areas within 7 days of slaughter and/or treatment. **Do not** apply through any type of irrigation system.
Poast Plus 1.0 lbs ai per gallon **POST applications:** 1.5-3.75 pt /A	**Active Ingredients:** Sethoxydim **Similar Products:** Poast **Rates may vary due to formulation.** **MOA:** 1	**POST.** Best control of annual grasses can be achieved when applied before grass weeds are mowed. If crop is irrigated, application 2-4 days after an irrigation is most effective. Spray spring and summer grasses as early in the season as possible. Spray fall-germinating weeds in the fall soon after they begin growing but before any killing frosts. Refer to label for application rates for specific regions and target weeds.	**Do not** apply more than 9.75 pt /A per season. **Do not** cut for dry hay within 14 days of application. **Do not** graze, feed, or cut for undried forage within 7 days of application. **Do not** apply through any type of irrigation equipment.
Pursuit DG 70% DG **POST applications:** 1.08-2.16 oz/A	**Active Ingredients:** Imazethapyr **Similar Products:** Pursuit W Pursuit W DG **MOA:** 2	**POST.** Apply to seedling crops in the second trifoliate stage or larger and when the majority of the weeds are 1-3 inches tall or before rosettes exceed 3 inches. Apply to established crops in the fall, in the spring to dormant, or semi-dormant(less than 3 inches of regrowth), or between cuttings. Any application should be made before significant growth or regrowth.	**Do not** apply more than 2.18 oz /A per year. **Do not** apply more than 1.44 oz /A to alfalfa during the last year of the stand. **Do not** replant crop in treated field for 4 months following application.

This section was not revised in 2007.

ALFALFA WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Raptor 1.0 lb ai per gallon **POST applications:** 4-6 fl oz /A	**Active Ingredients:** Imazamox **Similar Products:** None **MOA:** 2	**POST.** Apply as an early postemergence treatment when weeds are actively growing and before they exceed a height of 3 inches. Delay application until the majority of the weeds are in the recommended growth stage. Apply to seedling alfalfa when the crop is in the second trifoliate stage or larger in growth. When applied to crops grown for seed, apply before bud formation. May be applied to established crops in the fall, winter, or in the spring to dormant, or semi-dormant crops, or between cuttings.	**Do not** cut or feed crop forage or hay for at least 20 days after application. **Do not** harvest seed for feed or food for at least 70 days following application.
Roundup Original Max 5.5 lb ai per gallon **All applications:** 22-44 fl oz/A	**Active Ingredients:** Glyphosate **Similar Products:** Roundup Products & Many Others **Rates may vary due to formulation.** **MOA:** 9	**PRE.** Apply before, during, or after planting, but after weed emergence. Application must be made prior to emergence of the crop. **POST.** Apply in declining alfalfa stands or any stand of alfalfa where crop destruction is acceptable. The treated crop and weeds can be harvested and fed to livestock after 36 hours. **Spot Treatments.** Apply in areas where the movement of domestic livestock can be controlled. Apply with wiper applicators to control or suppress weeds.	**PRE. Do not** graze or harvest within 8 weeks of application if a rate greater than 44 fl oz /A is applied. There are no grazing or haying restrictions if less than 44 fl oz /A is applied. **POST. Do not** apply more than 44 fl oz /A as a preharvest treatment. **Preharvest** application is not recommended for alfalfa grown for seed, as a reduction in germination or vigor may occur. **Over-the-Top applications.** Apply as a broadcast over-the-top application only to Roundup Ready alfalfa varieties. **Spot Treatment. Do not** graze or harvest within 14 days of application. **Do not** treat more than 10% of the total field area at one time.
Select 2EC 2.0 lb. ai per gallon **POST applications:** 6-16 fl oz /A	**Active Ingredients:** Clethodim **Similar Products:** None **MOA:** 1	**POST.** Apply at the grass sizes indicated in the label. If grass has been cut, apply after active growth has resumed.	**Do not** graze, feed or harvest for forage or hay within 15 days of application.
Sencor 75% DF **Dormant Season applications:** 0.33 to 1.33 lb /A	**Active Ingredients:** Metribuzin **Similar Products:** Sencor 4 **MOA:** 5	**Dormant Season.** Apply when weeds are lees than 2 inches tall or before weed foliage is 2 inches in diameter. Refer to label for application rates for specific target weeds.	**Do not** apply before growth begins in the spring or before growth ceases in the fall. **Do not** graze or harvest within 28 days after application. **Do not** treat within 12 months of seeding.
Sinbar 80% WP **Dormant Season applications:** 1/2 to 1 1/2 lb /A	**Active Ingredients:** Terbacil **Similar Products:** None **MOA:** 5	**Dormant Season.** Make application in the fall after plants become dormant or in the spring before new growth starts. For semi-dormant and non-dormant varieties, apply in the fall or winter after last cutting or in the spring before new growth starts. **POST-Harvest.** Apply as a postharvest treatment at ½ - ¾ lba/a for the control of pigweed and the suppression of other warm season annual weeds such as crabgrass and foxtails. Two applications (dormant and/or postharvest) may be made but must be at least 60 days apart and must not exceed 2 lb /A per year.	**Do not** apply to established stands after new growth starts in the spring, as injury to the crop may result. **Postharvest applications: Do not** apply after June 15 or to first year, spring-seeded alfalfa. **Do not** apply more than 0.5 lb /A to fall seeded, first year stands of alfalfa.

This section was not revised in 2007.

ALFALFA WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Treflan HFP 4 lbs ai per gallon **POST applications:** 4.0 pt /A	**Active Ingredients:** Trifluralin **Similar Products:** Treflan TR-10 Trifluralin HF Trust 10G Trust Herbicide **MOA:** 3	**POST.** Apply during dormancy or semi-dormancy, or during the growing season immediately after a cutting. Application must be made prior to the expected time of weed germination. To control bromegrass and cheat, apply immediately after a cutting between August 1 and October 1, but prior to weed germination.	**Do not** cut or graze crop within 21 days after application. **Do not** apply more than 4.0 pt /A per season.
Velpar L 2.0 lb ai per gallon **Dormant Season applications:** See Table	**Active Ingredient:** Hexazinone **Similar Products:** None **MOA:** 5	**POST.** Make a single application to non-dormant and semi-dormant varieties during the winter months when alfalfa is in the least active stage of growth. Where weeds have emerged, use a surfactant. Refer to label for weeds controlled at specific application rates.	**Do not** use on crops grown for seed. **Do not** exceed 3 pt /A on crops less than one year old. **Do not** add a surfactant when treating non-dormant varieties. **Do not** apply to snow-covered or frozen ground. **Do not** graze or feed forage or hay to livestock within 30 days following application. **Do not** use on seedling alfalfa, alfalfa-grass mixtures, or other mixed stands as injury may result to the seedling alfalfa or companion crop.

Velpar L (pt/A)			
Soil Texture	**<1% Organic Matter**	**1-5% Organic Matter**	**>5% Organic Matter**
Coarse	2-3 pt /A	2-3 pt /A	4-6 pt /A
Medium	2-3 pt /A	3-6 pt /A	4-6 pt /A
Fine	4-6 pt /A	3-6 pt /A	4-6 pt /A

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Velpar AlfaMax MP 77.7 % DG **Dormant Season applications:** See Table	**Active Ingredient:** Hexazinone + Diuron **Similar Products:** None **MOA:** 5	**POST.** Make a single application to non-dormant and semi-dormant varieties during the winter months when alfalfa is in the least active stage of growth. Where weeds have emerged, use a surfactant. Refer to label for weeds controlled at specific application rates.	**Do not** use on crops grown for seed. **Do not** add a surfactant when treating non-dormant varieties. **Do not** apply to snow-covered or frozen ground. **Do not** graze or feed forage or hay to livestock within 30 days following application. **Do not** use on seedling alfalfa, alfalfa-grass mixtures, or other mixed stands as injury may result to the seedling alfalfa or companion crop.

Velpar AlfaMax (pounds/acre)		
Soil Texture	**1-5% Organic Matter**	**>5% Organic Matter**
Coarse	1.5 – 2	3 – 4.3
Medium	2 – 4.3	3 – 4.3
Fine	2 – 4.3	3 – 4.3

MOA Group Tables start on page 46 of the handbook.

CANOLA INSECT CONTROL SUGGESTIONS

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Aphids Cabbage aphid: small blue-gray aphid with short cornicles, and is usually covered with a powdery wax secretion. Green peach aphid: Pale green to yellow with long cornicles and three lark lines on abdomen. Turnip aphid: Pale gray green with short, swollen cornicles, 1/16 inches. Winged adults can be recognized by presence of transverse dark bands on last two abdominal segments. Damage: High populations can cause stunting and discoloration of leaves. Feeding by cabbage aphid can stop terminal growth and reduce yield. Damage is of little consequence after pod formation is completed. Threshold: No thresholds exist from Oklahoma data. **Georgia thresholds**: treat of seedling and rosette stage plants when aphids exceed 5 per leaf or 20% infested plants. Treat bud and early bloom stage when infested plants (racemes) exceed 15%. Do not treat at late flower or pod stage.	Azadirachtin (20B) Capture 2EC (3) Methyl parathion[r] (1B) Proaxis[r] 0.5 CS (3) Warrior[r] with Zeon (3)	Apply per label 2.1 to 2.6 fl oz 1 pt 3.84 fl oz 3.84 fl oz	No PHI for harvest (Aza-direct, Ecozin) 35 day PHI for harvest. (other names: Annex, Bifenture, Discipline, Empower, Fanfare, Sniper) 28 day PHI for harvest. Do not graze treated fields 30 Day PHI for harvest or grazing 30 day PHI for harvest or grazing (other names: Silencer, Tiaga) Spray in evening during bloom to avoid killing honeybees. Notify beekeepers before spraying if possible.
Beet Armyworm Green caterpillar, darker above with a white stripe along the side of the body and a small black spot above the second pair of true legs, three pairs of true (thoracic legs) and four pair of abdominal prolegs. Damage: Caterpillars can reduce seedling stand and chew conspicuous, irregular-shaped holes in leaves. Threshold: Seedling, treat when scouting indicates 1 or more per row-ft. Treat when defoliation becomes severe, and larvae are present.	Azadirachtin (20B) *B. thuringiensis* (11B1,2) Capture (3) Methyl parathion[r] (1B) Proaxis[r] 0.5 CS (3) Warrior[r] with Zeon (3)	Apply per label Apply per label 2.1 to 2.6 fl oz 1 pt 3.84 fl oz 3.84 fl oz	No PHI for harvest No PHI for harvest 35 day PHI for harvest 28 day PHI for harvest. Do not graze treated fields 30 Day PHI for harvest or grazing 30 day PHI for harvest or grazing
Cabbage looper Green caterpillar, with a thin white line along each side of the body, three pairs of thoracic legs and three pair of abdominal prolegs. Damage: Caterpillars chew conspicuous, irregular-shaped holes in leaves. Threshold: Treat when defoliation becomes severe, and larvae are present.	Azadirachtin (20B) *B. thuringiensis* (11B1, 2) Capture[r] (3) Methyl parathion[r] (1B) Proaxis[r] 0.5 CS (3) Warrior[r] with Zeon (3)	Apply per label Apply per label 2.1 to 2.6 fl oz 1 pt 3.84 fl oz 3.84 fl oz	No PHI for harvest No PHI for harvest 35 day PHI for harvest. 28 day PHI for harvest. Do not graze treated fields 30 Day PHI for harvest or grazing 30 day PHI for harvest or grazing

CANOLA INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Diamondback moth Adult moths are light grayish-brown with a white diamond-shaped marking along back when wings are folded. Larvae are slightly tapered at each end and pale green in color. Wriggle rapidly when disturbed. Damage: Larvae feed on all plant parts, preferring the undersides of older leaves. Threshold: No threshold established.	Azadirachtin (20B)	Apply per label	No PHI for harvest (Aza-direct, Ecozin)
	B. thuringiensis (11B1, 2)	Apply per label	No PHI for harvest (Dipel. Javelin, Leipnox, Xentari)
	Capture[r] (3)	2.1 to 2.6 fl oz	35 day PHI for harvest. (other names: Annex, Bifenture, Discipline, Empower, Fanfare, Sniper)
	Methyl parathion[r] (1B)	1 pt	28 day PHI for harvest. Do not graze treated fields
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 Day PHI for harvest or grazing
	Warrior[r] with Zeon (3)	3.84 fl oz	30 day PHI for harvest or grazing (other names: Silencer, Tiaga)
False chinch bug Adults 1/8 inch, long dirty gray, with brown or black markings, piercing mouthparts. Damage: Feed in groups. Large numbers may cause wilting of heads or small plants. Threshold: 140 or more per head Flowering: Treat when there is an AVERAGE of five to 10 per head. Early seed pod: Treat when there is an AVERAGE of 10 to 20 per head.	Azadirachtin (20B)	Apply per label	No PHI for harvest
	Capture[r] (3)	2.1 to 2.6 fl oz	35 day PHI for harvest.
	Methyl parathion[r] (1B)	1 pt	28 day PHI for harvest. Do not graze treated fields
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 Day PHI for harvest or grazing
	Warrior[r] with Zeon (3)	3.84 fl oz	30 day PHI for harvest or grazing
Flea beetle Shiny, black beetle about 1/16 inches that jumps when disturbed. Damage: Early spring. Plant tissue is scraped from leaf, small holes chewed in leaves. Can cause delayed development in cool growing conditions Threshold: Non established	Poncho 600 (4A)	3.84-10.23 fl oz/cwt seed	Rate depends on infestation level. Follow all label restrictions. No waiting period listed.
	Cruiser 5FS (4A)	10.24 fl oz/cwt seed	No PHI for harvest, do not graze for 120 days for some crops
	Azadirachtin (20B)	Apply per label	No PHI for harvest
	Capture[r] (3)	2.1 to 2.6 fl oz	35 day PHI for harvest.
	Methyl parathion[r] (1B)	1 pt	28 day PHI for harvest. Do not graze treated fields
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 Day PHI for harvest or grazing
	Warrior[r] with Zeon (3)	3.84 fl oz	30 day PHI for harvest or
Harlequin bug Black shield-shaped with orange, red and yellow markings. Measures 3/8 inches. Eggs barrel shaped, laid in clusters. Damage: Adults and nymphs pierce stalks, leaves with sucking mouthparts. Threshold: No threshold has been established.	Azadirachtin (20B)	Apply per label	No PHI for harvest
	Capture[r] (3)	2.1 to 2.6 fl oz	35 day PHI for harvest.
	Methyl parathion[r] (1B)	1 pt	28 day PHI for harvest. Do not graze treated fields
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 Day PHI for harvest or grazing
	Warrior[r] with Zeon (3)	3.84 fl oz	30 day PHI for harvest or grazing
Grasshopper 1-2 inches, outer wings leathery, inner wings clear or colored. Enlarged hind legs designed for jumping. Damage: Chew leaves or kills small plants. Threshold: 15-20 per square yard.	Capture[r] (3)	2.1 to 2.6 fl oz	35 day PHI for harvest.
	Methyl parathion[r] (1B)	1 pt	28 day PHI for harvest. Do not graze treated fields
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 Day PHI for harvest or grazing
	Warrior[r] with Zeon (3)	3.84 fl oz	30 day PHI for harvest or grazing

CANOLA INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Lygus bug Several species. Generally oval, about1/4 inch long, brown with some yellow or reddish markings. Damage: Feed on developing seeds, flowers, and leaves. Feed on buds. Thresholds are for infestations before or during petal fall. Threshold: North Dakota thresholds are 15 per 10 sweeps before petal fall, and 20 per 10 sweeps after petal fall.	Azadirachtin (20B)	Apply per label	No PHI for harvest (Aza-direct, Ecozin)
	Capture[r] (3)	2.1 to 2.6 fl oz	35 day PHI for harvest. (other names: Annex, Bifenture, Discipline, Empower, Fanfare, Sniper)
	Methyl parathion[r] (1B)	1 pt	28 day PHI for harvest. Do not graze treated fields
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 Day PHI for harvest or grazing
	Warrior[r] with Zeon (3)	3.84 fl oz	30 day PHI for harvest or grazing

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

Pre-harvest Intervals and grazing restrictions

Aza-direct (neem)	No PHI for harvest
Bacillus thuringiensis	No PHI for harvest.
Capture	35 day PHI for harvest.
Methyl parathion	28 day PHI for harvest. Do not graze treated fields
Proaxis	30 Day PHI for harvest or grazing
Warrior	30 day PHI for harvest or grazing

Numbers in parentheses (#) that follow the insecticide name are used to designate the mode of action of the insecticide according to the classification system developed by the Insecticide Resistance Action Committee, (IRAC) in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest during a growing season, simply select a registered insecticide with a different number for each application. To further delay resistance from developing, integrate other control methods into your pest management programs.

This section was not revised in 2007.

CANOLA WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Winter Canola Herbicides[a]																			
	Winter Broadleaves											Winter Grasses							
Herbicide	Bushy wallflower	Carolina geranium	Chickweed	Corn gromwell	Cutlf. eveningprimrose	Flixweed	GF Pepperweed (ALS Res.)	Henbit	Prickly lettuce	Purple deadnettle	Shepherd's purse	Cheat	Downy & Jap. brome	Jointed goatgrass	Rescuegrass	Rye	Ryegrass	Wild oats	**General or Restricted use**
Soil appl. **(PPI)**																			
Sonalan HFP	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	**8**	**8**	**7**	**8**	**9**	General use
Treflan	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	**8**	**8**	7	**8**	**8**	General use
Foliar appl. **(POST)**																			
Assure II	0	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**9**	**9**	**8**	**8**	**9**	General use
Poast	0	0	0	0	0	0	0	0	0	0	0	**8**	**8**	**8**	**8**	7	7	**8**	General use
Roundup Orignal Max (RR Varieties)	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	General use
Select 2 EC	0	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**8**	**8**	**7**	**9**	**9**	General use
Stinger	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	General use
Fallow / Burndown																			
Roundup Orignal Max	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	General use
a Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied according to the label under optimum growing conditions.																			

This section was not revised in 2007.

CANOLA WEED CONTROL (CON'TD)

Rotational Cropping Restrictions in Months for Canola Herbicides								
	Crop							
Herbicide	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Assure II	4	0	4	0	4	4	0	4
Poast	0	0	4	0	0	4	0	4
Roundup Origninal Max	0	0	0	0	0	0	0	0
Select 2 EC	1	1	1	1	1	1	1	1
Sonalan HFP	B	0	B	B	0	B	0	B
Stinger	10.5[a]	0	0	a	a	10.5	18[a]	0
Treflan	0	0	14	0	0	14	0	14

[a.] See labeld for specific crop rotation information.
[b.] Following cropping season.

This section was not revised in 2007.

CANOLA WEED SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Assure II 0.88 lb ai per gallon **POST applications:** 7to 12 fl oz/A	**Active Ingredients:** Quizalofop **Similar Products:** Matador **MOA:** 1	**POST.** Apply after crop and weed emergence but before grasses tiller.	**Do not** apply Assure II within 60 days of harvest. **Do not** apply more than 18 oz/A per season. Do not graze livestock in treated areas or feed forage, hay or straw from treated areas to livestock. **Do not** cultivate within 7 days after application. Optimum timing for cultivation is 7-14 days after application of Assure II. Applications must always include a crop oil concentrate or non-ionic surfactant
Poast 1.5 lb ai per gallon **POST applications:** 0.5 to 2.5 pt/A	**Active Ingredient:** Sethoxydim **Similar Products:** None **Rates may vary due to formulation** **MOA:** 1	**POST.** Apply POST to actively growing grass weeds within size limits on label. Apply to grasses after crop and weed emergence. Annual grasses that emerge after application will not be controlled. Apply to actively growing grasses at recommended weed heights. **Will NOT control sedges or broadleaf weeds.**	**Do not** harvest canola for at least 75 days after application. **Do not** apply more than 2.5 pt/A per application. **Do not** exceed 5 pt/A in a season. **Do not** graze or feed forage, hay, or straw.
Roundup Original Max 5.5 lb ai per gallon **EPP BURNDOWN application:** 11 to 44 fl oz/A **POST applications:** 11 to 22 fl oz/A	**Active Ingredient:** Glyphosate **Similar Products:** Many **Rates and required adjutants may vary due to formulation and manufacturer. See appropriate label.** **MOA:** 9	**EPP BURNDOWN.** Apply before planting the crop to control existing weeds. Will not control weeds that have not emerged. **PRE.** Apply after planting but before crop emergence. Will not control weeds that have not emerged. **POST.** Apply POST only in **Roundup Ready Canola varieties**. **Single Application.** One postemergence application of 11 to 16 fl oz/A can be applied no later than the 6 leaf stage. **Sequential Applications.** Two sequential applications of 11 to 22 fl oz/A, with a 60 day interval between applications, can be applied.	**Apply POST only in Roundup Ready Canola varieties. Do not** apply more than 44 fl oz/A of glyphosate during a growing season; **do not** apply more than 44 fl oz/A during EPP burndown or Pre-plant applications and no more than 22 fl oz/A over the top of Roundup Ready canola from emergence to the 6-leaf stage. Applications made during bolting or flowering may result in crop injury and yield loss. No more than two postemergence applications can be made to Roundup Ready canola from emergence to the 6 leaf stage. Allow at least 60 days between last glyphosate application and canola harvest.
Select 2 EC 2 lb ai per gallon **POST applications:** 4 to 6 fl oz/A	**Active Ingredient:** Clethodim **Similar Products:** Arrow Envoy Volunteer **Rates may vary due to formulation** **MOA:** 1	**POST.** Apply to grasses after crop and weed emergence. Annual grasses that emerge after application will not be controlled. Apply to actively growing grasses at recommended weed heights. **Will NOT control sedges or broadleaf weeds.** **The recommended rate for control of cheat, ryegrass, rye, wild oats, and other winter annual grasses common in Oklahoma wheat fields is 6 fl oz/A.**	**Do not** apply more than 6 fl oz/A per application and no more than 16 fl oz/A per season. **Do not** allow Select to drift onto wheat or other grass crops as severe crop injury will occur. **Do not** apply after canola has begun bolting. Apply with 1% v/v crop oil concentrate. Including liquid fertilizer with the application is **NOT** recommended. **Do not** apply under conditions of drought stress. **Do not** graze treated fields or feed treated forage or hay. **Do not** apply within 70 days of harvest. **Do not** plant any crop for 30 days after application unless registered for use in that crop.
Sonalan HFP 3.0 lb ai per gallon **PPI applications by soil texture:** 1.5 pt/A - Course Soil 2 pt/A - Medium 2.5 pt/A - Fine Soil	**Active Ingredients:** Ethalfluralin **Similar Products:** Sonalan 10G Trust Herbicide **MOA:** 3	**PPI.** To soil surface prior to planting and incorporate into the upper 2 to 3 inches of soil. Incorporation should occur within 48 hours of application. For best performance, incorporate with two passes in different directions.	**Do not** apply to soils that are wet or are subject to prolonged periods of flooding as poor weed control may result. **Do not** graze or harvest for livestock forage.

This section was not revised in 2007.

CANOLA WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Stinger 3 lb ai per gallon **POST applications:** 4 to 8 fl oz/A	**Active Ingredient:** Clopyralid **Similar Products:** None **MOA:** 4	**POST.** Apply postemergence when canola is in the 2 to 6 leaf stage. Apply by ground rig in 10 to 20 gallons of water carrier or by air in a minimum of 10 gallons per acre water carrier.	**Do not** exceed 0.25 lb ai/A of clopyralid per crop year. **Do not** move livestock from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture. Use of a spray adjuvant is not necessary but may increase control of some weeds. **Do not** apply within 50 days of harvest. **Do not** make more than 1 application/crop/year.
Treflan HFP 4.0 lb ai per gallon **PPI applications by soil texture:** 1 pt/A - Course Soil 1.5 pt/A - Medium 2 pt/A - Fine Soil	**Active Ingredients:** Trifluralin **Similar Products:** Treflan TR-10 Trifluralin HF Trust 10G Trust 4EC Trust Herbicide **MOA:** 3	**PPI.** To soil surface prior to planting and incorporate into the upper 2 to 3 inches of soil. Incorporation should occur within 24 hours of application. For best performance, incorporate with two passes in different directions.	**If applying through irrigation system:** Apply only through continuously moving center pivot, lateral move end tow, solid set, or hand move irrigation systems. **Refer** to label for additional chemigation instructions. **Do not** apply to soils that are wet or are subject to prolonged periods of flooding as poor weed control may result. **Do not** graze or harvest for livestock forage.

MOA Group Tables start on page 46 of the handbook.

CORN INSECT CONTROL SUGGESTIONS

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Armyworm 1- 1.5 inches. Dark green or brown caterpillar with 5 stripes along a smooth body. Head with honeycomb-like markings.	**Seed Treatments**		
	YieldGard Seed Herculex Seed	Transgenic seed Transgenic seed	Follow company's guidelines for providing refugia as a resistance management strategy.
Damage: Armyworms typically move in from maturing wheat fields in March-April. Feed on seedling leaves.	Ambush 25W[r] (3) Pounce 3.2[r] (3)	6.4 to 12.8 oz 4 to 8 fl oz	30 day waiting period
	Asana XL (3)	5.8 to 9.6 fl oz	21 day waiting period
Threshold: Treat if 25% of seedling corn plants are damaged.	*Bacillus thuringiensis* (Biobit, Condor, Dipel, Lepinox, Javelin, Xentari)	See product label for specific rates	Check label for waiting periods
	Baythroid XL[r] (3)	1.6 to 2.8 fl oz	21 day waiting period for grain or fodder, 0 day for green forage
	Capture 2EC[r] (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower)
	Cobalt[r] (3)	13 to 26 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Delta Gold (3)	1.5-2.4 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Intrepid 2F (18)	4 to 8 fl oz	0 day wait for green forage, 21 day waiting period for harvest or fodder
	Lannate LV (1A) SP	0.75 to 1.5 pt 0.25 to 0.5 lb	21 day waiting period
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1 to 2 pt	21 day waiting period
	Mustang MAX[r] (3)	3.2 to 4.0 fl oz	30 day waiting period for grain, 60 day waiting period for silage
	Methyl parathion 4E (1B)	0.5 pt	12 day waiting period
	Penncap-M[r] (1B)	2 to 3 pt	12 day waiting period
	Proaxis 0.5 SC[r] (3)	2.56 to 3.84 fl oz	21 day waiting period
	Sevin XLR (1A)	1 to 2 qt	0 day waiting period
	Tracer (5)	1 to 3 fl oz	28 day waiting period
	Warrior w Zeon[r] (3)	2.56 to 3.84 fl oz	21 day waiting period

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Chinch bug Nymphs are bright red with white band across back. Adults ½ inches, black with white "hour glass" shape on back Damage: Adults may fly into field, early (March April) or adults and nymphs move in to corn from maturing wheat fields (April-May). Threshold: Remove plant juices, cause stunting, wilting, and reddening of leaves.	**Seed Treatments**:		
	Cruiser 5FS (4A)	0.56 to 3.61 fl oz /80,000 seed	Do not feed treated seed. Generally must order through a seed dealer.
	Poncho 600 (4A)	1.13 fl oz/80,000 seed	Do not feed treated seed. See label for mixing and handling instructions. Follow all label restrictions.
	Planting Time Applications		
	Force CS®	0.46-0.57 fl oz/1000 ft row	T-band application. Read label carefully for restrictions.
	Regent (2B)	0.24 fl oz/1000 ft-row	90 day waiting period for harvest.
	Post-emergence Sprays		Border sprays (30-60 ft) are often effective.
	Asana XL (3)	5.8 to 9.6 fl oz	21 day waiting period
	Baythroid XL® (3)	1.6 to 2.8 fl oz	21 day waiting period for grain or fodder, 0 day for green forage
	Capture 2EC® (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower).
	Cobalt® (3)	19 to 38 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Chlorpyrifos 4E® (1B) (Lorsban, Warhawk)	1 to 2 pt	21 day waiting period
	Delta Gold (3)	1.5-2.4 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Mustang MAX® (3)	3.2 to 4.0 fl oz	30 day waiting period for grain, 60 days for silage
	Methyl parathion 4E (1B)	0.5 pt	12 day waiting period
	Proaxis 0.5 CS® (3)	3.84 fl oz	21 day waiting period
	Sevin XLR (1A)	1 to 2 qt	48 day waiting period for harvest, 14 days for grazing
	Warrior w Zeon® (3)	3.84 fl oz	21 day waiting period
Corn Earworm Striped robust caterpillars that range in color from green to pink to brown to black. Damage: Caterpillars injure ear tips, feed in whorls. Feeding damage may increase potential for aflatoxins in grain. Threshold: Not practical to control in field corn	NA	NA	

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Corn rootworm (adults) Small beetle, with black stripes, 12 spots, or green Damage: Feed on silks. Heavy populations may interfere with pollination Threshold: Treat if beetles are abundant (over 5 per plant and silks are being severely clipped)	Ambush 25W[r] (3) Pounce 3.2 (3)	6.4 to 12.8 oz 4 to 8 fl oz	30 day waiting period
	Asana (3)	5.8 to 9.6 fl oz	21 day waiting period
	Baythroid XL[r] (3)	1.6 to 2.8 fl oz	21 day waiting period for grain or fodder, 0 day for green forage
	Capture 2EC[r] (3)	2.1 to 6.4 fl oz	Use higher rates (greater than 5.1 fl oz) in areas where spider mites are a problem.
	Cobalt[r] (3)	13 to 26 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Delta Gold (3)	1.5-2.4 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Dimethoate 4E (1B)	0.66 to 1 pt	14 day waiting period
	Lannate LV (1A) SP	0.75 to 1.5 pt 0.25 to 0.5 lb	21 day waiting period
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1 to 2 pt	21 day waiting period
	Methyl parathion 4E (1B)	0.5 pt	12 day waiting period
	Mustang MAX[r] (3)	2.72 to 4.0 fl oz	30 day waiting period for grain, 60 day waiting period for forage
	Penncap-M[r] (1B)	1 to 2 pt	12 day waiting period
	Proaxis 0.5 CS[r] (3)	2.56 to 3.84 fl oz	21 day waiting period
	Sevin XLR (1A)	1 to 2 qt	48 day waiting period for harvest, 14 day for grazing
	Warrior w Zeon[r] (3)	2.56 to 3.84 fl oz	21 day waiting period

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Corn rootworm (larvae) Thin, white worm-like larva that lives in soil. Damage is likely to occur in early part of growing season (before June 15). Damage: Feed on roots, causing lodged plants and plants that "gooseneck". Root tissue and brace roots are often chewed back to the base of the stalk. Threshold: Consider a planting-time insecticide, or a seed variety that contains "rootworm" protection, such as 'YieldGard Rootworm™ ' if planting continuous corn.	**Seed Treatments**		
	YieldGard Rootworm Seed Herculex Rootworm Seed	Transgenic seed Transgenic seed	Follow company's guidelines for providing refugia as a resistance management strategy.
	Cruiser 5FS (4A)	5.6 fl oz/80,000 seed	Do not use treated seed for feed, food, or oil processing
	Poncho 600 (4A)	5.64 fl oz/80,000 seed	Do not use treated seed for feed, food, or oil processing
	Force ST^{r} (3)	3 to 4 oz/cwt seed	Do not apply Force 3G if Force ST was used.
	Planting Time		
	Aztec 2.1G^{r} (1B,3)	6.7 fl oz/1000 ft-row	Follow manufactures' guidelines for rates, application methods grazing and crop rotation restrictions. Rotation of insecticides during successive years is suggested.
	Capture 1.5G^{r} (3)	3.2 to 8 oz/1000 ft-row	
	Capture LFR^{r} (3) Capture 2EC^{r} (3)	0.39-0.49 fl oz/1000 ft-row	Read label carefully for application directions.
	Counter 15G^{r} (1B)	0.3 fl oz/1000 ft-row	
	Force 3G^{r} (3) Force^{r} CS	6 to 8 oz/1000 ft-row 0.46-0.57 fl oz/1000 ft row	
	Fortress 2.5G	4 to 5 oz/1000 ft-row	
	Furadan 4F^{r} (1A)	6 to 9 oz/1000 ft-row	
	Lorsban 15 G (1B)	2.5 fl oz/1000 ft-row	
	Proaxis 0.5 CS^{r} (3)	8 oz/1000 ft-row	
	Regent 4SC^{r} (2B)	0.66 fl oz/1000 ft-row	
	Thimet 20G^{r} (1B)	0.24 oz/1000 ft-row	
	Warrior w zeon^{r} (3)	4.5 to 6 oz/1000 ft row 0.66 fl oz/1000 ft-row	Follow label directions for at-cultivation applications. Do not make application if planting time application was made.
	Post Seedling-Emergence Application		
	Counter 15G^{r} (1B)	8 oz/1000 ft-row	
	Cobalt^{r} (3)	38 to 42 fl oz	
	Force 3G^{r} (3)	4 to 5 oz/1000 ft-row	
	Fortress 2.5G	6.0 to 7.5 oz/1000 ft-row	
	Furadan 4F^{r} (1A)	2.5 fl oz/1000 ft-row	
	Lorsban 15G^{r} (1B)	8 oz/1000 ft-row	
	Thimet 20G^{r} (1B)	4.5 to 6 oz/1000 ft row	

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Cutworms (black, granulate, sandhill) Striped or solid colored, robust caterpillars that "roll" up when disturbed, and prefer to live under ground. Damage: Cutworms generally feed at night, and live under the soil during the day. Plants will be cut at or slightly above the soil level, causing stand reductions. Threshold: Scout fields at seedling emergence. Treat when worms are less than ½ inch long, and skips are noticed.	**Seed Treatments**		
	YieldGard Seed	Transgenic seed	Follow company's guidelines for providing refugia as a resistance management strategy.
	Herculex Seed	Transgenic seed	
	Ambush 25W[r] (3)	12.8 oz	30 day waiting period
	Pounce 3.2[r] (3)	4 to 8 fl oz	
	Asana XL (3)	5.8 to 9.6 fl oz	21 day waiting period
	Baythroid XL[r] (3)	0.8 to 1.6 fl oz	21 day waiting period for grain or fodder, 0 days for green forage
	Capture (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower)
	Capture LFR[r] (3)	0.2-0.39 fl oz/1000 linear ft-row banded or 3.4-6.8 fl oz/acre as a foliar application	Follow label directions. Do not apply to soil with greater than 30% crop residue, do not apply more than 0.1 lb active per acre per season as an at-plant application.
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1 to 2 pt	21 day waiting period
	Cobalt[r] (3)	13 to 26 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Delta Gold (3)	1.0-1.5 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Mustang MAX[r] (3)	1.28 to 2.8 fl oz	30 day waiting period for grain and silage, 60 day for grazing
	Proaxis 0.5 CS[r] (3)	1.92 to 3.2 fl oz	21 day waiting period
	Warrior w Zeon[r] (3)	1.92 to 3.2 fl oz	21 day waiting period
			Always follow label directions, as methods and timing of applications may vary.

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Fall armyworm Large, striped, non-bristled worm up to 1.5 inches. Has a light colored, inverted "Y" on head. June-August Damage: Larvae cut holes in leaves at whorl stage, heaviest damage occurs on late corn when caterpillars tunnel into ear or ear shank. Threshold: No detailed threshold is suggested.	**Seed Treatments**		
	YieldGard Seed Herculex Seed	Transgenic seed Transgenic seed	Follow company's guidelines for providing refugia as a resistance management strategy.
	Ambush 25W^{r} (3) Pounce 3.2^{r} (3)	6.4 to 12.8 oz 4 to 8 fl oz	30 day waiting period
	Baythroid XL^{r} (3)	2.8 fl oz	(1st and 2nd instars) 21 day waiting period for grain or fodder
	Capture 2EC^{r} (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower)
	Cobalt^{r} (3)	13 to 26 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Lannate LV (1A) SP	0.75 to 1.5 pt 0.25 to 0.5 lb	21 day waiting period for silage, 3 days for grazing
	Chlorpyrifos 4E^{r} (1B) (Lorsban, Warhawk)	1 to 2 pt	35 day waiting period
	Delta Gold (3)	1.5-2.4 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Methyl parathion 4E (1B)	0.5 pt	12 day waiting period
	Mustang MAX^{r} (3)	3.2 to 4.0 fl oz	30 day waiting period for grain and silage, 60 day for grazing
	Proaxis 0.5 CS^{r} (3)	2.56 to 3.84 fl oz	21 day waiting period
	Sevin XLR (1A)	1 to 2 qt	48 day harvest: 14 day grazing.
	Tracer (5)	1 to 3 fl oz	28 day waiting period.
	Warrior w Zeon^{r} (3)	2.56 to 3.84 fl oz	21 day waiting period

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Flea beetles Shiny, black beetle about 1/16 inches that jumps when disturbed. Damage: Early spring-summer. Plant tissue is scraped from leaf, giving it a drought stress appearance. Can cause delayed development is cool growing conditions Threshold: Apply to small plants when beetles first appear and some plants are being killed.	Ambush 25W[r] (3) Pounce 3.2[r] (3)	6.4 to 12.8 oz 4 to 8 fl oz	30 day waiting period
	Asana XL (3)	5.8 to 9.6 fl oz	21 day waiting period
	Baythroid XL[r] (3)	0.8 to 1.6 fl oz	21 day waiting period for grain or fodder, 0 day for green forage
	Capture 2EC[r] (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower)
	Cobalt[r] (3)	13 to 26 fl oz	21 day waiting period for harvest. Follow label directions for application.
	Delta Gold (3)	1.0-1.5 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Lannate LV (1A) SP	0.75 to 1.5 pt 0.25 to 0.5 lb	21 day waiting period for silage, 3 day for grazing
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1 to 2 pt	35 day waiting period
	Mustang MAX[r] (3)	2.72 to 4.0 fl oz	30 day waiting period for grain and silage, 60 day for grazing
	Penncap-M[r] (1B)	2 to 3 pt	12 day waiting period
	Pounce 3.2 EC[r] (3)	4 to 8 fl oz	30 day waiting period
	Proaxis 0.5 CS[r] (3)	2.56 to 3.84 fl oz	21 day waiting period
	Sevin XLR (1A)	1 to 2 qt	48 day harvest: 14 day grazing.
	Warrior w Zeon[r] (3)	2.56 to 3.84 fl oz	21 day waiting period
Grasshopper 1-2 inches, outer wings leathery, inner wings clear or colored. Enlarged hind legs designed for jumping. Damage: Chew leaves, leaving ragged edges, or completely chewing leaf blade. Damage emerging seed heads, causing yield loss. Threshold: Consider treating if numbers reach 8-14 in the field, or 20-40 in field margins. See F-7196, Grasshopper Management in Rangeland, Pastures, and Crops for more information.	Asana XL (3)	5.8 to 9.6 fl oz	21 day waiting period
	Baythroid XL[r] (3)	2.1 to 2.8 fl oz	21 day waiting period for grain or fodder, 0 day for green forage
	Capture 2EC[r] (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower)
	Cobalt[r] (3)	7 to 13 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1 to 2 pt	35 day waiting period
	Delta Gold (3)	1.0-1.5 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Methyl parathion 4E (1B)	1 pt	12 day waiting period
	Mustang MAX[r] (3)	2.72 to 4.0 fl oz	30 day waiting period for grain and silage, 60 day for grazing
	Penncap-M[r] (1B)	2 to 3 pt	12 day waiting period
	Proaxis 0.5 CS[r] (3)	1.92 to 3.2 fl oz	21 day waiting period
	Sevin XLR (1A)	0.5 to 1.5 qt	48 day harvest: 14 day grazing.
	Warrior w Zeon[r] (3)	1.92 to 3.2 fl oz	21 day waiting period

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Mites Small, less than 1/100 inches. Cause brown stippling of leaves. Banks grass and two spotted spidermites are most common pests. Damage: Causes stippling of leaves, severe infestations can kill leaves. Infestations generally start at lower leaves and move upward. Threshold: Treat when there is visible damage on the lower third of the plant and small colonies are visible on the middle third of the plant, and the corn has not yet reached the hard dough stage.	Capture 2EC^{r} (3) Comite II (20) Dimethoate 4E (1B) Oberon	5.12 to 6.4 fl oz 2.25 to 3.32 pt 0.66 to 1 pt 5.7 to 8.5 fl oz	30 day waiting period 30 day waiting period. Apply when mite colonies first form, before leaves are killed. 14 day waiting period. 30 day wait for harvest, 5 days for forage or silage. NOTE: Treatments at hard-dough stage or later are not cost effective. When heavy infestations occur, erratic control will usually be the rule. Thorough coverage is important, higher volumes (2-3 gallons or more per acre) when applied by aircraft increase the effectiveness of the spray.
Seedcorn maggot, **Seed corn beetle** Maggots are yellowish-white, tapered larvae about 1/4 inches. Beetles are about 3/8 inches, with two black stripes on brown wing covers. Damage: Damage occurs in spring, especially if soils are cool and moist and seeds are not germinating rapidly. Damage is notices as skips in plant stands. Seed will be hollowed out. Threshold: Replanting is the only recourse if damage has already occurred. Use a planting-time treatment if fields have a history. No-till fields may be more vulnerable to attack.	**Seed Treatments** Kickstart **At Planting** Aztec 2.1G^{r} (1B,3) Capture 1.5G^{r} (3) Counter 15G^{r} (1B) Lorsban 15G^{r} (1B) Force 3G^{r} (3) Fortress 2.5G	 1.5 oz/42 lb seed 6.7 fl oz/1000 ft-row 3 to 8 oz/1000 ft row 6 to 8 oz/1000 ft-row 8 to 12 oz/1000 ft-row 4 to 5 oz/1000 ft-row 6 to 7.5 fl oz/1000 ft-row	 Registration for lindane has been canceled effective July 1, 2007 and all existing stocks must be used by October 1, 2009 Follow manufactures' guidelines for rates, application methods grazing and crop rotation restrictions. Rotation of insecticides during successive years is suggested.

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Southwestern corn borer Full grown caterpillars are white with prominent dark spots on body. Eggs are laid in masses of 12-30. They overlap like egg scales. Eggs are white when first laid, then red bands appear before they hatch. Damage: First generation causes "dead heart" in plants. Second generation tunnels throughout stalk. May girdle mature stalks causing lodging. Threshold:. Threshold based on egg masses. Treat if 25% of plants have egg masses or newly hatched larvae. A repeat application may be needed in 7-10 days.	**Seed Treatments**		
	YieldGard Seed	Transgenic seed	Follow company's guidelines for providing refugia as a resistance management strategy.
	Herculex Seed	Transgenic seed	
	Post-emergence Sprays		
	Capture 2EC[r] (3)	2.1 to 6.4 fl oz	30 day waiting period (Other names include Annex, Bifenture, and Empower)
	Cobalt[r] (3)	19 to 38 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Furadan 4F[r] (1A)	1 to 2 pt (foliar applic)	30 day waiting period
	Intrepid (18)	4 to 8 fl oz	21 day waiting period
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1.5 to 2 pt	12 day waiting period; follow directions for spray volume recommendations
	Delta Gold (3)	1.5-2.4 fl oz	1 day wait for green forage or harvest, 21 day waiting period for fodder
	Mustang MAX[r] (3)	2.72 to 4.0 fl oz	30 day waiting period for grain and silage
	Proaxis 0.5 CS[r] (3)	2.56 to 3.84 fl oz	21 day waiting period
	Tracer (5)	2 to 3 fl oz	28 day waiting period
	Warrior w Zeon[r] (3)	2.56 to 3.84 fl oz	21 day waiting period

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Western bean cutworm Larvae are dark brown with faint diamond-shaped markings on their backs. Measure 1.5 inches. Eggs are deposited in masses of 4-200 on upper surface of leaves. Damage: Larvae feed on developing tassel, or silk. They feed on developing kernels once the ear has formed. Threshold: Treat of eight percent or more of the plants have egg masses or small larvae in the tassels and the crop is 95% tasseled.	**Seed Treatments**		
	YieldGard Seed	Transgenic seed	Follow company's guidelines for providing refugia as a resistance management strategy.
	Herculex Seed	Transgenic seed	
	Ambush 25W[r] (3)	3.2 to 6.4 oz	30 day waiting period
	Pounce 3.2[r] (3)	2 to 4 fl oz	
	Asana XL (3)	2.9 to 5.8 fl oz	21 day waiting period
	Baythroid XL[r] (3)	1.6 to 2.8 fl oz	21 day waiting period for grain or fodder, 0 day for green forage
	Capture 2EC[r] (3)	2.1 to 6.4 fl oz	30 day waiting period. (Other names include Annex, Bifenture, and Empower)
	Cobalt[r] (3)	13 to 26 fl oz	21 day waiting period for harvest, 14 days for grazing or silage
	Intrepid (18)	4 to 8 fl oz	21 day waiting period
	Chlorpyrifos 4E[r] (1B) (Lorsban, Warhawk)	1 to 2 pt	35 day waiting period
	Methyl parathion 4 E (1B)	0.5 pt	12 day waiting period
	Mustang MAX[r] (3)	1.76 to 4.0 fl oz	30 day waiting period for grain and silage, 60 day for grazing
	Penncap-M[r] (1B)	2 to 4 pt	12 day waiting period
	Proaxis 0.5 CS[r] (3)	1.92 to 3.2 fl oz	21 day waiting period
	Sevin XLR (1A)	2 qt	48 day harvest: 14 day grazing.
	Tracer (5)	2 to 3 fl oz	28 day waiting period.
	Warrior w Zeon[r] (3)	1.92 to 3.2 fl oz	21 day waiting period

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
White grub Large, "C" shaped grub with a white body and a brown head. Damage: Feed on developing roots, cause slow growth, stunting, and stand loss. Threshold: No reliable thresholds are available. Consider using an at-planting treatment for "suppression" if field has a history of grub problems.	**Seed Treatments**		
	Cruiser 5FS (4A)	0.56 to 3.61 fl oz /80,000 seed	Do not use treated seed for feed, food, or oil processing
	Poncho 600 (4A)	1.13 fl oz/80,000 seed	Do not use treated seed for feed, food, or oil processing
	Force ST^{r} (3)	3 to 4 oz/cwt seed	Do not use Force 3G if Force ST was used
	Planting Time		Follow manufactures' guidelines for rates, application methods grazing and crop rotation restrictions. Rotation of insecticides during successive years is suggested.
	Aztec 2.1G^{r} (1B,3)	6.7 fl oz/1000 ft-row	
	Capture 1.5G^{r} (3)	3.2 to 8 oz/1000 ft row	
	Capture LFR^{r}	0.2-0.39 fl oz/1000 ft-row in-furrow or band	
	Counter 15G^{r} (1B)	6 to 8 oz/1000 ft-row	
	Lorsban 15G^{r} (1B)	8 to 12 oz/1000 ft-row	
	Force 3G^{r} (3) Force CS^{r} (3)	4 to 5 oz/1000 ft-row 0.46-0.57 fl zo/1000 ft row	
	Fortress 2.5G	6.0 to 7.5 oz/1000 ft-row	
	Proaxis 0.5 CS^{r} (3)	0.66 fl oz/1000 ft-row	
	Regent 4SC^{r} (2B)	0.24 oz/1000 ft-row	
	Warrior w Zeon^{r} (3)	0.66 fl oz/1000 ft-row	

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre or 1,000 ft-row	Comments
Wireworm Hard-shelled, smooth, cylindrical, yellowish to brown worms. 2-6 year life cycle. More common in corn planted into a sod or grass pasture. Damage: Feed on seed, seedling. Cause stunting and stand loss. Threshold: No reliable thresholds are available. Treat if field has a history of problems. Wireworms may be more of a problem in no-till or minimum till fields.	**Seed Treatments**		
	Cruiser 5FS (4A)	0.56 to 3.61 fl oz /80,000 seed	Do not use treated seed for feed, food, or oil processing.
	Poncho 600 (4A)	1.13 fl oz/80,000 seed	Do not use treated seed for feed, food, or oil processing Registration for lindane has been canceled effective July 1, 2007 and all existing stocks must be used by October 1, 2009.
	Kickstart (2A)	1.5 oz/42 lbs seed	Do not use Force 3G if Force ST was used
	Force ST[r] (3)	3 to 4 oz/cwt seed	Follow manufactures' guidelines for rates, application methods grazing and crop rotation restrictions. Rotation of insecticides during successive years is suggested.
	Planting Time		
	Aztec 2.1G[r] (1B,3)	6.7 fl oz/1000 ft-row	(Other names include Annex, Bifenture, and Empower)
	Capture 1.5G[r] (3)	3.2 to 8 oz/1000 ft-row	
	Capture LFR[r] (3)	0.2-0.39 fl oz/1000 ft-row in-furrow or band	
	Capture 2EC[r] (3)	0.3 fl oz/1000 ft-row	
	Counter 15G[r] (1B)	6 to 8 oz/1000 ft-row	
	Force 3G[r] (3)	4 to 5 oz/1000 ft-row	
	Force CS[r]	0.46-0.57 fl oz/1000 ft-row	
	Fortress 2.5G	6.0 to 7.5 oz/1000 ft-row	
	Lorsban 15G[r] (1B)	8 oz/1000 ft-row	
	Proaxis 0.5 CS[r] (3)	0.66 fl oz/1000 ft-row	
	Regent 4SC[r] (2B)	0.24 oz/1000 ft-row	
	Warrior w Zeon[r] (3)	0.66 fl oz/1000 ft-row	

[r] = Restricted Use

MOA Group Tables start on page 46 of the handbook.

CORN INSECT CONTROL SUGGESTIONS (CONT'D)

Pre-harvest Intervals and grazing restrictions

Ambush	Apply prior to brown silk stage. 30 day PHI for grazing or harvest
Asana XL	21 day PHI for harvest or grazing
Aztec 2.1G	Do not exceed 7.3 lb per acre per crop season
Baythroid XL	21 day waiting period for grain or fodder, 0 days for green forage.
Capture 2EC, 1.5 G, LFR	30 day PHI for harvest or grazing
Cobalt	21 day waiting period for harvest, 14 days for grazing or silage
Comite II	Apply in a minimum of 20 gal of water/acre ground, 5 gal by air
Counter 15G	Check label for precautions regarding application of Counter 15G and its interaction with ALS inhibiting herbicides.
Cruiser 5FS	no grazing restriction
Delta Gold	1 day PHI for green forage, 21 day for harvest or fodder
Dimethoate	Apply by aircraft. 14 day PHI for harvest or grazing
Force 3G, CS	30 day crop rotation restriction
Fortress 2.5 G	30 day crop rotation restriction
Furadan 4F	30 day PHI for harvest or grazing
Intrepid	0 day for green forage, 21 day PHI for harvest or fodder
Lorsban 4E	35 day PHI for harvest, do not graze or use for silage
Malathion	5 day PHI for harvest or grazing
Methyl parathion	12 day PHI for harvest or grazing
Methomyl	3 days for forage, 21 day PHI for harvest or grazing
Mustang Max	30 day PHI for harvest, 60 days for grazing
Poncho	45 day PHI for harvest or grazing
Pounce 3.2	Use prior to ear formation only. 30 day PHI for harvest or grazing
Proaxis	21 day PHI for harvest or grazing
Regent	90 day PHI for harvest or grazing
Sevin XLR	14 day PHI for grazing, 48 days for harvest
Tracer	Do not apply more than 6 fl oz per acre per year.
Warrior	21 day PHI for harvest or grazing

* Numbers in parentheses (#) that follow the insecticide name are used to designate the mode of action of the insecticide according to the classification system developed by the Insecticide Resistance Action Committee, (IRAC) in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest during a growing season, simply select a registered insecticide with a different number for each application. To further delay resistance from developing, integrate other control methods into your pest management programs.

This section was not revised in 2007.

CORN WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Corn Herbicides[a]

Herbicide	Winter Annuals					Summer Broadleaves										Summer Grasses									General or Restricted Use
	Brome grass	Carolina geranimu	Chickweed	Henbit	Italian ryegrass	black nightshade	cocklebur	common ragweed	giant ragweed	jimsonweed	lambsquarters	morningglory	pigweed	smartweed	velvetleaf	barnyardgrasss	fall panicum	giant foxtail	johnsongrass seedling	johnsongrass rhizome	large crabgrass	yellow foxtail	shattercane	yellow nutsedge	
Burndown **(POST)**																									
2,4-D	0	5	7	5	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Field Master	**9**	7	**9**	**8**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
Gramoxone Max	6	6	**9**	7	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
Roundup Original Max	**9**	6	**9**	**8**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
RT Master	**9**	7	**9**	**8**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
Surefire	6	6	**9**	7	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
Soil-applied **(EPP,PPI, PRE)**																									
Atrazine	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	3	7	0	0	5	7	0	7	Res.
Axiom DF	-	-	-	-	-	7	3	7	3	6	**9**	3	**9**	6	7	**9**	**8**	**9**	**8**	0	**9**	**9**	5	5	Gen.
Balance Pro	-	-	-	-	-	**9**	2	**9**	6	**9**	**9**	4	**9**	**8**	**9**	**8**	**8**	**8**	-	-	6	**8**	5	-	Res.
Bicep II Magnum, Cinch ATZ	-	-	-	-	-	**9**	**9**	**9**	7	**8**	**9**	**9**	**9**	**8**	**8**	**9**	**9**	**9**	6	5	**9**	**9**	6	**8**	Res.
Broadstrike+Dual	-	-	-	-	-	**9**	7	**8**	5	7	**9**	5	**9**	**9**	**8**	**9**	**9**	**9**	6	5	**9**	**9**	6	**9**	
Bullet	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	5	5	**9**	**9**	6	**8**	Res.
Callisto	-	-	-	-	-	**9**	5	7	6	-	**9**	6	**9**	**9**	**9**	3	3	3	0	0	6	3	0	0	Gen.
Camix	-	-	-	-	-	**9**	5	7	6	6	**9**	6	**9**	**9**	**9**	**9**	**9**	**9**	6	5	**9**	**9**	6	**8**	Gen.
Define	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	**9**	**8**	**9**	**8**	0	**9**	**9**	5	-	Gen.
Degree Xtra	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	6	**8**	3	3	6	**8**	3	**8**	Res.
Dual II Magnum, Cinch	-	-	-	-	-	**8**	0	5	5	5	6	0	**9**	5	0	**9**	**9**	**9**	6	5	**9**	**9**	6	**8**	Gen.
Epic	-	-	-	-	-	**9**	3	**9**	6	**9**	**9**	4	**9**	**8**	**9**	**9**	**8**	**8**	**8**	-	**9**	**8**	5	-	Res.
Expert	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	**9**	**9**	**9**	6	5	**9**	**9**	6	**8**	Res.
Field Master	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Res.
Guardsman Max	-	-	-	-	-	**9**	**8**	**8**	6	**8**	**8**	**8**	**9**	**8**	6	**9**	**9**	**9**	6	5	**9**	**9**	5	**8**	Res.
Harness/Surpass/TopNotch/Degree	-	-	-	-	-	**8**	5	7	5	5	**8**	5	**9**	5	6	**9**	**9**	**9**	5	5	**9**	**9**	6	**8**	Res.
Harness Xtra/Fultime	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	5	5	**9**	**9**	6	**8**	Res.
Hornet WDG	-	-	-	-	-	**9**	**8**	**8**	7	**8**	**9**	6	**9**	**9**	**8**	0	0	0	0	0	0	0	0	4	Gen.
Lumax						**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	6	5	**9**	**9**	6	**8**	Res.
Micro-Tech	-	-	-	-	-	**9**	0	5	5	5	7	0	**9**	5	0	**9**	**9**	**9**	5	5	**9**	**9**	6	**8**	Res.
Outlook	-	-	-	-	-	**9**	0	6	5	5	7	5	**9**	5	0	**9**	**9**	**9**	6	5	**9**	**9**	5	**8**	Gen.
Princep	-	-	-	-	-	**9**	**8**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	7	7	**8**	**8**	0	0	7	**8**	6	4	Gen.
Prowl (PRE only)	-	-	-	-	-	5	5	5	5	5	**9**	5	**9**	5	6	**9**	**9**	**9**	**8**	4	**9**	**9**	**8**	3	Gen.
Pursuit (Clearfield corn)	-	-	-	-	-	**9**	**8**	7	6	7	**8**	6	**9**	**9**	**8**	7	6	7	7	5	6	6	6	5	Gen.
Python	-	-	-	-	-	**8**	7	**8**	5	**8**	**9**	6	**9**	**9**	**8**	0	0	0	0	0	0	0	0	0	Gen.
Shotgun	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	3	7	0	0	5	7	0	7	Res.
Foliar-applied **(POST)**																									
2,4-D	-	-	-	-	-	**8**	**9**	**9**	**9**	7	**9**	**9**	**9**	7	**8**	0	0	0	0	0	0	0	0	0	Gen.
Accent	-	-	-	-	-	5	6	5	5	**8**	5	**8**	**8**	**8**	6	**8**	**8**	**8**	**9**	**9**	4	**8**	**9**	5	Gen.
Accent Gold	-	-	-	-	-	6	**8**	**8**	**8**	**8**	6	**8**	**8**	**8**	**8**	5	5	5	6	6	3	5	6	3	Gen.
Aim	-	-	-	-	-	**8**	7	6	2	6	**8**	**8**	**8**	5	**9**	0	0	0	0	0	0	0	0	0	Gen.
Atrazine+oil	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	5	7	0	0	6	7	0	7	Res.
Banvel, Clarity, Distinct	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	Gen.
Basagran	-	-	-	-	-	5	**9**	7	**8**	**9**	5	7	5	**9**	**9**	0	0	0	0	0	0	0	0	**8**	Gen.
Basis	-	-	-	-	-	0	7	5	3	4	**8**	4	**8**	**9**	**8**	7	**8**	**8**	4	0	6	**8**	**8**	4	Gen.
Basis Gold	-	-	-	-	-	7	**8**	**8**	7	**8**	**8**	7	**9**	**9**	7	**8**	**8**	**9**	7	6	7	**8**	**8**	5	Res.

This section was not revised in 2007.

CORN WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Corn Herbicides[a]

	Winter Annuals					Summer Broadleaves										Summer Grasses									
Herbicide	Brome grass	Carolina geranimu	Chickweed	Henbit	Italian ryegrass	black nightshade	cocklebur	common ragweed	giant ragweed	jimsonweed	lambsquarters	morningglory	pigweed	smartweed	velvetleaf	barnyardgrasss	fall panicum	giant foxtail	johnsongrass seedling	johnsongrass rhizome	large crabgrass	yellow foxtail	shattercane	yellow nutsedge	**General or Restricted Use**
Beacon	-	-	-	-	-	7	7	**9**	**9**	7	5	5	7	7	7	7	**8**	7	**8**	7	5	5	**9**	5	Gen.
Buctril, Moxy	-	-	-	-	-	**9**	**9**	**9**	7	**9**	**9**	**8**	7	**9**	**8**	0	0	0	0	0	0	0	0	0	Gen.
Buctril + Atrazine	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**8**	**9**	**8**	5	3	4	0	0	3	4	0	4	Res.
Callisto	-	-	-	-	-	**9**	-	**8**	**9**	-	**9**	7	**8**	**9**	**9**	0	0	0	0	0	9	0	0	5	Gen.
Celebrity Plus	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	5	5	5	6	6	3	5	6	3	Gen.
Equip Corn	-	-	-	-	-	**9**	**8**	**8**	**8**	**8**	**8**	6	**9**	**8**	**8**	**8**	7	**9**	**9**	**8**	7	7	**9**	3	Gen.
Exceed	-	-	-	-	-	**8**	**9**	**9**	**9**	**9**	**8**	7	**9**	**9**	**9**	0	7	5	**8**	5	0	5	**9**	6	Gen.
Expert (RR Corn)	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	Res.
Guardsman Max	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	5	7	0	0	6	7	0	7	Res.
Landmaster BW (RR Corn)	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
Liberty (Liberty Link Corn)	-	-	-	-	-	**8**	**9**	**9**	**9**	**9**	7	**8**	**8**	**9**	**8**	7	7	**8**	**8**	7	**8**	7	**8**	4	Gen.
Liberty AZT (Liberty Link Corn)	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**8**	**9**	**8**	**8**	7	**8**	**8**	7	**8**	7	**8**	5	Res.
Lighting (Clearfield Corn)	-	-	-	-	-	**9**	**9**	7	7	**8**	**8**	7	**9**	**9**	**9**	**8**	**8**	**9**	**9**	7	7	**8**	**9**	6	Gen.
Lumax						**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	5	7	0	0	**9**	0	0	7	Res.
Marksman	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	5	7	0	0	6	7	0	7	Res.
Northstar	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	5	6	6	7	6	4	4	7	4	Gen.
Option	-	-	-	-	-	**8**	7	7	5	**8**	7	5	**8**	6	**8**	**8**	**8**	**9**	**9**	**8**	7	7	**9**	3	Gen.
Permit	-	-	-	-	-	4	**9**	**8**	**8**	7	4	6	**9**	7	**8**	0	0	0	0	0	0	0	0	**9**	Gen.
Ready Master ATZ (RR Corn)	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
Resource	-	-	-	-	-	4	7	7	5	7	7	5	7	4	**9**	0	0	0	0	0	0	0	0	0	Gen.
Roundup Original Max (RR Corn)	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
Shotgun	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	5	7	0	0	6	7	0	7	Res.
Spirit	-	-	-	-	-	7	**8**	**8**	**8**	**8**	7	6	**8**	**8**	**8**	0	7	5	**8**	5	0	5	**9**	6	Gen.
Steadfast	-	-	-	-	-	5	6	5	5	**8**	5	**8**	**8**	**8**	6	**8**	**8**	**8**	**9**	**9**	7	**8**	**9**	5	Gen.
Steadfast ATZ	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**8**	**9**	**9**	**9**	**8**	**8**	**8**	**8**	**9**	**9**	6	**8**	**9**	7	Res.
Stinger	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	0	0	0	7	0	0	0	0	0	0	0	0	0	0	Gen.
Yukon	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	**9**	Gen.

[a] Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions. This information was compiled from weed control ratings from trials conducted within Oklahoma and from universities across the US.

This section was not revised in 2007.

CORN WEED CONTROL (CONT'D)

Rotational Cropping Restrictions in Months for Corn Herbicides

Herbicide	Crop							
	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Burndown **(POST)**								
2,4-D	1	1	0	1	1	1	1	1
Field Master	a	a	0	a	a	0	a	a
Gramoxone Max	0	0	0	0	0	0	0	0
Roundup Original Max	0	0	0	0	0	0	0	0
RT Master	1	1	0	1	1	1	0	1
Surefire	b	b	b	b	b	b	b	b
Soil-applied **(EPP,PPI, PRE)**								
Atrazine	a	a	0	a	a	0	a	a
Axiom DF	1	1	0	1	1	1	0	1
Balance Pro	10[c]	18[c]	0	18[c]	18[c]	6	6	4
Bicep II Magnum, Cinch ATZ	b	b	0	c	c	c	c	24
Broadstrike+Dual	b	b	b	b	b	b	b	b
Bullet	b	b	b	b	b	b	b	b
Callisto	18	c	0	c	18	c	c	4
Camix	d	d	0	c	d	c	c	4.5
Define	12	12	0	4	12	12	0	12
Degree Xtra	b	b	0	b	b	0	0	0
Dual II Magnum, Cinch	4	b	0	0	0	0	0	4.5
Epic	12	b	0	6	b	12	6	12
Expert	b	b	0	c	c	c	c	24
Field Master	a	a	0	a	a	0	a	a
Guardsman Max	d	d	0	c	c	0	c	d
Harness/Surpass/TopNotch/De	b	b	0	b	b	0	c	4
Harness Xtra/Fultime	d	d	c	d	d	c	c	15
Hornet WDG	18[b]	26	0	18	18	12	10.5[b]	4
Lumax	18	18	0	c	c	c	c	4.5
Micro-Tech	b	b	b	b	b	b	b	b
Outlook	b	b	0	0	0	0	0	4
Princep	b	b	b	b	b	b	b	b
Prowl	c	c	0	0	0	c	0	4
Pursuit	4	e	18.5[f]	18.5	0	18.5	0	4
Python	4	26[g]	0	18	4	12	0	4
Shotgun	a	a	0	a	a	0	a	a
Foliar-applied **(POST)**								
2,4-D	1	1	0	1	1	1	1	1
Accent	12	h	0	10	h	i	0.5	4
Accent Gold	10.5[j]	26[g]	0	26[g]	26[g]	12	10.5	4
Aim	12	12	0	0	12	0	0	0
Atrazine+oil	a	a	0	a	a	0	a	a
Banvel, Clarity, Distinct	b	b	b	b	b	b	b	b
Basagran	b	b	b	b	b	b	b	b
Basis	10/18[k]	18/18[k]	0/0[k]	18/18[k]	18/18[k]	10/18[k]	0.5/10[k]	4/4[k]

This section was not revised in 2007.

CORN WEED CONTROL (CONT'D)

Rotational Cropping Restrictions in Months for Corn Herbicides

	Crop							
Herbicide	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Basis Gold	18	18	0	10	18	10	10	10
Beacon	8	18	0.5[f]	8	8	8	8	3
Buctril, Moxy	1	1	1	1	1	1	1	1
Buctril + Atrazine	c	c	1	c	c	1	1	c
Callisto	18	c	0	c	18	c	c	4
Celebrity Plus	b	b	b	b	b	b	b	b
Equip Corn	18	18	0.5	9	18	9	9	2
Exceed	18m	10m	1[f]	10m	b	10m	10m	3m
Expert	b	b	0	c	c	c	c	24
Guardsman Max	d	d	0	c	c	0	c	d
Landmaster BW	0	0	0	0	0	0	0	0
Liberty	4	4[l]	4[l]	4[l]	4	2.5	4	2.5
Liberty AZT	a	a	0	a	a	0	a	a
Lighting	9.5	40	8.5[f]	18	9.5	18	9.5	4
Lumax	18	18	0	c	c	c	c	4.5
Marksman	a	a	0	a	a	0	a	a
Northstar	8	18	0.5[f]	8	8	8	8	3
Option	2	2	0.25	2	2	2	0.5	2
Permit	9	15	1[f]	4	6	2	9	2
Ready Master ATZ	a	a	0	a	a	0	a	a
Resource	b	b	1	b	b	b	1	4
Roundup Original Max	0	0	0	0	0	0	0	0
Shotgun	a	a	0	a	a	0	a	a
Spirit	18[m]	10[m]	1[fm]	10[m]	18[m]	10[m]	10[m]	3[m]
Steadfast	10[n]	10[n]	0	10	10 to 18[b]	10 to 18[b]	0.5	4
Steadfast ATZ	18	18	0	10	18	10	10	10
Stinger	10.5[b]	0	0	b	b	10.5	18[b]	0
Yukon	9	15	1[f]	4	6	2	9	2

[a.] If planted the following year, there is a possibility for crop injury.

[b.] See labeld for specific crop rotation restrictions.

[c.] May be planted the following cropping season.

[d.] May be planted after two complete growing seasons.

[e.] Only Clearfield or Sumner Canola varieites can be planted the year following a Pursuit application.

[f.] Clearfield corn hybrids can be planted anytime.

[g.] Must conduct a successful bioassay before planting.

[h.] Ten months for pH less than or equal to 6.5 and 18 months for pH greater than 6.5.

[i.] Ten months for pH less than or equal to 7.5 and 18 months for pH greater than 7.5.

[j.] Unless soil pH is greater than 8.0, then 12 months.

[k.] First listed interval is for 1/3 oz/A rate, second interval is for 1/3-1 oz/A rate.

[l.] Unless planting Liberty varieties, then 0 months.

[m.] Based on soil pH below 7.8, if soil pH is greater than 7.8 see label.

[n.] Unless less than 15 inches of rainfall have been received after application then restriction is 18 months.

This section was not revised in 2007.

CORN WEED SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
2,4-D Amine 4 3.8 lb ai per gallon **EPP applications:** 1 to 2 pt/A **POST applications:** 1 to 1.5 pt/A	**Active Ingredient:** 2,4-D **Similar Products:** Many **Rates may vary due to formulation** **MOA:** 4	**EPP.** Apply 7 to 14 days before planting to control existing weeds. Must wait at least 7 days after application before planting. **POST.** Apply POST to actively growing weeds when corn is no more than 8 inches in height, otherwise use drop nozzles and keep spray off corn foliage.	**Do not** graze or harvest for forage or fodder within 7 days of application. **Do not** use on light, sandy soils or where soil moisture is low. **Do not** apply near sensitive species, such as soybeans, or where herbicide spray can drift onto sensitive crops. **POST applications. Do not** spray corn in the tassel to dough stage. Corn treated with 2,4-D POST may become temporarily brittle and subject to stalk breakage by wind and/or cultivation.
Accent 75% WDG **POST applications:** 0.67 to 1.33 oz/A	**Active Ingredient:** Nicosulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply POST to weeds and to corn that has 6 or fewer collars but not taller than 20 inches in height. If 20 inches or taller see label.	See label for compatibility with soil insecticides. Must use a 1% crop oil concentrate or 0.25% to 0.5% nonionic surfactant. Before tank mixing with other products or applying within 7 days of other chemical applications, consult the label.
Accent Gold 83.8% WDG **POST applications:** 2.9 oz product/A	**Active Ingredient:** Clopyralid Flumetsulam Nicosulfuron Rimsulfuron **Similar Products:** Accent Gold WDG **Rates may vary due to formulation.** **MOA:** 2 & 4	**POST.** Apply postemergence to weeds when corn is no more than 12 inches tall and before it exhibits 6 leaf collars.	**Do not** make more than one application of Accent Gold per season. **Do not** apply to corn hybrids with a Relative Maturity rating less than 88 days. **Do not** apply to corn grown for seed, popcorn, or sweet corn. **Do not** use less than 2.9 oz of product per acre. **Do not** use on fields previously treated with Broadstrike+Dual, Hornet, Scorpion III, or Stinger in the same season. **Do not** tank mix with Basagran, Laddox, products containing 2,4-D, or foliar-applied organophosphate insecticides. **Do not** graze corn or harvest for grain, forage, hay, or straw within 85 days of application. See label for compatibility with soil insecticides. Must be applied with COC and ammonium nitrogen fertilizer. **Do not** apply through any type of irrigation system.
Aim 2 EW or 2 EC **POST applications:** 0.5 fl. Oz	**Active Ingredient:** Carfentrazone **Similar Products:** Avalanche Bulk Pak **MOA:** 14	EPP. Aim may be tankmixed with other burndown herbicides like glyphosate, 2,4-D to enhance burndown performane prior to planting. **POST.** Apply POST to most weeds 1 to 4 inches tall (velvetleaf to 36") and to corn up to the 8 leaf collar growth stage. May be applied in all tillage systems from 30 days before planting up to 8 leaf collar growth stage.	Apply with 0.25% NIS with at least 80% active ingredient strength, or COC at 1% v/v. Crop oil concentrate is recommended for improved performance under dry, stressed weed conditions. Consult label for recommended tank mix partners and directions. **Do not** apply more than 1.9 fl. Oz/season .

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Atrazine[r] 4 lb ai per gallon **SOIL applications:** See table. **POST applications:** up to 4 pt /A of Atrazine 4L	**Active Ingredient:** Atrazine **Similar Products:** AAtrex 4L, AAtrex Nine-O and Many Others **Rates may vary due to formulation.** **MOA:** 5	**PPI.** Apply up to 14 days prior to planting and incorporate 1 to 2 inches. **PRE.** Apply after planting but before crop and weeds emerge. **POST.** Apply before weeds exceed 1.5 inches and before crop reaches 12 inches.	**POST.** Apply with emulsifiable oil or oil concentrate. **Any Application Timing. Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover.

EPP, PPI, & PRE Applications

AAtrex 4L Use Rates (pt/A)

Soil Erodibility	Ground Cover at Planting	
	at least 30%	less than 30%
Non-highly Erodible	4 pt	4 pt
Highly Erodible	4 pt	3.2 pt

Axiom DF[r] 68% DF **SOIL applications:** See table.	**Active Ingredients:** Flufenacet Metribuzin **Similar Products:** None **MOA:** 5 & 15	**EPP.** Apply up to 45 days before planting. **PPI.** Apply up to 14 days before planting and incorporate in the top 1 to 2 inches of soil. **PRE.** Apply before weeds emerge or tank mix with a non-selective herbicide.	**Do not** apply more than 23 oz/A per season. **Do not** plant corn less than 1 to 1.5 inches deep. **Do not** apply aerially. **Do not** apply to popcorn, or sweet corn. See label for recommended sequential applications.

EPP, PPI, & PRE Applications

Axiom (68% DF) Use Rates (oz/A) in Conventional Tillage Applications Made Within Two Weeks Prior to Planting[a]

Soil Textural Group[b]	Soil Organic Matter Content				
	< 0.5%	0.5 to 1%	1 to 1.5%	1.5 to 3%	> 3%
Coarse	8 oz	8 to 10 oz	10 to 12 oz	13 oz	15 oz
Medium	10 to 15 oz		15 to 18 oz		17 to 20 oz
Fine	20 to 22 oz				20 to 23 oz

a. Use next higher rate under heavy surface residue, heavy weed pressures, or when soil OM is at the upper end of range. If soil pH is >7.4, use the lower rate of the rate range shown.

b. For more information refer to the "Rate Selection/Soil Texture" section of the label.

EPP, PPI, & PRE Applications

Axiom (68% DF) Use Rates (oz/A) in Conservation, Minimum, and No-till Systems; or Conventional Tillage System Applications Made Greater Than Two Weeks Prior to Planting[a]

Soil Textural Group[b]	Soil Organic Matter Content				
	< 0.5%	0.5 to 1%	1 to 1.5%	1.5 to 3%	> 3%
Coarse	9 oz	9 to 11 oz	11 to 13 oz	14 oz	16 oz
Medium	11 to 18 oz		18 to 20 oz		19 to 22 oz
Fine	20 to 23 oz				

a. Use next higher rate under heavy surface residue, heavy weed pressures, or when soil OM is at the upper end of range. If soil pH is >7.4, use the lower rate of the rate range shown.

b. For more information refer to the "Rate Selection/Soil Texture" section of the label.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Balance Pro 4 lb ai per gallon **SOIL applications:** See table. For tank mix rates see label.	**Active Ingredient:** Isoxaflutole **Similar Products:** Balance WDG **MOA:** 28	**EPP.** When followed by planned POST herbicide, apply up to 30 days before planting else, apply 21 days before planting. Consult label for burndown of existing weeds. **PPI.** When following with a planned POST herbicide, apply up to 30 days prior to planting else, apply 21 days prior to planting and incorporate no more than 2" deep. **PRE.** Apply after planting but before crop emergence.	**Read and observe all environmental precautions in label. Do not** irrigate Balance into coarse soils at planting when soils are saturated. **Do not** apply after corn emergence. **Do not** incorporate with a drag harrow after planting. **Do not** plant corn less than 1.5 inches deep. **Do not** apply more than 4.5 fl oz of Balance/A/season. Not recommended for soils with less than 1.5% OM **and** pH greater than 7.5. Completely cover corn seed and close seed furrow. **Do not** apply through any type of irrigation system.

EPP, PPI, & PRE Applications

Balance Pro Use Rates (fl oz/A) When Applied Alone as Part of a Planned Sequential Weed Control Program[a]

	Soil Texture					
	Coarse Soils[b]		Medium Soils[c]		Fine Soils	
Application Timing	<1.5% OM	>1.5% OM	<1.5% OM	>1.5% OM	<1.5% OM	>1.5% OM
8-30 days before planting	Not recommended	2.25 to 3.0	3.0 to 3.75	3.0 to 3.75	3.75 to 4.5	3.75 to 4.5
0-7 days before planting or PRE	Not recommended	1.5 to 1.88	1.88 to 2.6	2.25 to 3.0	2.25 to 3.0	2.25 to 3.75

a. Within rate ranges, use lower rate on soils that are relatively coarse textured or low in OM, and use higher rate on soils that are relatively fine-textured or high in organic matter or when preplant application is made further from planting.

b. Not recommended for coarse soils with less than 1.5% OM **or** pH greater than 7.5.

c. When applied preemergence to medium soils with pH greater than 7.5, reduce the rate by 0.25 fl oz/A.

EPP, PPI, & PRE Applications

Balance Pro Use Rates (fl oz/A)[a] When Applied in a Tank Mix with Other Soil-applied Herbicides

	Soil Texture					
	Coarse Soils[b]		Medium Soils[b]		Fine Soils	
Application Timing[c]	<1.5% OM[d]	>1.5% OM	<1.5% OM	>1.5% OM	<1.5% OM	>1.5% OM
EPP or PPI; applied 8 to 21 days before planting	Not recommended	1.5 to 3.0	2.25 to 3.75	3.0 to 3.75	3.75 to 4.5	3.75 to 4.5
EPP, PPI, or PRE; applied 0-7 days before planting	Not recommended	1.5 to 1.88	1.88 to 2.76	2.25 to 3.0	2.25 to 3.0	2.25 to 3.0

a. Potential tank mix partners include, but not limited to: Dual, Dual II, Dual II Magnum, Frontier, Harness, Lasso, Surpass, and Topnotch.

b. When applied preemergence to medium soils with pH greater than 7.5, reduce the rate by 0.25 fl oz/A.

c. Balance Pro may be applied up to 30 days before planting when used in a planned sequential application program.

d. Not recommended for coarse soils with less than 1.5% OM **or** pH greater than 7.5.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Basagran 4 lb ai per gallon **POST applications:** 1 to 3 pt/A	**Active Ingredients:** Bentazon **Similar Products:** None **MOA:** 6	**POST.** Apply POST to actively growing weeds within the size limits on the label.	**Do not** apply more than 4 pt Basagran/A/season or more than 2 lb bentazon/A/season. **Do not** apply Basagran to corn that is stressed due to environmental and/or previous herbicide applications. **Do not** graze treated fields for at least 12 days after treatment. Include 1.25% oil concentrate and/or 2.5 to 5% UAN in the application.
Basis 75% WDG **EPP & PRE applications:** 0.33 to 1.0 oz/A **POST applications:** 0.33 oz/A	**Active Ingredients:** Rimsulfuron, Thifensulfuron methyl **Similar Products:** None **MOA:** 2	**EPP.** Apply up to 30 days before planting but before corn emerges. **PRE.** Apply after planting but before corn emerges. **POST.** Apply POST to 1 to 2 inch weeds and to corn from spike through the 4-leaf (2-collar) stage.	**Do not** apply to popcorn, sweet corn, or field corn grown for seed. **Do not** apply more than 1 oz/A in a 12 month period. If using over 0.62 oz/A Basis, **do not** follow with POST application of Accent Gold or Basis Gold. **Do not** use liquid fertilizer as the total carrier solution. See label for compatibility with soil insecticides. **Do not** tank mix with Basagran, Laddok, Beacon, or any ALS inhibiting herbicides (unless listed on the label), or apply these materials within 7 days before or 3 days after a Basis application. Application must include 1% to 2% crop oil concentrate or 0.25% to 0.5% nonionic surfactant and an ammonium nitrogen fertilizer for burndown of emerged weeds.
Basis Gold 89.46% WDG **POST applications:** 14 oz/A	**Active Ingredients:** Nicosulfuron, Rimsulfuron, Atrazine **Similar Products:** None **MOA:** 2 & 5	**POST.** Apply POST to weeds and to corn that has 6 or fewer collars but not taller than 12 inches in height.	**Do not** apply to corn hybrids with a relative maturity rating less than 88 days. **Do not** apply to popcorn, sweet corn, or corn grown for seed. **Do not** use liquid fertilizer as the total carrier solution. See label for compatibility with soil insecticides. **Do not** tank mix with Basagran, Laddok, 2,4-D, or any foliar-applied organophosphate insecticide, or apply these materials within 7 days before or 3 days after a Basis application. Application must include 1% to 2% crop oil concentrate and the addition of 1 to 2 qt/A ammonium nitrogen fertilizer. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover.
Beacon 75% WDG **POST applications:** 0.76 oz/A	**Active Ingredients:** Primisulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply POST to actively growing weeds when the corn is 4 to 20 inches tall. Use drop nozzles from 20 inches until tassel emergence.	**Do not** use on sweet corn or ornamental corn. **Do not** apply with tank mixtures of Poast or Poast Plus. **Do not** graze or feed forage within 30 days after application. **Do not** harvest for silage within 45 days after application. **Do not** harvest for grain within 60 days after application. **Do not** apply after tassel emergence. See label for restrictions concerning organophosphate insecticides. Apply with a crop oil concentrate or nonionic surfactant.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Bicep II Magnum[r] 5.5 lb ai per gallon **SOIL applications:** See tables. **POST applications:** See table. **POST-directed applications:** See table.	**Active Ingredients:** Metolachlor Atrazine **Similar Products:** Bicep Lite II Magnum Bicep II Magnum FC Cinch ATZ **Rates may vary due to formulation.** **MOA:** 5 & 15	**EPP.** Apply up to 45 days before planting. **PPI.** Apply up to 14 days before planting and incorporate in the top 2 inches of soil. **PRE.** Apply to the soil surface after planting but before crop or weeds emerge. **POST.** Apply before weeds exceed 2 leaf stage and before corn exceeds 5 inches tall. **POST-directed.** Apply POST before corn reaches 12 inches in height and before weeds exceed the 2 leaf stage. **Minimize herbicide contact with corn leaves.**	**Do not** apply Bicep II to course textured soils more than 2 weeks prior to planting. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **Do not** exceed 1.9 lb ai metolachlor/A on fine textured soils with more than 3% OM. **Do not** exceed 1.6 lb ai metolachlor/A on medium, or fine textured soils with less than 3% OM. **Do not** apply POST or POST-directed in liquid fertilizer, or severe crop injury may occur. **Do not** graze or feed forage from treated areas for 30 days following application. **Do not** exceed 3.25 qt/A on a crop.

EPP Applications

Bicep II Magnum[r] Use Rates (qt/A)

Soil Texture	Single Application	Split Application[a]	
		30 – 45 Days Before Planting	At Planting
Coarse – sand, loamy sand, and sandy loam	2.1	Do Not Apply	
Medium – loam, silt loam, and silt	2.1[b]	1.4	0.7
	2.1 to 2.6[c]	1.4 to 1.75	0.7 to 0.9
Fine – sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay	2.1[b]	1.4	0.7
	2.6[c]	1.75	

a. Split applications can be made less than 30 days before planting if desired.

b. Do not exceed this rate on highly erodible land with less than 30% plant residue cover. Control or certain weeds may be reduced, and a tank-mix partner or an application of a postemergence herbicide may be needed.

c. Use these rates for all other applications.

PPI & PRE Applications

Bicep II Magnum[r] Use Rates (qt/A)

Soil Texture	Less Than3% OM	3% OM or More
Coarse – sand, loamy sand, and sandy loam	1.3	1.6
Medium – loam, silt loam, and silt	1.6	2.1
Fine – sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay	2.1	2.1[a]
		2.1 to 2.6[bc]
Muck or Peat soils (more than 20% OM)	Do Not Use	

a. Do not exceed this rate on highly erodible land (HEL) with less than 30% plant residue cover.

b. Use these rates for all other applications.

c. For cocklebur, yellow nutsedge, and velvetleaf control on fine-textured soils above 3% OM, apply 3.0 qt/A Bicep II.

POST Applications

Bicep II Magnum[r] Use Rates (qt/A)

Soil Texture	Broadcast Rate Per Acre
Coarse – sand, loamy sand, and sandy loam	1.6
Medium – loam, silt loam, and silt	2.1
Fine – sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay	2.1 to 2.6[a]

a. For cocklebur, yellow nutsedge, and velvetleaf control on fine-textured soils above 3% OM, apply 2.6 qt/A.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

POST-directed Applications

Bicep II Magnum[r] Use Rates (qt/A)

Soil Texture	Broadcast Rate Per Acre
Coarse – sand, loamy sand, and sandy loam	1.3
Medium – loam, silt loam, and silt	2.1
Fine – sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay	2.1 to 2.6[a]

a. For cocklebur, yellow nutsedge, and velvetleaf control on fine-textured soils above 3% OM, apply 2.6 qt/A.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Buctril 2 lb ai per gallon **POST applications:** 1 to 2 pt/A	**Active Ingredients:** Bromoxynil **Similar Products:** Buctril 4 EC Connect 20 WSP Moxy 2 EC **Rates may vary due to formulation** **MOA:** 6	**POST.** Apply to actively growing weeds, after corn emergence, but prior to tassel emergence.	**Do not** apply to seed corn inbreds before the 3 leaf stages as excessive leaf burn may occur. **Do not** harvest for feed or fodder, or graze within 45 days after application. **Do not** exceed 2 pt/A/season. Use of an adjuvant or liquid fertilizer may cause leaf burn.
Buctril+atrazine 3 lb ai per gallon **POST applications:** 1.5 to 3 pts/A. Rate is based on weed pressure and weed size. See label for specific weeds.	**Active Ingredients:** Bromoxynil Atrazine **Similar Products:** None **MOA:** 6 & 5	**POST.** Apply to actively growing weeds, after corn emergence, but prior to corn reaching 12 inches in height.	**Do not** apply with liquid fertilizer or spray additives if leaf burn is a major concern. **Do not** rely on this herbicide for control of grasses. **Do not** cut crop for feed or graze within 45 days after application. **Do not** exceed 4 pints/A per season. **Do not** apply prior to the 3 leaf stage to seed corn inbreds or popcorn. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. If application is to be made to a seed corn hybrid, consult the seed corn company regarding tolerance to this herbicide.
Bullet[r] 4 lb ai per gallon **SOIL applications:** See table. **POST applications:** See table.	**Active Ingredient:** Alachlor Atrazine **Similar Products:** Lariat **MOA:** 15 & 5	**EPP.** Apply up to 45 days before planting. Split applications may be made 30 to 45 days before planting. If applied in split application, apply 60% of recommended rate initially, and 40% at planting. **PPI.** Apply and incorporate 1 to 2 inches within 7 days before planting. **PRE.** Apply after planting but before crop and weeds emerge and within 5 days of last tillage operation or burndown application. **POST.** Apply before weeds reach 2 leaf stage and before the corn is 5 inches tall.	**Do not** make more than 2 applications of Bullet per year or exceed 6.4 qt/A/year. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **Do not** graze treated area or feed treated forage to livestock for 21 days following application. **Do not** apply POST using liquid fertilizer as the carrier. **Do not** apply through any type of irrigation system.

PPI, PRE & POST Applications

Bullet[r] Broadcast Rate (qt/A)[a]

Soil texture	Less than 3% OM	3% or more OM
Coarse	2.5	3
Medium	3	3.75
Fine	3.75	3.75 to 4.5

a. In areas of heavy infestations use 4 to 5 qt/A, but do not exceed 4.25 qt/A on highly erodible soils with less than 30% plant residue.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Callisto 3.8 lb ai per gallon **PRE applications:** 6.0-7.7 fl oz /A **POST applications:** 3.0 fl oz /A	**Active Ingredient:** Mesotrione **Similar Products:** None **MOA:** ?	**PRE. Do not** cultivate within 7 days before or after application. **POST.** May be applied to 30 inch tall corn or up to the 8-leaf stage of growth of corn.	**Do not** apply to popcorn, sweet corn, or ornamental corn. **Do not** apply more than a total of 10.7 fl oz/A/season. **Do not** make more than 2 applications per season. **Do not** make the second application within 14 days of the first application. **Do not** use Methylated Seed Oil (MSO) or MSO blend adjuvants. **Do not** harvest forage, grain, or stover within 45 days after application.
Camix 3.8 lb ai per gallon **PRE applications:** 2.0 to 2.4 qt /A	**Active Ingredient:** Metolachlor Mesotrione **Similar Products:** None **MOA:** 15 & ?	**PRE.** If soil organic matter content is less than 3% use 2.0 qts /A. If soil organic matter content is greater than 3% use 2.4 qts /A. May also be applied early POST for broadleaf control in field corn.	**Do not** apply more than 2.4 qts /A per growing season. **Do not** apply POST if area has been treated with Counter or Lorsban insecticide. **Do not** apply to sweet corn, popcorn, or ornamental corn. **Do not** allow product to contaminate feed or food. When used in reduced and no-till systems, apply as close to planting as possible.
Celebrity Plus 70% WDG **POST applications:** 4.7 oz/A	**Active Ingredient:** Dicamba, Diflufenzopyr Nicosulfuron **Similar Products:** None **MOA:** 4, 4, & 2	**POST.** Apply POST to actively growing weeds when the corn is between 4 and 24 inches tall.	**Do not** cultivate within 10 days before or 7 days after application. **Do not** tank mix with foliar organophosphate insecticide. **Do not** apply more than 1.0 oz ai/A nicosulfuron in a season. **Do not** apply more than 0.75 lb ai/A dicamba in a season. **Do not** apply more than 0.125 lb ai/A diflufenzopyr in a season. **Do not** apply sequential applications of Banvel, Clarity, Distinct, or Marksman within 15 days of application of Celebrity Plus. **Do not** apply more than 2 times in a year. **Do not** apply within 32 days of forage harvest. **Do not** apply within 72 days of grain harvest. **Do not** apply more than 9.4 oz/A per season.
Clarity 4 lb ai per gallon **EPP applications:** up to 8 fl oz/A **POST applications:** 8 to 16 fl oz/A **LATE POST applications:** 8 fl oz/A	**Active Ingredient:** Dicamba **Similar Products:** Banvel Sterling Diablo Distinct **<u>Rates may vary due to formulation</u>** **MOA:** 4	**EPP.** Apply 7 to 14 days before planting to control existing weeds in **no-till corn**. **POST.** Apply after corn emergence and through the 5-leaf growth stage or 8 inch tall corn, whichever comes first. **LATE POST.** Apply to corn that is 8 to 36 inches tall but not within 15 days of tassel emergence. Apply as a POST-directed application with drop nozzles when corn leaves prevent proper spray coverage.	**Do not** exceed 2 applications of Clarity in one growing season or 1.5 pt/A/growing season. **Do not** harvest for silage or graze treated corn for feed until it has reached the ensilage (milk) stage. **Do not** apply to corn larger than 36 inches or 15 days prior to tassel emergence, whichever comes first. **Do not** apply if soybeans are nearby and corn is more than 24 inches tall, soybeans are more than 10 inches tall, or soybeans have begun to bloom. **Do not** apply multiple Clarity applications within a 2 week time span.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Define 60% DF **SOIL applications:** See table.	**Active Ingredient:** Flufenacet **Similar Products:** None **MOA:** 15	**EPP.** Apply up to 45 days before planting and before weeds emerge. Will not control emerged weeds. **PPI.** Apply and incorporate in the upper 2 inches of soil within 14 days of planting. **PRE.** Apply after planting but before crop and weed emergence.	**Do not** use on popcorn or sweet corn. **Do not** apply aerially. **Do not** apply more than 21 oz/A per season. Plant corn at least 1 to 1.5 inches deep. **Do not** apply through any type of irrigation system.

EPP, PPI & PRE Applications

Define Use Rates (oz/A) for Conventional Tillage Systems when Applied within 2 Weeks of Planting[a]

Soil Textural Group	Less than 3% OM	3% or more OM
Coarse	12	14
Medium	14 to 16	16 to 18
Fine	18 to 20	18 to 21

a. Use higher rate within recommended rate range for heavy weed pressures, heavy surface plant residues, and/or when soil OM is at upper end of range.

EPP, PPI & PRE Applications

Define Use Rates (oz/A) for Conservation, Minimum, and No-till Systems and Conventional Tillage Systems When Applied Greater than 2 Weeks before Planting[a]

Soil Textural Group	Less than 3% OM	3% or more OM
Coarse	13	15
Medium	16 to 18	18 to 20
Fine	20 to 21	20 to 21

a. Use higher rate within recommended rate range for heavy weed pressures, heavy surface plant residues, and/or when soil OM is at upper end of range.

Dual II Magnum 7.64 lb ai per gallon **PPI & PRE appl.:** See table. **POST applications:** 1 to 2 pt/A	**Active Ingredient:** Metolachlor **Similar Products:** Dual II Magnum SI Dual IIG Magnum Dual Magnum Cinch **Rates may vary due to formulation** **MOA:** 15	**PPI.** Apply before planting and incorporated 1 to 2 inches. **PRE.** Apply after planting but before weeds emerge. **POST.** Apply POST to corn up to 40 inches tall but before weeds emerge as it will not control emerged weeds.	See label for soil type restrictions and for split application restrictions. No more than 3.9 pt/A can be applied during any one season, depending on soil texture. **Do not** graze or feed treated forage for 30 days after applications.

PPI, & PRE Applications

Dual II Magnum Use Rates (pt/A)[a]

Soil Textural Group	Less than 3% OM	3% or more OM
Coarse	1.0 to 1.33	1.33
Medium	1.33 to 1.67	1.33 to 1.67
Fine	1.33 to 1.67	1.67 to 2.0

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Epic DF 58% DF **SOIL applications:** See table.	**Active Ingredient:** Flufenacet Isoxaflutole **Similar Products:** None **MOA:** 15 & 28	**EPP.** May be applied up to 21 days before planting. **PPI.** May be applied up to 21 days before planting and incorporated in the to 1 to 2 inches of soil. **PRE.** May be applied after planting but before crop and weed emergence.	**Do not** make more than 1 application of Epic in a season. **Do not** use on popcorn, sweet corn, or corn grown for seed. **Do not** plant corn less than 1-1.5 inches deep. **Do not** use on coarse textured soil with soil pH greater than 7.5. **Do not** use on medium textured soil with soil pH greater than 7.5 and OM content less than 2.5%. **Do not** use on coarse or medium textured soils with less than 1.5% OM. **Do not** use on sandy loam, loamy sand, or sand surface soil and loamy sand or sand subsoil if the water table is <25 feet below ground and the OM is <2%. **Do not** apply aerially.

EPP, PPI, & PRE Applications

Epic Use Rates (oz/A) for <u>Coarse Textured Soils</u> Conventional tillage, Conservation tillage, and No-till Systems[a]

	Soil Organic Matter (% by Weight)			
Application Timing	**<1.5%**	**1.5 to 2**	**2 to 3%**	**>3%**
Preemergence (**PRE**)	DO NOT USE	6 to 8 oz	8 to 9 oz	8 to 10 oz
Preplant (surface or incorporated) 0 to 7 days before planting				
Preplant (surface or incorporated) 8 to 21 days before planting		7 to 9 oz	9 to 10 oz	9 to 11 oz

a. Use the higher rate of Epic within the applicable rate range under any of the following conditions: high soil OM, heavy surface plant residues, heavy weed pressure, or when applying no-till or EPP. Use the lower rate of Epic within the applicable rate range under any of the following conditions: low soil OM, increased tillage and/or incorporation of surface plant residues, or preplant applications made near the minimum interval prior to planting.

EPP, PPI, & PRE Applications

Epic Use Rates (oz/A) for <u>Medium Textured Soils</u> Conventional tillage, Conservation tillage, and No-till Systems[a]

	Soil Organic Matter (% by Weight)		
Application Timing	**<1.5%**	**1.5 to 2**	**>2%**
Preemergence (**PRE**)	DO NOT USE	7 to 10 oz	9 to 13 oz
Preplant (surface or incorporated) 0 to 7 days before planting			
Preplant (surface or incorporated) 8 to 21 days before planting		9 to 11 oz	11 to 15 oz

a. Use the higher rate of Epic within the applicable rate range under any of the following conditions: high soil OM, heavy surface plant residues, heavy weed pressure, or when applying no-till or EPP. Use the lower rate of Epic within the applicable rate range under any of the following conditions: low soil OM, increased tillage and/or incorporation of surface plant residues, or preplant applications made near the minimum interval prior to planting.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

EPP, PPI, & PRE Applications	Epic Use Rates (oz/A)[a] for Fine Textured Soils Conventional tillage, Conservation tillage, and No-till Systems		
		Soil Organic Matter (% by Weight)	
	Application Timing	**<1.5%**	**>1.5**
	Preemergence (**PRE**)	10 to 11 oz	11 to 15 oz
	Preplant (surface or incorporated) 0 to 7 days before planting		
	Preplant (surface or incorporated) 8 to 21 days before planting	11 to 13 oz	12 to 17 oz
	a. Use the higher rate of Epic within the applicable rate range under any of the following conditions: high soil OM, heavy surface plant residues, heavy weed pressure, or when applying no-till or EPP. Use the lower rate of Epic within the applicable rate range under any of the following conditions: low soil OM, increased tillage and/or incorporation of surface plant residues, or preplant applications made near the minimum interval prior to planting.		

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Equip Corn 32% WDG **POST applications:** 1.5 oz /A	**Active Ingredient:** Foramsulfuron Iodosulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply by broadcast when corn is 0-12 inches in height or when it is in the emergence through V4 growth stage, whichever is more restrictive. Drop nozzles must be used when corn is greater than V4 and less than V8 stage of growth or 12-36 inches in height. Minimize spray contact in the corn whorl.	**Do not** use on sweet corn or popcorn or corn grown for seed. **Must** use an external adjuvant and nitrogen fertilizer. **Do not** apply through aerial applications. **Do not** make more than one application per year. **Do not** apply to soils with pH≥8.5. **Do not** harvest for grain within 70 days of application. **Do not** graze or harvest for forage within 45 days of application. **Do not** use nitrogen solutions as spray carriers.
Exceed 57% WDG **POST applications:** 0.8 to 1 oz/A	**Active Ingredient:** Prosulfuron Primisulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply POST to corn between 4 and 20 inches in height. Use drop nozzles to apply if corn is taller than 20 inches, but prior to corn reaching 30 inches, 6 collar growth stage, or tassel emergence.	**Do not** graze or feed forage within 30 days of treatment. **Do not** harvest for silage until 40 days after treatment. **Do not** harvest for grain until 60 days after application. **Do not** apply more than one application of Exceed in a season. **Do not** apply if corn exceeds 30 inches tall or after tassel emergence. **Do not** apply after June 30 if rotating to a sensitive crop. **Do not** apply to sensitive hybrids. **Do not** apply to sweet or ornamental corn. **Do not** apply with Poast or Poast Plus. **Do not** apply with nozzles directly over the crop row. **Do not** use liquid fertilizer as carrier. See label for usage with foliar or soil insecticides. Apply with nonionic surfactant, crop oil concentrate, or liquid fertilizer.
Expert[r] 4.88 lb ai per gallon **All applications:** PRE and POST See table	**Active Ingredient:** Atrazine Metolachlor Glyphosate **Similar Products:** None **MOA:** 5 , 15, & 9	**Non-Roundup Ready.** May be applied up to 30 days before planting corn and prior to crop emergence if corn is **NOT** specifically designated Roundup Ready. **Roundup Ready.** May be applied broadcast, over-the-top of Roundup Ready corn up to a maximum plant height of 12 inches.	**Do not** apply this product by aerial equipment. **Do not** apply through any type of irrigation system. **Do not** graze or feed forage from treated areas for 60 days following application. **Do not** graze or feed forage from treated sweet corn for 45 days following application. **Do not** apply POST unless the seed is specifically designated as Roundup Ready. **Do not** exceed 3 qts /A when applying to highly erodible land with less than 30% plant residue cover.

Expert Application Rates		
	Rate Per Treated Acre	
Soil Texture	**Less than 3% Organic Matter**	**3% Organic Matter or Greater**
Coarse	2.5-3.75 qts	3-3.75 qts
Medium	3-3.75 qts	3-3.75 qts
Fine	3-3.75 qts	3-3.75 qts

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Field Master^{r} 4.25 lb ai per gallon **PRE applications:** See table **POST applications:** 2 to 4 quarts/A	**Active Ingredient:** Acetochlor Atrazine Glyphosate **Similar Products:** None **MOA:** 15, 5, & 9	**PRE.** Apply after planting but before crop emergence. **POST.** Apply 2 to 4 quarts up to 11 inch corn ONLY if the corn contains the Roundup Ready gene.	Use only in minimum or no-till systems prior to crop emergence. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **Do not** apply to the following soils where depth to ground water is 30 ft or less: sands with less than 3% OM, loamy sands with less than 2% OM, or sandy loams with less than 1% OM. **Do not** apply to emerged corn. **Do not** feed forage or graze treated areas within 8 weeks after application. **POST Appl:** tank-mix with additional glyphosate to improve weed control, but apply only to Roundup Ready corn.

PRE Applications

Field Master^{r} Use Rates (qt/A)

Soil Textural Group	qt/A
Coarse	3.5 to 5
Medium	4 to 5
Fine	4 to 5

FulTime 4 lb ai per gallon **SOIL applications:** See table. **POST applications:** See table.	**Active Ingredient:** Atrazine Acetochlor **Similar Products:** Degree Xtra **Rates may vary due to formulation** **MOA:** 5 & 15	**EPP.** On medium and fine textured soils, apply up to 40 days before planting. **PPI.** Apply and incorporate within 14 days of planting. **PRE.** Apply after planting but before crop and weed emergence. **POST.** Apply POST before corn reaches 11inches tall and before weeds emerge.	**Do not** apply to the following soils if ground water depth is 30 feet or less: sands with less than 3% OM; loamy sands with less than 2% OM; or sandy loams with less than 1% OM. **Do not** apply aerially. **Do not** apply after June 10 unless corn will be planted the following year. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **POST applications. Do not** apply POST with liquid fertilizer as the carrier. **Do not** mix with surfactants, crop oil, or other additives.

EPP, PPI, & PRE Applications

FulTime Use Rates (qt/A) in Conventional Tillage Systems When Applied within 14 Days Before Planting

Soil Textural Group	Less than 3% OM	3% OM or Greater
Coarse	2.5 to 2.7	2.7 to 3
Medium	2.7 to 3.3	3 to 3.3
Fine	3 to 3.5	3 to 5

EPP, PPI, PRE & POST Applications

FulTime Use Rates (qt/A) in Reduced or No-till System or Conventional Systems When Applied More than 14 Days Before Planting

	Time from Application to Planting		
Soil Textural Group	Greater than 10 Days Before Planting	Less than 10 Days Before or After Planting	After Planting and/or Emergence
Coarse	Do not apply more than 14 days before planting	2.5 to 3	2.5 to 3
Medium	2.7 to 4	2.7 to 3.3	2.7 to 3.3
Fine	3.3 to 5	3 to 5	3 to 4

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Gramoxone Max[r] 3 lb ai per gallon **EPP BURNDOWN applications:** 0.75 to 1.75 pt/A for 1 to 3 inch weeds 1.75 to 2 pt/A for 3 to 6 inch weeds 2 to 2.7 pt/A for 6 inch weeds.	**Active Ingredients:** Paraquat **Similar Products:** Gramoxone Extra[r] Cyclone Max[r] **Rates may vary due to formulation** **MOA:** 22	**EPP BURNDOWN.** Apply before planting for control of existing vegetation. **PRE BURNDOWN.** Apply after planting but before corn emergence for control of existing vegetation.	**Do not** exceed 4 pt/A/season. **Do not** apply after crop emergence. **Do not** use around home gardens, schools, recreational parks, or playgrounds. Always add NIS or COC to the spray mix. Weeds emerging after application will not be controlled.
Guardsman Max[r] 5 lb ai per gallon **EPP applications:** 4.75 to 5 pts/A **PPI, PRE, & POST applications:** See table.	**Active Ingredient:** Dimethenamid-P Atrazine **Similar Products:** None **Rates may vary due to formulation** **MOA:** 15 & 5	**EPP.** May be applied up to 45 days before planting in minimum and no-till production systems. Not recommended for coarse textured soils. **PPI.** Apply up to 14 days before planting and incorporate 1-2 inches. **PRE.** Apply after planting but before crop or **weed emergence.** **POST.** Apply after crop emergence but before corn exceeds 12 inches in height. Apply before weeds exceed 1.5 inches in height.	Early preplant applications are **not** recommended for use on coarse-textured soils or in areas where average annual rainfall exceeds 40 inches. **Do not** apply more than 4.6 pt/A/season. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **Do not** graze or feed treated plants to livestock within 40 days of treatment. **Do not** harvest sweet corn within 50 days of application.

PPI, PRE, & POST Applications	Guardsman Max[r] Use Rate as determined by Soil Texture and Organic Matter Content	
	OM Less than 3%	**OM 3% or More**
Coarse	2.5 – 3.0 pints	3.0 – 4.0 pints
Medium or Fine	3.0 – 4.0 pints	4.0 – 4.6 pints
	a. Reduced rates may be used when a POST herbicide application or cultivation is planned. For reduced rates, use 1.5-2.02.0-2.5, and 2.5-3.0pt/A on coarse, medium, and fine soil, respectively.	
	b. For EPP applications use 3.8-4.6pt/A. Do not exceed 3.8 pt/A on highly erodible soils with less than 30% plant residue cover prior to crop emergence.	

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Harness 7 lb ai per gallon **SOIL applications:** See table **POST applications:** Max 3.4 pts /A	**Active Ingredient:** Acetochlor **Other Names:** Harness 20G, Surpass TopNotch, Degree **Rates may vary due to formulation** **MOA:** 15	**EPP.** Apply in no-till or conservation tillage up to 45 days prior to planting. **PPI.** Apply up to 14 days prior to planting and incorporate 1-2 inches. **PRE.** Apply after planting and within 5 days after last preplant tillage. **POST.** May be applied postemergence until corn reaches 11 inches in height. **Will not control emerged weeds.**	**Do not** apply POST with liquid fertilizer. **Do not** apply to following soils if depth to ground water is 30 feet or less, sands with <3% OM, loamy sands with <2% OM, sandy loam with <1% OM. **Do not** apply through irrigation system. **Do not** apply aerially. **Do not** apply >3.4 pt/A per season. **Will not control emerged weeds.**

EPP, PPI, & PRE Applications	Harness[r] Broadcast Rate (pt/A)[a]	
	Organic Matter Content	
Soil texture	**Less than 3% OM**	**3% or more OM[b]**
Coarse	1.25 to 1.75 pt	1.75 pt
Medium	1.75 to 2.25 pt	1.75 to 2.25 pt
Fine	1.75 to 2.25 pt	2.25 to 2.75 pt
a. Use higher rate in recommended range in areas of high weed infestations.		

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Hornet WDG 78.5% WDG **PPI & PRE applications:** See table **POST applications:** 2 to 5 oz/A based on weed pressure and weed size. See label for specific weeds.	**Active Ingredient:** Flumetsulam Clopyralid **Similar Products:** None **MOA:** 2 & 4	**PPI.** Apply 0 to 30 days prior to planting and incorporate 2 to 3 inches. **PRE.** Apply after planting but before crop or weed emergence. **POST.** Apply from corn spike stage up to 20 inch tall or V6 corn, which ever occurs first. Apply to weeds less than 8 inches tall.	**Do not** apply more than 0.07 lb flumetsulam/year. **Do not** exceed 0.25 lb/A clopyralid/year. **Do not** apply within 85 days of harvest. **Do not** apply to sweet corn or popcorn. **Do not** plant less than 1.5 inches deep. **Do not** use on soils with pH >7.8. **Do not** apply to soils with >5% OM and <5.9 pH. **Do not** graze or feed treated forage, hay, or straw to livestock. **Do not** apply during expected near freezing temperatures. **Do not** apply when Counter or Thimet are to be used unless IR corn hybrid is planted. **Do not** use crop residues as compost or mulch where susceptible crops may be grown the following season. Using on soils with less than 1.5% OM is not recommended. Corn insecticides should be applied in a T-band or band. Not recommended for inbred corn grown for hybrid seed production; check with the seed corn agronomist before applying. **POST.** Apply with water as the carrier. Always use NIS, COC, or MSO as an adjuvant. Under dry conditions add UAN or AMS. Do not tank mix with Laddok, Lightning, or due to risk of crop injury.

PPI & PRE Applications

Hornet WDG Use Rates (oz./A)[a]		
Soil Textural Group	**Less Than 3% OM**	**Greater Than 3% OM**
Coarse	4	4 to 5
Medium or Fine	4 to 5	5 to 6

a. Use higher rate in range on soils with >3% OM and/or when applications are made 14 to 30 days before planting.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Landmaster BW 2.4 lbs ai per gallon **POST applications:** 27 to 54 fl oz /A	**Active Ingredient:** Glyphosate 2,4-D **Similar Products:** None **MOA:** 9 & 4	**POST.** Apply to vigorously growing weeds when they have reached optimum size. Refer to label for list of optimum weed size and application rate. For best results, apply after most weed seeds have germinated but before seedhead formation in grasses, or flower bud formation in broadleaves.	**Do not** feed or forage vegetation from treated areas for 8 weeks following application. Application of spot treatment must be made before silking.
Liberty 1.67 lb ai per gallon **POST applications:** 16 to 34 oz/A	**Active Ingredient:** Glufosinate **Similar Products:** None **MOA:** 10	**POST.** Apply POST to actively growing weeds. Can be applied broadcast over-the-top or with drop nozzles from corn emergence until corn reaches 24 inches tall or has 7 developed collars. Use drop nozzles for 24 to 36 inch corn.	**Use only on Liberty Link® hybrids. Do not** use more than two applications per growing season. **Do not** exceed 62 oz/A/growing season. **Do not** harvest for forage within 60 days of application. **Do not** harvest for grain or fodder within 70 days of application. **Do not** add any surfactants or crop oils. **Do not** use nitrogen solutions as carrier. Must include 3 lb/A ammonium sulfate fertilizer (AMS).
Liberty ATZ^{r} 4.3 lb ai per gallon **POST applications:** 32 to 48 oz/A	**Active Ingredient:** Glufosinate Atrazine **Similar Products:** None **MOA:** 10 & 5	**POST.** Apply POST to actively growing weeds after corn emergence and until corn reaches 12 inches tall.	**Use only on Liberty Link® hybrids. Do not** use more than 1 application per corn crop. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **Do not** add any surfactants or crop oils. **Do not** harvest for forage within 60 days of application. **Do not** harvest for grain or fodder within 70 days of application. **Do not** use nitrogen solutions as carrier. **Do not** rotate to any crop other than corn or sorghum until the following year. **Do not** rotate to any crop other than corn or sorghum if applied after June 10 the previous year. **Must include 3 lb/A ammonium sulfate fertilizer (AMS).**
Lightning 70% WDG **POST applications:** 1.28 oz/A	**Active Ingredient:** Imazethapyr Imazapyr **Similar Products:** None **MOA:** 2	**POST.** Apply POST to actively growing weeds within the size restrictions on the label and to corn less than 18 inches in height.	**For use on Clearfield*Corn only. Do not** use liquid fertilizer as the carrier. **Do not** apply more than one application per growing season. **Do not** harvest for grain, forage, fodder, or silage or graze within 45 days after application. **Do not** use Counter 15G insecticide when Lightning will be applied. A COC or MSO (1.0% v/v)and liquid fertilizer (1 to 2 qt/A) must be included.
Lumax^{r} 3.95 lb ai/gallon **All applications:** 2.5 to 3 qt/A	**Active Ingredient:** Metolachlor, Atrazine, & Mesotrione **Similar Products:** Lexar **MOA:** 15, 5, ?	**EPP.** Apply up to 14 days prior to planting. **PRE.** Apply after planting and prior to crop emergence. **POST.** Apply POST to actively growing weeds and before corn reached 5 inches in height.	**Do not** apply more than 3 qt/A/growing season. **Do not** apply other mesotrione containing products to ground that has been treated with Lumax in the same season. **Do not** apply Lumax POST to corn that has received an at-plant application of Counter insecticide, or severe crop injury will result. Do not apply Lumax POST within 7 days of an OP insecticide application. A nonionic surfactant (0.25% v/v) is recommended for POST applications. **Do not** harvest for grain or feed, or graze treated areas for 45 days following application.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Marksman[r] 3.2 lb ai per gallon **POST applications:** 3.5 pt/A or 2 pt/A for coarse textured soils	**Active Ingredient:** Atrazine Dicamba **Similar Products:** Banvel-K+Atrazine **Rates may vary due to formulation** **MOA:** 5 & 4	**POST.** Apply POST to actively growing weeds and from corn emergence through the 5-leaf growth stage but before corn exceeds 8 inches tall.	**Do not** use on sweet corn. **Do not** harvest treated plants or graze for feed before the ensilage stage. **Do not** make more than 2 applications before the 5-leaf stage or before the corn is 8 inches tall, whichever comes first. **Do not** apply a second application within 2 weeks of the first application. **Do not** exceed 5.25 pt/A per year. **Do not** apply within 2 weeks of another dicamba application. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. Check varietal restrictions before applying to seed corn or popcorn.
Micro-Tech[r] 4 lb ai per gallon **PPI, PRE & POST applications:** See table	**Active Ingredient:** Alachlor **Similar Products:** None **Rates may vary due to formulation** **MOA:** 15	**PPI.** Apply up to 7 days before planting and incorporate 1-2 inches. **PRE**. May be applied up to 5 days after planting, and before crop and weed emergence. **POST**. Apply up to 5 inch tall corn. Will not control emerged weeds.	**Do not** make more than 2 applications in a year. **Do not** exceed total of 6 qt/A/year. See label for split applications.

PPI Applications	Micro-Tech[r] Use Rates (qt/A)[a]		
	Soil Textural Group	**Less Than 3% OM**	**Greater Than 3% OM**
	Coarse	2.5	2.5
	Medium	2.5 to 3	2.5 to 3
	Fine	2.5 to 3	3 to 3.5
	a. Use higher rate in the recommended range in areas of heavy weed infestations. Use a minimum of 3 qt/A on coarse-textured soils for control of yellow nutsedge or red rice. Rates may be increased to a maximum of 4 qt/A on any soil type when heavy infestations of yellow nutsedge are present.		

PRE Applications	Micro-Tech[r] Use Rates (qt/A)[a]		
	Soil Textural Group	**Less Than 3% OM**	**Greater Than 3% OM**
	Coarse	2 to 2.25	2 to 2.25
	Medium	2 to 2.75	2 to 2.75
	Fine	2 to 2.75	2.5 to 3.25
	a. Use higher rate in the recommended range in areas of heavy weed infestations. Use a minimum of 2.5 qt/A on coarse-textured soils and 3 to 4 qt/A on medium or fine textured soils to control black or hairy nightshade.		

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
NorthStar 51.4% WDG **POST applications:** 5 oz/A	**Active Ingredient:** Primisulfuron Dicamba **Similar Products:** None **MOA:** 2 & 4	**POST.** Apply POST over-the-top, semi-directed, or directed to actively growing weeds and when corn is 4 to 20 inches tall (V2-V6). **POST-directed.** Apply only as a POST directed spray when corn is between 20 to 36 inches tall.	**Do not** apply to corn less than 4 inches tall. **Do not** apply if corn is under environmental stress. **Do not** make a foliar application of an OP insecticide 10 days before or 7 days after a NorthStar application. **Do not** apply to sweet corn. **Do not** apply as tank mixes with Poast or Poast Plus. **Do not** apply as a banded application directly over the corn rows. See label concerning interactions with soil applied OP insecticides. Some field corn hybrids are not tolerant to NorthStar.
Option 35% WDG **POST applications:** 1.5 oz /A	**Active Ingredient:** Foramsulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply to young actively growing weeds, when corn is 0-16 inches in height or when it is in the emergence through V5 growth stage, whichever is more restrictive. Drop nozzles must be used for applications when corn is 16-36 inches in height.	**Do not** use on sweet corn or popcorn. **Do not** apply through aerial applications. **Do not** exceed a maximum of two applications or 3.5 oz /A per use season. **Do not** apply within 70 days of harvesting for grain, or 45 days of harvesting for forage. **Do not** graze within 45 days following application. **Do not** use nitrogen solutions as spray carriers.
Outlook 6 lb ai per gallon **SOIL applications:** See table	**Active Ingredient:** Dimethenamid-p **Similar Products:** Frontier 6.0 **MOA:** 15	**EPP.** May be applied up to 45 days before planting. **PPI.** May be applied up to 2 weeks before planting and incorporated 1 to 2 inches. **PRE.** After planting but before weeds emerge.	**Do not** apply more than 21oz/A in one crop year. **Do not** apply to coarse soil classified as sand with less than 3% OM and where depth to ground water is 30 feet or less, or where annual irrigation + rainfall exceeds 40 inches. **Do not** graze or feed forage, hay, or straw to livestock until 40 days after application. **Do not** apply to sweet corn.

EPP, PPI, & PRE Applications

Outlook Use Rates (fl oz/A)

Soil Texture	Organic Matter Content	
	Less than 3%	3% or more
Coarse	12 to 14	14 to 18
Medium/Fine	14 to 18	18 to 21

Permit 75% WDG **POST applications:** 0.67 to 1.33 oz/A	**Active Ingredient:** Halosulfuron **Similar Products:** Sempra **Rates may vary due to formulation** **MOA:** 2	**POST.** Apply POST to actively growing weeds from the spike through the lay by stage of corn.	**Do not** use liquid fertilizer as the carrier. **Do not** exceed 2 applications per season. **Do not** exceed 2.66 oz/A/season. **Do not** harvest for forage or silage or graze within 30 days of application. A nonionic surfactant (0.25 to 0.5% v/v) or crop oil concentrate (1% v/v) must be used.
Princep 4L 4 lb ai per gallon **SOIL applications:** See table	**Active Ingredient:** Simazine **Similar Products:** Princep Caliber 90 Simazine 4L Simazine 90 DF **Rates may vary due to formulation** MOA: **5**	**EPP.** Apply up to 14 days prior to planting and before weeds emerge. **PPI.** Apply up to 14 days prior to planting and incorporate2 to 3 inches. **PRE.** Apply after planting but before weeds emerge.	**Do not** apply after corn emerges when applying in nitrogen solution. **Do not** apply more than 8 pt/A per year. **Do not** graze treated areas.

EPP, PPI, & PRE Applications

Princep 4L Use Rates (pt/A)

Soil Texture	pt/A
Sand, silt, and loam that is low in organic matter	4
Soil containing moderate amounts of clay and organic matter	4.8

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Prowl 3.3EC 3.3 lb ai per gallon **PRE applications:** See table	**Active Ingredient:** Pendimethalin **Similar Products:** Pendimax Prowl H_2O **Rates may vary due to formulation** **MOA:** 3	**PRE.** After planting but before weeds and crop emerge. POST – Apply postemergence untilcorn is 30" tall or has 8 visible leaf collars.	**Do not** apply preplant or preplant incorporated. **Do not** apply if soil surface is cloddy or covered with residue unless no-till or minimum tillage systems are used. **Do not** use on peat or muck soils. Corn seed must be planted at least 1.5 inches deep and completely covered with soil. If corn is replanted, seeding depth must be below treated soil.

PRE Applications

Prowl Use Rates (pt/A)

Soil Texture	Soil Organic Matter Content [a]		
	Less than 1.5%	**1.5% to 3%**	**More than 3%**
Coarse	1.8 to 2.4 pts	2.4 to 3.6 pts	3.6 pts
Medium	2.4 to 3.6 pts	3.6 pts	3.6 to 4.8 pts
Fine	2.4 to 3.6 pts	3.6 to 4.8 pts	3.6 to 4.8 pts

a. Use the high rate for each soil classification when using Prowl 3.3 EC alone.

Pursuit DG 70% DG **EPP, PPI, PRE & POST applications:** 1.44 oz/A	**Active Ingredient:** Imazethapyr **Similar Products:** Pursuit DG Pursuit W Pursuit W DG **Rates may vary due to formulation** **MOA:** 2	**EPP.** Apply up to 45 days before planting. **PPI.** Apply before planting and incorporate the top 1 to 2 inches of soil. **PRE.** Apply after planting and before weeds and crop emergence. **POST.** Apply after crop emergence and before or after weeds emerge.	**Use with Clearfield Corn Hybrids Only.** **Do not** make more than one application a year. **Do not** apply within 45 days of harvest. **Do not** apply to sweet corn or popcorn. Check label for application restrictions concerning soil insecticides and Pursuit herbicide. **PPI** applications are more consistent for grass, velvetleaf, jimsonweed, and common lambsquarters control. When heavy grass pressure is anticipated, use with a grass herbicide underlay.
Pursuit Plus EC 2.9 lbs ai per gallon **POST applications:** 2.5 pts /A	**Active Ingredient:** Imazethapyr Pendimethalin **Similar Products:** None **MOA:** 2 & 3	**PRE.** Apply preemergance after planting. **Do not** incorporate, as crop injury will occur. **POST.** Apply when crop and weeds are actively growing. Apply before weeds exceed a height of 3". Apply to Clearfield corn varieties only.	**For use on Clearfield corn varieties only. Do not** make more than one application per year. **Do not** apply in a liquid fertilizer as a carrier.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Python WDG 80% WDG **SOIL applications:** See table	**Active Ingredient:** Flumetsulam **Similar Products:** None **MOA:** 2	**EPP.** Apply alone or tank mixed with other labeled herbicides as a preplant burndown up to 30 days prior to planting. Plant seed at least 1.5 inches deep. **PPI.** Apply alone or tank mixed with other labeled herbicides as a preplant burndown up to 30 days prior to planting and incorporate. Plant seed at least 1.5 inches deep. **PRE.** Apply after planting but before weeds emerge. May be applied up to spike stage of corn with water as the carrier.	**Do not** make more than one application a year. **Do not** apply more than 0.07 lb of flumetsulam in a single year. **Do not** apply within 85 days of harvest. **Do not** apply to sweet corn or popcorn. **Do not** use on soils with pH greater than 7.8. **Do not** apply to soils with >5% OM and <5.9 pH. **Do not** graze or feed treated forage, hay, or straw to livestock. **Do not** apply during expected near freezing temperatures. **Do not** apply when Counter or Thimet are to be used unless IR corn hybrid is planted. Using on soils with less than 1.5% OM is not recommended. Corn insecticides should be applied in a T-band or band. Not recommended for hybrid seed production; consult your seed corn agronomist before applying.

EPP, PPI & PRE Applications

Python WDG Use Rates (oz/A)

Soil Textural Group	Ounces per acre
Coarse	0.80 to 1.0 oz.
Medium or Fine	0.89 to 1.33 oz
a. See Python label for use rates for specific weed species and specific soil organic matter content.	

Ready Master ATZ^{r} 4 lb ai per gallon **POST applications:** 1.5 to 2 qt/A	**Active Ingredient:** Glyphosate Atrazine **Similar Products:** None **MOA:** 9 & 5	**POST.** Apply POST to actively growing weeds from crop emergence and until corn reaches 12 inches in height.	**For use only with Roundup Ready corn hybrids. Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/appl. on HES with <30% residue cover. **Do not** apply > 2 lb atrazine/A/appl. on non-HES or on HES with at least 30% residue cover.
Resource 0.86 lb ai per gallon **POST applications:** 4 to 8 fl oz/A. See label for rates concerning specific species.	**Active Ingredient:** Flumiclorac **Similar Products:** None **MOA:** 14	**POST.** Apply POST to actively growing weeds within the size restrictions on the label.	**Do not** apply to popcorn or sweet corn. **Do not** apply to corn before the 2-leaf stage or after the 10-leaf stage. **Do not** apply more than 6 fl oz/A in a single broadcast application, or more than a total of 8 fl oz/A to field corn during a single season. **Do not** apply more than a total of 8 fl oz/A to field corn in a single season as a directed spray application. **Do not** graze animals on green forage or use as feed less than 28 days after application. See label for specific use rates and additive rates

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Roundup Original Max 5.5 lb ai per gallon **EPP, PRE, & POST applications:** 22 to 44 fl oz/A	**Active Ingredient:** glyphosate **Similar Products:** Many **Rates and required adjutants may vary due to formulation and manufacturer. See appropriate label.** **MOA:** 9	**EPP.** Apply before planting the crop. **PRE.** Apply after planting but before crop emergence. **POST. Apply POST only in Roundup Ready corn and Roundup Ready Corn 2 hybrids or with a hooded sprayer.** See special instructions and remarks.	**Apply POST only in Roundup Ready Corn Hybrids or with a hooded sprayer.** **For Hooded Sprayer Applications. Do not** graze, harvest, or feed treated vegetation. **Do not** apply more than 26 fl oz/A in a single application or apply more than 2.4 qt/A per year with a hooded sprayer. **Do not** apply to corn less than 12 inches tall. **Do not** treat within 4 inches of drill row. **Do not** spray faster than 5 mph. **Do not** apply if wind speed is greater than 10 mph. **Do not use any other nozzles than low-drift nozzles.** **For Applications in Roundup Ready Corn Hybrids.** Apply POST to Roundup Ready Corn Hybrid from emergence through the V8 stage (8 leaves with collars) or until corn reaches 30 inches in height. **Do not** apply more than 26 fl oz/A in a single application. Sequential in-crop POST applications must not exceed 1.6 qt/A/year**. Do not** apply within 50 days of harvesting crop for forage or within 7 days of harvesting crop for grain. **For Applications in Roundup Ready Corn 2 Hybrids:** Apply POST from emergence through 48 inch corn. Use drop nozzles between 30 and 48 inch corn height. Do not apply more than 32 fl oz/A in a single application. Sequential in-crop POST applications must not exceed 2 qt/A/year. **Do not** apply within 50 days of harvesting from grain or 7 days within harvesting for grain.
RT Master 4.4 lbs ai per gallon **EPP & PRE applications:** 2 qt /A **POST applications:** 3 qt /A	**Active Ingredient:** Glyphosate 2,4-D **Similar Products:** None **MOA:** 9 & 4	**EPP & PRE.** May be applied before, during, or after planting but before crop emergence. **Spot Treatments.** Apply prior to silking of corn. **POST.** May be applied as preharvest application. Make application at 35% grain moisture or less. Ensure that maximum kernel fill is complete and the corn is physiologically mature. For ground applications, apply up to 3 qt/A. For aerial applications use up to 1 qt/A. **Postharvest applications.** May be applied after harvest of corn. Higher rates needed for control of large weeds.	**EPP & PRE applications: Do not** apply after emergence of crop. **Spot treatments: Do not** graze or feed treated forage for 7 days after treatment. **Do not** harvest sweet corn ears within 45 days of application. **POST(Roundup Ready hybrids only).** Allow a minimum of 7 days between application and harvest of grain or fodder. **Do not** apply preharvest to sweet corn. **Do not** treat corn grown for seed. **Postharvest applications: Do not** graze, harvest, or feed treated vegetation for 7 days following application. **Labeled Counties:** Alfalfa, Beaver, Blaine, Canadian, Cimarron, Custer, Dewey, Ellis, Garfield, Grant, Harper, Kay, Kingfisher, Logan, Major, Noble, Pawnee, Payne, Roger Mills, Texas, Woods, & Woodward

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Shotgun[r] 3.25 lb ai per gallon **POST applications:** See table	**Active Ingredient:** Atrazine 2,4-D **Similar Products:** None **MOA:** 5 & 4	**EPP.** Apply 7 to 14 days before planting. **PRE.** Apply after planting but before crop and weed emergence. Cover seed with at least 1.5 inches of soil. Do not apply PRE if EPP application of this product has been made. **POST.** Apply POST to corn from the spike to 5 leaf growth stages but before corn reaches 12 inches in height.	**Do not** apply within 7 days before or within 3 days after an Accent SP application. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/appl. on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **POST application. Do not** apply this product POST within 3 weeks of its application EPP. Avoid spraying just after corn leaves unfold. Crop may become brittle within 2 weeks following application and is subject to breaking by wind or cultivation.

POST Applications

Shotgun[r] Use Rates (pt/A) by Crop Stage

Crop Stage	Rate pt/A		Comments
Spike to 4-leaf or up to 8 inches tall	All soil textures	2 pt	Over the top broadcast spray for small, easy to control weeds
	Fine or medium soils (silt and clay loams) with 2% or more OM	up to 3 pt	Over the top broadcast spray. Do not apply to coarse soils (sand, sandy loam, loamy sand).
5-leaf or 8 to 12 inches tall	Fine or medium soils (silt and clay loams).	up to 3 pt	Directed spray. For all soil textures, use drop nozzles to keep spray off corn leaves. Especially whorl. Ground application only.
	Coarse soils (sand, sandy loam, loamy sand).	2 pt	

Spirit 57% WDG **POST applications:** 1 oz/A	**Active Ingredient:** Prosulfuron Primisulfuron **Similar Products:** None **MOA:** 2 & 2	**POST.** Apply POST to actively growing weeds and when corn is 4 to 24 inches tall corn.	**Do not** graze or feed forage from Spirit-treated crops to livestock until 30 days after application. **Do not** harvest silage until 40 days after application. **Do not** harvest grain until 60 days after application. **Do not** apply more than one application of Spirit in a cropping season. **Do not** apply to corn smaller than 4 inches or larger than 24 inches. **Do not** apply to seed corn larger than 20 inches. **Do not** apply any organophosphate insecticide within 10 days before or 7 days after a Spirit application.
Steadfast 75% WDG **POST applications:** 0.75 oz /A	**Active Ingredient:** Nicosulfuron Rimsulfuron **Similar Products:** DPX-79406 **MOA:** 2 & 2	**POST.** Apply to corn that is up to 20 inches tall. Apply to field corn hybrids with a relative maturity (RM) rating of 88 days or more. Consult with seed supplier before application. Apply to grasses that are young and actively growing, but before they exceed the sizes listed in label.	**Do not** apply to field corn grown for seed, to popcorn or to sweet corn. **Do not** use less than 3/4 oz /A. **Applications** must include either a crop oil concentrate or a nonionic surfactant. In addition, an ammonium nitrogen fertilizer must be used. **Do not** graze or feed forage, hay, or straw from treated areas to livestock within 30 days of application.
Steadfast ATZ 89.3% WDG **POST applications:** 14 oz /A	**Active Ingredient:** Nicosulfuron Rimsulfuron Atrazine **Similar Products:** None **MOA:** 2, 2, & 5	**POST.** Apply to corn that is up to 12 inches tall. Do not apply to corn taller than 12 inches or exhibiting 7 or more leaf collars, whichever is more restrictive. Apply to field corn hybrids with a relative maturity (RM) rating of 77 days or more. Consult with seed supplier before application.	**Do not** apply to field corn grown for seed, to popcorn or to sweet corn. **Do not** make more than one application per season and do not apply both Steadfast and Steadfast ATZ to the same field in the same cropping season. Applications must include either a crop oil concentrate or a nonionic surfactant. In addition, an ammonium nitrogen fertilizer must be used. **Do not** graze or feed forage, hay, or straw from treated areas to livestock within 30 days of application.

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Stinger 3 lb ai per gallon **POST applications:** 0.25 to 0.66 pt/A	**Active Ingredient:** Clopyralid **Similar Products:** None **MOA:** 4	**POST.** Apply POST to actively growing weeds from corn emergence through 24 inch tall corn.	**Do not** apply by aircraft. **Do not** move livestock from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture. Use of a spray adjuvant is not necessary but may increase control of some weeds.
Surefire 3.0 lbs ai per gallon **PRE BURNDOWN applications:** 1 to 2 qt /A	**Active Ingredient:** Paraquat Diuron **Similar Products:** None **MOA:** 22 & 7	**PRE BURNDOWN.** Apply 1 to 2 qt. per sprayed acre as a band treatment over the crop row, or as a broadcast treatment , prior to, during, or after planting – but before emergence or the crop.	**Always** use a nonionic surfactant which contains at least 75% surface active ingredient **Do not** use around home gardens, schools, recreational parks, golf courses, or playgrounds. **Do not** use dirty or muddy water for dilution because product will be inactivated. **Do not** apply after corn has emerged or after soil cracking.
Surpass EC[r] 6.4 lb ai per gallon **SOIL applications:** See table	**Active Ingredient:** Acetochlor **Other Names:** Surpass 20-G **MOA:** 15	**EPP.** Apply in no-till or conservation tillage systems up to 30 days prior to planting. **Will not control emerged weeds.** **PPI.** Apply up to 14 days prior to planting and incorporate 1-2 inches. **PRE.** Apply after planting but before weed emergence. **Will not control emerged weeds.** **POST.** Apply after corn emergence but before corn exceeds 11 inches in height. **Will not control emerged weeds.**	**Do not** apply to following soils if depth to ground water is 30 feet or less; sands with <3% OM, loamy sands with <2% OM, sandy loam with <1% OM. **Do not** apply through irrigation system. **Do not** apply aerially. **Do not** apply more than 3.75 pt/A per season. **Will not control emerged weeds.**

SOIL & POST Applications

Surpass EC[r] Use Rates (pt/A) in Conventional Tillage Systems When Applied within 14 Days Before Planting[a]

Soil Textural Group	Less than 3% OM	3% OM or Greater
Coarse	1.5 to 2.25	1.5 to 2.5
Medium	1.5 to 2.5	1.5 to 2.5
Fine	1.5 to 2.75	2 to 3

a. Use higher end of rate range if OM content is at higher end of rate range or under anticipated heavy weed infestations.

SOIL and POST Applications

Surpass EC Use Rates (pt/A) in Reduced or No-till System or Conventional Systems When Applied More than 14 Days Before Planting

	Soil Organic Matter Content	
Soil Textural Group	**Less than 3% OM**	**3% OM or Greater**
Coarse	2	2
Medium	2 to 2.5	2.5
Fine	3	3

This section was not revised in 2007.

CORN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
TopNotch 3.2 lb ai per gallon **SOIL applications:** See table. **POST applications:** See table.	**Active Ingredient:** microencapsulated acetochlor **Similar Products:** Degree **Rates may vary due to formulation** **MOA:** 15	**EPP.** Apply in no-till and conservation tillage systems before weeds emerge and up to 45 days before planting. **PPI.** Apply and incorporate within 10 days of planting. **PRE.** Apply after planting but before crop and weed emergence. **POST.** Apply POST before corn reaches 11" tall. Will not control emerged weeds.	**Do not** apply to the following soils if ground water depth is 30 feet or less; sands with less than 3% OM; loamy sands with less than 2% OM; or sandy loams with less than 1% OM. **Do not** apply aerially. **Do not** exceed 6.25 pt/A in a season. **POST applications. Do not** apply POST with liquid fertilizer as the carrier.

EPP, PPI, PRE & POST Applications

TopNotch Use Rates (qt/A)

	Time from Application to Planting			
Soil Textural Group	**Less than 10 Days**	**10 to 30 Days**	**30 to 40 Days**	**After planting &/or Emergence**
Coarse	2	2 to 2.5[a]	2.5[a]	2
Medium	2 to 2.5	2.5	2.5 to 3	2 to 2.5
Fine	2.5 to 3	2.5 to 3	3 to 3.75	2.5 to 3

a. On coarse textured soils with less than 3% OM the maximum use rate is 2.25 qt/A.

Yukon 77.5% WDG **POST applications:** 4 to 8 oz /A	**Active Ingredient:** Halosulfuron Dicamba **Similar Products:** None **MOA:** 2 & 4	**POST.** Apply over-the-top or with drop nozzles from the spike through 36 inch field corn. Up to 2 applications may be applied with a total application not to exceed 8 oz /A. Allow at least 2 weeks between applications.	**Do not** graze or harvest for feed for at least 30 days after foliar application. Use higher rates for heavy weed infestations or weeds close to the maximum height for control listed in the label.

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MAJOR PESTS

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT ORAL	TOXICITY RABBIT DERMAL	COMMENTS
BOLLWORM/TOBACCO BUDWORM								
Treat when 10 small worms are found per 100 plants during the first week of bloom (before 7/10); or 5 small worms per 100 plants from 7/10 through 9/15. After 9/15 treat field if worms exceed 10 worms per 100 plants.	Denim (Syngenta)	0.16	___	0.01-0.015	10.6-16.0	2950	>2000	Curacron and Lannate may be phytoxic to cotton under stress and may redden cotton.
	Curacron[r] E (Syngenta)	8.0	1B	0.75-1.0	16.0-8.0	662	192	
	Lannate[r] LV (DuPont)	2.4	1A	0.45-0.67	5.3-3.6	49	≥2000	Pyrethroid Management: To reduce chance of increasing pyrethroid resistance, all applications before 7/10 should be an alternative chemistry (OP, Carbamate, Bt or Naturalyte).
	Larvin AF (Bayer Crop Science)	3.2	1A	0.6-0.9	5.3-3.6	66	2000	
	Phaser[r] EC (Bayer Crop Science)	3.0	2A	1.0-1.5	3.0-2.0	160	359	
	Orthene S (Valent)	0.9 0.75	1B	0.45-0.9 0.45-0.9	2.0-1.0 1.5-0.75	700	2000	
	Asana[r] XL E (DuPont)	0.66	3B	0.03-0.05	22.0-13.2	458	≥2000	After 9/15, alternative control; different classes of insecticides should be used instead of a pyrethroid to reduce the level of pyrethroid resistance in the population.
	Baythroid[r] E (Bayer Crop Science)	2.0	3B	0.025-0.05	80.0-40.0	590	5000	
	Capture[r] EC (FMC)	2.0	3B	0.04-0.1	50.0-20.0	275	2000	
	Danitol[r] EC (Valent)	2.4	3B	0.02-0.03	12.0 – 8.0	164	≥2000	The pyrethroids are occasionally used in combination with other insecticides. Check label for tank mix directions and restrictions.
	Decis[r] EC (Bayer Crop Science)	1.5	3B	0.019-0.03	79.0-50.0	431	2000	
	Mustang[r] Max (FMC)	1.5	3B	0.033-0.045	45.0-33.0	403	7200	
	Generic Cypermethrin EC (Helena, UAP, Estes)	2.5	3B	0.4-0.1	62.5-25.0	251	2000	Consult area or state entomologists concerning tank mixtures.
	Karate[r] (Syngenta)	2.08	3B	0.025-0.04	80.0-50.0	245	≥7200	

Growers should not use excessively alkaline water to make spray mixtures. In areas where water pH exceeds 9.0, deterioration of insecticides may be expected. Insecticide mixture should be used within three to six hours after preparation and/or a buffering agent added.

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MAJOR PESTS (CONT'D)

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT ORAL	TOXICITY RABBIT DERMAL	COMMENTS
BOLLWORM/TOBACCO BUDWORM (cont'd)								
	Steward (DuPont)	1.25	22B	0.09*-0.11 *Transgenic Bt Cotton rate only.	13.9-11.3	751	≥5000	**NOTE**: Many of the pyrethroids have received federal and state [24(c)] labels for ULV application, 1 qt/A with refined vegetable oil.
	Tracer SC (Dow Agro Sciences)	4.0	5	0.045-0.089	90.0-45.0	75,000	75,000	
	Leverage® (Bayer Crop Sciences)	2.7	3B	0.079	34.1	200	5000	For irrigated cotton B.t. treatment is only suggested for early season infestation (when eggs are observed) and then only when used as part of an IPM program with frequent scouting. A good consideration for dryland cotton because of mild effects on beneficials.
	Bacillus thuringiensis (e.g., Biobit, Bactospeine, Bactur, Design, Dipel ES, Javelin, or Lepinox)	See label for rates.	11 B1					
COTTON FLEAHOPPER								
Treat when 40 or more fleahoppers are found per 100 terminals, the first three weeks of squaring.	Bidrin® MW (Amvac)	8.0	1B	0.1-0.5	80.0-16.0	22	225	After 7/25, control of fleahoppers generally is not economical due to Oklahoma's short growing season. In most cases, low yields coupled with the chance of unleashing bollworms offsets the advantages of protecting the early squares by a late-season infestation.
	Dimethoate EC (Helena, UAP, Estes)	2.67	1B	0.12-0.25	21.3-10.6	320	650	
	Centric (Syngenta)	0.40	4A	0.047	8.0	≥5000 ≥2000		
	Cygon EC (Wilber- Ellis)	4.0	1B	0.12-0.25	32.0-16.0	320	650	
	Intruder (Dupont)	2.0	4A	0.025-0.05	28.0 - 14.0	1064	≥2000	
	Lorsban E (Dow Agro Sci)	4.0	1B	0.18-0.5	22.2-8.0	163	2000	
	Orthene S (Valent)	0.97 0.9 0.75	1B	0.25 0.25 0.25	5.3 5.0 4.1	700	2000	
	Phaser® EC (Bayer Crop Science)	3.0	2A	1.0-1.5	3.0-2.0	40	359	
	Provado (Bayer Crop Sci)	1.6	4A	0.047	34.1	450	5000	

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MAJOR PESTS (CONT'D) AND MINOR PESTS

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT ORAL	TOXICITY RABBIT DERMAL	COMMENTS
COTTON FLEAHOPPER (cont'd)								
	Steward (Dupont)	1.25	22B	0.09-0.11	13.9-11.3	751	≥5000	Single applications will provide control of light to moderate infestations only.
	Thiodan E (FMC)	3.0	2A	1.125-1.50	2.7-2.0	40	359	
	Thiodan WP (FMC)	0.5	2A	2.0-3.0	0.33-0.50	40	359	
	Trimax (Bayer Crop Science)	4.0	4A	0.031-0.047	128.0-85.0	4350	5000	
	Vydate[r] C-LV (DuPont)	3.77	1A	0.125-0.5	30.1 – 7.5	8.7	≥5000	
MINOR PESTS								
COTTON APHID								
Treat when 50% of the plant terminals are infested with aphids and numbers exceed 50 per leaf.	Bidrin[r] MW (Amvac)	8.0	1B	0.1-0.5	80.0-16.0	22	225	Control difficulties could result with use of any of these products. Application of high rates reduces the chance of control failure.
	Dimethoate EC (Helena, UAP Estes)	2.67	1B	0.12-0.25	21.3-10.6	320	650	
	Centric (Syngenta)	0.40	4A	0.031-0.05	12.8 – 8.0	5000	2000	
	Cygon EC (Wilber-Ellis)	4.0	1B	0.12-0.25	32.0-16.0	320	650	
	Curacron[r] E (Syngenta)	8.0	1B	0.5	16.0	662	192	Two applications maximum per season. Closely observe re-entry requirements.
	Di-Syston[r] E (Bayer Crop Science)	8.0	1B	0.18-0.56	42.7-14.3	6	20	
	Intruder (Dupont)	0.7	4B	.025-.045	28.0 – 14.0	1064	≥2000	
	Lannate LV[r] (DuPont)	2.4	1A	0.25	9.6	49	≥2000	
	Leverage[r] (Bayer Crop Science)	2.7	3B	0.063	42.7	200	5000	
	Lorsban E (Dow Agro Sciences)	4.0	1B	0.5-1.0	8.0-4.0	272	2000	

Be sure to read and follow directions provided on the label of pesticide containers since certain restrictions on post-treatment harvest, feeding of gin trash, and grazing limitations exist (also see limitations/restrictions below).

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MINOR PESTS (CONT'D)

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT ORAL	TOXICITY RABBIT DERMAL	COMMENTS
COTTON APHID (cont'd)								
	Provado (Bayer Crop Science)	1.6	4A	0.047	34.1	450	5000	
	Phaser[r] EC (Bayer Crop Science)	3. 0	2A	0.375-0.75	8.0-4.0	40	359	
	Thiodan EC (FMC)	3. 0	2A	0.375-0.75	8.0-4.0	40	359	
	Trimax (Bayer Crop Science)	4. 0	4A	.031-.047	128.0-85.0	4350	>5050	
	Thiodan WP (FMC)	0.5	2A	0.75-1.5	0.375-0.18	40	359	
BEET ARMYWORM/FALL ARMYWORM								
Treat when worms are small for best control.	Confirm F (Dow AgroSciences)	2. 0	18B	0.06-0.25	32. 0-8. 0	≥5000	≥5000	
Treatment should begin when 10% of the plants are infested or when the field average is 1 beet armyworm/ row ft.	Curacron[r] E (Syngenta)	8. 0	1B	1. 0	16.0-8.0	662	192	
	Denim (Syngenta)	0.16	6C	0.0075 - 0.015	21.0 – 10.6	2950	>2000	
	Diamond (Crompton)	0.83	_____	0.06-0.12	21.0-11.0	3914	8000	
	Intrepid (Dow Agro Sciences)	2. 0	18B	0.6-0.16	32.0-12.8	5000	2000	
	Lannate[r] LV (DuPont)	2.4	1A	0.45	5.3	49	≥2000	
	Larvin AF (Bayer Crop Science)	3.2	1A	0.6-0.9	5.3-3.6	66	2000	
	Lorsban E (Dow Agro Sciences)	4. 0	1B	0.75-1.0	5.3-4.0	272	2000	
	Steward (DuPont)	1.25	22B	0.09-0.11	13.9-11.3	49	≥5000	
	Tracer SC (Dow Agro Sciences)	4. 0	5	0.067-0.089	60.0-45.0	75000	75000	
EGG MASSES								
Treat when 3 or more egg masses are found per 100 plants	Dimilin 2F (Uniroyal)	2. 0	15B	0.063-0.125	32.0-16.0	4640	10,000	Repeat application when fresh egg masses are found.
	Dimilin 25W (Uniroyal)	0.25	15B	0.063-0.125	4.0-2.0	>40	>20	

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MINOR PESTS (CONT'D)

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT ORAL	TOXICITY RABBIT DERMAL	COMMENTS
CABBAGE LOOPER								
Treat when loopers are present and 25% - 30% defoliation and bolls are still developing.	Denim (Syngenta)	0.16	6C	0.08-0.12	16.0-11.0	2950	>2000	
	Diamond (Crompton)	0.83	_____	0.06-0.12	0.06-0.12	3914	8000	
	Intrepid (Dow Agro Sciences)	2. 0	18B	0.06-0.16	32.0-12.8	≥5000	≥2000	
	Larvin AF (Bayer Crop Science)	3.2	1A	0.6-0.9	5.3-3.6	17	5000	
	Orthene S (Valent)	0.97 0.9 0.75	1B	0.9 0.9	1. 0 1. 0 0.75	700	2000	Economic damage rarely occurs. In rank, lush cotton; leaf feeding may allow increased air flow reducing the chance of boll rot.
	Steward (DuPont)	1.25	22B	0.065-0.09	19.1-13.9	751	≥5000	
	Tracer SC (Dow Agro Sciences)	4. 0	4	0.067-0.089	60.0-45.0	75,000	75,000	
	Bacillus thuringiensis (e.g., Biobit, Bactospeine, Bactur, DiPel ES, Design, Javelin, or Lepinox)	See label for rate	11 B1					
GRASSHOPPER								
Treat when grasshopper damage is noticed and grasshoppers are present.	Lorsban E (Dow Agro Sciences)	4. 0	1B	0.25-0.5	16.0-8.0	163	2000	Border treatment or application of properly labeled baits around field margins as soon as nymphs are first noticed will often prevent economic damage later.
	Malathion (American Cyanamid)	5. 0	1B	0.58	8.5	2800	4000	Pyrethroid Management: To lessen the chance of pyrethroid resistance developing select an alternating chemistry (op or carbamate) for grasshopper control.

Workers should observe the following reentry intervals for each of the respective insecticides: Confirm and Intrepid - 4 hours after application; Zephyr - 12 hours after application. Many other cotton insecticide labels state "Do no enter treated fields before spray is dry."

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MINOR PESTS (CONT'D)

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT ORAL	TOXICITY RABBIT DERMAL	COMMENTS
				THRIPS				
Economic damage may occur when plants avg. 3 or more thrips per plant before the 4-leaf stage.	**At Planting**							Di-Syston and Orthene are labeled for hopperbox and in-furrow application. Consult label for proper rates and application instructions.
	Di-Syston E (Bayer Crop Science)	8. 0	1B	0.75-1.0	10.7-8.0	6	20	
	Di-Syston G (Bayer Crop Science)	0.15	1B	0.75-1.0	0.2-0.15	700	2000	
	Othene S (Valent)	0.9	1B	0.14-0.9	6.4-1.0	700	2000	
	Furadan F (FMC)	4. 0	1A	2.5oz/1000ft	4.0	11	10200	
	Temik[r] G (Bayer Crop Science)	0.15	1A	0.3-0.75	0.5-0.2	1	20	
	Thimet[r] 20-G	0.2	1B	0.5-0.75	0.4-0.27	2	6	
	Thimet[r] 15-G (American Cyanamid)	0.15	1B	0.5-0.75	0.3-0.2			
	Foliar							
	Bidrin[r] MW (Amvac)	8. 0	1B	0.1-0.5	80.0-16.0	22	225	
	Dimethoate EC (Helena, UAP Estes)	2.67	1B	0.12-0.25	21.3-10.6	320	650	
	Centric (Syngenta)	0.4	4B	0.05	64.0	≥5000	≥2000	
	Cygon EC (Wilber-Ellis)	4. 0	1B	0.12-0.25	32.0-16.0	320	650	
	Orthene S (Valent)	0.97 0.9 0.75	1B	0.18 0.18 0.18	5.1 5.0 4.0	700	2000	
	Phaser[r] (Bayer Crop Science)	3. 0	2A	1.5	2.0	40	359	

Publications to help cotton producers are: EPP 7153, 7154, and 7161; CR 7172, 7173, and 7181; and L233.

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MINOR PESTS (CONT'D)

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT RABBIT ORAL DERMAL	COMMENTS
	Seed Treatment						
	Cruiser 5FS (Syngenta)		4A	0.476	7.75 FL OZ/ 100 lbs seed	>5000 ≥2000	Control will vary depending on thrips species encountered.
	Guacho 480 (Bayer Crop Science)	4.0	4A		6-8 FL OZ/ 100 lbs seed	4350 ≥2000	Poor control may result in production regions where the western flower thrips is the predominate species.
	Guacho 600 (Bayer Crop Science)	5.0	4A		12.8floz/cwt	4360 ≥2000	
STINK BUGS							
Treat stink bugs when 20% of 12 16-day-old bolls have internal injury. Stink bug populations are normally clumped in fields, thus numerous samples may be required to assess infestation.	Acephate 90 (TenKoz)	0.90	1B	0.72	1.25	700 2000	
	Bidrin MF (Amvac)	8.0	1B	0.25-0.5	32-16	22 225	
	Orthene 97 (Valent)	0.97	1B	0.72	1.29	700 2000	
	Vydate C-LV (Dupont)	3.77	1A	0.33-0.5	11.4-7.5	8.7 >5000	
WESTERN FLOWER THRIPS							
Control measures should begin when western flower thrips exceed 15/bloom.	Monitor™ L (Bayer Crop Science)	4. 0	1B	0.5-1.0	8.0-4.0	19 118	Control difficulties may occur due to the resurgence of this pest. Late season infestation reduces the immature fruit normally shed when harvest aids are applied to condition cotton for harvest.

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS
MINOR PESTS (CONT'D)

ECONOMIC THRESHOLDS	INSECTICIDE (COMPANY)	LBS/GAL TECH.	MOA GROUP NUMBER	RATE/ACRE LB/A.I.	ACRES TREATED PER GAL/LB	TOXICITY RAT RABBIT ORAL DERMAL	COMMENTS
MITES							
Consider treatment when leaves first start to look silvery on under-sides and discoloration appears on upper surface; and mites are present.	Bidrin[r] MW (Amvac)	8. 0	1B	0.25-0.50	32.0-16.0	22 225	Applications should begin after plants have hardened, usually when plants reach 10-12 inches tall.
	Capture[r] EC (FMC)	2. 0	3B	0.04-0.1	49.2-20.0	275 2000	
	Comite EC (Uniroyal)	6. 0	2A	0.8-1.6	7.5-3.7	2000 10,000	
	Dimethoate EC (Helena, UAP Estes)	2.67	1B	0.25	10.6	320 650	
	Cygon EC (Wilber-Ellis)	4. 0	1B	0.25	16.0	320 650	
	Curacron[r] E (Syngenta)	8. 0	1B	0.5-1.0	16.0-8.0	662 192	
	Kelthane MF (Dow Agro Science)	4. 0	20B	1.0-1.5	4.0-2.7	809 1870	
	Zephyr[r] (Syngenta)	0.15	6C	.00468-0.01875	16.0-8.0	300 1800	Rate depends on size of plant and density of foliage. Begin applications when mites are first noticed and repeat if necessary.

r Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

This section has not been revised since 2006.

COTTON INSECT CONTROL SUGGESTIONS

LIMITATIONS/RESTRICTIONS ON COTTON INSECTICIDES:

Asana® XL Wait 21 days to harvest. Do not graze livestock on treated fields or feed treated trash. Do not plant root crops other than those listed on the Asana XL label within 12 months after last application. Root crops on the label and all other rotation crops may be planted immediately after last application. Do not apply more than .05 lbs (A.I.) to a crop in a growing season.

Capture® Do not apply more than 0.5 lb active per acre per season. Do not apply within 14 days of harvest. Do not graze or feed treated forage.

Centric Do not exceed total of 6 oz (2 applications) per acre per crop. Allow 14 days between applications. Wait 21 days to harvest.

Comite Apply only before bolls open. Do not feed treated foliage or cotton trash.

Confirm Do no apply any more than 16 fl. oz per application and do not exceed 64 fl oz per application. Allow at least 14 days to elapse between final application and harvest.

Curacron® Wait 14 days to harvest. Do not apply more than 3 qts of Curacron 8E per acre per season. Do not graze treated cotton or feed gin waste.

Danitol® Do not exceed 0.8lb AI/acre. Do not apply within 21 days of harvest and do not feed gin trash.

Denim Do not apply through any type of irrigation system. Do not apply more than a total of 48 oz/A per crop season. Do not apply within 21 days of harvest. Do not allow livestock to graze in treated areas.

Diamond Do not apply more than 4 applications against armyworm or other foliage feeding caterpillars per season. Do not apply more than 42 oz. per acre per season. Do not apply within 30 days of harvest.

Dimethoate (Cygon) Wait 14 days to harvest. Do not apply more than once every 14 days and do not pasture fields or feed gin waste.

Dimilin Do not exceed six applications per season or 24 oz A.I. per season. Do not graze or plant crops within six months after treatment.

Di-Syston® Soil application: Do not apply more than twice per season (then a minimum of 21 days between applications). Foliar: A single application (1-2 pt) may be applied up to first bloom or a single application (1pt) can be applied up to 28 days before harvest. Do not apply more than twice per season.

Generic Cypermethrin® A maximum of 0.6 lb (A.I.) may be applied per season. Do not graze or feed cotton for forage. Do not apply within 21 days of harvest and do not plant rotational crops within 30 days after last application.

Intrepid Do not apply more than 60 oz per acre per season. Allow at least 14 days to elapse between final application and harvest.

Intruder Do not make more than 4 applications per season; closer than 7 days apart nor exceed 0.4 lbs AI per acre. Pre harvest restriction is 28 days.

Kelthane Do not apply within 14 days of harvest. Do not feed cotton stalks or trash to cattle.

Lannate® Wait 15 days to harvest. Do not allow livestock to graze in treated areas. Do not feed gin trash or treated foliage to livestock.

Lorsban Wait 14 days to harvest. Do not allow livestock to graze in treated areas. Do not feed gin trash or treated foliage to livestock.

Malathion No restrictions up to 4 lb tech/A as dilute spray or 1.2 lb tech/A as ULV spray.

Orthene Wait 21 days to harvest. Do not graze treated fields and do not feed gin trash.

Phaser®/Thiodan® Do not apply after bolls open. Do not graze treated fields. Do not exceed 3.0 lb A.I. (i.e. 4 qts) per acre per year.

Provado Do not apply more than .5 lb A.I./acre per season or apply more than six applications. Do not graze treated fields.

Sevin No restrictions.

Steward - 12 hrs. REI. Do not apply more than 45 fl oz (.44 lb A.I./A) per crop. Wait 14 days to harvest.

Tracer Do not apply more than .45 lb A.I (14.4 oz) per acre per season. Do not apply within 28 days of harvest. Do not apply through any type of irrigation equipment.

Trimax - Miximum rate for application 1.5 ox (0.047 lb A.I.); maximum rate per crop season 7.5ox (0.235 lb A.I.); Do not graze treated cotton fields.

Vydate® C-LV Do not graze or feed treated cotton to livestock. Wait 14 days to harvest.

Warrior® Do not apply within 21 days of harvest. Do not graze livestock in treated fields. Do not apply more than 1.6pts per season.

Zephyr - Do not apply more than two applications per acre per growing season. Do not apply within 20 days of harvest. Do not graze or feed foliage. Do not apply through any type of irrigation system.

COTTON WEED SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
2,4-D LV6 5.6 lb ai per gallon **All applications:** 2/3 – 2 2/3 pt /A	**Active Ingredients:** 2,4-Dichlorophenoxyacetic Acid **MOA:** 4	**PRE-PLANT BURNDOWN.** Apply at least 30 days prior to planting cotton for control of existing broadleaf weeds. Tank-mix with glyphosate for additional control of grass species.	**Coverage is essential for good control. Do not** apply this product through any type of irrigation system. In order to maximize control of horseweed, apply before horseweed reaches 6 inches in height. A minimum of 1.0 lb ai/acre is recommended for optimum control of horseweed.
Assure II 0.88 lb ai per gallon **POST applications:** 5-12 fl oz. /A	**Active Ingredients:** Quizalofop **Similar Products:** None **MOA:** 1	**POST.** Apply to young, actively growing grasses according to the rate chart listed in the label. If field is to be irrigated, apply product after irrigation. **Do not** apply more than 18 fl oz /A per season.	**Do not** apply this product through any type of irrigation system. **Do not** apply within 80 days of harvest. **Do not** feed forage or hay from treated areas.
Caparol 4 lb ai per gallon **PRE applications:** 2.4 pt /A	**Active Ingredients:** Prometryn **Similar Products:** None **MOA:** 5	**PRE.** Apply only in loam soil types. Apply at planting or shortly after planting at the rate of 2.4 pt /A. Labeled for use only in the Blacklands region.	**Do not** feed treated forage to livestock, or graze treated areas, or illegal residues may result. **Do not** use on glandless cotton varieties, or crop injury will occur. **Do not** make more than one application per year.
Clarity 4 lbs. ai per gallon **EPP applications:** 8 fl oz /A	**Active Ingredients:** Dicamba **Similar Products:** Banvel Rates may vary due to formulation. **MOA:** 4	**EPP BURNDOWN.** For best performance, apply when weeds are in the 2-4 leaf stage and rosettes are less than 2" in diameter. Following application and a minimum 1" of rainfall or overhead irrigation, a waiting interval of 21 days is required per 8 fluid ounces per acre or less. These intervals must be observed prior to planting cotton.	**Do not** apply through any type of irrigation equipment. **Do not** cultivate within 7 days after application. For optimum control of horseweed apply a minimum of 8 oz/A to 2-4 leaf weeds or rosettes less than 2 inches across. Consult label for cotton plant-back interval following application. Tank-mix with glyphosate for additional control of grass species.

COTTON WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Dual II Magnum 7.64 lb ai per gallon **All applications:** 1 to 1.33 pt /A	**Active Ingredients:** Metolachlor **Similar Products:** Dual Magnum Cinch **MOA:** 15	**PPI.** Apply and incorporate into top 1 inch immediately before planting, at planting, or after planting, but before crop or weeds emerge. **PRE.** Apply to soil surface at planting or after planting, but before weeds or crop emerges. **POST.** Apply after cotton emergence but prior to weed emergence. Will not control weeds that have already emerged prior to application. **All applications.** Apply at a rate of 1.0 pt/A on sandy loams, 1.0-1.33 pts/A on medium soil, or 1.33 pts/A on fine soils.	**Do not** use on sands and loamy sand. **Do not** feed forage from treated areas to livestock. **PPI.** PPI application is recommended if furrow irrigation is used or when a period of dry weather after application is expected. Crop should be planted below the level of incorporation; i.e., at least 1 inch on fine soils and 1.5 inches on coarse and medium soils. **PRE. Do not** apply on areas where water is likely to pond over the bed. **Do not** make broadcast applications to crops planted in furrows more than 2 inches deep.
Fusilade DX 2 lb ai per gallon **POST applications:** 48 fl oz /A	**Active Ingredients:** Fluazifop **Similar Products:** None **MOA:** 1	**POST.** Refer to label for weed specific application rates and timing. Thorough coverage of all plant grass foliage is important for good activity. Optimum control is achieved when young actively growing grasses are treated that are not under stress from moisture, temperature, low soil fertility, mechanical, or chemical stress. **Always** add either a crop oil, nonionic surfactant, or other adjuvant.	**Do not** apply to crop after boll set. **Do not** harvest within 90 days of application. **Do not** graze fields or harvest for forage or hay. **If applied through irrigation system,** apply only through sprinkler systems including center pivot, lateral move, end tow, side (wheel) roller, big gun, solid set, or hand move. **Do not** apply through any other type of irrigation system.
Fusion 2.56 lb ai per gallon **POST applications:** 6-12 fl oz /A	**Active Ingredients:** Fluazifop Fenoxaprop **Similar Products:** None **MOA:** 1 & 1	**POST.** Best control of susceptible grasses is obtained when applied to actively growing grasses before they exceed the recommended growth stages listed, refer to label for list of grasses and application rates for specific weeds and areas.	**Do not** apply this product through any type of irrigation system. **Do not** apply if rainfall is expected within 1 hour. **Do not** apply more than 24 fluid ounces per acre per season. **Do not** apply after boll set. **Do not** harvest within 90 days of application. **Do not** graze fields or feed treated forage or hay to livestock.
Roundup Original Max 5.5 lb ai per gallon **All applications:** 22 to 32 oz /A	**Active Ingredients:** Glyphosate **Similar Products:** Many Rates may vary due to formulation. **MOA:** 9	**PPS or PRE.** May be applied before, during or after planting crop. Applications must be made prior to emergence of the crop. **POST (conventional cotton).** May be applied through hooded sprayers, recirculating sprayers, shielded applicators or wiper applicators. Allow at least 7 days between application and harvest. **POST (Roundup Ready Cotton).** Apply from ground cracking up to the four leaf stage of growth. May be applied through layby with directed or hooded sprayers. Contact with leaves should be avoided. **Post (Roundup Ready Flex Cottton).** Apply anytime from preemergence to 7 days prior to harvest. Late season applications may require directed applications to ensure proper coverage.	**Do not** apply through any type of irrigation system. **Do not** apply more than 5.3 qt per acre per year. **Refer** to label for application rates for specific weed types. **Do not** apply postemergence to any crops other than those listed as Roundup Ready or Roundup Ready Flex. **Do not** apply to Roundup Ready or Roundup Ready Flex crops within 7 days of harvest. For optimal horseweed control apply a tank-mix of 22 oz/A Roundup Original Max + a minimum of 1.0 lb ai /A 2,4-D or 8 oz/A of Banvel. Consult product labels for optimum horseweed size at application.

COTTON WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Gramoxone Inteon^{r} 2 lb ai per gallon **PRE Burndown applications:** 2.5 to 4 pt /A	**Active Ingredients:** Paraquat **Similar Products:** Firestorm (3 lb) **MOA:** 22	**PRE BURNDOWN.** Apply prior to, during, or after planting, but before crop emergence. For fallow bed treatment, beds should be preformed to permit maximum broadleaf weed and grass emergence prior to treatment. Seeding should be done with minimum soil disturbance.	**Do not** apply this product through any type of irrigation system. **Always** add nonionic surfactant. Complete coverage is essential for good control.
Ignite 280 2.34 lb ai per gallon **POST applications:** 22 to 29 fl oz /A	**Active Ingredients:** Glufosinate-ammonium **Similar Products:** None **MOA:** N	**PREPLANT BURNDOWN.** Apply to actively growing weeds up to 120 prior to planting cotton. **POST over-the-top.** Apply POST, over LibertyLink Cotton varieties only, to actively growing weeds when the cotton has emerged and up to the cotton early bloom stage.	**Do not** apply more than 29 fl oz/A in a single application. **Do not** apply more than 58 fl oz/A in a growing season. **Do not** apply within 70 days prior to harvest. Herbicide should be applied broadcast in a minimum of 15 gallons of water per acre. Use a spray volume of 20 to 40 gallons per acre for dense weed/crop canopies so that thorough spray coverage will be obtained.
Karmex DF 80% DF **EPP applications:** See table **PRE applications:** See table **POST applications:** 1 to 1.5 lb /A	**Active Ingredients:** Diuron **Similar Products:** Direx 4L Direx 80 DF Diuron 4L Diuron 80 DF Diuron 80 WDG **MOA:** 7	**PPS.** Apply from 15 to 45 days prior to planting. **PRE.** Use only where crop is planted on flat or raised seedbeds. **POST-directed applications.** Apply 1 to 1.5 lb/A when crop is at least 12" high. In irrigated crops, best control is obtained if the field is irrigated within 3-4 days after application. Apply to soil beneath crop and between rows immediately after last cultivation.	**Do not** spray over the top of crop plants. **Do not** apply to sand or loamy sand soils. **Do not** use on soils with less than 1% organic matter as crop injury may result. **Do not** use in preplant or preemergence applications where soil-applied organophosphate insecticides are used due to potential for severe crop injury and possible stand loss. **Do not** allow livestock to graze treated cotton. **EPP & PRE.** If less than the maximum rate is used, a second PRE application can be made, but total can not exceed maximum use rates listed. **Do not** apply PRE if maximum application rate was used in preplant application.

Karmex DF Application Rates

Soil Texture	Rate/Acre	Rate/Acre/Season
Sandy loam, Loam, Silt loam, Silt	1 lb /A	1 lb /A
Sandy clay loam, Clay loam, Silty clay loam, Sandy clay	1.25 lb /A	1.25 lb /A
Silty clay, Clay	2 lb /A	2.75 lb /A

COTTON WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
MSMA 6.6 6.6 lb ai per gallon **All applications:** 0.5 to 2.5 pt /A	**Active Ingredients:** MSMA **Similar Products:** MSMA 6 Plus 120 Herbicide 912 Herbicide **MOA:** 17	**PRE.** Apply preplant or postplant up to cracking of soil before cotton emergence using ground or aircraft equipment. Apply at a rate of 2.5 pt/A of product with a suitable surfactant. **POST (Over the Top).** Apply over the top when crop is 3 to 6 inches tall or up to early first square stage, apply at a rate of 1 to 1.25 pts/A with a suitable surfactant. **Will cause significant leaf burn of the crop. POST (Directed Spray).** Applicable as a directed spray with ground equipment when crop is 3 inches tall to first bloom, apply at a rate of 2.5 pt/A with a suitable surfactant.	**Apply** over the top of crop only as a salvage operation, apply only to healthy, rapidly growing crops, 3 inches high but no later than 6 inches high. **POST (Directed Spray). Do not** apply as a directed spray after the first bloom. A second or repeat application, if needed, should be timed about 1 to 3 weeks after first application.
Poast Plus 1 lb ai per gallon **POST applications:** 1.5 to 3.75 pt /A	**Active Ingredients:** Sethoxydim **Similar Products:** Poast **Rates may vary due to formulation.** **MOA:** 1	**POST.** Applications can be made to actively growing weeds as aerial, broadcast, band, or spot spray applications. Most effective control is achieved if applied when weeds are small and actively growing.	**Do not** apply this product through any type of irrigation system. **Do not** apply within 40 days of harvest. To achieve consistent weed control, always use either a seed oil or crop oil concentrate. **Do not** cultivate within 5 days before or 7 days after application. **Processed** meal may be fed to animals.

COTTON WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Prowl 3.3 EC 3.3 lb ai per gallon **All applications:** See table.	**Active Ingredients:** Pendimethalin **Similar Products:** Pendimax 3.3 **MOA:** 3	**PPS.** Apply up to 15 days prior to planting. **PPI.** Apply up to 60 days prior to planting and incorporate within 7 days of application; however, immediate incorporation is best. **PRE.** Apply overlay application at planting or up to 2 days after planting. Total amount applied per acre cannot exceed the highest labeled rate for a given soil type. **POST/LAYBY.** Apply directly to the soil between rows as a directed spray following the last normal cultivation (layby). **Fall Application.** May be applied for weed control in cotton in the fall, after Oct. 15 (up to 140 days prior to planting). Apply at a broadcast rate of 1.8 pt /A on coarse soils, 2.4 pt /A on medium soils and 3.6 pt /A on fine soils.	**If applied through irrigation system,** use only center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move irrigation systems. **Do not** apply this product through any other type of irrigation system for layby applications. **Do not** apply as a broadcast spray over the top of crop. **Do not** feed forage or graze livestock in treated fields. **Product** is most effective when adequate rainfall or overhead irrigation is received within 7 days after application. **Use** higher rates listed for no-tillage applications for control of rhizome johnsongrass in specified soil textures. This use is not recommended for soils with more than 3% organic matter. **There** must be an interval of at least 60 days between the last application and harvest.

PPS, PPI &/or PRE

Prowl 3.3 EC Broadcast Rates pts/A

Soil Texture	Conventional or Minimum Tillage	No-Tillage
Coarse	1.2 to 2.4 pts /A	1.8 to 2.4 pts /A
Medium	1.8 to 2.4 pts /A	2.4 to 3.6 pts /A
Fine	2.4 to 3.6 pts /A	3.6 to 4.8 pts /A
For heavy clay soils, apply at a broadcast rate of 3.6 pts /A.		
Total amount applied per acre cannot exceed the highest labeled rate for a given soil type.		

POST/LAYBY

Prowl 3.3 EC Layby Application Use Rates

Soil Texture	Use Rate pts /A
Coarse	1.2 to 1.8 pts /A
Medium	1.8 to 2.4 pts /A
Fine	2.4 to 3.6 pts /A

COTTON WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Select 2 EC 2 lb ai per gallon **POST applications:** 6 to 16 fl oz /A	**Active Ingredients:** Clethodim **Similar Products:** Prism **MOA:** 1	**POST.** Apply to actively growing grasses, refer to label for specific rates for weed type. In arid regions, application should be made as soon as possible after an irrigation (within 7 days). A second application will generally provide more effective perennial grass control in arid conditions than a single application. Make second application to actively growing grass 2 to 3 weeks after emergence of new growth.	**Do not** apply within 60 days of harvest. **Do not** graze treated fields or feed treated forage or hay to livestock. **Do not** apply through any type of irrigation system. **Do not** apply if rainfall is expected within one hour of application. **Always** use a crop oil concentrate at 1.0 qt /A by ground or 1% v/v in the finished spray volume by air. **Refer** to label for application rates for specific grass species controlled.
Sequence 5.25 lb ai per gallon **All applications:** 2.5 to 4 pt/A	**Active Ingredients:** Metolachlor & Glyphosate **Similar Products:** None **MOA:** 15 & 9	**EPP.** Apply prior to planting for control of emerged actively growing weeds and soil residual activity. **Do not** incorporate if applied EPP, or crop injury will result. **PRE.** Apply after planting in no-till production system for control of emerged actively growing weeds and soil residual activity. **POST only on Roundup Ready Cotton Varieties.** Apply after crop and weeds have emerged for control of emerged actively growing weeds and soil residual activity.	**Do not** apply POST to non-Roundup Ready cotton varieties. **Do not** graze or feed forage or fodder from Sequence treated cotton to livestock. **Do not** apply EPP or PRE on sand or loamy sand soils. **POST applications on Roundup Ready Cotton Varieties**: apply to cotton that is 3 inch tall up to 4-lf stage of growth. **Do not** exceed 2.5 pt/A in a single application. **Do not** exceed 3.5 pt/A/season. **Do not** harvest cotton within 100 days of POST application. **Do not** use AMS or other adjuvants when POST applications are made.
Staple LX 3.2 lb ai per gallon **PRE applications:** 1.3 to 2.1 oz /A **POST applications:** 2.6 to 3.8 oz /A	**Active Ingredients:** Pyrithiobac **Similar Products:** None **MOA:** 2	**PRE.** May be applied preemergence to aid in the control of many problematic weeds. Applications require rainfall or sprinkler irrigation to activate the herbicide. Use the higher application rate for difficult to control weeds or in fields where high infestation of weeds occur. **POST.** Application should be made over-the-top or as a post-directed spray to cotton (begin at cotyledon stage) and actively growing weeds.	**PRE. Do not** apply through any type of irrigation system. **Do not** use on coarse soils such as sands or loamy sands. **Do not** use on soils with less than 0.5% organic matter. **Do not** use on crops planted in furrows. **POST.** Use a minimum of 10 gallons of water per acre by ground or 3 gallons of water per acre by air. All rates are broadcast. Use proportionately less for banded applications. **All applications. Do not** apply more than 5.1 oz/A per year. Add a non-ionic surfactant at the rate of 0.25-0.5% v/v or a crop oil concentrate at the rate of 1-2% v/v with all postemergence applications. Under arid conditions, a crop oil concentrate is recommended. Weed size at application is critical for optimal control, consult label for appropriate weed sizes.

COTTON WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Treflan HFP 4.0 lb ai per gallon **PPI applications:** See table.	**Active Ingredients:** Trifluralin **Similar Products:** Treflan TR-10 Trifluralin HF Trust 10G Trust 4EC Trust Herbicide **MOA:** 3	**Fall applications.** Apply to flat ground and incorporate once within 24 hours. **Spring applications.** Application and incorporation may occur before planting or after planting prior to crop emergence. Use the lower application rates when sequential applications are anticipated. **Layby applications.** Application may be made in established crops from the 4 true leaf stage of growth up to layby, but no less than 90 days before harvest.	**If applying through irrigation system:** Apply only through continuously moving center pivot, lateral move end tow, solid set, or hand move irrigation systems. **Refer** to label for additional chemigation instructions. **Do not** apply to soils that are wet or are subject to prolonged periods of flooding as poor weed control may result.

Treflan HFP Application Rates

Soil Texture	Spring Application	Fall Application	Chemigation Application	Conservation Tillage	Layby Application
Coarse	1 pt /A	2 pt /A	1-3 pt /A	1-2 pt /A	1 pt /A
Medium	1.25-1.5 pt /A	2 pt /A	1.5-4 pt /A	1.5-2 pt /A	1.5 pt /A
Fine	1.5-2 pt /A	2.5 pt /A	2-4 pt/A	2-4 pt /A	2 pt /A

Valor SX 51% WP **Preplant Burndown applications:** 1 to 2 oz/A **POST-Directed/Hooded applications:** 2.0 oz/A	**Active Ingredient:** Flumioxazin **Similar Products:** Valor **<u>Rates may vary due to formulation</u>** **MOA:** 14	**Preplant Burndown Applications.** A minimum of 14 to 30 days must pass prior to planting cotton after application depending on tillage system and rate applied, consult label. **POST-Directed/Hooded Applications.** Precautions should be taken to avoid contacting the green foliage of cotton plants or severe crop injury may result. Cotton should be at least 6 inches in height at the time of application. Direct the spray onto the bottom 2 inches of the cotton stem-bark layer. **Do not** allow spray to contact green cotton stems.	**Do not** graze treated fields or feed treated forage or hay to livestock. **Do not** incorporate into the soil after application. **Do not** apply more than 2 oz/A in a single application or 4 oz/A during a single growing season. **Do not** make a sequential Valor WP application within 30 days of the previous Valor application. Do not apply within 60 days of harvest. **Do not** use on crops grown for seed. Only apply with nonionic surfactant, d**o not** apply with crop oil concentrate, methylated seed oil or other types of adjuvants as crop injury may result. Valor should be tank mixed with glyphosate or MSMA to provide grass control.

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR GROWTH REGULATORS IN COTTON

Trade Name	Active Indredients Similar Products	Suggested Rates Per Acre	Water Volume Recommended GROUND AIR	COMMENTS
GROWTH REGULATORS				
Mepichlor 0.35 lb ai per gallon	Mepiquat Chloride Pix Mepex	2-16 fl oz	>2 >2	Apply when plants are in early bloom stage. Mepichlor should not be applied if plants are under severe stress from weather factors, mite, insect or nematode damage, disease stress, herbicide injury or fertility stress. Option of single, dual or up to four low rate multiple applications. If drought stress occurs when Pix is applied, or after a full rate (0.5 to 1 pt) is applied, results won't be optimal. Low rate multiple applications initiated at pin-head square give producers the option of discontinuing applications if stresses occur.
Mepex Gin Out 0.35 lb ai per gallon	Mepiquat Chloride + Kinetin	8 fl oz	>2 >2	Apply when plants are in early bloom stage. Product should not be applied if plants are under severe stress from weather factors, mite, insect or nematode damage, disease stress, herbicide injury or fertility stress. Sequential applications can be made 14-21 days later if needed.
Pentia 0.82 lb ai per gallon	Mepiquat Pentaborate	4-24 fl oz/A	>10 >2	Lower application rates may begin at pinhead square with sequential applications 14 days apart as needed. Total seasonal use must not exceed 48 oz/A. Do not apply to insect, disease, or fertility-stressed cotton, drought-stressed cotton or cotton lacking soil moisture. Do not apply to cotton stressed from herbicide injury.
Stance 0.736 lb ai per gallon 0.184 lb ai per gallon	Mepiquat Chloride + Cyclanilide	2-3 fl oz/A	>10 >2	Begin initial applications at 50% matchhead square growth stage. Sequential applications may be made 7-14 days later as needed. Do not apply to insect, disease, or fertility-stressed cotton, drought-stressed cotton or cotton lacking soil moisture. Do not apply to cotton stressed from herbicide injury.

COTTON HARVEST AID SUGGESTIONS FOR OKLAHOMA

	AVERAGE TEMP >70 F	AVERAGE TEMP < 70 F
Yield Projection **<300 lbs./A**	Gramoxone Inteon* (16-32 oz) Gramoxone Inteon fb Gramoxone Inteon* (8-16 oz fb 16-32 oz) Ginstar* (6-8 oz) Resource (6-8 oz) or Aim* (1 oz) or ET (1.4 oz) or Blizzard* 0.5-0.6 oz plus COC	Gramoxone Inteon* (16-32 oz) Gramoxone Inteon fb Gramoxone Inteon* (8-16 oz fb 16-32 oz) Resource* (6-8 oz) or Aim* (1 oz) or ET (1.4 oz.) or Blizzard* 0.5-0.6 oz plus COC
Yield Projection **300 – 500 lbs./A**	Gramoxone Inteon fb Gramoxone Inteon* (8-16 oz fb 16-32 oz) Ethephon + Def or Folex (1-2 pt + 0.75 pt) Ethephon + Resource (1-2 pt + 6-8 oz) Finish fb Def or Folex (1 pt. fb 12-16 oz) First Pick + Ginstar (3 pts + 3-6 oz) First Pick + Def or Folex (3 pts + 1 pt) Ginstar* (6-10 oz) Finish + Ginstar (1 pt + 3-8 oz) Ethephon (1-2 pt) + Resource* (6-8 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz) fb Resource* (4-6 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz) fb Resource* (4-6 oz)	Gramoxone Inteon fb Gramoxone Inteon* (8-16 oz fb 16-32 oz) Ethephon + Def or Folex (1-2 pt + 1 pt) Ethephon + Resource (1-2 pt + 6-8 oz) Finish + Def or Folex (1 pt + 1 pt) First Pick + Ginstar (3 pts + 3 oz) First Pick + Def or Folex (3 pts + 1 pt) Ethephon + Harvade (1-2 pt + 8 oz) Ethephon (1-2 pt) + Resource* (6-8 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz) fb Resource* (4-6 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz)
Yield Projection **>500 lbs./A**	Finish + Def. or Folex (1-2 pt + 1 pt) Ethephon + Def or Folex (1-2 pt + 1 pt) Ethephon + Resource (1-2 pt + 6-8 oz) Def./Folex fb Gramoxone Max* (1 pt fb 11-21 oz) First Pick + Ginstar (3 pts + 3-6 oz) First Pick + Def or Folex (3 pts + 1 pt) Finish + Ginstar (1 pt + 6-8 oz) Ginstar* (12 oz) Ethephon (1-2 pt) + Resource* (6-8 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz) fb Resource (4-6 oz) or Aim* (1oz) or ET (1.4 oz) or Blizzard	Finish + Def. or Folex (1.5-2 pt + 1 pt) Ethephon + Def or Folex (1-2 pt + 1 pt) Ethephon + Resource (1-2 pt + 6-8 oz) Gramoxone Max fb Gramoxone Max* (5-11 oz fb 16-21 oz) First Pick + Ginstar (3 pts + 3 oz) First Pick + Def or Folex (3 pts + 1 pt) Ethephon (1-2 pt) + Resource (6-8 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz) fb Resource* (4-6 oz) or Aim* (1oz) or ET* (1.4 oz) or Blizzard* (0.5-0.6 oz)

Fb= followed by (a second application normally made 7-14 days after initial application).
Most chemicals applied to dry leaves will need addition of a silicone surfactant to aid in leaf penetration.
In cooler temperatures, addition of a crop oil concentrate and/or ammonium sulfate will enhance activity of Ethephon, Def./Folex or Dropp. COC required with Harvade.
A desiccant rate of Gramoxone Max (11-21 oz) might be required 7-10 days after a boll opener and/or defoliant application to condition the crop for stripper harvest.
Use ET or Aim + COC to help desiccate weeds in problems areas.
Ethephon is sold as Prep, Ethephon 6, Super Boll, Boll'd.
Resource must be applied with 1-2 pints COC/A; NIS can be used under ideal conditions)
*These Treatments do not include a boll opener and should only be used on cotton that is >85% open.

PASTURE AND RANGE INSECT CONTROL SUGGESTIONS

Pest, Damage and Treatment Threshold	Insecticide Formulation and MOA Group*	Rate of Product/Acre	Comments
Ants (including fire ants) Ants range in size from 1/16 inches to nearly 1/2 inch in length and from light tan to black in color. These social insects live in a colony with thousands of workers. The two most important pest species for rangeland and pasture are the red imported fire ant and the red harvester ant. Damage: Fire ants can be an irritant to cattle as they feed. Harvester ants sometimes clear large patches of grass as they feed. Threshold: No threshold established.	**Baits**		
	Amdro Pro (20)	3-5 tbs/mound (1 to 1.5 lb/acre)	Do not exceed 4 applications per year. Do not exceed 8 lb per acre/year. 7 day waiting period for harvest.
	Award (7B)	1-3 tbs/mound (1 to 1.5 lb/acre)	For non-grazed or horse-grazed pasture/rangeland only.
	Distance (7C)	1 to 4 tbs/mound (1 to 1.5 lb/acre)	For non-grazed rangeland and pasture only.
	Extinguish (7A)	3-5 tbs/mound (1 to 1.5 lb/acre)	0 day waiting period for grazing or harvesting.
	Justice (5)	4-6 tbs/mound	Individual mound treatment only. Repeat every 10-12 weeks as needed.
	Non Baits		
	Sevin 80S (1A) Sevin 80 WSP (1A) Sevin 4F (1A) Sevin XLR Plus (1A)	8.3 gms/gal water 1 pak/67.3 gal water 0.75 oz/gal water 0.75 oz/gal water	For red imported fire ants. Individual mound treatment only. Repeat application in 7 days if activity resumes. For all ant baits: Apply treatment when ants are active and soil temperatures exceed 60 degrees. If treating individual mounds, estimate the mound density, and do not disturb the mound or apply the bait directly on the mound according to label directions.
Armyworm Caterpillar can reach slightly over 1 inch. Dark green or brown with 5 stripes along body. Damage: Feed on foliage, usually a problem in the spring. Threshold: Treat when caterpillars are abundant and foliage is being destroyed.	*Bacillus thuringiensis* Biobit (11B1, B2) Javelin WG (11B1, B2) Xen Tari(11B1, B2)	 0.5 - 2 lb 0.25 - 1.5 lb 0.5 - 2 lb	Use higher rate for heavy infestations or when plant growth is rapid. A contact insecticide may be added for enhanced control of heavy populations. 0 day waiting period for grazing or harvesting.
	Confirm 2F (18)	8 fl oz	0 day waiting period for grazing or harvesting.
	Lannate^{r} (1A)	0.75 - 3 pt	For Bermudagrass pasture ONLY. 7 day waiting period for grazing, 3 day waiting period for harvest.
	Malathion 5EC (1B)	2 pt	0 day waiting period for grazing or harvesting.
	Methyl parathion^{r} 4E (1B)	1.5 pt	Remove livestock when spraying; 15 day waiting period for grazing or harvesting.
	Sevin 80S (1A) Sevin 80 WSP (1A) Sevin 4F (1A) Sevin XLR Plus (1A)	1.25 - 1.875 lb 1.25 - 1.875 lb 2 - 3 pt 2 - 3 pt	For improved pasture only: do not apply more than 2 applications per season and not more than once every 14 days. Sevin label states a 14 day waiting period for grazing or harvesting.
	Tracer (5)	1-2 fl oz	0 day wait for grazing, 3 day wait for hay or fodder

PASTURE AND RANGE INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and MOA Group*	Rate of Product/Acre	Comments
Fall armyworm Large striped caterpillar that reaches 1.5 inches when mature. Has an inverted "Y" in the front of its head. Damage: Feed on foliage, reducing forage. Typically a problem in the fall. Threshold: Treat when worms are abundant and foliage is being destroyed.	*Bacillus thuringiensis* Biobit (11B1, B2) Javelin WG (11B1, B2) XenTari (11B1, B2) Confirm 2F (18) Lannate[r] LV (1A) Lannate[r] SP (1A) Malathion 5E (1B) Sevin 80S (1A) Sevin 80 WSP (1A) Sevin 4F (1A) Sevin XLR Plus (1A) Tracer (5)	 0.5 to 2 lb 0.25 to 1.5 lb 0.5 to 2 lb 8 fl oz 0.75 to 3 pt 0.25-0.5 lb 2 pt 1.25 to 1.875 lb 1.25 to 1.875 lb 2 to 3 pt 2 to 3 pt 1-2 fl oz	Use higher rate for heavy infestations or when plant growth is rapid. A contact insecticide may be added for enhanced control of heavy populations. 0 day waiting period for grazing or harvesting. 0 day waiting period for grazing or harvesting. For Bermudagrass pasture ONLY. 7 day waiting period for grazing, 3 day waiting period for harvest. 0 day waiting period for grazing or harvesting. For improved pasture only: do not apply more than 2 applications per season and not more than once every 14 days. Sevin label states a 14 day waiting period for grazing or harvesting. 0 day wait for grazing, 3 day wait for hay or fodder.
Grasshopper Distinctive insects with enlarged hind legs for jumping. Adults have two pair of wings, forewings leathery, hind wings membranous, They have chewing mouthparts. Adults range in size from 1/2 – 2 inches long. Damage: Feed on foliage. Can damage from spring through fall, but more of a problem in late summer. Small grasshoppers less than 1/2 inches are more easily controlled and can be spot treated with foliar spray if nesting sites are mapped out in spring. Threshold: Small nymphs:(less than 1/2 inches) 24-100 per yard^2 Large: (greater than 1/2 inches) 8-40 per yard^2	**PASTURE:** Dimilin 2L (15) Sevin 80S (1A) Sevin 80 WSP (1A) Sevin 4F (1A) Sevin XLR Plus (1A) **RANGE:** Dimilin[r] 2L (15) Malathion 5E (1B) Methyl parathion 4E[r] (1B) Sevin 80S (1A) Sevin 80 WSP (1A) Sevin 4F (1A) Sevin XLR Plus (1A)	 2 fl oz 1.25 to 1.875 lb 1.25 to 1.875 lb 2 to 3 pt 2 to 3 pt 0.5 – 2 fl oz 1.5 – 2 pt 1.5 pt 0.675 to 1.875 lb 0.675 to 1.875 lb 1 to 3 pt 1 to 3 pt	 Apply when majority of grasshoppers are 2nd or 3rd instar nymphs (less than 1/2 inches). Do not exceed a total of 2 fl oz per year. For improved pasture: do not apply more than 2 applications per season and not more than once every 14 days. Sevin label states a 14 day waiting period for grazing or harvest in pastures. Applications of Dimilin may be applied as a Reduced Area & Agent Treatment (RAAT) strip spray. See label for specific directions. Apply when majority of grasshoppers are 2nd or 3rd instar nymphs (less than 1/2 inches). Do not exceed 1 fl oz/acre/year. If second application is needed, wait 2-3 weeks from first application. 0 day waiting period for grazing or harvesting. Remove livestock when spraying; 15 day waiting period for grazing or harvesting. 0 day waiting period for grazing. Do not make more than one application of Sevin per year, and do not exceed 1.0 lb ai/acre per year.

PASTURE AND RANGE INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and MOA Group*	Rate of Product/Acre	Comments
Tick:	**PASTURE:**		
	Sevin 80S (1A)	1.25 to 1.875 lb	For improved pasture: do not apply more than 2 applications per season and not more than once every 14 days. Sevin label states a 14 day waiting period for grazing or harvesting in pastures.
	Sevin 80 WSP (1A)	1.25 to 1.875 lb	
	Sevin 4F (1A)	1 to 1.5 qt	
	Sevin XLR Plus (1A)	1 to 1.5 qt	
	RANGE:		
	Sevin 80S (1A)	1.25 lb	0 day waiting period for grazing. Do not make more than one application of Sevin per year, and do not exceed 1.0 lb ai/acre per year.
	Sevin 80 WSP (1A)	1.25 lb	
	Sevin 4F (1A)	1 qt	
	Sevin XLR Plus (1A)	1 qt	

[r] Restricted Use Insecticide.
MOA Group Tables start on page 46 of the handbook.

Pre-harvest Intervals and grazing restrictions

Amdro	7 day waiting period for harvest
Confirm	0 day waiting period for grazing or harvest
Dimilin	0 day waiting period for grazing or harvest
Extinguish	0 day waiting period for grazing or harvest
Lannate[r]	For bermudagrass ONLY. 7 day waiting period for grazing, 3 day waiting period for harvest
Malathion	0 day waiting period for grazing or harvest
Methyl parathion[r]	15 day waiting period for grazing or harvest
Sevin	14 day waiting period for grazing or harvest
Tracer	0 day waiting period for grazing, 3 day waiting period for hay or fodder.

* Numbers in parentheses (#) that follow the insecticide name are used to designate the mode of action of the insecticide according to the classification system developed by the Insecticide Resistance Action Committee, (IRAC) in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest during a growing season, simply select a registered insecticide with a different number for each application. To further delay resistance from developing, integrate other control methods into your pest management programs.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Pasture and Range Herbicides[a]

Herbicide	Summer Annual Broadleaves												Summer Perennial Broadleaves									Thistles			Other Weeds				
	Bitter sneezeweed	Broomweed	Buffalobur	Cocklebur	Crotons	Daisy fleabane	Horseweed (Marestail)	Lanceleaf ragweed	Marshelder	Pigweeds	Smartweed	Sunflowers	Docks	Goldenrod	Horsenettle	Louisiana wormwood	Perennial asters	Sericea lespedeza	Silverleaf nightshade	Western ironweed	Western ragweed	Western yarrow	Annuals (Musk & Scotch)	Biennials (Bull, Musk, Scotch)	Perennials (Wavyleaf)	Summer Annual Grasses	Summer Perennial Grasses	Winter Annual Broadleaves	Winter Annual Grasses	Sedges
In-season Use																													
2,4-D Amine	7	**8**	7	**9**	7	**9**	5	**9**	5	**8**	7	**9**	4	7	3	7	6	3	-	5	**8**	**9**	**8**	**8**	6	0	0	**9**	0	0
2,4-D Ester	**8**	**9**	**8**	**9**	7	**9**	5	**9**	6	**8**	7	**9**	5	7	3	**8**	7	3	-	5	**9**	**9**	**8**	**8**	7	0	0	**9**	0	0
Amber CustomPak	7	**9**	7	**8**	6	7	7	**9**	7	7	7	**8**	5	3	-	7	-	4	-	1	**9**	4	5	5	4	0	0	**9**	0	0
Banvel	7	**9**	**8**	**9**	7	**8**	7	**9**	3	**8**	**9**	**9**	**8**	**8**	3	**8**	-	5	-	7	**8**	6	**8**	**8**	7	0	0	**9**	0	0
Cimarron	**9**	**9**	7	**9**	**9**	-	**9**	4	7	**9**	**9**	**9**	6	3	4	0	-	**9**	4	1	0	**9**	**9**	**9**	**9**	0	0	**9**	0	0
Cimarron Max	**9**	**9**	**9**	**9**	**9**	**-**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	**9**	**8**	**9**	7	5	**9**	**9**	**9**	**9**	**9**	0	0	**9**	0	0
Crossbow	**9**	**9**	**8**	**9**	**8**	**8**	7	**8**	-	**8**	**8**	**9**	7	**8**	3	**8**	-	6	-	7	**9**	5	**9**	**9**	**9**	0	0	**9**	0	0
Curtail	-	**9**	**8**	**9**	7	-	6	**8**	6	**8**	7	**9**	6	7	-	7	-	5	-	4	**9**	4	**8**	**8**	**8**	0	0	**8**	0	0
Curtail M	-	**8**	7	**9**	7	-	6	7	6	7	6	**9**	5	6	-	6	-	5	-	4	**8**	4	7	7	7	0	0	**8**	0	0
Grazon P+D	**9**	**9**	**9**	**9**	**9**	**9**	7	**9**	6	**9**	**9**	**9**	**8**	**9**	7	**9**	**8**	5	**9**	7	**9**	7	**9**	**9**	**9**	0	0	**9**	0	0
Pasturegard	-	**8**	-	-	-	-	-	**8**	-	-	-	-	-	7	-	7	-	**9**	-	7	7	-	7	7	7	0	0	**8**	0	0
Rave	**8**	**9**	**8**	**9**	7	**8**	**8**	**9**	7	**8**	**8**	**9**	**8**	**8**	3	**8**	-	5	-	7	**9**	6	-	-	-	0	0	**9**	0	0
Reclaim	-	**8**	7	**8**	7	-	6	7	6	7	-	**8**	**8**	6	-	5	-	5	-	7	6	4	-	-	-	0	0	**9**	0	0
Redeem R&P	-	**8**	7	**8**	7	-	6	7	6	-	-	**8**	-	**9**	-	6	-	5	-	6	7	5	-	-	-	0	0	**9**	0	0
Remedy	**9**	**8**	-	-	-	**9**	-	**8**	-	-	-	-	-	7	-	7	-	**9**	-	7	7	6	-	-	-	0	0	**8**	0	0
Surmount	-	**9**	**8**	**9**	**8**	-	6	**8**	7	**8**	**9**	**9**	**8**	7	7	**8**	**8**	5	7	8	**8**	6	**8**	**8**	**8**	0	0	**9**	0	0
Tordon 22K	-	**9**	**8**	**9**	**8**	-	6	**8**	7	**8**	**9**	**9**	**8**	7	-	**8**	-	5	-	**8**	-	5	**8**	**8**	**8**	0	0	**9**	0	0
Weedmaster	**9**	**9**	**8**	**9**	**9**	**9**	**8**	**9**	6	**9**	**9**	**9**	**8**	**9**	6	**9**	**8**	4	**9**	7	**9**	6	**9**	**9**	**9**	0	0	**9**	0	0
Dormant-Season Use																														
Gramoxone Extra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	-	-	**8**	**8**	2
Roundup Orig. Max	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**9**	**9**	-	-	**8**	**9**	7
RT Master	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**9**	**9**	-	-	**9**	**9**	7

[a] Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
2,4-D Amine 3.8 lb ai per gallon **POST applications:** 1 to 2 qt/A	**Active Ingredients:** 2,4-D **Similar Products:** Many Rates may vary due to formulation. **MOA:** 4	**POST.** Preferably apply when weeds are small and actively growing before the bud stage. Repeated applications may be needed for less susceptible weeds. Refer to label for application rates for specific target weeds.	**Do not** graze dairy animals for 7 days after application. **Do not** cut grass for hay for 30 days after treatment. **Remove** meat animals from treated areas 3 days prior to slaughter. **Do not** use on alfalfa, clover, other legumes, or newly seeded pastures. **Do not** apply if rainfall is expected within 1 hour.
2,4-D Ester 3.8 lb ai per gallon **POST applications:** 1 to 2 qt/A	**Active Ingredients:** 2,4-D **Similar Products:** Many Rates may vary due to formulation. **MOA:** 4	**POST.** Preferably apply when weeds are small and actively growing. Repeated applications may be needed for less susceptible weeds. Refer to label for application rates for specific target weeds.	**Do not** graze dairy animals for 7 days after application. **Do not** cut grass for hay for 30 days after treatment. **Remove** meat animals from treated areas 3 days prior to slaughter. **Do not** use on alfalfa, clover, other legumes, or newly seeded pastures. **Do not** apply if rainfall is expected within 1 hour. Use with caution as this formulation is volatile.
Amber CustomPak 75% WDG **POST applications:** 0.28 to 0.56 oz/A	**Active Ingredient:** Triasulfuron **Similar Products:** Amber Accu-Pak **MOA:** 2	**POST.** Apply to emerged and actively growing weeds. A nonionic surfactant should be included in the spray mixture. Apply the initial application at the standard rate of 0.28 oz/A, followed by a second application not more than 60 days later at up to 0.56 oz/A.	**Do not** cut for hay for 30 days following application. Grazing may occur immediately following application. **Do not** apply more than 0.84 oz/A per year.
Banvel 4 lb ai per gallon **All applications:** 0.5 pt/A to 2 qt/A	**Active Ingredient:** Dicamba **Similar Products:** Clarity, Overdrive, Sterling **MOA:** 4	**POST.** May be applied to small actively growing weeds as well as established weed growth. Refer to label for application rates for specific target weeds and growth stages. Use rates of 0.5 to 3 pt/A for annual and biennial weeds, and 0.5 to 2 qt/A for perennial weeds and woody brush and vines.	**Do not** exceed a total of 2 qt/A per season. **Do not** remove animals from treated areas for slaughter prior to 30 days after last application. **See table** for lactating animal grazing and haying restrictions. **There is no** waiting period between treatment and grazing for non-lactating animals.

Banvel timing Restrictions for Lactating Animals

Rate per Treated Acre	Days Before Grazing	Days before Hay Harvest
Up to 1 pt /A	7 days	37 days
Up to 1 qt /A	21 days	51 days
Up to 2 qt /A	40 days	70 days

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Cimarron 60% DF **POST applications:** 0.1 to 1.0 oz/A	**Active Ingredient:** Metsulfuron methyl **Similar Products:** Ally XP Metsulfuron Methyl 60 DF Purestand **MOA:** 2	**POST.** For best results, apply to young, actively growing weeds. The use rate depends upon the weed spectrum and size of weeds at application.	**Do not** apply more than 1.66 oz/A per year. **There are no** grazing or haying restrictions for this product. . **Refer** to label for precautions and restrictions of use in fescue and timothy grass. **For sericea lespedeza control, apply 0.4 - 0.5 oz/A Cimarron plus 0.5% v/v surfactant in the fall during full bloom stage.**
Cimarron Max **PART A** = 60% DF - metsulfuron methyl **PART B**=3.87 lb ai/gal - 2,4-D & dicamba **POST applications:** See table below	**Active Ingredients:** Metsulfuron methyl, Dicamba & 2,4-D **Similar Products:** None **MOA:** 2, 4 & 4	**POST.** Product is a two part herbicide that should always be mixed in a ratio of 5 oz. of Part A to 2.5 gallons of Part B.	**Do not** apply more than the equivalent of 1.66 oz /A of part A per year. **Refer** to label for precautions and restrictions of use in fescue and timothy grass. **For sericea lespedeza control, apply Cimarron Max at Rate II plus 0.5% v/v surfactant in the fall during full bloom stage.**

Rate Structure for Cimarron Max

Rate	Dry oz/A of Part A	Pints/A of Part B	# of Acres Treated with 5 oz Part A and 2.5 Gallons Part B
Rate 1	0.25 oz/A	1	20
Rate 2	0.5 oz/A	2	10
Rate 3	1 oz/A	4	5

Crossbow 3.0 lb ai per gal **POST applications:** 1 to 4 qt/A	**Active Ingredients:** 2,4-D Triclopyr **Similar Products:** None **MOA:** 4 & 4	**POST.** Apply when weeds are actively growing. Re-treatment of hard to control weeds may be necessary. Apply no more than 1 gallon/A per season.	**Do not** allow lactating dairy animals to graze treated areas until the next growing season following application. **Do not** harvest hay for 14 days after application. **Remove** livestock from treated grass at least 3 days before slaughter.
Curtail 2.38 lb ai per gallon **POST applications:** 2 to 4 qt/A	**Active Ingredients:** Clopyralid 2,4-D **Similar Products:** None **MOA:** 4 & 4	**POST.** Apply when weeds are actively growing. Apply 2 qt/A rate on light to moderate infestations under good growing conditions. Apply 3 qt/A rate on dense infestations or poor growing conditions such as drought. For control of Russian knapweed, apply 3-4 qt/A at the early bud to mid-flowering stage or on fall regrowth.	**Do not** use on newly seeded areas until grass is well established as indicated by vigorous growth and development of tillers and secondary roots. **Do not** graze lactating dairy animals in treated areas for 14 days after application. **Do not** cut treated grass for hay within 30 days after application. **Remove** meat animals from freshly treated areas 7 days before slaughter. Withdrawal is not needed if 2 weeks or more have elapsed since application. **Do not** transfer livestock from treated grazing areas to sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Curtail M 2.77 lb ai per gallon **POST applications:** 2 to 4 qt/A	**Active Ingredients:** Clopyralid MCPA **Similar Products:** None **MOA:** 4 & 4	**POST.** Apply when weeds are actively growing. Apply 2 qt/A rate on light to moderate infestations under good growing conditions. Apply 3 qt/A rate on dense infestations or poor growing conditions such as drought. For control of Russian knapweed, apply 3-4 qt/A at the early bud to mid-flowering stage or on fall regrowth.	**Do not** use on newly seeded areas until grass is well established as indicated by vigorous growth and development of tillers and secondary roots. **Do not** forage or graze dairy animals on treated areas for 7days after application. **Do not** cut treated grass for hay within 30 days after application. **Do not** forage or graze meat animals on treated areas within 7 days of slaughter. **Do not** transfer livestock from treated grazing areas to sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture.
Diuron 80 80% WDG **PRE applications:** 1 to 3 lb/A	**Active Ingredients:** Diuron **Similar Products:** None **MOA:** 7	**PRE.** Apply 1 to 3 lb/A after sprigging bermudagrass and before emergence of bermudagrass or weeds. For control of emerged annual weeds up to 4 in height, apply 0.5 to 1 lb/A. If bermudagrass has emerged at time of treatment, temporary burn of exposed plant parts may occur.	**Do not** graze or feed foliage from treated areas to livestock within 70 days after application. **Do not** treat areas where sprigs are planted less than 2" deep as crop injury may result.
Gramoxone Extra^{r} 2.5 lb ai per gallon **POST applications:** 1.25 to 1.5 pt/A	**Active Ingredients:** Paraquat **Similar Products:** Gramoxone Max Gramoxone Super Tres Cyclone Max **MOA:** 22	**POST.** Apply to native pastures for control of downy and Japanese brome. Apply in spring after 90% node formation of brome species, but before full bloom. Emerged grasses will be burned by application, but application after 90% node formation will allow adequate time for native grasses to recover and attain maximum growth in the use season. Addition of either an NIS or COC is required.	**Do not** apply more than 1.5 pt/A per year. **Do not** apply to pastures with more than 3 inches of height at time of application.
Grazon P+D^{r} 2.54 lbs ai per gallon **POST applications:** 1 to 4 pt/A	**Active Ingredients:** Picloram 2,4-D **Similar Products:** Galaxy **MOA:** 4 & 4	**POST** Use higher application rates in areas with dense weed populations or for longer residual control. For best results the lower rate should be used only when environmental conditions are favorable for plant growth and when the plants are in the growth stage recommended on the label. Repeat treatments may be applied if necessary as long as 4 qt/A per year is not exceeded.	**Do not** allow lactating dairy animals to graze treated areas within 7 days after application. **Do not** harvest grass cut for hay from treated areas for 30 days after application. **Meat animals** must be withdrawn from treated forage at least 3 days before slaughter. **Do not** exceed 4 qt/A per year. **Do not** transfer livestock from treated grazing areas to broadleaf crop areas without first allowing 7 days of grazing on untreated grass pasture.
Overdrive 0.7 lb ae per gallon **POST applications:** 4 to 8 fl oz/A	**Active Ingredients:** Diflufenzopyr Dicamba **Similar Products:** Banvel, Clarity, Sterling **MOA:** 4 & 4	**POST.** Apply to small actively growing weeds. Use higher rates within the rate range if treating larger weeds.	**Do not** apply in less than 3 gallons of spray volume per acre. **Do not** apply within 4 hours of an expected rainfall. **Do not** apply more than 10 fl oz/A per year. **Do not** apply aerially. Near desirable vegetation. **Do not** apply near crops sensitive to growth regulator type herbicides.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Pasturegard 2 lb ae per gallon **POST applications:** 1.5 to 4 pt/A	**Active Ingredients:** Triclopyr Fluroxypyr **Similar Products:** None **MOA:** 4 & 4	**POST.** Apply to small actively growing weeds. **For sericea lespedeza control, apply 1.5 to 2 pts/A, with surfactant, from late May through July when soil moisture is adequate.** New sericea growth should not be grazed and should be taller than the standing old growth from previous year.	**Do not** apply more than 4 quarts per acre per growing season. **Do not** exceed 0.5 lb ae/A fluroxypyr or 2.0 lb ae/A triclopyr per season. **Do not** reseed treated areas for at least 3 weeks after application. **Do not** harvest treated area for hay for at least 14 days after application. **Do not** feed treated hay or allow livestock to graze treated grass within 3 days of slaughter, if treatment and slaughter occur in the same year.
Rave 63.8% WDG **POST applications:** 2 to 4 oz/A	**Active Ingredients:** Triasulfuron Dicamba **Similar Products:** None **MOA:** 2 & 4	**POST.** Refer to label for treatable grasses and specific application rates. For new seedlings of these grasses, do not apply until at least 60 days after emergence of the desirable grasses or 30 days after sprigging of bermudagrass. In addition to the 2 to 4 oz/A rate, applications of 5oz/A may be made to when heavy infestations of the weeds listed in the label exist.	**Do not** cut for hay for 37 days after application. **Do not** apply within 4 hours of an expected rainfall. **Do not** make more than one application per year. **Do not** apply near vegetation that is sensitive to growth regulator type herbicides.
Reclaim 3 lb ai per gal **POST applications:** 1.33 pt/A	**Active Ingredient:** Clopyralid **Similar Products:** Stinger Transline Rates may vary due to formulation. **MOA:** 4 & 4	**POST.** The herbicidal response of mesquite is strongly influenced by foliage condition, stage of growth and environmental conditions. For best results, apply when new growth foliage has turned from light to dark green, when soil temperature is above 75°F at a depth of 12 to 18 inches, and soil moisture is adequate for plant growth.	**Do not** apply more than 1.33 pt/A per annual growing season. **Hay harvest** is not considered to be feasible for at least one year following application because of standing woody plants.
Redeem R&P 3 lb ai per gal **POST applications:** 1.5 to 4 pt/A	**Active Ingredient:** Triclopyr Clopyralid **Similar Products:** None **MOA:** 4 & 4	**POST.** Apply at a rate of 1.5 to 2 pt/A for control of annuals and up to 4 pt/A for control of deep rooted perennial broadleaf weeds. Refer to the label for suggested application rates for specific target weeds.	**Do not** harvest hay for lactating dairy animals until the next growing season. **Do not** harvest hay for other livestock for 7 days after treatment. **Do not** graze or harvest green forage for lactating dairy animals for 14 days after treatment. There are no grazing restrictions for other livestock. **Do not** transfer from treated areas to sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture or feeding of untreated hay. **Do not** apply more than 4 pt/A per year.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Remedy 4 lb ai per gal **POST applications:** 1.33 pt/A	**Active Ingredient:** Triclopyr **Similar Products:** Forestry Garlon 4 Garlon 3A Garlon 4 Pathfinder II Remedy RTU Tahoe 3A Rates may vary due to formulation. **MOA:** 4	**POST.** Apply anytime the target weeds or brush is actively growing. Refer to label for application rates for specific target weeds and brush.	**Grazing and Haying Restrictions (Lactating Dairy Animals): Application of 2 qt/A or less: Do not** graze or harvest green forage from treated area for 14 days after treatment. **Greater than 2 qt/A: Do not** graze or harvest green forage until the next growing season. **Do not** harvest hay until the next growing season. **Grazing and Haying Restrictions (Other Livestock): Application of 2 qt/A or less: No** grazing restrictions. **Do not** harvest hay for 7 days after treatment. **Greater than 2 qt/A to 4 qt/A: Do not** graze or harvest green forage from treated area for 14 days following treatment. **Do not** harvest hay for 14 days after treatment. **Greater than 4 qt/A: Do not** harvest hay until the next growing season. **Withdraw** livestock from grazing treated areas or consumption of treated hay at least 3 days before slaughter.
Roundup Original Max 5.5 lb ai per gal **All applications:** 8 to 11 fl oz/A	**Active Ingredient:** Glyphosate **Similar Products:** Many Rates may vary due to formulation. **MOA:** 9	**PRE (pasture).** May be applied prior to planting or emergence of forage grasses. **Spot Treatment (pasture).** Apply in areas where the movement of domestic livestock can be controlled. **POST (rangeland).** Apply 8 to 11 fl oz/A to control or suppress many weeds. Apply when most mature brome plants are in early flower and before green-up of desired rangeland grasses	**PRE (pasture). Remove** domestic livestock before application and wait 8 weeks after application before grazing or harvesting. **Spot Treatment (pasture). Do not** treat more than 10% of the total pasture area at one time. **Remove** domestic livestock before application and wait 14 days after application before grazing livestock or harvesting. **POST (rangeland). Do not** make more than one application per year. **Grazing** of treated areas should be delayed to encourage growth of desirable perennials.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
RT Master 3 lb ai per gal **All applications:** 12 to 48 fl oz/A	**Active Ingredient:** Glyphosate 2,4-D **Similar Products:** None **MOA:** 9 & 4	**PRE (pastures).** May be used to control perennial pasture species listed on the label prior to replanting. **Spot treatment (pastures).** Apply in areas where the movement of domestic animals can be controlled. Remove domestic livestock before application and wait 14 days after application before grazing livestock or harvesting. No more than 0.1 of any acre should be treated at one time. **POST (rangelands).** Apply 12 to 16 fl oz/A to control or suppress many weeds. Apply when most mature brome plants are in the early flower and before the plants including seedheads turn color.	**Do not** use in any counties other than: Alfalfa, Beaver, Blaine, Canadian, Cimarron, Custer, Dewey, Ellis, Garfield, Grant, Harper, Kay, Kingfisher, Logan, Major, Noble, Pawnee, Payne, Roger Mills, Texas, Woods, and Woodward. **PRE (pastures).** Remove domestic livestock before application and wait 8 weeks after application before grazing or harvesting. **POST (rangelands). Do not** graze lactating dairy animals on treated areas within 7 days after application. **Do not** harvest grass cut for hay from treated areas for 30 days. **Withdraw** meat animals from treated forage at least 3 days before slaughter.
Spike 20P 0.2 lb ai per gal **POST applications:** Less than 20 inches of annual rainfall: 10 lb/A More than 20 inches annual rainfall: 20 lb/A	**Active Ingredient:** Tebuthiuron **Similar Products:** None **MOA:** 7	**POST.** May be applied anytime except when the soil is frozen or is saturated with moisture. Applications should be made prior to the resumption of active seasonal growth in the spring or before expected seasonal rainfall. Dormant season application is recommended to minimize herbicidal effects on desirable forage grasses. Refer to label for application rates for specific target weeds.	**Do not** apply where bedrock is continuously exposed or in areas of bedrock overlain by soils that are shallow or discontinuous. **Do not** apply in areas adjacent to sinkholes or depressions lacking external drainage which occur in areas of karst topography. **Do not** apply to high shrink/swell soils which develop deep cracks upon drying. **Do not** cut hay for livestock feed for one year after a treatment. **Do not** apply more than once per year. **There are no** label restrictions which require livestock grazing to be delayed following an application.
Surmount 1.34 lb ae per gal **POST applications:** Up to 0.75 to 3 qt/A	**Active Ingredient:** Picloram Fluroxypyr **Similar Products:** None **MOA:** 4 & 4	**POST.** For best results treat when weeds are small and actively growing in the spring before bloom, however, certain weeds may also be treated in late summer to fall. Refer to label for application rates for specific target weeds.	**Do not** apply more than 3 qt/a per year. **Do not** apply to newly sprigged bermudagrass until runners (stolons) have reached at least 6 inches in length. **Do not** harvest hay within 7 days after application. **Meat animals** grazing for up to 2 weeks after treatment should be removed from treated areas three days prior to slaughter. **Do not** graze lactating dairy animals on treated areas within two weeks after treatment. **Do not** exceed a total of 2 qt /A per year. **Do not** transfer livestock from treated areas onto broadleaf crops without first allowing 7 days of grazing untreated grass pasture.

This section was not revised in 2007.

PASTURE AND RANGE WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Tordon 22K[r] 2 lb ai per gal **POST applications:** Up to 2 qt/A	**Active Ingredient:** Picloram **Similar Products:** None **MOA:** 4	**POST.** For best results treat when weeds are small and actively growing in the spring before bloom, however, certain weeds may also be treated in late summer to fall. Refer to label for application rates for specific target weeds. May be applied at up to 2 qt /A for control of noxious weeds.	**Do not** cut grass for feed within two weeks after treatment when applying more than 1 qt /A. **Meat animals** grazing for up to 2 weeks after treatment should be removed from treated areas three days prior to slaughter. **Do not** graze lactating dairy animals on treated areas within two weeks after treatment. **Do not** exceed a total of 2 qt /A per year.
Velpar DF 75% DF **PRE applications:** 0.9 – 1.5 lb/A	**Active Ingredient:** Hexazinone **Similar Products:** None **MOA:** 5	**POST.** Make a single application when weeds are actively growing for control of smutgrass and other weeds in bermudagrass/bahiagrass. For control of undesirable woody plants, apply from late winter through summer, pre-budbreak until new growth hardens off.	**Do not** treat newly sprigged or sodden areas. **Do not** cut treated vegetation for hay or forage nor graze domestic animals on treated areas for 60 days. **Do not** use on frozen soils.
Weedmaster 3.87 lb ai per gal **POST applications:** 4 pt/A	**Active Ingredient:** Dicamba 2,4-D **Similar Products:** Brash KambaMaster Veteran 720 Rates may vary due to formulation. **MOA:** 4	**POST.** Best results will be obtained if applied at the germinating stage of weeds. Retreatments may be made as needed, however, do not exceed a total of 8 pt/A per season. Newly seeded areas may be injured if rates greater than 2 pt/A are applied.	**Do not** apply more than 8 pt/A per season. **Do not** permit meat animals being finished for slaughter to graze treated fields within 30 days of slaughter. **Do not** graze lactating dairy animals within 7 days of treatment. **Do not** harvest dry hay or silage within 37 days of treatment. **There is no** waiting period between treatment and grazing of non-lactating animals. **Do not** use on bentgrass, susceptible grass pastures, lesedeza, wild winter peas, vetch, clover, and alfalfa pastures as injury will occur.

[r] Restricted Use.

MOA Group Tables start on page 46 of the handbook.

This section has not been revised since 2006.

BRUSH CONTROL

Estimated Levels of Weed Control Normally Expected with Brush Herbicides[a]

Herbicide	Black berry	Buckbrush	Black Locust	Cedar	Elms	Greenbriar	Hawthorn	Honey locust	Honey suckle	Mesquite	Multiflora rose	Oak, Blackjack	Oak, Post	Oak, Sand Shinery	Osage Orange	Pecan	Persimmon	Pine	Poison Ivy	Prickly pear	Sagebrush	Salt Cedar	Sumac	Wild plum	Willows	Yucca
2,4-D	N	**H**	**H**	N	N	N	**H**	N	N	--	N	R	--	--	N	--	N	N	N	--	--	--	**H**	--	--	--
Banvel	R	N	N	N	N	N	N	N	N	--	R	N	--	--	N	--	R4	N	N	--	--	--	N	--	--	--
Cimarron	H	R	**H**	N	R	N	R	**H**	R	3	R	N	--	--	R	--	N	N	N	--	3	--	H	H	R	--
Cimarron Max	H	R	**H**	N	R	N	R	**H**	R	R	R	N	--	--	R	3	N	N	3	--	R	3	H	H	R	3
Crossbow	R	R	R	N	R	N	R	R	R	--	N	R	--	--	N	--	N	N	R	--	--	--	R	--	--	--
glyphosate	**H**	N	R	N	R	N	R	R	**H**	--	**H**	R	--	--	N	--	N	N	**H**	--	--	--	N	--	--	--
Grazon P+D[r]	R	R	R	N	R	R	R	**H**	R	--	R	R	--	--	N	--	R	N	N	--	--	--	R	--	--	--
Remedy	**H**	R	R	N	R	R	R	R	R	--	N	R	--	--	**H**	--	N	R	R	--	--	--	R	--	--	--
Spike	R	R	R	R1	**H**	N	R	R	**H**	--	**H**	R	--	--	N	--	N	**H**	R	--	--	--	N	--	--	--
Surmount	R	--	R	R1	R	N	R	R	R	N	R	N	N	N	R	N	R	**N**	N	--	R	--	R	R	N	N
Tordon 22K[r]	R	N	N	R	N	N	N	**H**	N	--	R	N	--	--	N	--	R4	R	N	--	--	--	N	--	--	--
Velpar	R	R	R	H	R	N	R	**H**	**H**	R	**H**	R	R	--	R	R	R	N	R	--	--	--	R	R	R	R
Weedmaster	R	R	N	N	R	N	R	R	R	--	N	R	--	--	N	--	N	N	R	--	--	--	R	--	--	--

a. **H** = Highly recommended, has been shown to be effective if used properly. [r] Restricted Use.

H = Highly recommended, has been shown to be effective if used properly.

R = Recommended, intermediately susceptible or listed on company label.

N = Not recommended, has not performed in research or is not listed on the label.

1 = Small red cedar

2 = September application

3 = Suppression only

4 = Soil application

This section has not been revised since 2006.

SUGGESTED HERBICIDES FOR BRUSH CONTROL

WEEDS	TIME OF APPLICATION	AMOUNT OF HERBICIDE PER ACRE	COMMENTS
Yucca	April-May	Velpar L (hexazinone)	Resistant to most herbicides used on rangelands. Some control with Velpar applied to individual plants. Spot apply 2 cc/plant on up-hill side.
Brush Blackberry	Flowering through September	Roundup or Touchdown (glyphosate) (1 to 1.5%) solution with hand-held equipment	Plants must be actively growing and thorough coverage is necessary. Treat spots (less 10% of area) and there is a 14 day grazing restriction. Grass in treated spot is also killed. Various formulations of glyphosate require different additives, so read label.
	July after next year's canes have developed	Remedy (triclopyr) (1 to 2 pt product/A)	One application will control 85 to 90% of plants. Important that plants are actively growing and fruiting canes fully developed before spraying. Respraying is often necessary to get satisfactory kill of established plants. Control of blackberry after burning has been variable with control often being unsatisfactory.
Buckbrush	May	2,4-D LV ester (1.5 to 2 lb/A)	Treat as soon as leaves fully expanded and plants actively growing. Treatment only effective for a two week period and treatments made after May are often ineffective.
	Spring (soil application)	Spike (20P) (tebuthiuron) (10 to 20 lb product)	Rate depends on soil type. Refer to label for correct rate.
Cedars	March to May	Tordon 22K[r] (picloram) Velpar L (hexazinone)	Tordon 22K is the current formulation being marketed for rangeland use. Effective as individual tree treatment by applying at base of tree. See label for rate and use restriction. Can be effective as spot treatment of individual trees. Herbicide is applied at base of tree and rate depends on tree size. See label for rate and use.
Elms	Fall to Spring (soil application) March to May	Spike (20P) tebuthiuron) (10 to 20 lb product) Tordon 22K[r] (picloram) (2 qt product/A)	Rate depends on soil texture. Not effective on fine textured clay soils. For individual trees, use 1 cc of undiluted Tordon 22K per inch of stem diameter.
Greenbriar	May and June	Tordon 22K[r] (picloram) + Remedy (triclopyr)	Mixture as foliage wetting spray gives some control. Respraying will be necessary. Burning, mowing, and grazing will help control.
Hawthorn	May and June	2,4-D LV ester (2 lb/A)	Retreatment is usually necessary to obtain tree kill.
Locust, Black	June and July	2,4-D (1 lb/A)	Some respraying may be necessary to control resprouts.
Locust, Honey	June and July	Remedy (triclopyr) (1 qt/A)	Best results with spraying individual trees. Mix 2 qts Remedy with 100 gallons water and spray to wet leaves. Some respraying may be necessary to control resprouts.
Mesquite	June	Remedy (triclopyr) (1 pt product/A) or Reclaim (1.33 pt/A)	For best results, spray during the period 40 to 90 days after green growth appears in spring and when soil moisture is adequate and soil temperature at 12 inches is 75°F. One good way to get good tree kill is to individually treat the base of each tree with 20% Remedy and 80% diesel fuel mix applied as low volume basal application. Applications can be made from May through October and will cost about 15¢/1-inch diameter tree.

[r] Restricted Use Pesticide

This section has not been revised since 2006.

SUGGESTED HERBICIDES FOR BRUSH CONTROL (CONT'D)

WEEDS	TIME OF APPLICATION	AMOUNT OF HERBICIDE PER ACRE	COMMENTS
Oak, Blackjack and Post	June	Remedy (triclopyr)	Spray only if conditions are desirable for good tree growth. Refer to label for rate and other information.
	Early Spring (soil application)	Spike (20P) (tebuthiuron) (10 to 20 lb product/A)	Rate depends on soil texture. Do not use on fine textured clay soils. See label for detailed instructions.
Oak, Sand Shinnery	June	Remedy (triclopyr) (0.5 to 1 pt product/A)	Spray in years of good soil moisture. A bad basal resprouter so retreatment will be necessary. This rate will give fair to good top control of oaks, but little root-kill. Increasing rate helps some on top kill, but doesn't really help root-kill that much.
Oak, Sand Shinnery (cont'd)	Early Spring	Spike (20P) (tebuthiuron) (5 to 15 lb product/A)	The results with Spike on sand shinnery oak have not been as predictable as with the other oaks. It is very difficult to get good root-kill of shinnery without getting grass damage. Sometimes there is adequate root-kill at the low rate while on other sites it takes the high rate. Some of this variation is probably due to variations in amount and depth of sand deposited. However, part of the variation may also be due to past management practices. It is very difficult to get adequate root-kill on areas that have been burned, sprayed, or mowed recently.
Osageorange	June-July	Remedy (triclopyr) (1 to 2 pt product/A)	Easy to control if adequate soil moisture.
Pecan	June	2,4-D (2 to 4 lb/A)	Retreatment will be necessary.
Persimmon, Common	June-Feb.	Banvel (injected) (1 cc product/injection)	Injection cuts made every 3 inches around the base of the tree. Cuts must penetrate the bark. This treatment is very effective on undisturbed larger trees. For sprouts, 1 inch and smaller, one cc of Banvel applied in early spring or September at the base of each sprout has given good control.
		Banvel (conventional basal spray) (4 to 8 lb/100 gal of water)	Apply to ground under tree as basal treatment using 1/8 to 1/4 pint of spray mix per inch of stem diameter.
	May-June	Tordon 22K[r] (picloram) (basal spray) 2 cc/inch diameter	On stems 2 inches or less in diameter, apply 2 cc per inch of stem diameter. Apply undiluted herbicide at base of plants. Applications can also be made in September if moisture conditions are adequate. Applications made directly on the stem at ground level have been very effective on sprouts. On larger trees, stems must be injected with 2 cc of product every 3 inches around the base of the tree.
	June-July	Remedy (triclopyr) 1 pt/A broadcast or 1 pt/100 gal and spray to wet leaves to point of run-off	Expect good brown-out and top kill pf persimmons with resprouting from roots 1 and 2 years after treatment with only 50% reduction in stem density 2 years after treatment. Will require retreatment every 4 to 5 years. Probably a better option than mowing since some stem reduction results.
Plum, Wild	June	2,4-D (1 to 2 lb/A)	Retreatment will be necessary.
Poison Ivy	When foliage full leaf	Roundup or Touchdown (glyphosate) 2% solution with hand-held equipment	Thoroughly wet all foliage. Repeated applications may be required to maintain control. There is a 14 day grazing restriction after spot treating.

[r] Restricted Use Pesticide

This section has not been revised since 2006.

SUGGESTED HERBICIDES FOR BRUSH CONTROL (CONT'D)

WEEDS	TIME OF APPLICATION	AMOUNT OF HERBICIDE PER ACRE	COMMENTS
Brush (cont'd) Rose, Multiflora	Early spring (soil application)	Tordon 22K[r] (picloram)	Tordon 22K is very effective. See label for rate and use restrictions.
	Early Spring (soil application)	Spike (20P) (tebuthiuron) (10 to 20 lb product)	Rate depends on soil texture.
Sagebrush	May and June	2,4-D (0.5 to 1 lb/A)	Spray only in year of adequate rainfall.
Salt cedar	When leaves fully developed	2,4-D (0.25 to 0.5 lb/A)	For suppression but very little tree kill with this treatment. Repeat applications every time trees releaf. May require several treatments each year.
Sumac	June	2,4-D LV ester (1 lb/A)	Usually easy to control.
		Grazon P+D[r] (1 qt/A)	
	Spring (soil application)	Spike (20P) (tebuthiuron) (10 to 20 lb product)	Rate depends on soil texture.
Willows	Summer	2,4-D (1 lb/A)	Usually easy to control.

[r] Restricted Use Pesticide

Footnote: All uses of atrazine on pastures and rangelands have been discontinued.

For additional information the following may be helpful:

Pest Plants of Oklahoma Grazing Lands at http://www.pestplants.okstate.edu
Weed Control in Pastures Fact Sheet 2771
Ecology and Management of Sericea Lespedeza Fact Sheet 2874
Thistles in Oklahoma and Their Identification Fact Sheet 2776
Integrated Control of Musk Thistles in Oklahoma Fact Sheet 7318

Response of Selected Woody Plants in the United States to Herbicides
ARS Agriculture Handbook No. 493

This section has not been revised since 2006.

SUGGESTED HERBICIDES FOR BRUSH CONTROL (CONT'D)

	Rates	Lactating Dairy Animals	Beef and Non-Lactating Dairy Animals				
Herbicides	**Product**	**Ib/ai**	**Before Grazing**	**Before Hay Harvest**	**Before Grazing**	**Before Hay Harvest**	**Removal Before Slaughter**
CIMARRON (Metsulfuron, Methyl)	0.10 to 0.40 oz	0.06 to 0.24 oz	0	0	0	0	0
AMBER	0.28-0.56 oz		0	30 days	0	30 days	0
BANVEL 4L (Dicamba)	Up to 1 pt Up to 2 pt Up to 4 pt	0.5 1.0 2.0	7 days 21 days 40 days	37 days 51 days 70 days	0 0 0	0 0 0	30 days 30 days 30 days
CROSSBOW 3S (Triclopyr + 2,4-D)	1 to 6 qts	0.75 to 4.50	14 days	N.G.S.	0[5]	7 days[5]	3 days
CURTAIL (2,4-D + Clopyralid)	2 to 4 qts	1.19 to 2.38	14 days	30 days	0	30 days	7 days[11]
CYCLONE MAX[r] (paraquat)	0.7 to 1.3 pts	0.25 to 0.47	1 month[2]	1 month[2]	1 month[2]	1 month[2]	0
GRAZON P+D[r]	1 to 8 pts	0.32 to 2.54	7 days	30 days	0	30 days	3 days
REMEDY (Triclopyr)	2 qts or less 2 to 4 qts over 4 qts	.0 or less 2.0+ -4.0 4.0+ -6.0	14 days N.G.S. N.G.S.	N.G.S. N.G.S. N.G.S.	0 14 days[10] 14 days[10]	7 days 14 days N.G.S.	3 days 3 days 3 days
ROUNDUP/RASCAL/ RULER/ TOUCHDOWN (Glyphosate) Spot or Wiper[1] Broadcast	 Any labeled rate Any labeled rate	 -- --	 14 days 8 weeks	 14 days 8 weeks	 14 days 8 weeks	 14 days 8 weeks	 0 0
SPIKE 20 P (Tebuthiuron)	0.5 oz/14 sq ft 3.75-20 lbs/A	-- 0.75 to 4.0	0[7] 0[7]	1 year[7] 1 year[7]	0[7] 0[7]	1 year[7] 1 year[7]	0[7] 0[7]
STINGER 3E (Clopyralid)	0.66 to 1.33 pt	0.25 to 0.5	0	0	0	0	0[9]
TORDON 22K[r] (Picloram[3])	0.5 to 2 pts	0.125 to 0.5	14 days	14 days	0	0	0
2,4-D/MCPA[4]	--	0.5 to 2.0	7-14 days	30 days	0-7 days	0-30 days	3 days
WEEDMASTER/ CIMARRON MAX (Dicamba + 2,4-D)	1 to 4 pts	0.48 to 1.93	7 days	37 days	0	37 days	30 days
WILFARM 2,4-D	--	1.0 to 2.0	7 days	30 days	0	30 days	3 days

N.G.S. = Not until the next growing season.

[1]Do not treat more than one-tenth of any given acre at one time with spot or wiper applications. Remove livestock before application.

[2]Restrictions based on the degree of new seedling establishment before grazing. Suggested at least 6 inches of grass or legume seedling growth which is approximately one month. Late fall seeding may require 3 to 5 months before the suggested 6-inch height is reached.

[3]Remove livestock to untreated grass pasture for 7 days before transferring livestock to broadleaf crop or pasture areas. Removal before slaughter statement only applies to animals grazing treated forage for a period of up to 2 weeks after application. Use only west of the Mississippi.

[4]Be sure to check individual product labels for restrictions and use rates due to the large number of formulations available.

[5]14 days if more than 2 gal/A rate used.

[7]If no more than 20 lbs per acre used, in areas receiving greater than 20" rain/year--areas less than 20" rain/year if no more than 10 lbs per acre used.

[9]Remove livestock to untreated grass pasture for 7 days before transferring livestock to broadleaf crop or pasture areas.

[10]If less than 25% of a grazed area is treated; no restrictions.

[11]Withdrawal not needed if 2 weeks or more elapsed since application.

[r] Restricted Use Pesticide

PEANUT INSECT CONTROL SUGGESTIONS

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Beet armyworm	Striped-green caterpillar, that has a black spot above the second pair of true legs.	Warrior® (3)	3.84 oz	14 day waiting period to harvest.
Summer Note: Treatment thresholds[1]		Lannate LV® (1A)	1.25-3.0 pt	Do not feed treated vines and do not apply within 21 days of harvest.
		Lannate SP® (1A)	.375-1.0 lb	
		Asana XL® (3)	5.8-9.6 oz	Do not feed or graze livestock on treated vines. Do not exceed 29 oz per season. 21 day waiting period to harvest.
		Tracer (5)	2.0-3.0 oz	Do not allow grazing of crop residue or harvest of crop residue for hay until 14 days after application. Do not apply within 3 days of nut harvest. Do not apply more than 9.0 fl oz per acre per crop, or make more than 3 applications per calendar year.
		Proaxis® (3)	3.84 oz	Do not apply within 14 days of harvest. Do not apply more than 0.96 pts per acre per season.
		Prolex® (3)	1.54 oz	Do not apply within 14 days of harvest. Do not apply more than 0.38 pts per acre per season.
		Javelin (11B2)	0.25-1.5 lb	No waiting period to harvest. A *Bacillus thuringiensis* (B.t.) product.
Blister beetles July-August	3-striped most common in peanuts.	Sevin XLR+ (1A)	0.5-1.0 qt	14 day waiting period to harvest
Cabbage looper	Looper - large green caterpillar with white stripes – tapers toward head			Large loopers can be difficult to control.
		Lannate LV® (1A)	1.5-3.0 pt	See restrictions under beet armyworm comments.
Summer See comments[1]		Lannate SP® (1A)	0.50-1.0 lb	See restrictions under beet armyworm comments.
		Javelin (11B2)	0.25-1.5 lb	See restrictions under beet armyworm comments.
		Tracer (5)	1.5-3.0 oz	See restrictions under beet armyworm comments.
		Orthene75S (1B)	1.0-1.3 lbs	14 days to digging.
Corn earworm	Caterpillars chew holes in foliage and feed on terminal buds	Sevin XLR+ (1A)	1.0-1.5 qt	14 day waiting period to harvest.
		Lannate LV® (1A)	0.75-3.0 pt	See restrictions under beet armyworm comments.
Summer See comments[1]		Lannate SP® (1A)	0.25-1.0 lb	
		Orthene 75S (1B)	1.0-1.3 lbs	14 days to digging.
		Warrior® (3)	2.56-3.84 oz	14 day waiting period to harvest.
		Tracer (5)	1.5-3.0 oz	See restrictions under beet armyworm comments.
		Danitol® (3)	10.6-16.0 oz	14 days to digging.
		Asana XL® (3)	2.9-5.8 oz	See restrictions under beet armyworm comments.
		Javelin (11B2)	0.25-1.5 lb	See restrictions under beet armyworm comments.
		Proaxis® (3)	2.56-3.84 oz	See restrictions under beet armyworm comments.
		Prolex® (3)	1.02-1.54 oz	See restrictions under beet armyworm comments.
Granulate Cutworm[1]	Larvae found at soil surface beneath peanut foliage. Mottled gray and tan with many dark granules over surface of the body.	Asana XL® (3)	5.8-9.6 oz	See restrictions under beet armyworm comments.
		Sevin XLR+ (1A)	2.0 qt	14 day waiting period to harvest.
		Lannate LV® (1A)	1.5-3.0 pt	See restrictions under beet armyworm comments.
		Lannate SP® (1A)	0.50-1.0 lb	See restrictions under beet armyworm comments.
		Javelin (11B2)	0.25-1.5 lb	
		Proaxis® (3)	1.92-3.20 oz	See restrictions under beet armyworm comments.
		Prolex® (3)	0.77-1.28 oz	See restrictions under beet armyworm comments.
		Warrior® (3)	1.92-3.20 oz	14 day waiting period to harvest.

PEANUT INSECT CONTROL SUGGESTIONS (CONT'D)

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Fall armyworm	Large striped caterpillar with inverted "y" on front of head.	Sevin XLR+ (1A)	1.0-1.5 qt	14 day waiting period to harvest.
		Danitol[r] (3)	10.6-16.0 oz	14 day waiting period to harvest.
Summer[1]		Lannate LV[r] (1A)	0.75-1.5 pt	See restrictions under beet armyworm comments.
		Lannate SP[r] (1A)	0.25-0.50 lb	See restrictions under beet armyworm comments.
		Tracer (5)	2.0-3.0 oz	See restrictions under beet armyworm comments.
		Javelin (11B2)	0.25-1.5 lb	
		Asana XL[r] (3)	9.6 oz	See restrictions under beet armyworm comments.
		Orthene 75S (1B)	1.0-1.3 lb	14 days to digging.
		Proaxis[r] (3)	2.56-3.84 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	1.28-2.05 oz	See restrictions under beet armyworm comments.
		Warrior[r] (3)	2.56-3.84 oz	See restrictions under beet armyworm comments.
Grasshoppers Summer	Consume foliage	Warrior[r] (3)	2.56-3.84 oz	14 day waiting period to harvest.
		Orthene 75S (1B)	0.33-0.66 lbs	14 day waiting period to harvest.
		Asana XL[r] (3)	5.8-9.6 oz	See restrictions under beet armyworm comments.
Potato Leafhopper Summer	Small hopping or flying wedge-shaped insects– sap feeders, cause yellowing of foliage and brown leaf tips (called "Hopperburn").	Warrior[r] (3)	1.92-3.20 oz	14 day waiting period to harvest.
		Sevin XLR+ (1A)	1.0 qt	14 day waiting period to harvest.
		Orthene 75S (1B)	1.0-1.3 lb	See additional restrictions on previous page.
		Asana XL[r] (3)	2.9-5.8 oz	Note. Threshold information from Georgia states treatments should be considered when you find 25-30% hopperburn and leafhoppers present
		Danitol[r] (3)	6.0-10.6 oz	14 day waiting period to harvest.
		Lannate LV[r] (1A)	0.75-3.0 pts	See restrictions under beet armyworm comments.
		Lannate SP[r] (1A)	0.25-1.0 lb	See restrictions under beet armyworm comments.
		Proaxis[r] (3)	1.92-3.20 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	0.77-1.28 oz	See restrictions under beet armyworm comments.
Lesser cornstalk borer (LCB)	Bluish-green worm; up to 0.66 in long - very active when touched.	Lorsban 15G (1B)	6.8-13.9 lb	Lorsban granular application at pegging using the higher rate in a narrow band over the row and an in-row foliage opener can provide excellent control of LCB's and good suppression of Southern blight, with rainfall or irrigation following application. Two full rate (2.0 lb) applications per season may be applied. Also, provides suppression of Southern blight. Do not harvest within 21 days after treatment and do not feed treated peanut forage or hay to meat or dairy animals
Mid-June through September. Economic infestation more common from late July on	Tunnels nuts and stems, cuts pegs near soil surface.	Warrior[r] (3)	3.84 oz	
	Begin applicaton when infestation level reaches 8-10% in dryland peanuts and 15% in irrigated peanuts.	Orthene 97 (1B)	4.0-8.0 oz	Do not feed treated forage or hay to lievestock or allow grazing in treated areas.
		Asana XL[r] (3) (aids in control)	9.6 oz	See restrictions under beet armyworm comments.
		Javelin (11B2)	0.25-1.5 lb	
		Proaxis[r] (3)	3.84 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	1.54 oz	See restrictions under beet armyworm comments.

PEANUT INSECT CONTROL SUGGESTIONS (CONT'D)

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Rednecked peanutworm	Small, greenish-white worm with crimson necks. Scar and perforate terminals (buds) destroying or deforming the young leaves and stunting growth.	Sevin XLR+ (1A)	1.0 qt	Research indicates that peanuts can tolerate considerable feeding by peanutworms without reducing yield. Unless populations become quite heavy (80-100% terminals infested) or infestations occur in combination with other foliage feeders, such as corn earworms, insecticide applications are unwarranted
May to September with heaviest infestations occurring from mid-summer through September.		Asana XL[r] (3)	2.9-5.8 oz	
		Tracer (5)	1.5-3.0 oz	See restrictions under beet armyworm comments.
		Proaxis[r] (3)	1.92-3.20 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	0.77-1.28 oz	See restrictions under beet armyworm comments.
		Warrior[r] (3)	1.92-3.20 oz	14 day waiting period to harvest.
Spider mites Summer; during hot dry weather, most common after first of August.	Very small (1/50 inch) damage indicated by reddish brown discoloration of leaves. Mites can be wind or machinery transported to fields. Frequently develop in early summer in weeds, fence/turn rows, and move to peanuts when dry weather hits	Omite (14)	3.0-5.0 lb	Do not apply within 14 days of harvest. No more than two applications per season. Two or more treatments 5 days apart may be necessary to get control.
		Warrior[r] (3)	3.84 oz	14 day waiting period to harvest.
		Comite (14)	2.0 pt	Apply 20 gal. of finished spray per acre by ground and 5 gal. per acre by air. Do not apply within 14 days of harvest and do not graze or feed livestock on treated area.
Note: See footnote 2 for additional products.		Danitol[r] (3)	10.6-16.0 oz	Do not apply within 14 days of harvest or grazing.
		Proaxis[r] (3)	3.84 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	1.54 oz	See restrictions under beet armyworm comments.
Southern corn rootworm	This rootworm is the larva of the spotted cucumber beetles. The larva is yellowish-white with a brown head and somewhat wrinkled body. The larva may reach 0.5 inch in length	Lorsban15G (1B)	6.8-13.9 lb	Apply in a narrow band over the row during early pegging. (See comments under LCB section.) Rainfall or irrigation is needed following application. Rate based on 36" row spacing.
	Tend to occur most commonly on heavier soils. Damage to shell may appear as a small brown spot on nut. If spots are noted, open nuts and check for larvae	Thimet[r] 20G (1B)	3.87-5.28 lb	Apply as a band over the fruiting zone at pegging. Do not graze or feed hay for forage. Rate based on 36" row spacing.
		Warrior[r] (3)	2.56-3.84 oz	14 day waiting period before harvest.
		Proaxis[r] (3)	2.56-3.84 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	1.02-1.54 oz	See restrictions under beet armyworm comments.

PEANUT INSECT CONTROL SUGGESTIONS (CONT'D)

Insect and Time Most Prevalent	Damage and/or Insect Description	Insecticide (MOA Group) and Amount Per Acre		Comments
Thrips	Tiny, slender, insects, most commonly found in terminals—rasp new leaves causes blotching and deformed terminals	Lannate LV[r] (1A)	1.5-3.0 pt	Do not feed treated vines.
May through June Check immediately after emergence.		Lannate SP[r] (1A)	0.5-1.0 lb	21 day waiting period before harvest.
		Sevin XLR+ (1A)	1.0 qt	14 day waiting period to harvest.
		Proaxis[r] (3)	2.54-3.84 oz	See restrictions under beet armyworm comments.
		Prolex[r] (3)	1.02-1.54 oz	See restrictions under beet armyworm comments.
		Orthene 75S (1B)	0.5-1.0 lb	Do not feed forage or hay or graze treated areas.
		Orthene 97 (1B)		Note: Research has not been able to show consistent yield
		Broadcast	6.0-12.0 oz	increases even with control of heavy thrips populations.
		Banded	3.0-6.0 oz	Insecticide applications should be restricted to instances where very high populations exist and severe damage, with destruction of terminals, occurring in seedling plants.
		Warrior[r] (3)	2.56-3.84 oz	Do not feed forage or hay or graze treated areas. Do not apply more than 15.36 oz/A/season.
		"AT PLANT APPLICATONS" Granular Insecticide Box applications		See footnote 3.
		Thimet 20G[r] (1B)	3.87 lb	Apply granules evenly in the furrow at planting. Do not graze or feed treated hay or forage. 90 day pre-harvest interval. Rate is for 36" row spacing.
		Temik 15G[r] (1A)	7.0-14.0 lb	Apply in seed furrow and cover with soil. Check label for restrictions. 90 day pre-harvest interval.
		Hopperbox application		Apply as a planter box treatment evenly over seed, alternating 1/3
		Orthene 75S (1B)	4.0 oz/100 lbs of seed	seed, then 1/3 chemical until box is filled. Do not attempt to mix Orthene with seeds by stirring or agitation. This may damage seeds prior to planting. Do not graze or feed treated hay or forage

[r] Restricted use Pesticides.

MOA Group Tables start on page 46 of the handbook.

1 Thresholds: For foliage feeding pests (e.g., corn earworm and armyworms) - the threat of yield reduction due to defoliation exists primarily when plants are from 60 to 90 days old. Check fields frequently durng July and August for earworms, armyworms, etc. and apply insecticides if populations exceed 3 to 5 larvae/row ft. in dryland or 6 to 8 larvae/row ft. in irrigated peanuts. For granulate cutworms - if feeding on foliage, use the same guidelines provided above for foliage feeders; however, if cutworms are feeding on pegs or pods, treatment should begin if larval numbers exceed 2 to 3 per row ft. in irrigated or dryland peanuts.

2 Additional miticides: Limited control (supperession) has been obtained using either M-pede (potassium salts of fatty acids), Pyrellin(pyrethrins and rotenone) or Saf-T-Side (petroleum oil). The latter two are toxic to fish and should not be used near water. Saf-T-Side should not be used with, before, or after spraying dinitro compounds, or fungicides containing sulfur. Also, do not use with Carbaryl or Dimethoate.

3 Systemics for thrips: Several formulations of this type have been used in Oklahoma with erratic results. Success with these compounds is usually related to thrips pressure, moisture conditttions and planting time. Currently, prophylactic use of these compounds in Okalhoma is not recommended. These compounds are presented here only as a guideline to rates and applicaton methods.

This section was not revised in 2007.

PEANUT WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Peanut Herbicides[a]																																			
	Broadleaf Weeds																					Grass Weeds														
Herbicide	buffalobur	carpetweed	common cocklebur	common lambsquarters	common purslane	common ragweed	common sunflower	crownbeard	cutleaf groundcherry	devil's-claw	eclipta	eastern black nightshade	hophornbeam copperleaf	jimsonweed	Pennsylvania smartweed	Pigweed	prickly sida	prostrate spurge	puncturevine	velvetleaf		barnyardgrass	bermudagrass	broadleaf signalgrass	fall panicum	field sandbur	goosegrass	green foxtail	johnsongrass (rhizome)	johnsongrass (seedling)	large crabgrass	Texas panicum	red sprangletop	yellow foxtail		yellow nutsedge	**General or Restricted Use**
Soil-applied																																			
Dual II Magnum, Cinch	2	**9**	1	7	2	5	0	2	**8**	0	0	**9**	5	4	5	**9**	3	3	0	3		**9**	0	7	**9**	5	**9**	**9**	0	5	**9**	**8**	**9**	**9**		6	Gen.
Outlook, Propel	0	**9**	0	6	**9**	6	0	**8**	**8**	6	6	**8**	6	0	6	**9**	6	6	0	4		**9**	0	**8**	**9**	**9**	**9**	**9**	3	6	**9**	6	5	**9**		6	Gen.
Prowl	0	**8**	0	**8**	**8**	2	0	1	0	0	0	0	0	2	1	**8**	0	1	**8**	1		**8**	0	**8**	**8**	**8**	**8**	**8**	5	**8**	**8**	**8**	**8**	**8**		0	Gen.
Pursuit	6	5	**9**	0	0	5	7	**8**	0	**8**	3	0	3	6	5	**9c**	1	0	0	5		5	0	3	6	4	3	7	2	4	5	2	0	7		5	Gen.
Sequence[b]	2	9	**1**	7	2	5	0	**2**	8	**0**	0	9	5	4	5	**9**	3	3	0	3		9	0	7	9	5	9	9	0	5	9	8	9	9		6	Gen.
Sonalan HFP	0	**8**	0	**8**	**8**	2	0	1	0	0	0	**8**	0	2	1	**8**	0	1	**8**	1		**8**	0	**8**	**8**	**8**	**8**	**8**	5	**8**	**8**	**8**	**8**	**8**		0	Gen.
Strongarm	4	4	**8**	**8**	6	**8**	**8**	**9**	5	**8**	**9**	3	**8**	7	**8**	**9**	**8**	**8**	4	**8**		0	0	2	3	6	3	4	0	0	2	2	3	4		7	Gen.
Treflan HFP	0	**8**	0	**8**	**8**	2	0	1	0	0	0	0	0	2	1	**8**	0	1	**8**	1		**8**	0	**8**	**8**	**8**	**8**	**8**	5	**8**	**8**	**8**	**8**	**8**		0	Gen.
Valor	4	**9**	5	**9**	**8**	7	4	**8**	5	4	**9**	**9**	**8**	**8**	5	**9**	**9**	**9**	**8**	7		4	0	4	5	3	2	3	0	0	4	4	3	3		5	Gen.
Zorial Rapid 80	**8**	**9**	6	**9**	**9**	7	2	7	0	6	5	7	**9**	7	7	**8**	**8**	**8**	5	**8**		**9**	2	**8**	**8**	7	**8**	**8**	6	**8**	**8**	**8**	6	**8**		5	Gen.
Foliar-applied																																			
2,4-DB	6	4	**9**	4	3	3	5	6	0	5	1	0	3	3	3	4	2	0	5	2		0	0	0	0	0	0	0	0	0	0	0	0	0		0	Gen.
Basagran	3	**8**	**9**	4	3	4	6	5	0	5	2	3	0	7	7	3	5	0	0	6		0	0	0	0	0	0	0	0	0	0	0	0	0		7	Gen.
Cadre	0	0	**9**	1	2	4	0	0	2	0	2	2	0	**9**	7	**9c**	2	0	0	1		5	0	4	5	0	4	0	4	6	5	6	0	0		7	Gen.
Gramoxone Max	7	**8**	**8**	5	0	5	6	7	0	**8**	4	0	1	**8**	1	**8**	1	0	0	1		**8**	1	**8**	**8**	**8**	**8**	**8**	7	**8**	**8**	**8**	**8**	**8**		7	Res.
Poast Plus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**		0	Gen.
Pursuit	5	5	**9**	0	0	5	6	6	0	7	0	0	0	5	5	7c	0	0	0	5		5	0	2	5	3	0	6	2	4	0	0	0	5		5	Gen.
Select 2EC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		**9**	**8**	**8**	**8**	**8**	**8**	**9**	7	**8**	**9**	**8**	**9**	**9**		0	Gen.
Storm	3	7	7	4	6	**8**	7	7	7	**8**	6	4	8	7	7	6	6	5	0	4		0	0	0	0	0	0	0	0	0	0	0	0	0		5	Gen.
Ultra Blazer	3	7	2	3	6	4	7	6	6	**8**	4	4	**8**	7	5	5	0	**8**	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	Gen.

a Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions.

b Will also control emerged weeds with better performance than rated here, but cannot be applied POST to peanuts or crop injury will occur.

c Will not control populations of this species that are resistant to this herbicide mode of action.

This section was not revised in 2007.

PEANUT WEED CONTROL (CONT'D)

Rotational Cropping Restrictions in Months for Peanut Herbicides

	Crops							
Herbicide	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Soil-applied								
Dual II Magnum, Cinch	4	a	0	0	0	0	0	4.5
Outlook, Propel	a	a	0	0	0	0	0	4
Prowl	b	b	0	0	0	b	0	4
Pursuit	4	c	18.5[d]	18.5	0	18.5	0	4
Sequence	4	a	0	0	0	0	0	4.5
Sonalan HFP	b	b	b	b	0	b	0	b
Strongarm	30[e]	30[e]	18[f]	10	0	18	0	4
Treflan HFP	0	0	12	0	0	12	0	12
Valor	12[g]	12[g]	1/2[h]	1/2[h]	0	1/2[h]	0	1/2[h]
Zorial Rapid 80	0	a	a	0	0	a	0	a
Foliar-applied								
2,4-DB	a	a	a	a	a	a	a	a
Basagran	a	a	a	a	a	a	a	a
Cadre	a	40	9	18[i]	0	18	9	4
Gramoxone Max	0	0	0	0	0	0	0	0
Poast Plus	0	0	4	0	0	4	0	4
Pursuit	4	c	18.5d	19	0	19	0	4
Select 2EC	1	1	1	1	1	1	1	1
Storm	a	a	a	a	a	a	a	a
Ultra Blazer	a	a	a	a	a	a	a	a

[a.] See labeld for specific crop rotation restrictions.

[b.] May be planted the following cropping season.

[c.] Only Clearfield or Sumner Canola varieites can be planted the year following a Pursuit application.

[d.] Clearfield corn hybrids can be planted anytime.

[e.] Must also conduct a successful field bioassay.

[f.] Unless Clearfield corn will be planted, then 10 months.

[g.] Must conduct a successful field bioassay.

[h.] First listed interval is for up to 2 oz/A rate, second interval is for 2 to 3 oz/A rate.

[i] The restriction is 18 months if at least 15 inches of rainfall has been received since the time of application and November 1 of the same year, otherwise, the restriction is 26 months.

This section was not revised in 2007.

PEANUT WEED CONTROL

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
2,4-DB 2 lb ai/gal **POST applications.** 0.8 to 1.6 pts /A	**Active Ingredient:** 2,4-DB **Similar Products:** Butoxone 200 Butoxone 7500 Butyrac 200 **MOA:** 4	**POST.** Apply to peanuts 2 to 12 weeks after planting. Refer to label for tank mix instructions.	**Do not** apply later than 100 days after planting or 30 days before harvest. **Do not** feed treated vines or peanut hay to livestock. **Do not** apply if peanut plants are under stress from drought as injury may occur. **Do not** apply more than 2 applications per season. **Do not** apply this product through any type of irrigation system.
Basagran 4 lbs. ai per gallon **POST applications:** 1 to 2 pints /A	**Active Ingredients:** Bentazon **Similar Products:** None **MOA:** 6	**POST.** Product can be applied from peanut cracking through pegging. Product may be applied in a tank mix with one of the following herbicides: Blazer, Frontier, Poast Plus, Starfire, 2,4-DB amine. Refer to label for specific tank mix instructions.	**Do not** cultivate within 5 days before or 7 days after application. To achieve consistent weed control, crop oil concentrate, urea ammonium nitrate, or ammonium sulfate additives need to be used. Refer to label for more specifics on additives to be used. **Do not** apply more than 4 pts per acre per season. Rainfall or overhead irrigation within 4 hours after application may reduce effectiveness of product. **Do not** apply through any type of irrigation system. Treated peanut hay and forage may be fed to livestock. **Do not** graze treated fields for at least 50 days after the last treatment.
Cadre 70 % WSP **POST applications:** 1.44 fl oz. /A	**Active Ingredient:** Imazapic **Similar Products:** None **MOA:** 2	**POST.** Apply at a rate of 1.44 fl oz. per acre early postemergence to control broadleaf and grass weeds. Refer to label for tank mix applications. **Will not control pigweed populations that have developed resistance to this herbicide mode of action.**	**Do not** apply this product through any type of irrigation system. **Do not** graze or feed treated peanut hay to livestock. **Do not** apply more than 1.44 fl oz. per acre of Cadre DG per application or per use season. **Do not** apply if rainfall within 3 hours is expected, reduced weed control may result. **Do not** apply by helicopter, airplane, or any other aerial equipment. **Do not** use a nonionic surfactant as an adjuvant. Include either a crop oil concentrate, or methylated seed oil concentrate or blends of these two at 1 qt. per acre.
Dual II Magnum 7.64 lbs. ai per gallon **All applications:** 0.8 to 1.33 pts. /A	**Active Ingredient:** Metolachlor **Similar Products:** Dual IIG Magnum Dual Magnum Cinch **MOA:** 15	**PPI.** Apply and incorporate into the top 2 inches of soil within 2 weeks before planting. **PRE.** Apply during or after planting, but before weeds or crops emerge. **Postplant Incorperated.** Apply and shallowly incorporate into the soil after planting, but before peanut germination.	**Do not** apply through any type of irrigation system other than a center pivot.
Gramoxone Max[r] 3 lb. ai per gallon **POST applications:** 5.4 to 10.8 fl. oz. /A	**Active Ingredients:** Paraquat **Similar Products:** Cyclone Max **MOA:** 22	**POST.** Application to 1" to 6" emerged annual grass and broadleaf weeds at ground crack. A second application may be made up to 28 days after ground crack.	**Do not** apply this product through any type of irrigation equipment. Rain occurring 30 minutes or more after application will have no effect on the activity of the product. **Do not** apply a total of more than 10.8 fl. oz. per acre per season. **Do not** make more than two applications per season. **Do not** apply by air. Refer to label for tank mix applications.

[r] Restricted Use.

This section was not revised in 2007.

PEANUT WEED CONTROL (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Outlook 6 lbs ai per gallon **All applications:** See table.	**Active Ingredient:** Dimethenamid **Similar Products:** Frontier 6.0 Propel **MOA:** 15	**PPI.** Apply and incorporate into the top 1-2 inches of soil up to 2 weeks before planting. **PRE.** Rainfall, irrigation, or shallow incorporation after application is required to move this product off of the soil surface. **POST.** Must be applied **before** weed seedling emergence. Apply up to 80 days prior to harvest. **ALL applications.** May be used in split applications as long as the total rate does not exceed the maximum rate given for each soil type.	**Herbigation** applications must be appied only through center pivot, lateral move, solid set, or hand move irrigation systems. **Do not** apply this product through any other irrigation system. Refer to label for specific herbigation instructions. **Do not** apply more than a total of 32 fl. oz per acre, per season. **Use** higher rates (25-32 fl. oz. per acre) for improved control or suppression of difficult weeds.

All Applications	Outlook Application Rates Per Acre		
	Soil Textural Group	**Less than 3% OM**	**3% or more OM**
	Coarse	20-24 fl. oz	24-28 fl. oz
	Medium	24-28 fl. oz	28-32 fl. oz
	Fine	28-32 fl. oz	32 fl. oz

Poast Plus 1.0 lbs ai per gallon **POST applications:** 1.5 to 3.75 pts /A	**Active Ingredients:** Sethoxydim **Similar Products:** Poast **MOA:** 1	**POST.** Apply to actively growing weeds. Most effective control will result from making applications early when weeds are small.	**Do not** cultivate within 5 days before or 7 days after application. Cultivating 7 days or later after treatment may help provide season-long control. **Do not** apply through any type of irrigation equipment. **Do not** apply to crops under stress, in irrigated areas it may be necessary to irrigate before application to insure active weed growth. **Do not** graze or feed hay or forage to livestock. **Do not** apply within 40 days of harvest.
Prowl 3.3 lb. ai per gal **SOIL applications:** 1.2 to 2.4 pts per acre	**Active Ingredients:** Pendimethalin **Similar Products:** Pendimax & Prowl H2O **MOA:** 3	**PPI.** Apply up to 60 days prior to planting and incorporate within 7 days of application.	This product can be applied through a sprinkler including center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move irrigation systems. **Do not** apply this product through any other type of irrigation system.

This section was not revised in 2007.

PEANUT WEED CONTROL (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Pursuit 2S 2.0 lb. ai per gallon **All applications:** 4 fl oz. /A **Sequential applications:** 2 oz. /A PRE & 2 oz. /A POST	**Active Ingredients:** Imazethapyr **Similar Products:** Pursuit DG **MOA:** 2	**POST.** Apply when weeds are actively growing and before they exceed a height of 3 inches. **SOIL.** May be applied before, during, or after planting. May be applied up to 45 days prior to planting. **PPI.** Should be **thoroughly incorporated** to a depth of 1 to 2 inches.	Should be applied a minimum of one hour before rainfall or overhead irrigation. **Do not** apply more than 4 fl oz. /A during the growing season. Refer to label for weeds controlled and weeds reduced. **Will not control pigweed populations that have developed resistance to this herbicide mode of action.**
Select 2EC 2.0 lb. ai per gallon **POST applications:** 6 to 16 fl. ozs /A	**Active Ingredients:** Clethodim **Similar Products:** None **MOA:** 1	**POST.** Apply to actively growing grasses. Applications made to grass plants stressed by insufficient moisture or cold temperatures, or to grass plants exceeding recommended growth stages may result in unsatisfactory control.	**Do not** apply if rain is expected within 1 hour of application. **Do not** apply through any type of irrigation equipment. The addition of AMS may improve grass control for difficult to control species. **Do not** apply to crop under stress. **Do not** apply within 40 days of harvest.
Sequence 5.25 lb ai per gallon **All applications:** 2.5 to 3.5 pt/A	**Active Ingredients:** Metolachlor & Glyphosate **Similar Products:** None **MOA:** 15 & 9	**EPP.** Apply prior to planting for control of emerged actively growing weeds and soil residual activity. **Do not** incorporate if applied EPP, or crop injury will result. **PRE.** Apply after planting but before crop emergence for control of emerged actively growing weeds and soil residual activity.	**Do not** graze or feed forage or fodder from Sequence treated crops to livestock for 30 days following application. **Do not** harvest peanuts for 90 days following application. **Do not** exceed 2.5 pt/A on sandy loam soils or 3.5 pt/A on medium and fine soils. **Do not** exceed 2.67 lb ai/A S-metolachlor per crop year. **PRE applications** must be applied before ground cracking of emerging peanut plants.
Sonalan HFP 3.0 lb. ai per gallon **PPI applications:** See table.	**Active Ingredients:** Ethalfluralin **Similar Products:** Sonalan 10G **MOA:** 3	**PPI.** Incorporate into the top 2 to 3 inches of soil. Incorporation should occur within 48 hours of application.	**Do not** graze or forage treated crop, or cut for hay or silage.

Broadcast Rates/Acre for Sonalan HFP

Soil texture	Pints/A
Coarse	1.2 to 2
Medium	2 to 2.5
Fine	2.5 to 3

This section was not revised in 2007.

PEANUT WEED CONTROL (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Storm 4 lbs. ai per gallon **POST applications:** 1.5 pts. /A	**Active Ingredients:** Bentazon & Acifluorfen **Similar Products:** Galaxy **MOA:** 6 & 14	**POST** Refer to label for required additives. **Do not** apply sequential applications of Blazer or Storm within 15 days of the initial application of Storm.	**Do not** apply within 75 days of harvest. **Do not** use treated plants for feed or forage. **Do not** apply to weeds or crops under stress. Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of product. **Do not** apply through any type of irrigation system. **Do not** cultivate within 5 days before or 7 days after application.
Strongarm 84% WDG **All applications:** 0.3 to 0.45 oz. /A	**Active Ingredients:** Diclosulam **Similar Products:** None **MOA:** 2	**PRE.** A rate of 0.3 oz. /A may be applied from immediately after planting through "at-cracking" stage. **Delayed PRE and at cracking applications.** Rate of 0.45 oz. /A may be applied from no less than 5 days after planting through "at-cracking" stage.	**Do not** allow livestock to graze treated areas or harvest forage or hay from treated areas. **Do not** harvest peanuts for 30 days following application. **Do not** apply more than 0.45 oz. per acre per year. **Do not** apply to soils with a pH of 7.2 or greater. **Do not** apply when below normal soil and/or air temperatures are expected within 5 days of application. **Do not** apply by air. **Do not** apply through any type of irrigation system. **Do not** use in peanuts grown under drip irrigation.
Treflan HFP 4 lbs ai per gallon **PRE applications:** 1.0 to 1.5 pts /A	**Active Ingredients:** Trifluralin **Similar Products:** Treflan Trifluralin **MOA:** 3	**PRE.** Apply and **incorporate** before planting, at planting or immediately after planting. For coarse soil textures, apply 1.0 pts /A. For medium soil textures, apply 1.5 pts /A. Refer to label for tank mix applications.	**Must** be incorporated within 24 hours of application. Refer to label for chemigation directions.
Ultra Blazer 2 lb ai per gal **All applications:** 1.5 pts /A	**Active Ingredient:** Acifluorfen **Similar Products:** None **MOA:** 14	**All applications:** Apply product at soil cracking stage or postemergence.	**Do not** apply more than 2.0 pts per acre per season. Allow at least 15 days between sequential applications of product. **Do not** use treated plants for feed or forage. Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of product. **Do not** apply through any type of irrigation equipment.
Valor WP 51% WP **SOIL applications:** 1.0 to 2.0 oz/A	**Active Ingredient:** Flumioxazin **Similar Products:** Valor **<u>Rates may vary due to formulation</u>** **MOA:** 14	**PRE.** Application may be made prior to planting or preemergence. Application must be made within 2 days after planting and prior to crop emergence. Application after the crop has begun to crack, or are emerged, will result in severe crop injury.	**Do not** graze treated fields or feed treated forage or hay to livestock. **Do not** incorporate into the soil after application. **Do not** apply more than 3 oz/A during a single growing season. **Do not** irrigate when crop is cracking. **Do not** use on crops grown for seed. **Do not** tank mix with Strongarm.
Zorial Rapid 80 80% DF **PRE applications:** 0.5 lb /A	**Active Ingredients:** Norflurazon **Similar Products:** None **MOA:** 12	**PRE.** Apply as a preemergence surface application immediately after planting and before weeds and crop emerge.	**Do not** apply to crops that are near cracking, at cracking, or emerged, as crop injury may result. **Do not** make more than one application per year.

MOA Group Tables start on page 46 of the handbook.

PEANUT DISEASE CONTROL GUIDELINES

QUICK GUIDE TO PEANUT DISEASES

DISEASE (PATHOGEN)	SYMPTOMS	CONTROL
Seedling disease (*Rhizoctonia solani, Pythium* spp., *Fusarium* spp.)	Seed rot, pre- or post-emergence death of seedlings. Dark brown sunken lesions on stems. Seedlings are stunted or die at a later date. Inadequate stand may result.	(1) Plant high quality seed with strong vigor. (2) Treat seed with fungicide(s). (3) In-furrow or planter box application of fungicide. See Table 1.
Aspergillus crown rot (*Aspergillus niger*)	Swelling of lower stem below soil line, becoming corky and brittle, eventual dark decay develops; branches or whole plants wilt and die; extensive crown and root decay; decayed crown and stem bases covered with black, powdery mass.	(1) Plant high quality seed with strong vigor. (2) Plant seed treated with fungicide(s). (3) Do not throw dirt to peanuts. (4) Control stem and root boring insects where warranted.
Early leaf spot (*Cercospora arachidicola*)	Circular, brown to dark brown spots on leaves usually surrounded by a yellow border. Spots are brown on lower leaf surface. Infected leaves turn yellow and drop. Stems and pegs have oval, dark brown spots.	(1) Apply foliar fungicides either on a 14-day schedule or according to the early leaf spot advisory where available. (2) Practice crop rotation. (3) Utilize residue management program. See Table 3.
Late leaf spot (*Cercosporidium personatum*)	Symptoms are similar to early leaf spot except spots are darker in color and the yellow border is faint absent. Spots are black on the lower leaf surface.	(1) Apply foliar fungicides on a 10 to 14-day schedule. (2) Same cultural controls as for early leaf spot. See Table 3.
Pepper spot (*Leptoshpaerulina crassiasca*)	Numerous small, dark brown to black spots on one leaf surface which lack yellow borders. Leaves may develop a V-shaped scorch before yellowing and dropping. Similar spots on stems.	(1) Apply foliar fungicides on a 14-day schedule. (2) Same cultural controls as for early leaf spot. See Table 3.
Web blotch (*Phoma arachidicola*)	First appears as a greenish-gray to brown webbing or irregularly-shaped blotch on upper leaf surface, later becoming darker brown and extending through to the lower leaf surface.	(1) Apply foliar fungicides on a 10 to 14-day schedule. (2) Same cultural controls as for early leaf spot. See Table 3.
Tomato Spotted Wilt (Tomato spotted wilt virus (TSWV))	Symptoms are variable and may include leaf mottling and distortion; ring spots on new leaflets; plant stunting; and yellowing, wilting, and death of shoots or entire plants.	Plant varieties with resistance to tomato spotted wilt.
Southern blight (*Sclerotium rolfsii*)	Yellowing and wilting of branches or whole plants, wilted branches turn brown and die. White, coarse mold covers lower stems and may grow over the soil surface and plant debris on ground. Numerous small, round, brown sclerotia are formed on stems and debris.	(1) Rotate peanuts with cotton, corn, or grain sorghum. (2) Moldboard plow to bury sclerotia. (3) Do not throw soil to plants during cultivation. (4) Make preventive applications of a suggested fungicide. See Table 4.
Limb rot (*Rhizoctonia solani*)	Circular, sunken lesions on lower limbs contacting soil, light to dark brown in color, becoming elongated and zonate (banded). Infected branches wilt and die, infection may spread inward to kill several branches or whole plant.	(1) Rotate with grain crops to slow disease build-up. (2) Avoid excessive mechanical damage to vines. (3) Time irrigations to avoid excessive canopy wetness. (4) Manage peanuts to avoid excessive top growth. (5) Make foliar applications of a suggested fungicide. See Table 4.
Sclerotinia blight (*Sclerotinia minor*)	May be confused with southern blight. White and fluffy mold, most evident when canopy is wet, growing on lower stems near crown or on lateral branches. Light tan to pale white lesions develop. Affected branches or whole plants wilt, die, and turn dark brown to black. Small, irregularly shaped, black sclerotia found on and in infected stems, pegs, pods, and seeds.	(1) Plant a resistant variety (Tamspan 90). (2) Avoid spreading sclerotia to clean fields on equipment, animals, or hay. (3) Time irrigations to avoid prolonged canopy wetness. (4) Harvest and/or plant early to avoid cool, wet conditions late in season. (5) Apply suggested fungicide to susceptible runner varieties. See Table 4.
Verticillium wilt (*Verticillium dahliae*)	Symptoms usually become apparent at mid-season; leaves turn yellow with brown marginal scorch. Branches or whole plants are stunted, turn yellow, and may wilt and may die when drought stressed. Cutting across petiole bases, stems, or roots reveals brown discoloration of vascular system.	(1) Long-term rotation with non-host crops may provide control. (2) Avoid rotations with cotton, okra, or potatoes in infested fields. (3) Irrigate to maintain adequate soil moisture. (4) Clean equipment when moving from infested to clean fields.

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

QUICK GUIDE TO PEANUT DISEASES (CONT'D)

DISEASE (PATHOGEN)	SYMPTOMS	CONTROL
Northern root-knot nematode (*Meloidogyne hapla*)	Infected plants form dense, bushy root system. Tiny galls (swellings) are formed at the points of root branching. Galls may also form on pods and pegs. On sandy soils, plants may be stunted and pale green in color. Stunted plants are usually clustered and rows grow unevenly.	Sample soil to determine population level. Where populations are damaging rotate with corn, grain sorghum, sudan grass, or cotton and sample again. Apply a suggested nematicide if necessary. See Table 2.
Peanut root-knot nematode (*Meloidogyne arenaria*)	Large galls form on roots and pods causing extreme swelling and disfiguration of below ground plant parts. Severly affected plants are stunted and pale green in color. Stunted plants are usually clustered and rows grow unevenly.	Sample soil to determine population level. Where populations are damaging rotate with corn, grain sorghum, sudan grass, or cotton and sample again. Apply a suggested nematicide if necessary or plant a resistant variety. See Table 2.
Root-lesion nematode (*Pratylenchus brachyurus*)	Brown pin-point spots on pods and pegs. Spots enlarge and turn darker in color leaving a peppered appearance. High populations reduce plant growth and pod set. Pegs may be weakened leaving pods in soil at harvest.	Rotation is not effective for this nematode. Sample soil and roots and apply a suggested nematicide if damaging levels are present. See Table 2.
Pod rot (*Rhizoctonia solani*, *Pythium* spp.)	Light brown to reddish-brown areas on pods, later becoming black, entire pod may be affected. Pod may rot completely and be either soft and mushy or firm and skeletonized. Kernel and inner pod wall may be covered with cream to dark brown mold (mycelium). Kernels are often completely decayed.	(1) Rotate peanuts with summer grain crops or sudan grass. (2) Spanish varieties are more tolerant than runners. (3) Maintain adequate levels of calcium fertility in soil. (4) Avoid excessive use of low-quality irrigation water. (5) Make preventive applications of a fungicide suggested for pod rot control where severe. See Table 4.
Black hull (*Thielasviopsis basicola*)	Superficial, large, dull black patches on pod hulls. May cause seed discoloration and peg decay when severe.	Rotate infested fields with grain sorghum.

For additional information about peanut diseases and their control consult EPP 7186, 7187, 7655, 7663, and 7664.

SEEDLING DISEASE CONTROL IN PEANUTS

The goal of seedling disease control is to achieve an adequate and uniform stand. Seedling diseases are effectively controlled in most instances by fungicide seed treatments already applied by seed dealers. However some growers report difficulty in stand establishment. Hopper-box or in-furrow treatments (See Table 1) may increase the level of seedling disease control in problem fields over a seed treatment alone. Expect about 2-3 weeks of protection from these treatments. Other stresses such as cold soil, a poorly prepared seedbed, herbicide injury, excessive rain, and poor quality seed may also contribute to stand failures.

TABLE 1. FUNGICIDES FOR AT-PLANT CONTROL OF PEANUT SEEDLING DISEASE

COMMON NAME (FUNGICIDE MOA GROUP): FORMULATION AND RATE	REMARKS
azoxystrobin (11): Abound 2.08F 0.4 to 0.6 fl oz/1000 ft row	Spray in furrow at planting.
Bacillus subtilis: Kodiak HB 0.3D 2 to 4 oz/cwt seed	Biological seed treatment that can be used in combination with a fungicide seed treatment. Treat seed in planter box.
carboxin (7) + PCNB (14) + metalaxyl (4): Prevail 33.1D 4 to 8 oz/cwt seed	Treat seed in planter box.
mefenoxam (4) + PCNB (14): Ridomil Gold PC 10.5G 12.5 to 25 lb/acre	Apply in a 4-inch band at planting.
PCNB (14): Terraclor 15G 7 to 13 lb/acre Terraclor 4F 2 to 4 pt/acre Terraclor 2E 4 to 8 pt/acre	Apply in furrow at planting.

Check labels for feeding restrictions.

MOA Group Tables start on page 46 of the handbook.

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

NEMATODE CONTROL IN PEANUTS

Plant parasitic nematodes are microscopic, slender worm-like organisms that live in soil and feed on plant roots. The most important nematode pest of peanuts in Oklahoma is the northern root-knot nematode. The peanut root-knot nematode was recently identified in a few fields in southwesten Oklahoma. Root-lesion and ring nematodes are also common in peanuts, but they are less damaging. Reductions in plant growth and yield result when nematode populations exceed critical levels. High populations may damage peanuts to an extent that a crop cannot be grown profitably. The goal of nematode management is to reduce populations below damaging levels. Crop rotation is very effective in reducing populations of root-knot nematodes. Cotton, corn, grain sorghum, and sudan grass are excellent rotation crops for root-knot control. However, rotation is not as effective against the root-lesion nematode because it can reproduce on a wide range of crops. If rotation cannot be practiced or if root-lesion nematode is a problem, chemical control should be considered. Fields can be checked for potential nematode problems by examining roots and pods during the season for symptoms of nematode feeding. Above-ground symptoms of nematode do not always develop, but where they do, these areas of poor growth or stunted plants should be examined. Declining yields are also symptom of a nematode problem.

Efficient nematode management depends upon knowing which species is present and its population level in the soil. Symptoms of nematode feeding on plants during the growing season are a warning of a potential nematode problem. Soil sampling also is useful for assessing the potential for economic damage. Sampling must be done before a peanut crop is planted because nematode problems cannot be corrected during the growing season. Samples can be collected before planting in the spring. However, sampling late in the season, just prior to or at harvest will increase the chances of accurately measuring nematode levels. Root-lesion nematode can be difficult to detect in soil. Therefore, both roots and soil are needed for more accurate analysis of this nematode. Entire fields, areas in fields where plants are growing poorly, or both may be sampled. If a large field is to be sampled, divide it into smaller units and process the samples separately or sample along a w-shaped pattern across the entire field to ensure a representative sample. Collect soil from root zone (2-10 inches deep avoiding the upper 2 inches of soil). Include some fibrous (feeder) roots when possible. Bulk the samples in a bucket, thoroughly mix the sampled soil and roots, and retain approximately one quart for analysis. Avoid letting the samples dry or exposing them to intense heat or freezing temperatures. Mail samples as soon as possible after collection to the OSU Plant Disease and Insect Diagnostic Laboratory, Oklahoma State university, 125A Noble Research Center, Stillwater, OK 74078; either directly or through your county extension office.

If the test report indicates a potentially damaging level of nematodes, management strategies should be implemented. Infested fields with damaging populations may either be rotated to a non-host crops for two years, a nematicide applied (See Table 2), or a nematode resistant variety (NemaTAM) can be planted where peanut root knot is found. 'NemaTAM' is not effective against the northern root-knot nematode. Where crop rotation is applied, fields should be sampled again to ensure nematode populations have declined to safe levels before planting peanuts without nematicide. Nematicides are dangerous pesticides and should be used with utmost caution.

TABLE 2. NEMATICIDES FOR CONTROL OF PEANUT NEMATODES

COMMON NAME (INSECTICIDE MOA GROUP): FORMULATION AND RATE	REMARKS
aldicarb (1A): Temik 15G[r] 15 to 22 oz/1000 ft of row - single application or Temik 15G[r] 11 oz/1000 ft of row- split application	Single application at planting. Apply in a 6 to 12-inch band and incorporate 2 to 4 inches deep. Split application. Apply in seed furrow or banded (6 to 12 inches) and incorporate 2 to 4 inches deep. Make second application 45 days after planting in a 12 to 18-inch band over the row, and incorporate immediately. Do not apply within 90 days of harvest.
dichloropropene: Telone II[r] 52 to 106 fl oz/1000 ft	Row fumigation at least 7 days before planting. Apply when soil is dry to allow fumigant penetration. Inject through one or two (8 to 12 inches apart) chisels 12 inches deep and seal by packing. Plant when odor is no longer detectable at the fumigation depth.

[r] Restricted Use Pesticide CHECK LABELS FOR FEEDING RESTRICTIONS

MOA Group Tables start on page 46 of the handbook.

FOLIAR DISEASE CONTROL IN PEANUTS

Early leaf spot is the most important foliar disease of peanuts in Oklahoma. The disease affects nearly all of the peanut acreage in the state each year. Web blotch is a problem mainly in the western half of the state on Spanish varieties. Late leaf spot is less common, but more difficult to control. Pepper spot also is an occasional problem. Foliar disease control is essential in the production of a high-yielding peanut crop. Yield losses can exceed 50% where foliar diseases are allowed to defoliate plants.

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

FOLIAR DISEASE CONTROL IN PEANUTS (CONT'D)

Spanish varieties are particularly prone to leaf spot damage because they often become infected earlier in the season than runner varieties.

While crop rotation is useful in delaying the development of foliar diseases, fungicide sprays (See Table 3) are required for effective control. Fungicides provide from 10 to 14 days of protection before weathering and loss of effectiveness occurs. In addition, fungicides only protect healthy foliage from infection and do not cure established infections. Therefore, they must be applied preventively, and repeated applications are required to provide season-long control. Fungicides should be applied in a sufficient volume of water to achieve thorough coverage. A minimum volume of 15 gal/acre is suggested for ground applications while aerial applications should be in a minimum volume of 5 gal/acre. While chemigation is effective when targeting soilborne diseases, it is not very effective in the control of foliar diseases because residue left on the leaf after chemigation is not sufficient to provide adequate disease control. Chlorothalonil (e.g. Bravo) at the maximum labeled rate would be the only recommended fungicide for foliar disease control by chemigation.

Spray programs should be started 30 to 45 days after planting. Delaying spray programs until disease appears is risky and resulting disease control may not be satisfactory. Once the first application is made, sprays should be repeated on 14-day intervals until two weeks before anticipated harvest.

Early Leaf Spot Advisory (MESONET) - Daily leaf spot advisories are available to assist growers in the efficient application of fungicides for control of early leaf spot. Using a full-season calendar program to time sprays is very effective, but expensive. The advisory program permits growers to spray only when weather conditions are favorable for infection. Weather variables are collected from automated weather stations located in each county of the state. Use of the advisory program permits a reduction of the number of sprays while maintaining control. The advisory program has been extensively tested in Oklahoma and proven to be effective. However, strict adherence to risk management rules is required to ensure success. Fields must be closely monitored to ensure that early leaf spot does not exceed damaging levels or that other foliar diseases, not controlled with the advisory program, are not present. Daily advisories are available on the Internet at http://agweather.mesonet.org/ by selecting “Crops” and then “Peanuts” and then “Peanut leaf spot model”.

The advisory program identifies and accumulates hours of weather favorable for infection of peanut leaves by the fungus that causes early leaf spot. An infection hour is one hour when the relative humidity is 95% or greater and temperature is between 60.8° and 86.7°F. Beginning 30 days after planting or ten days since the last spray, a spray is recommended when 36 infection hours are exceeded. To simplify advisories and make their use more general, the last effective spray date is reported daily. As favorable periods for infection accumulate, the last effective spray date moves forward in time. For the first spray, a spray is recommended when the last effective spray first exceeds 30 days after planting. For subsequent sprays, a spray is recommended when the last effective spray date first exceeds the date of the previous spray. A spray is not needed when the last effective spray date is before 30 days after planting or when the peanuts have been sprayed after the last effective spray date. Advisories must be received daily once the peanuts are thirty days old or it has been 10 days since the last spray. The Internet site for the advisory program contains an interactive page where a spray advisory can be obtained simply by entering the planting date and the date of the last spray (if applicable).

Risk management rules for the early leaf spot advisory are:

1) If fields cannot be sprayed within three days of exceeding the last effective spray date, spray on a 14-day schedule.
2) Use only highly effective fungicides (Absolute, Bravo, Tilt/Bravo, Folicur, Proline, Provost, Stratego, Headline). If another fungicide is used, spray on a 14-day schedule.
3) If levels of early leaf spot exceed 25% infection (leaflets with spots or defoliated), revert to a 14-day schedule.
4) If late leaf spot, web blotch, or pepper spot are identified, revert to a 14-day schedule.
5) Be wary of weather forecasts, spray if rain or dew is in the forecast and a field is close to exceeding the last effective spray date. The Internet site contains a forecast page with 60-hr precipitation and dew point forecasts for several locations in the state. If forecasted temperatures are below the forecasted dew point, dew is expected.
6) Maintain the spray program until 14 days before anticipated harvest.

AUPnuts Advisory Program - AUPnuts is another spray advisory program that can be used by growers to efficiently time fungicide sprays for foliar disease control. The program was developed in Alabama and has been tested for early leaf spot in Oklahoma and proven to be effective. The program also has been effective in the southeast where late leaf spot also is a problem. Its effectiveness against web blotch and pepper spot is unknown. The AUPnuts program is likely to recommend more sprays than

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

FOLIAR DISEASE CONTROL IN PEANUTS (CONT'D)

the early leaf spot program. Risk management rules described above for the early leaf spot advisory also must be followed for AUPnuts except for rule 4 (AUPnuts controls late leaf spot) and rule 5 (forecasts are part of the AUPnuts program).

The main weather variable used in AuPnuts is a rain event. A rain event is any day with 1/10 of an inch or more of rain and/or irrigation. The program also uses five-day NWS precipitation forecasts which can be obtained from the news. For days when irrigation is planned, substitute 100% for the precipitation forecast. Calculate an average precipitation forecast for next five days (add the precipitation forecasts for the next five days and divide by five). A rain gauge (one per field) is the only equipment needed to run AUPnuts. Rules for the AUPnuts advisory program are:

First spray: After emergence begin counting rain events. Spray if: 1) four rain events have been counted since emergence and the average chance of rain for the next five days is 50% or greater; or, 2) five rain events have been counted since emergence and the average chance of rain for the next five days is 40% or greater; or, 3) six or more rain events have been counted since emergence. If leaf spot is seen (two or more spots per plant), spray immediately.

Second and all later sprays: Ten days after the previous spray, begin counting rain events and check the five-day forecast daily. Spray if: 1) no rain event has been counted and the average chance of rain for the next five days is 50% or greater; or, 2) one rain event has been counted and the average chance of rain for the next five days is 40% or greater; or, 3) two rain events have been counted and the average chance of rain for the next five days is 20% or greater; or, 4) three rain events have been recorded. Continue the program until 14 days before anticipated harvest.

Fungicide resistance management - The potential for development of resistance in leaf spot fungi is a concern for several fungicide classes that have a site specific mode of action. Resistance development can result in loss of effectiveness and control failures. Most of the at-risk fungicides are systemic to some degree. At-risk fungicides can be grouped according to mode of action. Group 1 fungicides (benzimidazoles) such as Topsin, and Group 11 (strobilurin) fungicides such as Abound and Headline are very prone to resistance development and sudden losses in effectiveness have been reported for some diseases. Group 3 (triazole) fungicides such as Folicur and Tilt are less prone to resistance development. However, a slow decline in sensitivity to triazole fungicides can develop after prolonged use. The following resistance management guidelines should be followed when using at-risk fungicides:

1) Reduce initial pathogen levels through the use of good cultural practices such as crop rotation.
2) Follow label directions - do not exceed the maximum number of consecutive applications, and do not use less than the minimum labeled rate.
3) Do not exceed the maximum allowed amount or number of applications per season. Extending the allowed amount of one group 11 fungicide with another, or one group 3 fungicide with another will increase the risk of resistance development.
4) Keep the disease pressure low by using an effective application schedule.
5) Calibrate the sprayer. Configure spray tips to apply a sufficient volume of water to achieve good coverage.
6) Avoid using Group 1, Group 3, or Group 11 fungicides all season long. Use alternating sprays or blocks of sprays of these fungicides with unrelated fungicides or tank-mix with unrelated fungicides. For example, Group 3 and Group 11 fungicides can by applied in alternating sprays or blocks of sprays with a protectant (multi-site, Group M) fungicide such as chlorothalonil (e.g. Bravo) or mancozeb (e.g. Dithane). Group 3 and Group 11 fungicides also can be applied in alternating sprays or blocks of sprays with each other. Tank mixtures of at risk fungicides with a protectant or with fungicides in another group are appropriate.
7) Alternating or tank-mixing one Group 3 fungicide with another or one Group 11 fungicide with another will not help prevent resistance development.

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

TABLE 3. FUNGICIDES FOR CONTROL OF FOLIAR PEANUT DISEASES

COMMON NAME (FUNGICIDE MOA GROUP) FORMULATION AND RATE/ACRE	REMARKS
azoxystrobin (11): Abound 2.1F 18.5 to 24.6 fl oz	Controls leaf spots, southern blight, and limb rot (see Table 4). Apply 60 and 90 days after planting. Apply a non Group 11 fungicide for foliar disease control as needed during other parts of the season.
boscalid (7): Endura 70WG 6.5 to 10 oz	Apply on 14-day intervals. Also controls Sclerotinia blight at 8 to 10 oz (See Table 4).
chlorothalonil (M): Bravo, Applause, Chloronil, Echo, Equus, or Chlorothalonil 6F 1.0 to1.5 pt Bravo Ultrex or Equus 82.5DF 0.9 to 1.36 lb Echo 90DF 0.87 to 1.25 lb	Apply on 14-day intervals. Use the high rate when applied alone or the low rate when applied in a tank mixture with another fungicide.
copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1.5 to 3 lb Kocide or Nu Cop DF 1.5 to 3 lb Kocide, Champ, or Nu Cop 3F 1 to 2 pt Kocide 2000 or Champ DF 1 to 2 lb	Tank mix or alternate with another fungicide on 14-day intervals. Use the high rate when applied alone or the low rate when applied in a tank mixture with another fungicide.
copper sulfate (M): Cuprofix Disperss 20DF 2-4 lb Cuprofix Ultra 40DF 1-2 lb	Tank mix or alternate with another fungicide on 14-day intervals. Use the high rate when applied alone or the low rate when applied in a tank mixture with another fungicide.
fluoxastrobin (11): Evito 480SC 5.7 fl oz	Controls leaf spots, southern blight, and limb rot (see Table 4). Apply on 14-day intervals. Do not make more than two sequential applications before alternating with a non Group 11 fungicide. Utilize resistance management strategies.
mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 1.5 to 2.0 lb Dithane, Manzate, or Penncozeb 4F 1.2 to 1.6 qt	Tank mix or alternate with another fungicide on 14-day intervals. Use the high rate when applied alone or the low rate when applied in a tank mixture with another fungicide. Use a spreader/sticker.
mancozeb (M) + copper (M) Mankocide DF 3 to 4 lb Cuprofix MZ Disperss 2.5 to 4.75 lb	Tank mix or alternate with another fungicide on 14-day intervals. Use the low rate for tank-mixes and the high rate when applied alone in alternation with another fungicide. Use a spreader/sticker.
propiconazole (3): Tilt, Bumper, or Propimax 3.6E 2.5 to 4 fl oz	Tank mix the low rate with another fungicide or use the high rate alone on 14-day intervals. Utilize resistance management strategies.
propiconazole (3) + chlorothalonil (M) Tilt Bravo SE 4.3F 1.5 pt	Contains an equivalent of 2 fl oz Tilt and 1 pt Bravo 6F per acre. Apply on 14-day intervals.
propiconazole (3) + flutolanil (7): Artisan 3.6F 1.6 to 2 pt	Combination of Tilt (0.6 lb/gal) for foliar diseases and Moncut (3 lb/gal) for southern blight and limb rot (See Table 4). Apply at mid season and repeat 4 weeks later. Use a non-group 3 fungicide for foliar disease control before, in between, and after Artisan applications as necessary.
propiconazole (3) + trifloxystrobin (11): Stratego 2.08F 7 fl oz	Apply on 14-day intervals. Do not make more than 2 consecutive applications before switching to a non Group 11 fungicide.
prothioconazole (3): Proline 4F 5 to 5.7 fl oz/A	Controls leaf spots, southern blight, and limb rot (see Table 4). Make up to 4 mid-season applications on 14-day intervals. Utilize resistance management strategies.
prothioconazole (3) + tebuconazole (3): Provost 3.6F 7 to 8 fl oz	Controls leaf spots, southern blight, and limb rot (see Table 4). Make up to 4 mid-season applications on 14-day intervals. Utilize resistance management strategies.
pyraclostrobin (11): Headline 2.08E 6 to 12 fl oz	Controls foliar diseases, and southern blight and limb rot (See Table 4). For foliar diseases, use 6 fl oz on 14-day intervals or 9 to 12 fl oz for 21-day intervals. Utilize resistance management strategies. Do not make more than two sequential applications before alternating with a non Group 11 fungicide.
tebuconazole (3) : Folicur, Muscle, Orius, Trisum, or Tebuzol 3.6F 7.2 fl oz	Controls leaf spots, southern blight, and limb rot (see Table 4). Use a spreader/sticker. Make up to 4 mid-season applications beginning 60 days after planting. Use another fungicide for early and late-season leaf spot control. Utilize resistance management strategies.

Check labels for feeding and days to harvest restrictions. MOA Group Tables start on page 46 of the handbook.

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

TABLE 3. FUNGICIDES FOR CONTROL OF FOLIAR PEANUT DISEASES (CONT'D)

COMMON NAME (FUNGICIDE MOA GROUP) FORMULATION AND RATE/ACRE	REMARKS
tebuconazole (3) + trifloxystrobin (11) : Absolute 500SC 4.36F 3.5 fl oz	Apply on 14-day intervals, but do not make more than 2 consecutive applications before alternating with a non Group 11 fungicide. Use a spreader/sticker.
thiophanate methyl (1): Topsin or T-Methyl 70W 8 oz Topsin or T-Methyl 4.5F 10 fl oz Thiophanate Methyl 85 WDG 6.4 oz	Apply on 14-day intervals in a tank mixture with chlorothalonil (e.g. Bravo) or mancozeb (e.g Dithane).

Check labels for feeding and days to harvest restrictions. MOA Group Tables start on page 46 of the handbook.

SOILBORNE DISEASE CONTROL IN PEANUTS

Important soilborne diseases of peanuts include southern blight, Sclerotinia blight, pod rot, and Verticillium wilt. Limb rot can also be a problem in the production of irrigated runner varieties. These diseases usually appear from mid-season to late-season. Soilborne diseases can increase to high levels with continuous cropping of peanuts, causing substantial yield losses. Crop rotation should be practiced in the long-term management of these diseases. Fungicides are effective in reducing losses to these diseases, but they must be applied preventively for maximum effectiveness. Knowledge of field history is essential in anticipating outbreaks of these diseases.

Southern blight can be reduced with cultural practices. These include: 1) Long rotations (at least 2 years out of peanut) with corn, grain sorghum, cotton, or sudan grass; 2) Moldboard plow to reduce levels of the fungus in the upper soil profile; 3) Planting on a raised bed; 4) Avoid throwing dirt against peanut vines during cultivation; 5) Avoid frequent irrigation with small amounts of water. Fungicides (See Table IV) should be applied where long rotations have not been practiced and where southern blight is a yield-limiting factor.

Sclerotinia blight is extremely destructive so precautions should be taken to avoid contamination of clean fields. Avoid carrying sclerotia (seeds of the fungus) into clean fields in soil or on infested plant debris with equipment or animals. Sclerotia can survive for long periods (at least five years), but crop rotation will slow disease build-up. Avoid frequent irrigations with small amounts of water. Tamspan 90 is a resistant variety and should be planted where Sclerotinia blight is anticipated. The fungicide registered for Sclerotinia blight (See Table IV) provides only about 40% control and a yield increase of about 750 lb/acre on susceptible runner varieties. Yield increases with this fungicide in Tamspan 90 and other spanish varieties have not been sufficient to offset the cost of treatment.

Verticillium wilt can be severe some years in contaminated fields. Spanish varieties are most susceptible. There are no effective controls for this disease except to avoid drought stress with adequate irrigation and to dig peanuts before infected plants die where a large number of plants show symptoms. Avoid rotations with cotton which is also susceptible to this disease. Avoid spreading the fungus to clean fields in soil or infested plant debris.

Limb rot is not normally severe in Oklahoma, but can become a problem in wet years on irrigated runner varieties. Avoid over-irrigation and excessive vine injury. The fungicides Abound, Folicur, and Moncut (See Table 4) effectively control this disease. Crop rotations with corn, grain sorghum, and sudan grass also may be beneficial.

Pod rot is a complex disease caused by one or more of several different fungi. It can be severe on some sandy soils, on runner and virginia varieties, and may be aggravated by nematode and soil insect feeding. Calcium deficiency may be involved in the pod rot complex, but most soils in Oklahoma are innately high in calcium and do not respond to applications of gypsum. Salty irrigation water also has been implicated in increasing pod rot. Crop rotation with corn, grain sorghum, or sudan grass is suggested where pod rot becomes severe. A full-season, preventive fungicide program may provide an economic return (See Table 4). Avoid using PCNB alone where pod rot is a problem because this fungicide increases levels of Pythium pod rot.

PEANUT DISEASE CONTROL GUIDELINES (CONT'D)

TABLE 4. FUNGICIDES FOR CONTROL OF SOILBORNE PEANUT DISEASES

DISEASE	COMMON NAME (FUNGICIDE MOA GROUP): FORMULATION AND RATE/ACRE	REMARKS
Southern blight Limb rot	azoxystrobin (11): Abound 2.08F 18.5 to 24.6 fl oz	Ground sprayer and aerial applications. Controls southern blight, limb rot, and leaf spots (see Table 3). Apply 60 and 90 days after planting.
	fluoxastrobin (11): Evito 480SC 4F 5.7 fl oz	Ground sprayer and aerial applications. Controls southern blight, limb rot, and leaf spots (see Table 3). Apply on 14-day intervals during mid-season. Do not make more than two consecutive applications before switching to a non Group 11 fungicide.
	flutolanil (7): Moncut 50W 2 to 4 lb	Make ground, aerial, or chemigation application 60 days after planting. Use the higher rates where disease pressure is heavy. A split application may be used by making a second 2-lb application 30 days after the first.
	propiconazole (3): Tilt, Bumper, or Propimax 3.6E 4 to 8 fl oz	Southern blight only. Apply by chemigation in a minimum of 1/2 inch water 45 to 60 days after planting and repeat on 2-3 week intervals. Do not apply more than 16 fl oz per season. Chemigation application will not control of leaf spots.
	propiconazole (3) + flutolanil (7): Artisan 3.6F 1.6 to 2 pt	Combination of Tilt (0.6 lb/gal) for foliar diseases (See Table 3) and Moncut (3 lb/gal) for southern blight and limb rot. Ground, aerial, or chemigation application. Apply at mid season (60-70 days after planting) and repeat 4 weeks later.
	propiconazole (3) + trifloxystrobin (11): Stratego 2.08F 14 fl oz	Limb rot only. Ground and aerial applications. Apply 60 days after planting and repeat 30 days later. Applications for limb rot will also control leaf spots (See Table 3).
	prothioconazole (3): Proline 4F 5.7 fl oz/A	Ground and aerial applications. Controls southern blight, limb rot , and leaf spots (see Table 3). Make up to 4 mid-season applications on 14-day intervals. Utilize resistance management strategies.
	prothioconazole (3) + tebuconazole (3): Provost 3.6F 7 to 8 fl oz	Ground and aerial applications. Controls southern blight, limb rot , and leaf spots (see Table 3). Make up to 4 mid-season applications on 14-day intervals beginning 60 days after planting. Utilize resistance management strategies.
	pyraclostrobin (11): Headline 2.08E 12 to 15 fl oz	Controls southern blight, limb rot, and leaf spots (see Table 3). Apply on 14-day intervals by ground sprayer, aircraft, or chemigation. Do not make more than two consecutive applications before alternating with a non Group 11 fungicide.
	tebuconazole (3): Folicur, Muscle, Orius, Trisum, or Tebuzol 3.6F 7.2 fl oz	Controls southern blight, limb rot, and leaf spots (see Table 3). Make up to 4 mid-season applications by ground sprayer or aircraft on a 14-day schedule beginning 60 days after planting. Use a spreader/sticker.
	tebuconazole (3) + trifloxystrobin (11) : Absolute 500SC 4.36F 7 fl oz	Limb rot only. Ground and aerial applications. Apply 60 days after planting and repeat 30 days later. Applications for limb rot will also control leaf spots (See Table 3).
Pod rot	mefenoxam (4) + PCNB (14): Ridomil Gold PC 10.5G 50 lb	Pythium and Rhizoctonia pod rots. Apply in a 12-inch band at pegging to early pod set (45 to 60 days after planting). Do not apply within 75 days to harvest.
	mefenoxam (4): Ridomil Gold 4E 0.5 to 1 pt	Pythium pod rot only. Apply by chemigation in a minimum of ½ inch water at pegging to early pod set (45 to 60 days after planting).
	mefenoxam (4): Ridomil Gold 2.4G 11.8 lb	Pythium pod rot only. Apply in a 12-inch band at pegging to early pod set (45 to 60 days after planting).
Sclerotinia blight	boscalid (7): Endura 70WG 8 to 10 oz	Ground-sprayer, aerial, and chemigation applications. Make first application after row closure when conditions become favorable, or at the first sign of disease. Make up to two additional applications on 14 to 21 day intervals. Also controls foliar diseases (see Table 3). Do not exceed 30 oz/season or apply within 14 days of harvest.
	fluazinam (M): Omega 4F 1 to 1.5 pt	Apply by ground sprayer or chemigation. Make the first application at canopy closure, after canopy closure when conditions become favorable, or at the first sign of disease. Make up to 2 additional applications at 3 to 4 week intervals. Do not exceed 4 pints per season or apply within 30 days of harvest.

Check labels for days to harvest and feeding restrictions. MOA Group Tables start on page 46 of the handbook.

SMALL GRAINS INSECT CONTROL SUGGESTIONS

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
Aphids Corn leaf aphid: blue green with black legs, cornicles and antennae; antennae less than ½ length of body English grain aphid: lime green, "spindly legs" with black antennae, cornicles and legs. Antennae more than ½ length of body. Bird cherry oat aphid: olive green with brownish-red spot on back around base of cornicles. Rice root aphid is similar in appearance to bird cherry oat aphid, but tends to feed on crown, beneath the soil. Damage: Corn leaf aphid and English grain aphid do not usually require control. Bird cherry oat aphid can reduce yield, and is an important vector of Barley Yellow Dwarf virus. Threshold: Treat for bird cherry oat aphids if numbers exceed 30 per stem, or calculate threshold using worksheet found in *F-7183: Small Grain Aphids in Oklahoma*. Consider using low rate of Cruiser or Gaucho seed treatment if planting for forage + grain. There is no established threshold for English grain aphid, corn leaf aphid, or rice root aphid.	**Planting Time**		
	Cruiser 5FS (4A)	0.75 to 1.33 fl oz/cwt seed	Wheat and barley. No grazing restriction. Do not use treated seed as feed.
	Gaucho 480 (4A) Gaucho XT (4A)	1 to 3 fl oz/cwt seed 3.4 fl oz/cwt seed	Wheat and barley. 45 day waiting period for grazing. Do not use treated seed as feed.
	Post-Plant		
	Dimethoate 4E (1B)	0.5 to 0.75 pt	Wheat only. 14 day waiting period for grazing, 35 day waiting period for harvest. Two applications per season.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	1.92 fl oz 3.84 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest.
	Lannate LV (1A) Lannate SP (1A)	0.75 to 1.5 pt 0.25 to 0.5 lb	10 day waiting period for grazing, 7 day waiting period for harvest.
	Lorsban 4E (1B) (Warhawk, Whirlwind)	0.5 to 1 pt	14 day waiting period for grazing, 28 day waiting period for harvest. Two applications per season.
	Malathion (1B)	1.5 pt	7 day waiting period for grazing or harvesting.
	Methyl parathion 4E (1B)	0.5 to 1.5 pt	15 day waiting period for grazing or harvest. Temperatures should be above 50°F for application.
	Mustang MAX (3)	3.2 to 4.0 fl oz	Control may be variable. 14 day waiting period for grazing or harvesting.
	Proaxis 0.5 CS (3) Prolex 1.25 CS (3)	3.84 fl oz 1.54 fl oz	Wheat, wheat hay, and triticale. 30 day waiting period for grazing or harvesting.
Army cutworm Gray striped caterpillar that curls up in to a tight "C" when disturbed. Evident from January through March Damage: Cuts plants at soil line, can kill plants if it enters the crown Threshold: 2-3 caterpillars per foot of row if conditions are dry, if moisture is adequate, 4-5 per foot of row.	Baythroid XL (3)	1 to 1.8 fl oz.	7 day waiting period for grazing, 30 days for harvest.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	0.96 to 1.60 fl oz 1.92 to 3.20 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest.
	Mustang MAX (3)	1.28 to 4.0 fl oz	14 day waiting period for grazing or harvesting.
	Proaxis 0.5 CS (3) Prolex 1.25 CS (3)	1.92 to 3.20 fl oz 0.77 to 1.28 fl oz	Wheat, wheat hay, and triticale. 30 day waiting period for grazing or harvest.

SMALL GRAINS INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
Armyworm Dark green or brown caterpillar with 5 stripes along body. Damage: Feed on flag leaf, awns and may "clip" heads. Threshold: Treat if 4-5 unparasitized armyworms are found per ft of row.	Baythroid XL (3)	1.8 to 2.4 fl oz	7 day waiting period for grazing, 30 days for harvest.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest.
	Lannate[r] LV (1A) Lannate[r] SP (1A	0.75 to 1.5 pt 0.25 to 0.5 lb	10 day waiting period for grazing, 7 day waiting period for harvest.
	Methyl parathion[r] 4E (1B)	1.5 pt	15 day waiting period for grazing or harvest. Temperatures should be above 50°F for application.
	Mustang MAX[r] (3)	1.76 to 4.0 fl oz	14 day waiting period for grazing or harvesting.
	Penncap-M[r] (1B)	2 to 3 pt	15 day waiting period for grazing or harvesting.
	Proaxis[r] 0.5CS (3) Prolex[r] 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	Wheat, wheat hay, triticale. 30 day waiting period for grazing or harvest.
	Tracer (5)	1 to 3 fl oz	14 day waiting period for grazing, 21 day waiting period for harvest.
Brown wheat mite Tiny red to dark brown mites that feed on leaves, associated with dry, hot weather. Damage: Plants appear to be drought stricken. Threshold: Treat if mites and damage are evident.	Dimethoate 4E (1B)	0.33 to 0.5 pt	Wheat only. 14 day waiting period for grazing, 35 day waiting period for harvest. Two applications per season.
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	0.5 to 1 pt	14 day waiting period for grazing, 28 day waiting period for harvest. Two applications per season.
	Methyl parathion[r] 4E (1B)	1 pt	15 day waiting period for grazing or harvest. Temperatures should be above 50°F for application.
Fall armyworm Large, brown, green or black caterpillar with stripes, up to 1.5 inches. Has a light colored, inverted "Y" on head. Damage: Eat small plants in Fall Threshold: Treat if 3-4 larvae are found per foot of row AND feeding damage is evident.	Baythroid XL (3)	1.8 to 2.4 fl oz	7 day waiting period for grazing; 30 days for harvest.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest. Do not apply more than 0.06 lb ai./season.
	Lannate[r] LV (1A) Lannate[r] SP (1A	0.75 to 1.5 pt 0.25 to 0.5 lb	10 day waiting period for grazing, 7 day waiting period for harvest.
	Methyl parathion[r] 4E (1B)	1.5 pt	15 day waiting period for grazing or harvest. Temperatures should be above 50°F for application.
	Mustang MAX[r] (3)	3.2 to 4.0 fl oz	14 day waiting period for grazing or harvesting. Wheat, wheat hay, triticale. 30 day waiting period for grazing or harvest.
	Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	14 day waiting period for grazing, 21 day waiting period for harvest.
	Tracer (5)	1.5 to 3 fl oz	

SMALL GRAINS INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
False wireworm/Wireworm Slender, hard bodied, wormlike larvae. Damage: Feed on seed and newly germinated plants below the soil surface. Results in bare patches with no stand emergence. More severe when dry soils delay germination. Threshold: Treat if 1 larva is found per foot^2.	Cruiser 5FS (4A)	0.75 to 1.33 fl oz/cwt seed	Wheat and barley. Do not use surplus treated seed for feed or food. Follow label instructions for application and storage conditions.
	Gaucho 480 (4A) Gaucho XT	1 to 3 fl oz/cwt seed 3.4 fl oz/cwt	Wheat and barley. 45 day waiting period for grazing. Do not use treated seed as feed. Gaucho and Cruiser are not labeled specifically for false wireworm; performance varies with soil moisture and soil temperature.
	Lindane 30^r (2A) barley: wheat, rye oats:	 1.35 fl oz/cwt seed 1.40 fl oz/cwt seed	Registration for lindane has been canceled effective July 1, 2007 and all existing stocks must be used by July 2009.
Grasshopper Damage: May occur in mid-May through early June and August through October. May destroy field margins in fall, or chew leaves and clip heads in spring. Threshold: 7-10 per yd^2 in vegetation next to wheat. 3 per yd^2 in the field. See F-7196 for additional information.	Baythroid XL (3)	1.8 to 2.4 fl oz	7 day waiting period for grazing; 30 days for harvest.
	Dimethoate 4E (1B)	0.75 pt	Wheat only. 14 day waiting period for grazing, 35 day waiting period for harvest. Two applications per season.
	Furadan LFR (1A)	0.25 to 0.5 pt	Do not graze or feed treated forage to livestock. 2 applications per season.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest.
	Lorsban^r 4E (1B) (Warhawk, Whirlwind)	0.5 to 1 pt	14 day waiting period for grazing, 28 day waiting period for harvest. Two applications per season.
	Malathion 5E (1B)	1.5 pt	7 day waiting period for grazing or harvesting.
	Methyl parathion^r 4E (1B)	0.75 to 1 pt	15 day waiting period for grazing or harvesting.
	Mustang MAX^r (3)	3.2 to 4.0 fl oz	14 day waiting period for grazing or harvesting.
	Penncap-M^r (1B)	2 to 3 pt	15 day waiting period for grazing or harvesting.
	Proaxis^r 0.5 CS (3) Prolex^r 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	Wheat, wheat hay, triticale. 30 day waiting period for grazing or harvesting.
	Sevin XLR (1A)	0.5 to 1.5 qt	Apply 0.5 to 0.75 qt for small nymphs; apply 1 to 1.5 qt for mature grasshoppers. Wheat only; 21 day waiting period for harvest.

SMALL GRAINS INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
Greenbug Lime-green aphid with darker green stripe down back. Tips of legs, cornicles and most of antennae are black. Damage: Injures plants by injecting toxin, leaves turn yellow, then die. Occasional problem in fall or spring; occurs more commonly in warm, dry conditions. Threshold: Treatment thresholds depend on value of crop, and cost of control. To determine treatment threshold, and obtain a Glance 'n Go sampling form, use the Cereal Aphid Expert System: http://entoplp.okstate.edu/gbweb/ or request a CD-Rom Copy and a set of laminated Glance 'n Go forms from Tom Royer (rtom@okstate.edu) 127 NRC, Stillwater, OK 74078 or contact you local county OCES office for information on determining thresholds and sampling.	**Seed Treatment**		
	Cruiser 5FS (4A)	0.75 to 1.33 fl oz/cwt seed	Wheat and barley. No grazing restriction. Do not use treated seed as feed.
	Gaucho 480 (4A) Gaucho XT (4A)	1 to 3 fl oz/cwt seed 3.4 fl oz/cwt seed	Wheat and barley. 45 day waiting period for grazing. Do not use treated seed as feed.
	Post-Plant		
	Dimethoate 4E (1B)	0.5 to 0.75 pt	Wheat only. 14 day waiting period for grazing, 35 day waiting period for harvest. Two applications per season.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	1.92 fl oz 3.84 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest.
	Lorsban^{r} 4E (1B) (Warhawk, Whirlwind)	0.5 to 1 pt	14 day waiting period for grazing, 28 day waiting period for harvest. Two applications per season.
	Malathion (1B)	0.5 to 1.5 pt	7 day waiting period for grazing or harvesting.
	Methyl parathion^{r} 4E (1B)	0.5 to 1.5 pt	15 day waiting period for grazing or harvest. Temperatures should be above 50^{o}F for application.
	Mustang MAX^{r} (3)	3.2 to 4 fl oz	Control may be variable. 14 day waiting period for grazing or harvesting.
	Penncap-M^{r} (1B)	2 to 3 pt	15 day waiting period for grazing or harvesting.
	Proaxis^{r} 0.5 CS (3) Prolex^{r} 1.25 CS (3)	3.84 fl oz 1.54 fl oz	Wheat, wheat hay, and triticale. 30 day waiting period for grazing or harvesting.

SMALL GRAINS INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
Hessian fly Small, fragile mosquito-like fly (adult) larva is whitish, shiny, about 3/16 inches. Flaxseed (puparium) is 3/16 inches, dark brown, inserted at joint of stem. Damage: Stunts plants in fall, causes lodging of heads in spring. Threshold: No established threshold. Delayed planting will reduce the incidence of Hessian fly infestations, but there is no established "fly free" planting date for most of Oklahoma. Some wheat varieties are resistant to the common Hessian fly biotypes (A, B, C and D) found in Oklahoma.	Cruiser 5FS (4A) Gaucho 480 (4A) Gaucho XT	0.75 to 1.33 fl oz/cwt seed 1 to 3 fl oz/cwt seed 3.4 fl oz/cwt	Do not use surplus treated seed for feed or food. Follow label instructions for application and storage conditions. Wheat and barley. 45 day waiting period for grazing. Do not use treated seed as feed. Seed treatments will not provide control of spring brood Hessian fly.
Pale western cutworm Caterpillar is gray with no prominent stripes. Damage: Cuts plants below soil surface. Generally found in the Oklahoma Panhandle, about 2-3 weeks later than army cutworm. Threshold: Treat if 2 or more larvae are found per linear foot of row.	Baythroid XL (3) Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others) Mustang MAX^{r} (3) Proaxis^{r} 0.5 CS (3) Prolex^{r} 1.25 CS (3)	1.0 to 1.8 fl oz 0.96 to 1.6 fl oz 1.92 to 3.2 fl oz 1.76 to 4.0 fl oz 1.92 to 3.20 fl oz 0.77 to 1.28 fl oz	7 day waiting period for grazing; 30 days for harvest. Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest. 14 day waiting period for grazing or harvest. Wheat, wheat hay, and triticale. 30 day waiting period for grazing or harvest.

SMALL GRAINS INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
Russian wheat aphid Lime to green colored, "powdery" body, with an elongated, spindle-shaped body. Has a "double tail" appearance when viewed from the side. Lacks prominent cornicles. Damage: Infested leaves may have longitudinal white or purple streaks. Leaves may roll up and look like "onion leaves." If heavily infested, plants may become prostrate or flattened. Thresholds: Treatment thresholds are variable, depending upon growth stage and crop condition. See FS-7183 for treatment guidelines.	**Planting Time**		
	Cruiser 5FS (4A)	0.75 to 1.33 fl oz/cwt seed	Wheat and barley. No grazing restriction. Do not use treated seed as feed
	Gaucho 480 (4A) Gaucho XT	1 to 3 fl oz/cwt seed	Wheat and barley. 45 day waiting period for grazing. Do not use treated seed as feed.
	Post-Plant		
	Baythroid XL (3)	1.8 to 2.4 fl oz	7 day waiting period for grazing; 30 days for harvest.
	Dimethoate 4E (1B)	0.5 to 0.75 pt	Wheat only. 14 day waiting period for grazing, 35 day waiting period for harvest. Two applications per season.
	Karate w Zeon (3) Warrior w Zeon (3) (Lambda T and others)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	Wheat, wheat hay, and triticale. 7 day waiting period for grazing and 30 day waiting period for harvest.
	Lorsban^{r} 4E (1B) (Warhawk, Whirlwind)	0.5 to 1 pt	14 day waiting period for grazing, 28 day waiting period for harvest. Two applications per season.
	Methyl parathion^{r} 4 E (1B)	0.5 to 1.5 pt	15 day waiting period for grazing or harvest. Temperatures should be above 50^{o}F for application.
	Mustang MAX^{r} (3)	3.2 to 4.0 fl oz	Control may be variable. 14 day waiting period for grazing or harvest.
	Proaxis^{r} 0.5 CS (3) Prolex^{r} 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	Wheat, wheat hay, triticale. 30 day waiting period for grazing or harvest
Wheat curl mite Tiny sausage-shaped mites that feed on leaves and heads. Damage: They do not cause direct damage, but are a vector for Wheat Streak Mosaic Virus. Threshold: None	No effective chemical control is registered.		Delayed planting and management of volunteer wheat may reduce problems.

SMALL GRAINS INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage and Treatment Threshold	Insecticide Formulation and (MOA Group)*	Rate of Product per Acre	Comments
White grub "C" shaped whitish grub with a tan head and swollen tip of abdomen, measuring up to 1½ inches. Damage: Feed on roots. Cause stand loss, poor emergence and thin stands. Threshold: None	No effective chemical control is registered.		While there is no effective insecticide registered for white grub control, systemic seed treatments such as Gaucho or Cruiser may provide some suppression because they are labeled for control of white grubs in other crops; however, there is no Oklahoma data to support that possibility.
Winter grain mite Tiny dark brown mites with red legs and a red spot on its abdomen. Prefer cool, moist climate, and are more active on cloudy days or evenings. Damage: Leaves appear stunted and silver colored. Threshold: No established threshold; treat if injury symptoms and mites are present. Day time temperatures that exceed 75° F will reduce populations.	Malathion (1B) Methyl parathion[f] 4E (1B)	2 pt 0.5 to 1.5 pt	7 day waiting period for grazing or harvest. 15 day waiting period for grazing or harvest. Temperatures should be above 50°F for application. *Other products, such as dimethoate (Dimate and others) and chlorpyrifos (Lorsban, Whirlwind and others) can be applied under 2ee regulations, however since this pest is not specifically labeled, the user assumes all responsibility for the application and results.

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

Pre-harvest Intervals and grazing restrictions

Baythroid XL	7 day PHI for grazing, 30 day PHI for harvest. Two applications per season.
Cruiser 5FS	No grazing restriction
Dimethoate	14 day PHI for grazing, 35 days for harvest. Do not make more than 2 applications per season.
Furadan 4F, LFR	DO NOT GRAZE. See label for further restrictions
Gaucho 480, XT	45 day PHI for harvest or grazing.
Lorsban 4E	14 day PHI for grazing, 28 day PHI for harvest. Two applications per season.
Methomyl	14 day PHI for harvest or grazing.
Mustang MAX	14 day PHI for grazing or harvest.
Proaxis 0.5EC	30 day PHI for harvest or grazing
Prolex 1.25 CS	30 day PHI for harvest or grazing
Sevin XLR	No PHI for grazing, 21 day PHI for harvest.
Tracer	14 day PHI for grazing, 21 day PHI for harvest.
Thimet G	28 day PHI for harvest or grazing.
Warrior 1CS	7 days for grazing, 30 day PHI for harvest.
and others	

* Numbers in parentheses (#) that follow the insecticide name are used to designate its mode of action according to the classification system developed by the Insecticide Resistance Action Committee, (IRAC) in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest during a growing season, simply select a registered insecticide with a different number for each application. To further delay resistance from developing, integrate other control methods into your pest management programs.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Wheat Herbicides[a]

Herbicide	Winter Broadleaves											Summer Broadleaves										Winter Grasses							General or Restricted Use
	Bushy wallflower	Carolina geranium	Chickweed	Corn gromwell	Cutlf. eveningprimrose	Flixweed	GF Pepperweed (ALS Res.)	Henbit	Prickly lettuce	Purple deadnettle	Shepherd's purse	Curly dock	Field bindweed	Horseweed	Kochia (ALS Suscept.)	Pigweed spp.	Plains coreopsis	Red Horned Poppy	Russian thistle	Smallseeded Falseflax	Vetch spp.	Wild buckwheat	Wild sunflower	Cheat	Downy & Jap. brome	Jointed goatgrass	Rescuegrass	Rye	Ryegrass	Wild oats	
Soil appl. (PRE)																														
Amber	**9**	**9**	**9**	-	**9**	**9**	0	**9**	**8**	**9**	**9**	**8**	-	**8**	**8**	**9**	**9**	-	**8**	**8**	**8**	**8**	**9**	0	0	0	0	0	**8**	0	Gen.
Finesse	**9**	**9**	**9**	**9**	**9**	**9**	0	**9**	**9**	-	**9**	**8**	-	**8**	-	-	7	**9**	-	**9**	-	**9**	**9**	0	0	0	0	0	**8**	0	Gen.
Glean	**9**	**9**	**9**	**9**	**9**	**9**	0	**9**	**9**	-	**9**	**8**	-	**8**	-	-	**9**	**9**	-	**9**	-	**9**	**9**	0	0	0	0	0	**8**	0	Gen.
Foliar appl (POST)																														
Aim	**8**	-	3	-	6	**8**	7	**8**	5	**8**	**8**	-	7	-	**8**	**8**	-	-	**8**	-	0	7	7	0	0	0	0	0	0	0	Gen.
Ally	**8**	-	-	-	-	**8**	-	0	7	-	**8**	-	-	7	6	7	-	-	5	-	0	4	6	0	0	0	0	0	0	0	Gen.
Amber	**8**	-	-	-	7	**9**	-	6	**9**	-	**8**	-	-	**8**	**8**	7	**8**	-	**8**	7	**8**	7	**9**	0	0	0	0	0	0	0	Gen.
Banvel	**9**	-	-	-	-	**9**	-	**9**	7	-	**9**	-	-	6	**9**	**9**	-	-	**9**	-	**8**	7	**9**	0	0	0	0	0	0	0	Gen.
Beyond	**8**	-	-	-	-	**8**	-	0	0	-	**8**	-	-	0	0	0	-	-	0	-	0	0	0	**9**	**9**	**9**	**8**	**8**	**8**	**9**	Gen.
Bronate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**8**	-	-	**9**	-	**8**	7	**8**	0	0	0	0	0	0	0	Gen.
Buctril	**8**	-	-	-	-	**8**	-	**8**	**8**	-	**8**	-	-	6	**9**	7	-	-	**8**	-	7	7	**8**	0	0	0	0	0	0	0	Gen.
Express	**8**	-	-	-	-	**8**	-	-	7	-	**8**	-	-	6	**8**	7	-	-	7	-	5	6	6	0	0	0	0	0	0	0	Gen.
Finesse	**9**	**9**	**9**	**9**	**9**	**9**	0	**9**	**9**	-	**9**	**9**	-	**9**	-	-	**9**	**9**	-	**9**	6	**9**	6	0	0	0	0	0	0	0	Gen.
Finesse G & B	**9**	**9**	**9**	**9**	**9**	**9**	0	**9**	**9**	-	**9**	-	-	-	-	-	7	**9**	-	**9**	6	**9**	6	**9**	6	0	4	0	7	**8**	Gen.
Glean	**9**	**9**	**9**	**9**	**9**	**9**	0	**9**	**9**	-	**9**	-	-	-	-	-	7	**9**	-	**9**	6	**9**	6	0	0	0	0	0	0	0	Gen.
Harmony GT	**9**	-	-	-	-	-	-	-	7	-	-	-	-	6	**8**	**8**	-	-	7	-	5	7	7	0	0	0	0	0	0	0	Gen.
Hoelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	**9**	Res.
Maverick	**8**	-	-	-	-	**8**	-	0	6	-	**8**	-	-	5	2	3	-	-	2	-	1	3	2	**9**	5	0	4	0	5	5	Gen.
MCPA	**8**	-	-	-	**8**	**8**	**8**	-	5	-	**8**	-	-	4	4	5	-	-	5	-	4	4	5	0	0	0	0	0	0	0	Gen.
Olympus	**8**	2	**8**	2	2	**9**	-	5	6	-	**9**	-	2	-	2	5	2	-	2	**9**	-	-	-	**9**	**8**	4	3	0	0	7	Gen.
Olympus Flex	**8**	2	**8**	2	5	**9**	-	5	6	-	**9**	-	2	-	2	5	2	-	2	**9**	5	-	-	**9**	7	3	3	0	**8**	**9**	Gen.
Osprey	-	-	6	-	5	-	-	5	-	-	5	-	-	-	-	5	-	-	-	-	5	-	-	6	6	0	0	0	**9**	**9**	Gen.
Peak	**8**	-	**8**	-	**8**	**9**	-	4	**8**	**8**	-	-	-	6	5	7	-	-	**8**	**8**	0	7	7	0	0	0	0	0	0	0	Gen.
Puma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**8**	**9**	Gen.
Rave	**9**	-	**8**	-	**8**	**9**	**8**	**8**	**9**	-	**9**	7	7	**8**	**9**	**9**	**9**	-	**9**	**8**	**8**	**8**	**9**	0	0	0	0	0	0	0	Gen.
2,4-D	**9**	-	-	-	-	**9**	-	6	**8**	-	**9**	-	7	4	7	**8**	**9**	-	**9**	-	6	5	**8**	0	0	0	0	0	0	0	Gen.
Harvest Aids																														
Ally + 2,4-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	Gen.
Ally + glyphosate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	Gen.
Banvel+2,4-D+Ally	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	Gen.
Banvel + Bronate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	Gen.
glyphosate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	Gen.
Landmaster BW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	Gen.
Fallow / Burndown																														
Banvel	-	-	-	-	-	-	-	-	-	-	-	7	6	7	**8**	**8**	-	-	-	-	-	-	-	0	0	0	0	0	0	0	Gen.
Gramoxone Max	-	-	-	-	-	-	-	-	-	-	-	0	0	5	5	4	-	-	-	-	-	-	-	**8**	**8**	**8**	**8**	**8**	**8**	**8**	Res.
Fallowmaster	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	-	-	-	-	-	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	Gen.
glyphosate	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	6	**9**	**9**	-	-	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	Gen.
MCPA	-	-	-	-	-	-	-	-	-	-	-	6	3	6	6	7	-	-	-	-	-	-	-	0	0	0	0	0	0	0	Gen.
RT Master	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	-	-	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	Gen.
2,4-D	-	-	-	-	-	-	-	-	-	-	-	6	5	6	7	7	-	-	-	-	-	-	-	0	0	0	0	0	0	0	Gen.

[a] Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied according to the label under optimum growing

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL (CONT'D)

Rotational Cropping Restrictions in Months with Wheat Herbicides

Herbicide	Crops							
	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Soil appl. (PRE)								
Amber	a	a	22[b]	a	a	14[c]	14 to 36[c]	0
Finesse	a	a	11[c]	14[c]	a	14 to 25[c]	14[c]	0
Glean	a	a	a	14[c]	a	14 to 25[c]	14[c]	0
Foliar appl (POST)								
Aim	12	12	0	0	12	0	0	0
Ally	c	c	12[c]	14 to 22[c]	c	10[c]	c	1
Amber	a	a	22[b]	a	a	14[c]	14 to 36[c]	0
Banvel	b	b	b	b	b	b	b	b
Beyond	-	40	9	18[d]	0	18	9	4
Bronate Advanced	1	1	1	1	1	1	1	1
Buctril	1	1	1	1	1	1	1	1
Express	1.5	2	1.5	1.5	1.5	1.5	1.5	0
Finesse	a	a	11[c]	14[c]	a	14 to 25[c]	14[c]	0
Finesse Grass & BL	b	b	b	b	b	b	b	b
Glean	a	a	a	14[c]	a	14 to 25[c]	14[c]	0
Harmony GT	1.5	1.5	0	1.5	1.5	1.5	0	0
Hoelon	b	b	b	b	b	b	b	b
Maverick	a	a	22[c]	12[c]	a	22[c]	12[c]	0
MCPA	b	b	b	b	b	b	b	b
Olympus	a	a	18[b]	12[b]	a	12[b]	12[h]	0
Olympus Flex	b	12[b]	12[b]	10[b]	b	9[b]	5[b]	0
Osprey	10	10	12	3	3	10	3	0.25
Peak	22	10 to 18[f]	1[e]	10 to 18[f]	10	1	10 to 18[f]	0
Puma	b	b	b	b	b	b	b	b
Rave	24[a]	b	4 to 36[b]	b	b	14[g]	11 to 36[b]	0.5
2,4-D	1	1	0	1	1	1	1	1
Harvest Aids								
Ally + 2,4-D	c	c	12[c]	14 to 22[c]	c	10[c]	c	1
Ally + glyphosate	c	c	12[c]	14 to 22[c]	c	10[c]	c	1
Banvel+2,4-D+Ally	c	c	12[c]	14 to 22[c]	c	10[c]	c	1
Banvel + Bronate	b	b	b	b	b	b	b	b
glyphosate	0	0	0	0	0	0	0	0
Landmaster BW	1	1	0	1	1	1	1	1
Fallow / Burndown								
Banvel	b	b	b	b	b	b	b	b
Gramoxone Max	0	0	0	0	0	0	0	0
Fallowmaster	b	b	b	b	b	b	b	b
glyphosate	0	0	0	0	0	0	0	0
MCPA	b	b	b	b	b	b	b	b
RT Master	1	1	0	1	1	1	1	1
2,4-D	1	1	0	1	1	1	1	1

a. Must conduct a successful bioassay before planting.

b. See labeld for specific crop rotation restrictions.

c. Based on soil pH below 7.9, if soil pH is greater than 7.9 see label. Clearfield hybrids may be planted 4 months after application.

d The restriction is 18 months if at least 15 inches of rainfall has been received since the time of application and November 1 of the same year, otherwise, the restriction is 26 months. See label.

e. Clearfield hybrids may be planted immediately after application.

f. STS soybeans may be planted 10 months after application.

g. Based on soil pH below 7.9, if soil pH is greater than 7.9 then the rotation must be 24 months.

h. STS soybeans may be planted 4 months after application.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
2,4-D 3.8 lbs. ai per gallon **POST applications:** 1/2 to 3 pints /A	**Active Ingredient:** 2,4-D **Similar Products:** **Many** **MOA:** 4	**POST.** For annual and biennial broadleaf weeds, apply 1/2 to 2 pints per acre. **Do not** apply until wheat is fully tillered and prior to the jointing stage. For perennial broadleaf weeds, apply 1 to 2 pints per acre. **Do not** apply until wheat is fully tillered and prior to the jointing stage. **Emergency Weed Control.** For perennial broadleaf weeds, apply 3 pints per acre, when weeds are approaching bud stage, after the grain dough stage.	**Do not** spray grain in the boot to dough stage. **Emergency Weed Control.** The 3 pints per acre application can produce crop injury to wheat. Where scattered weeds are present, spot treatment is suggested to minimize the extent of crop injury. 2,4-D can stop or limit tillering of wheat, therefore do not apply unless wheat is fully tillered.
Aim 2 EC **POST applications:** 0.5 – 1.9 fl. Oz.	**Active Ingredient:** Carfentrazone **Similar Products:** Avalanche Aim EW **MOA:** 14	**POST.** Apply POST to weeds 1 to 4 inches tall and rosettes less than three inches across. For dense weed pressure, use the higher recommended rate plus tank mix combinations. **Any Application Timing:** Apply to all tillage systems from 30 days before planting up to the jointing stage of growth.	**Post: Can be tank-mixed with most other herbicides like 2,4-D, Banvel, or ALS herbicides to broaden weed spectrum. Contact herbicide, good coverage essential for control.** Apply with 0.25% NIS with at least 80% active ingredient strength. UAN at 0.5-1.0% or 2-4 lb of Ammonium sulfate may be added. . Aim has no soil residual. Rotation to most other row crops can occur immediately after application. **Do not** apply more than 1.9 oz/acre/season. **Do not** harvest for forage within 7 days of application..
Ally Extra 71.25% XP **POST applications:** 0.2 to 0.4 oz. /A	**Active Ingredient:** Thifensulfuron **methyl** Tribenuron **methyl** Metsulfuron **methyl** **Similar Products:** None **MOA:** 2, 2 & 2	**POST.** Make applications after the crop is in the 2-leaf stage, but before the flag leaf is visible.	**POST.** If sprayed at a rate less than 0.4 oz. per acre, consult Tank Mix Section of the label for additional info on required combinations. **Any Application Timing: Do not** harvest sooner than 45 days after the last application. **Do not** make more than one application per crop season. **Do not** use in soils with a pH greater than 7.9. **Do not** apply when rainfall is threatening, 6 hours of dry weather are needed to allow sufficient absorbtion.
Ally XP 60% XP **POST applications:** 0.1 oz/A **Harvest Aid: 0**.1 oz/A **Fallow applications:** 0.1 oz/A	**Active Ingredient:** Metsulfuron methyl **Similar Products:** None **MOA:** 2	**POST.** Make applications after the crop is in the 2-leaf stage but before the boot stage. **Harvest Aid.** Make applications after the crop has reached the hard dough stage, but no later than 10 days before harvest. **Fallow.** May be used in the spring, summer or fall when the majority of weeds have emerged and are actively growing.	**Do not** apply during boot or early heading, as crop injury may result. **Should not** be used on soils having a pH above 7.9. **Do not** use Ally XP plus Malathion, as crop injury will result. **Refer** to label for other tank mix precautions.
Amber Custom-Pak 75% WDG **SOIL applications:** 0.28 oz./A up to 0.56 oz./A **POST applications:** Up to 0.56 oz./A	**Active Ingredient:** Triasulfuron **Similar Products** Amber Accu-Pak **MOA:** 2	**PPI.** Apply and incorporate into top 1 inch of soil. **PRE.** Apply after crop planting. Activating rainfall is required before weed emergence. **POST.** Apply before weeds exceed 6.0 inches and before the wheat is at pre-boot.	**POST. Do not** apply the enhanced rate (0.56 oz/A) in areas with a soil pH greater than 7.5, except in the Blacklands of TX and OK. **Any Application Timing. Do not** apply more than 0.56 oz./A in a calendar year. **Do not** plant Durum wheat less than 8 months after an Amber application. Other spring and winter wheat varieties may be replanted any time.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Assert 2.5 lbs. ai per gallon **POST applications:** 1.2 to 1.5 pts. /A	**Active Ingredient:** Imazamethabenz **Similar Products:** None **MOA:** 2	**POST.** Apply to wheat from the 2 leaf stage of the crop, but before development of the first internode (jointing). For use in controlling wild oats and wild mustard. A non-ionic surfactant containing at least 80% active ingredient must be used with Assert. Apply 1.5 pts per acre to control wild oat populations. Apply 1.2 pts per acre to wheat planted after November 15.	**Do not** make more than one application per growing season. **Do not** graze treated fields or cut treated forage for silage or hay. Wheat or barley straw may be fed or used for bedding. **Do not** tank mix Assert with 2,4-D ester unless the crop is fully tillered. **Do not** allow Assert to remain overnight in a liquid fertilizer solution. **Do not** apply when freezing temperatures have occurred or are forecasted. **Do not** tank mix with Banvel, any product containing dicamba, MCPA amine, or 2,4-D amine formulations. Allow at least 2 days of non-freezing temperatures before and after application.
Banvel 4 lb ai per gallon **POST applications:** 2 to 8 fl. oz. /A	**Active Ingredient:** Dicamba **Similar Products:** Clarity Distinct **MOA:** 4	**POST.** May be applied at rate up to 8fl. oz. /A on fall seeded wheat after it exceeds the 3 leaf stage for suppression of perennial weeds. Applications may be made in the fall following a frost but before a killing freeze.	**POST.** Animals cannot be removed from treated area for slaughter prior to 30 days after last application. There is no waiting period between treatment and grazing for non-lactating dairy animals. Treated areas may not be grazed by lactating dairy animals before 7 days after treatment. Do not harvest hay from treated areas before 37 days after treatment. **Any Application Timing: Do not** use low rates of sulfonylurea herbicides on more mature weeds and/or on dense vegetative growth. **For best performance**, make applications when weeds are in the 2-3 leaf stage and rosettes are less than 2 inches across.
Beyond 1.0 lb ai per gallon **POST applications:** 4-6 fl oz. /A **Apply to Clearfield wheat only**	**Active Ingredient:** Imazamox **Similar Products:** None **MOA:** 2	**POST.** Apply from tillering to just prior to joint. Apply to broadleaf weeds less than 3 inches and grass weeds less than 4-5 inches.	**POST. Do not** apply to any wheat not designated as being imidazolinone tolerant **(Clearfield)**. **Do not** apply more than 8 fl. oz. during the growing season. There should be an interval of at least 30 days between an application and feeding or grazing of wheat forage and hay. There should be at least 60 days from an application and wheat harvested for grain.
Bronate Advanced 5 lb ai per gallon **POST applications:** 12.8 to 25.6 fl oz/A	**Active Ingredient:** Bromoxynil MCPA **Similar Products:** Wolfpack Advanced Wildcard Xtra **MOA:** 6 & 4	**POST.** Optimum control when applied to actively growing weed seedlings. Apply from the 3 leaf stage but before the crop reaches the boot stage.	**POST.** Apply from the 3 leaf stage but before the crop reaches the boot stage. **Refer to label for Application Method restrictions** **Any Application Method: Do not** graze treated fields within 45 days after application. **Do not** apply when weeds are under moisture stress. **Do not** when weeds are under stress from cold temperatures.
Buctril 4 Cereals 4 lb ai per gallon **Post applications:** 0.75 -1pt/A	**Active Ingredient:** Bromoxynil **Similar Products:** Bromox Wildcard **MOA:** 6	**POST.** Apply from emergence to the boot stage of wheat. **All applications:** Optimum weed control is obtained when applied to actively growing weed seedlings.	**POST.** Apply to the most susceptible weeds up to the 8 leaf stage or 4 in. in height. If weed forms rosette apply before weeds exceed 2 in. in diameter. Apply to other broadleaf weeds up to the 4 leaf stage, 2 in. in height or 1in. in diameter. **Refer to label for General Weed List.** **Any Application Method: Do not** graze fields within 45 days following treatment. **Do not** apply when crops are under moisture stress. **Do not** apply when crop canopy covers the weeds. **Do not** apply more than 1 pint per acre per year. **Do not** cut for feed or graze fall or winter treated underseeded alfalfa until spring, at least 60 days following treatment. **Do not** cut for feed or graze spring treated underseeded alfalfa within 30 days of following treatment.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Everest 70% WDG **POST applications:** 0.61 oz /A	**Active Ingredient:** Flucarbazone **Similar Products:** None **MOA:** 2	**POST.** Apply max of 0.61 oz per acre once per season. Make only one application per season.	**POST. Do not** apply by air. **Do not** apply when rain is expected within the next hour. **Do not** apply this product through any type of irrigation system. **Observe** minimum interval to harvest of 60 days after treatment. **Do not** apply before crop is fully emerged. **Do not** apply after jointing has started.
Express XP 75% XP **POST applications:** 1/6 to 1/3 oz /A	**Active Ingredient:** Tribenuron methyl **Similar Products:** None **MOA:** 2	**POST.** Apply 1/6 to 1/4 oz per acre for light infestation of broadleaf weeds. Apply 1/3 oz per acre for heavy infestation. Two applications may be made as long as the total does not exceed 1/3 oz per acre.	**POST.** Apply after the crop is in the 2-leaf stage, but before the flag leaf is visible. **Do not** harvest within 45 days of last application. **Do not** apply to stressed crops. **Do not** apply to underseeded crops.
Fallowmaster 2.0 lbs ai per gallon **POST applications:** 32 to 52 oz. /A	**Active Ingredients:** Glyphosphate and Dicamba **Similar Products:** None **MOA:** 9 & 4	**POST.** Refer to label for weeds controlled and specific application rates.	**Do not** plant any crop other than corn, wheat, barley, oats, or sorghum for 3 months after application. **Delay** planting for 15 days after application of this product. **Do not** feed or forage treated vegetation within 8 weeks after application.
Finesse 75% DF **All applications:** 0.2 to 0.5 oz. /A	**Active Ingredient:** Chlorsulfuron & Metsulfuron methyl **Similar Products:** None **MOA:** 2 & 2	**PPI.** May be applied at 0.4 oz. per acre (before winter wheat is planted) **PRE.** May be applied at 0.5 oz. per acre (after planting but before weeds emerge). **POST.** Apply 0.2- 0.4 oz. to wheat and barley any time the crop is in the 1-leaf stage, but before boot stage. **Fallow.** May be used at 0.2-0.4 oz/a in the spring, summer or fall when the majority of weeds have emerged and are actively growing.	Apply at ½ oz. per acre preemergence for suppression of annual ryegrass. **Do not** apply to fields with a soil pH of more than 7.9. **Do not** apply to fields with a pH less than 5.0.
Finesse Grass & Broadleaf 71.7% DF **POST applications:** See label	**Active Ingredient:** Chlorsulfuron and Flucarbazone **Similar Products:** None **MOA:** 2 & 2	**POST.** Apply in the fall or spring after the crop has at least 2 leaves present on the main stem and before crop jointing. If the wheat was seeded late, apply after the crop has started to tiller.	**Do not** apply PRE to the crop. **Do not** apply to fields with a soil pH of more than 7.9. For best control of annual ryegrass and wild oat, apply as early POST application when weeds are 1 leaf to tillering stage of growth. **Do not** graze, harvest forage, or harvest grain for at least 60 days after application.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Glean FC 75% WDG **SOIL applications:** See Table **POST applications:** 1/6 to 1/3 oz. /A	**Active Ingredient:** Chlorsulfuron **Similar Products:** None **MOA:** 2	**PRE.** Apply preemergence in Southern part of state only. Adequate rainfall is needed to activate product before weeds germinate. POST. **Apply 1/6 – 1/3 oz/a anytime after the crop has reached the 2-leaf stage, but before boot.**	Apply at ½ oz. per acre preemergence for suppression of annual ryegrass. **Do not** make more than one application in the same season.

Glean FC Application Areas and Rates

Area of the State	Max. Application Rate	Minimum Application Interval
Southern	1/2 oz. per acre preemergence	Once per crop period
Panhandle	1/3 oz. per acre postemergence	Once every 36 months
Areas east of Panhandle	1/3 oz. per acre postemergence	Once per crop period

Glyphosate 41% WSL **POST applications:** 1 to 4 pts /A	**Active Ingredients:** Glyphosate **Similar Products:** Roundup Ultra Roundup Ultra Max Roundup Pro Rattler Debit Credit Glyphomax Etc. **MOA:** 9	**Harvest Aid.** Apply after the dough stage of grain (30% or less grain moisture) and at least 7 days prior to harvest. Refer to label for weeds controlled list and application rates for each weed type. **Pre Plant Burndown:** Apply 8 fl. oz. per acre of product plus 0.5 to 1 percent nonionic surfactant in 3 to 10 gallons of water per acre. Application must be followed by conventional tillage no more than 15 days after treatment. **Allow at least 2 days after application before tillage.**	**Do not** apply to crops grown for seed, reduction in germination or vigor may occur. **Do not** apply more than 1 qt. per acre for preharvest applications.
Gramoxone Max[r] 3.0 lbs. ai per gallon **All applications:** 1.3 to 1.7 pt/A	**Active Ingredients:** Paraquat **Similar Products:** None **MOA:** 22	**PRE Plant Burndown** Weeds 1-3": 1.3-1.7 pts Weeds 3-6": 1.7-2.0 pts Weeds 6": 2.0-2.7 pts	**Always** use either a crop oil concentrate or a nonionic surfactant at rates recommended by the label. **Apply** with a minimum of 5 gals. of spray mix per acre. **Apply** when weeds are actively growing and 1-6" in height. Weeds 6" or taller may not be contolled. **Avoid** applying in extremely dusty conditions. **Do not** use around home gardens, schools, recreation parks, or playgrounds. Soil should be prepared as far ahead of planting as possible to allow maximum weed and grass emergence prior to treatment. Weeds and grasses emerging after application will not be controlled or suppressed. **Do not** apply to emerged crop as crop injury/death will occur.

[r] Restricted Use

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Hoelon[r] 3EC 3 lb ai per gallon **POST applications:** See table	**Active Ingredient:** Diclofop-methyl **Similar Products:** None **MOA:** 1	**POST.** 1 pint to 1 quart per acre of crop oil approved for use in the crop may be added. **Do not** apply less than 77 days before harvesting wheat.	**Do not** allow livestock to graze treated fields. **Do not** harvest, forage or straw from treated fields prior to grain harvest. **Do not** apply more than one treatment per growing season. Maximum application rate is 1 lb/acre per growing season. Product does not control broadleaf weeds or perennial grassy weeds. **Do not** apply any phenoxy based herbicides, or Banvel within 5 days of application, or reduced grassy weed control will occur.
Harmony Extra XP 75% XP **POST applications:** 0.3 to 0.6 oz per acre.	**Active Ingredient:** Thifensulfuron methyl Tribenuron methyl **Similar Products:** None **MOA:** 2	**POST.** Apply 0.3 – 0.6 oz per acre for control or partial control of weeds listed on label. Apply 0.5 - 0.6 oz per acre when weed infestation is heavy. Apply 0.3 – 0.4 oz per acre when weed infestation is light. Make applications after the crop is in the 2-leaf stage, but before the flag leaf is visible.	**Do not** use less than 0.3 oz per acre. **Do not** apply if rain is expected within 1 hour. **Do not** graze or feed forage or hay from treated areas to livestock (harvested straw may be used for bedding and/or feed) Multiple applications allowed as long as total does not exceed 1.0 oz /A. Crop rotation: wheat, barley and oat can be planted anytime after application. Any other crop can be planted 45 days after application days after application except sugarbeets, winter rape and canola which can be planted 60 days after application.
Harmony GT XP 75% XP **POST applications:** 0.3 to 0.6 oz per acre.	**Active Ingredient:** Thifensulfuron methyl **Similar Products:** None **MOA:** 2	**POST.** Apply 0.3 – 0.6 oz per acre for control or partial control of weeds listed on label. Apply 0.6 oz per acre when weed infestation is heavy. Apply 0.3 oz per acre when weed infestation is light. Make applications after the crop is in the 2-leaf stage, but before the flag leaf is visible. Fallow: Apply 0.3-0.6 oz/a in the **spring, summer or fall when the majority of weeds have emerged and are actively growing.**	**Do not** use less than 0.3 oz per acre. **Do not** apply if rain is expected within 1 hour. **Do not** graze or feed forage or hay from treated areas to livestock (harvested straw may be used for bedding and/or feed) Multiple applications allowed as long as total does not exceed 1.0 oz /A Crop rotation: wheat, barley, oat, soybeans and field corn can be planted anytime after application. Any other crop can be planted 45 days after application.

	Holeon[r] 3EC Use rates Relative to Growth Stage Pints/A		
Susceptible Annual Grassy Weeds	**1-3 Leaf Stage**	**3-4 Leaf Stage**	**5 Leaf-2 Tillers**
Annual ryegrass	1 1/3	1 1/3 to 2	2 to 2 2/3
Wild oat	2 to 2 2/3	2 2/3	Do not apply. Reduced weed control will occur.

[r] Restricted Use.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Landmaster BW 1.2 lbs ai per gallon **EPP applications:** 27 to 54 fl. oz. /A	**Active Ingredient:** glyphosate and 2,4-D **Similar Products:** None **MOA:** 9 & 4	**EPP.** Refer to label for specific rates on various weeds controlled. Product should be applied postemergence to vigorously growing weeds, prior to planting or emergence of wheat. Application should be delayed until maximum emergence of target weeds, but before weeds exceed the maximum size recommended.	**Do not** harvest or feed treated vegetation for 8 weeks after application. **Do not** graze or harvest spot treated areas for 30 days after application.
Maverick 75% WDG **POST.** 2/3 oz /A	**Active Ingredient:** Sulfosulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply when target weeds are actively growing. Use 0.5 percent by volume nonionic surfactant concentration. Application should be made after the 2-leaf stage, but prior to the jointing stage.	**Preemergence applications are not recommended Do not** use product plus Malathion, as crop injury may result. **Do not** use nonionic surfactants or other additives that alter the pH of the spray solution below pH 5. **Do not** use low rates of liquid fertilizer as a substitute for surfactant.
MCPA Amine 3.7 lbs. ai per gallon **POST applications:** Up to 3 ¼ pints /A	**Active Ingredient:** MCPA **Similar Products:** None **MOA:** 4	**POST.** Apply as a water mix spray by ground sprayer or airplane. Use ½ to 1 pint per acre for the more susceptible weeds after crop has reached the 3-4 leaf stage up to the boot stage. Use up to 3 pints per acre for less susceptible weeds after the crop has tillered and up to early boot stage. **Do not** spray from boot to dough stage.	**Emergency control.** Use 3 ¼ pints per acre for perennial broadleaf weeds. Apply when weeds are approaching bud stage, but do not spray grain in the boot to dough stage. The 3 ¼ pints per acre application can produce injury to wheat. Balance the severity of your weed problem against the possibility of crop damage. Where perennial weeds are scattered, spot treatment is suggested to minimize the effect of crop injury.
Olympus 70% WDG **POST applications:** 0.61 to 0.9 oz /A	**Active Ingredient:** Propoxycarbazone **Similar Products:** None **MOA:** 2	**POST.** Apply in the fall or spring to small actively growing weeds after the crop has emerged and has began tillering. Best results are achieved when applied in the fall. Olympus is both foliar and root absorbed.	**Do not** apply more than 1.2 oz/A per crop year. **Do not** harvest of grain within 71 days after application.
Olympus Flex 11.25 % WDG **POST applications:** 3 to 3.5 oz/A	**Active Ingredient:** Propoxycarbazone Mesosulfuron **Similar Products:** None **MOA:** 2 & 2	**POST applications:** Apply 3 oz/A to fall-sown or winter wheat in the fall or spring after the crop and weeds have emerged and before crop jointing. Apply to small actively growing weeds. Under dry conditions or in dense weed canopies, use 3.5 oz/A for best results.	**Do not** apply more than 3.5 oz/A in a crop year. **Do not** apply within 30 days of harvesting forage, and 71 days within harvesting for grain or straw. **Do not** apply with malathion, mancozeb, phosphorodithioate, chlorpyrifos, or methyl parathion as unacceptable crop response may occur.
Osprey 4.5 % WDG **POST applications:** 4.75 oz/A for most weed infestation 3.2 oz/A for wild oat control only	**Active Ingredient:** mesosulfuron **Similar Products:** None **MOA:** 2	**POST applications:** Apply to small actively growing weeds at the recommended rate once the crop and weeds have emerged. Osprey is only foliar absorbed, so the weeds must be emerged and actively growing at the time of application.	**Do not** make more than one application in a crop year. **Do not** apply more than 4.75 oz/A in a crop year. Do not apply within 30 days of harvesting for forage, and 60 days within harvesting for grain or straw. Do not apply with malathion, di-syston, mancobez, or methyl parathion as crop injury/death may occur.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Paramount 75% WSG **SOIL applications:** 5.3 oz /A	**Active Ingredient:** quinchlorac **Similar Products:** None **MOA:** 4	**PPL** Apply at 5.3 oz per acre for control of annual grasses and broadleaf weeds. **All applications:** Should be applied by ground application equipment. May be applied using aerial application equipment only when permitted by supplemental labeling. May be applied as either a broadcast or a spot spray application. Applications must be made to actively growing weeds.	**Do not** allow livestock to graze in treated areas. **Do not** harvest hay from treated areas within 309 days after application. **Do not feed** treated grasses, forage, hay, silage, straw, seed, nor seed screenings to livestock. **Do not** apply to water or to areas where surface water is present. **Do not** apply to irrigation ditches or areas that act as a channel for water entering cropland. **Do not** apply by air in the following counties: Choctaw, Craig, Rogers.
Peak Custom Pak 57% WDG **POST applications:** 0.38 to 0.5 oz /A	**Active Ingredient:** Prosulfuron **Similar Products:** Peak Accu-Pak **MOA:** 2	**POST.** May be applied over-the-top to actively growing crops from the emergence to before the second node is detectable in stem elongation. It is more important to time applications to the optimum weed heights listed on the table. Refer to product label for specifics on weed heights. In dry climates, crop oil is the preferred additive, instead of nonionic surfactant, when applying product alone with water as the carrier.	**Do not** apply to crops which are under severe stress due to drought, cold weather, hail, wind damage, sand cutting, flooding, water-logged soil, compacted soil, disease, insect damage, nutrient deficiency, or other causes. Also, should not be applied if weeds are under severe stress due to drought or are larger than optimum height listed on label. **Do not** apply if cold, wet environmental conditions are expected within 1 week after application. **Do not** make a foliar or soil application of any organophosphate insecticide within 15 days prior to or 10 days after an application of product. **Do not** apply product to crops that exhibit injury symptoms from a previous herbicide application or other causes.
Puma 1EC 1 lb. ai per gallon **POST applications:** 5.3 to 10.6 oz /A	**Active Ingredient:** Fenoxaprop **Similar Products:** None **MOA:** 1	**POST.** May be tank mixed with liquid nitrogen fertilizer. Only 28-32% UAN may be added. **Do not** exceed 5 gallons/acre of liquid nitrogen for ground applications or 50% of the total spray volume by air.	**Do not** apply within 70 days of harvest. **Do not** make more than one application in a growing season. **Do not** apply this product through any irrigation system.
Rave 63.89% WDG **POST applications:** 2-4 oz. /A	**Active Ingredient:** Triasulfuron Dicamba **Similar Products:** None **MOA:** 2 & 4	**POST.** Apply 4 oz per acre after crop is fully tillered but not forming joints in the stem, and when the target weeds are actively growing.	**Do not** apply within 4 hours of an expected rainfall. **Do not** apply to stressed or dormant weeds or when expected within one week after application. For optimum control, make applications before emerged weeds are exposed to extended periods of freezing temperatures. **Do not** harvest hay or grain from treated fields for 37 days after treatment. **Do not** make more than one application per year.
Rhonox 75% DF **POST applications:** Up to 1 ½ pints /A	**Active Ingredient:** MCPA **Similar Products:** None **MOA:** 4	**POST.** Apply after grain is in the 3 to 4 leaf stage, but not forming joints in the stem. **Do not** spray in the boot to dough stage.	**Do not** allow livestock animals to forage or graze treated areas within 7 days of slaughter. **Use** a minimum of 10 gallons of water per acre for ground application and 2 gallons of water per acre for aerial application.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
RT Master 4 lbs. ai per gallon **EPP. applications:** 2 qt. /A **PRE. applications:** 2 qt. /A **Harvest Aid:** 1 qt. /A	**Active Ingredients:** Glyphosate 2,4-D **Similar Products:** None **MOA:** 9 & 4	**EPP. & PRE. Do not** exceed 2 qts. per acre. **Application** must be made at least 30 days prior to planting. **Harvest Aid.** Provides weed control when applied prior to harvest. Apply after the hard dough stage of grain.	**Do not** apply more than 1 qt. per acre in preharvest applications. **It is advised** to not treat crops grown for seed. **Allow** at least 14 days between application and harvest of grain. **Allow** 7 days between application and grazing or harvest of forage or straw. This product may be applied after harvest of crop. Higher application rates may be required for control of large weeds which were growing in the crop at the time of harvest. **This product is only labeled for the following counties:** Alfalfa, Beaver, Blaine, Canadian, Cimarron, Custer, Dewey, Ellis, Garfield, Grant, Harper, Kay, Kingfisher, Logan, Major, Noble, Pawnee, Payne, Roger Mills, Texas, Woods, and Woodward.
Sencor 4 4 lb. ai per gallon **POST applications:** See table	**Active Ingredients:** Metribuzin **Similar Products:** Sencor DF **MOA:** 5	**POST.** Apply when crop is healthy and actively growing. May apply more than once per crop season. Allow a minimum of 21 days between applications if wheat is actively growing or allow 45 days if wheat is growing in adverse conditions, has entered dormancy, or is stressed due to frost damage, disease, drought, or excessive moisture. **A maximum of 8 fl. oz. per acre for any one application is OSU's recommendation for Oklahoma.**	**Do not** apply more than a total of 16 fl. oz. per acre per year. **Do not** graze wheat within 14 days of application. **Do not** harvest grain within 21 days after last application. **Do not** use a crop oil or any adjuvant containing vegetable or petroleum oil in any tank mix applications as crop injury may result. **Do not** use on soils containing less than 0.75% organic matter. **Refer** to label for variety tolerances.

This section has not been revised since 2006.

SMALL GRAIN WEED CONTROL SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Recommended Postemergence Broadcast Applications of Sencor 4			
Crop Growth Soil	**Soil Texture**	**Sencor 4 Rate (fl oz/A) % Organic Matter**	
		0.75 TO 2.0 % O.M.	**OVER 2.0 % O.M.**
2 Leaf to 2 Tiller	Coarse	1.5 to 3	1.5 to 4.5
	Medium	1.5 to 4.5	3 to 4.5
	Fine	3 to 4.5	3 to 6
	Use these rates on crops with secondary roots smaller than 1 inch.		
3 Tiller to 4 Tiller	Coarse	4.5 to 6	6 to 7.5
	Medium	6 to 7.5	7.5 to 9
	Fine	7.5 to 9	7.5 to 9
	Do not apply within 2 weeks after grazing or breaking of winter dormancy. Apply after the crop is at or beyond the 3 tiller growth stage but before jointing. Secondary roots should be developed and larger than 1 inch long. **Do not** apply before 75 days after planting.		
Over 4 Tillers	Coarse	6 to 9	7.5 to 12
	Medium	6 to 12	7.5 to 12
	Fine	7.5 to12	12 to 16
	Do not apply within 2 weeks after grazing or breaking of winter dormancy. Apply after the crop is at or beyond the 3 tiller growth stage but before jointing. Secondary roots should be developed and larger than 1 inch long. **Do not** apply before 75 days after planting.		

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Weedmaster 3.87 lb ai per gallon **POST applications:** 2 pints /A	**Active Ingredients:** Dicamba and 2,4-D **Similar Products:** Rangestar **MOA:** 4 & 4	**POST. Do not** apply until the wheat is fully tillered and prior to the jointing stage. Apply 0.5-1.33 pts. per acre for control of annual broadleaf weeds and suppression of perennial weeds. **Preharvest:** Product can be used to control weeds that may interfere with harvest of wheat. Apply up to 2 pints per acre to annual broadleaf weeds when wheat is in the hard dough stage and the green color is gone from the nodes (joints) of the stem.	**Do not** use preharvest-treated wheat for seed unless a germination test is performed on the seed with an acceptable result of 95% germination or better. **Do not** graze or harvest for livestock feed prior to crop maturity. **Do not use** product in wheat underseeded with legumes. **For crops grown for pasture or hay only:** refer to Pastures, Rangeland and Grass portion of the label.

MOA Group Tables start on page 46 of the handbook.

SMALL GRAIN DISEASES CONTROL GUIDE

DISEASE	SYMPTOMS	CONTROL
BARLEY		
Seedling Blights and Seed Rots (*Helminthosporium* spp. *Fusarium* spp. *Rhizoctonia* spp. *Pythium* spp.)	Poor stand - seed rot, pre- or postemergence death of seedling. Stunted plants.	See supplement on seed treatments.
Covered Smut (*Ustilago hordei*)	Covered smut becomes noticeable at heading time when smutted heads emerge from the boot. Hard, black masses of smut, each covered with a grayish membrane, are found in place of kernels in infected heads.	Treat with certain fungicides. See supplement on seed treatments.
Common Dryland Root or Crown Rot	Areas of sterile heads found at maturity.	Treat with certain fungicides. See supplement on seed treatments.
Loose Smut (*Ustilago nuda*)	Loose Smut is first noticed at heading time when dark smutted heads appear. Infected heads contain millions of loosely held black microscopic spores that are scattered by the wind. All parts of the head are destroyed leaving only the naked rachis.	Plant certified seed free from the fungus. Treat with certain fungicides. See supplement on seed treatments.
OATS		
Seedling Blights and Seed Rots (*Helminthosporium* spp. *Fusarium* spp. *Rhizoctonia* spp. *Pythium* spp.)	Poor stand, seed rot, pre- or postemergence death of seedling, stunted plants.	See supplement on seed treatments.
Smut, Covered and Loose (*Ustilago kolleri*, *Ustilago avenae*)	Black smut spores replace kernels in infected panicles, covered smut spores are enclosed within a grayish membrane. The two smuts cannot be clearly differentiated in the field.	Treat with certain fungicides. See supplement on seed treatments.
WHEAT		
Seedling Blights and Seed Rots B*ipolaris* spp., *Fusarium* spp., *Rhizoctonia* spp., *Pythium* spp.)	Poor stand, seed rot, pre- or postemergence death of seedling, stunted plants.	See supplement on seed treatment.
Common Rot Root/Dryland Root Rot (*Bipolaris sorokiniana*) (*Fusarium spp.*)	Chocolate brown to grey discoloration at base of wheat seedlings. Presence of a reddish/purple color indicates Fusarium. At crop maturity, patches of sterile plants can be found.	Clean cultivation. Late planting date (after Oct. 1 for northern Oklahoma and after Oct. 15 for southern Oklahoma). Seed treatments (see supplement) also may provide some protection.
Common Bunt or Stinking Smut *(Tilletia tritici caries)* *(Tilletia laevis)*	Common Bunt or Stinking Smut is generally not apparent until 10 to 20 days after heading. The infected plants are stunted, being about three-fourths as tall as healthy plants. The heads have a characteristic bluish green color. The smut balls replace the kernels of wheat. These smut spore filled kernels have a distinct fishy odor.	See supplement on seed treatments.

SMALL GRAIN DISEASES CONTROL GUIDE (CONT'D)

DISEASE	SYMPTOMS	CONTROL
WHEAT (cont'd) Common Bunt or Stinking Smut *(Tilletia tritici caries)* *(Tilletia laevis)*	Common Bunt or Stinking Smut is generally not apparent until 10 to 20 days after heading. The infected plants are stunted, being about three-fourths as tall as healthy plants. The heads have a characteristic bluish green color. The smut balls replace the kernels of wheat. These smut spore filled kernels have a distinct fishy odor.	See supplement on seed treatments.
Karnal Bunt (*Tilletia indica*)	Although Karnal bunt has not been reported in Oklahoma as of September, 2007, wheat seed can be treated to help control Karnal bunt. Wheat seed infected by Karnal bunt has a similar appearance and the same fishy odor as wheat seed infected with common bunt except that only a small portion of the seed is usually bunted.	See supplement on seed treatments.
Loose Smut (*Ustilago tritici*)	Loose Smut is noticeable as soon as wheat heads. All parts of the head are completely replaced by masses of black smut spores. The smut spores soon disperse, leaving only the naked rachis.	Treat seed with a systemic fungicide. See supplement on seed treatments.
Leaf Rust *(Puccinia triticina*)	Green wheat leaves and leaf sheaths become covered with small, round or oval bright-to-reddish-orange pustules.	Plant resistant varieties. The most common chemicals used to control leaf and stripe rust include Propimax (propiconazole), Tilt (propiconazole), Quilt (propiconazole + azoxystrobin), Headline (pyraclostrobin) and Stratego (propiconazole + trifloxystrobin). See Fact Sheet 7609 - Leaf Rust and Stem Rust of Wheat. See labels for approved tank mixtures. For fall infection see supplement on seed treatments.
Stripe Rust *(Puccinia striiformis* f. sp. *tritici)*	Green wheat leaves, leaf sheaths and heads are covered with small, round or oval pustules arranged in "stripes" on leaves. Pustules are yellowish-orange in color.	
Septoria Leaf Blotch (*Septoria tritici*)	Infected plants show oval, light brown spots on leaves, speckled with minute, dark brown fungus fruiting bodies. As the spots increase in number the entire leaf can be killed.	The most common chemicals used to control Septoria Leaf Blotch include Propimax (propiconazole), Tilt (propiconazole), Quilt (propiconazole + azoxystrobin), Headline (pyraclostrobin) and Stratego (propiconazole + trifloxystrobin). See Fact Sheet 7613 - Septoria Leaf Blotch and Glume Blotch of Wheat. See labels for approved tank mixtures. For fall infection see supplement on seed treatment.
Glume Blotch (*Stagonospora nodorum*)	This disease is most conspicuous on the glumes. The lesions are irregular chocolate-brown spots, sprinkled with tiny, black fruiting bodies.	The most common chemicals used to control Glume Blotch include Propimax (propiconazole), Tilt (propiconazole), Quilt (propiconazole + azoxystrobin), Headline (pyraclostrobin) and Stratego (propiconazole + trifloxystrobin). See Fact Sheet 7613 - Septoria Leaf Blotch and Glume Blotch of Wheat. See labels for approved tank mixtures. For fall infection see supplement on seed treatment.

SMALL GRAIN DISEASES CONTROL GUIDE (CONT'D)

DISEASE	SYMPTOMS	CONTROL
WHEAT (cont'd)		
Powdery Mildew (*Blumeria graminis*)	Powdery Mildew appears as white cotton tufts of fungus mycelium on the surfaces of wheat leaves. The sports from these tufts of mycelium will easily break loose giving the appearance of white powder flying through the air.	The most common chemicals used to control Powdery Mildew include Propimax (propiconazole), Tilt (propiconazole), Quilt (propiconazole + azoxystrobin), Headline (pyraclostrobin) and Stratego (propiconazole + trifloxystrobin). See labels for approved tank mixtures. For fall infection see supplement on seed treatment. See labels for approved tank mixtures. Plant resistant varieties. See Fact Sheet 7633 - Powdery Mildew of Wheat. For fall infection see supplement on seed treatments.
Tan Spot (*Pyrenophora tritici-repentis*)	Dark oval lesions on leaves with light to dark brown centers often surrounded by distinct yellow borders.	Use crop rotation, clean tillage, resistant varieties, chemical control or a combination of these to reduce tan spot severity. The most common chemicals used to control Tan Spot include Propimax (propiconazole), Tilt (propiconazole), Quilt (propiconazole + azoxystrobin), Headline (pyraclostrobin) and Stratego (propiconazole + trifloxystrobin). See Fact Sheet 7624 - Tan Spot of Wheat.
Viruses	Yellow streaking or mosaic; purpling or mottled mosaic appearance in new leaves; stunting.	Check Fact Sheets (#7636 and #7629) and Informational Sheets at http://www.entoplp.okstate.edu/ddd/hosts/wheat.htm) for symptom descriptions and control recommendations for specific viruses including Wheat Soilborne Mosaic Virus, Wheat Spindle Streak Mosaic Virus, Wheat Streak Mosaic Virus, High Plains Virus, and Barley Yellow Dwarf Virus.

SUPPLEMENT FUNGICIDES SUGGESTED FOR WHEAT, OATS, BARLEY AND RYE SEED TREATMENTS

FUNGICIDE TRADE NAME and (Group)	RATE OF FORMULATION	DISEASES CONTROLLED
	WHEAT	
Apron XL LS- Metalaxyl (4)	0.32 – 0.64 fl oz/100lb.	Specific for root rots caused by *Pythium* and *Phytophthora*.
Baytan – Triadimenol (3)	0.75-1.5 fl oz/100 lb	Seed Decay, Seedling Blight, Common Bunt and Loose Smut; Acso controls fall foliar diseases.
Captan - Captan (M)	1.5 – 4.0 fl oz/100 lb	Seed Decay, Seedling Blight
Cruiser - Thiamethoxam (4?) ***This is an insecticide***.	.75 – 1.33 fl oz/100lb	Controls many aphids, which can spread barely yellow dwarf viruses, wireworms and Hessian fly.
Dividend-Difenoconazole (3)	1.0 fl oz/100 lb	Control of loose smut and common bunt (stinking smut). Control during the fall of wheat leaf rust, powdery mildew, and septoria leaf blotch. Partial control of common root rot, Fusarium root rot, Fusarium crown rot, take-all, and Karnal bunt.
Dividend Extreme Difenoconazole (3) Metalaxyl (4) Dividend XL RTA Difenoconazole (3) Metalaxyl (4)	1.0-4.0 fl. oz/100 lb	Control of loose smut, common bunt (stinking smut), *Pythium* damping-off, seed-borne Fusarium scab, septoria seedling blight, and seed rots. Partial control of common root rot and Karnal bunt. Control of fall foliar diseases.
Nu-Zone – Imazalil (3)	0.8-1.5 fl oz/bu	Specific for Common (Dryland) Root Rot
Agsco RR – Imazalil (3)	0.8-1.5 fl oz/bu	Specific for Common and Dryland Root Rot
Fecundal - Imazalil (3)	0.8-1.5 fl oz/100 lb	Specific for Common and Dryland Root Rot
Flo-Pro-IMZ - Imazalil (3)	0.5-0.8 fl oz/bu	Specific for Common (Dryland) Root Rot
Gaucho - Imidacloprid (4A) ***This is an insecticide***.	1 to 3 fl oz/100 lb	Lower rates (1-1.5 fl oz) controls aphids (Bird Cherry-Oat, English Grain, Greenbug, and Russian Wheat), Hessian Fly, and Wireworms. Higher rates (2-3 oz) reduce the potential spread of Barley Yellow Drawf Virus due to aphid vectors
Gaucho XT ***(This is a combination of insecticide + two fungicides)*** Imidacloprid (4A) Metalaxyl (4) Tebuconazole (3)	3.4 fl oz/100 lb	Activity against aphid/BYDV complex, smuts and bunts, early season (fall) root rots, early season (fall) damping-off, and early season (fall) foliar diseases such as rusts, powdery mildew, and the septoria complex
PCNB Pentachloronitrobenzene (14)	3 fl oz/100 lb	Common Bunt (Stinking Smut) and Karnal Bunt (partial control), Rhizoctonia, Fusarium
Raxil-MD Tebuconazole (3) Metalaxyl (4)	5 to 6.5 fl oz per 100 lb	Common Bunt or Stinking Smut, loose smut; early season Septoria complex; general seed rots; *Pythium* damping-off; early season Rhizoctonia and common root rots; seedborne Fusarium scab; early season Fusarium foot rot; and early season suppression of powdery mildew and rust.

SUPPLEMENT FUNGICIDES SUGGESTED FOR WHEAT, OATS, BARLEY AND RYE SEED TREATMENTS (CONT'D)

FUNGICIDE TRADE NAME and (Group)	RATE OF FORMULATION	DISEASES CONTROLLED
	WHEAT (cont'd)	
Raxil MD-W ***(This is a combination of insecticide + two fungicides)*** Imidacloprid (4A) Tebuconazole (3) Metalaxyl (4)	5 fl oz per 100 lb seed	Common Bunt or Stinking Smut, loose smut; early season Septoria complex; general seed rots; *Pythium* damping-off; early season Rhizoctonia and common root rots; seedborne Fusarium scab; early season Fusarium foot rot; early season suppression of powdery mildew and rust; suppression of wireworm activity on seed and young seedlings.
RTU Vitavax Thiram Carboxin – (7) Thiram (M)	5-6.8 oz/100 lb	Rhizoctonia, Helminthosporium, Fusarium, *Pythium*, Common bunt (Stinking Smut), Loose Smut, Karnal Bunt (partial control)
Vitavax- Carboxin (7)	2-3 oz/100 lb	Specific for Loose Smut
Vitavax-Thiram-Lindane Carboxin (7) Thiram (M) Lindane (2A)	5 fl oz/100 lb	Common Bunt or Stinking Smut, Loose Smut, Covered Smut, Seedling Blight, Seed Decay, Wireworms, Seed Corn Maggots
Dry Powder Formulations that can be used as Drill Box Treatments:		
Agsco DB-Green + Vitavax Lindane (2A) Maneb (M) Carboxin (7)	2 oz/bu	Seed Decay, Seedling Blight, Bunt and Wireworm
Enhance Captan (M) Carboxin (7)	4 oz/100 lb	Seed Decay, Seedling Blight, Bunt and Wireworm
Enhance Plus Carboxin (7) Lindane (2A) Maneb (M)	2 oz/bu	Seedling Blight, Bunt and Wireworms
Vitavax - Captan Carboxin (7) Captan (M)	4 oz/100 lb	Seed Decay, Seedling Blight and Bunt
	OATS	
Captan Captan (M)	2 fl oz/100 lb	Seed Decay and Seedling Blight
RTU Vitavax Thiram Carboxin (7) Thiram (M)	5 - 6.8 fl oz/100 lb	Seed Decay and Seedling Blight
Baytan Triadimenol (3)	0.75 - 1.5 fl oz/100 lb	Seed Decay, Seedling Blight, Covered and Loose Smut
Apron XL LS Metalaxyl (4)	0.32 – 0.64 fl oz/100 lb	Specific for root rots caused by *Pythium* and *Phytophthora*.
Vitavax-Captan Carboxin (7) Captan (M)	4 oz/100 lb	Seed Decay, Seedling Blight, Covered and Loose Smut
Terra-Coat LT-2N Pentachloronitrobenzene (14)	2-4 oz/bu	Seed Decay, Seedling Blight, and Covered Smut
-PCNB Pentachloronitrobenzene (14)	5.5 - 11 fl oz/100 lb	Oat Smut

SUPPLEMENT FUNGICIDES SUGGESTED FOR WHEAT, OATS, BARLEY AND RYE SEED TREATMENTS (CONT'D)

FUNGICIDE TRADE NAME and (Group)	RATE OF FORMULATION	DISEASES CONTROLLED
	OATS (cont'd)	
Raxil --Thiram Tebuconazole (3) Thiram (M)	3.5 to 4.6 fl oz per 100 lb	Stinking, flag & loose smut; early season Septoria complex; general seed rots; *Pythium* damping-off; early season Rhizoctonia and common root rots; seedborne Fusarium scab; early season Fusarium foot rot; and early season suppression of powdery mildew and leaf rust. Dilute product with sufficient water to apply at 9 to 20 fl oz per 100 lb seed.
Raxil MD Tebuconazole (3) Metalaxyl (4)	5-6.5 fl oz/100 lb	Common Bunt or Stinking Smut, loose smut; early season Septoria complex; general seed rots; *Pythium* damping-off; early season Rhizoctonia and common root rots; seedborne Fusarium scab; early season Fusarium foot rot; early season suppression of powdery mildew and rust; suppression of wireworm activity on seed and young seedlings.
Drill Box Seed Treatments for Oats:		
Enhance Captan (M) Carboxin (7)	4 oz/100 lb	Seed Decay, Seedling Blight, Covered and Loose Smut
Enhance Plus Carboxin (7) Lindane (2A) Maneb (M)	2 oz/bu	Seed Decay, Seedling Blight, Loose Smut, and Wireworms
	BARLEY	
Agsco - RR - Imazalil (3)	0.5-0.8 fl oz/bu	Specific for Common Root Rot
Apron XL LS- Metalaxyl (4)	0.32 – 0.64 fl oz/100 lb	Specific for root rots caused by *Pythium* and *Phytophthora*
Baytan -Triadimenol (3)	0.75-1.5 fl oz/100 lb	Seed Decay, Seedling Blight, Covered Smut
Captan - (1:5 dilution)	320 cc/100 lb	Seed Decay and Seedling Blight
Cruiser - Thiamethoxam (4?) ***This is an insecticide***.	.75 – 1.33 fl oz/100lb	Controls many aphids, which can spread barley yellow dwarf viruses, wireworms and Hessian fly.
Fecundal – Imazalil (3)	0.5-0.8 fl oz/100 lb	Common Root Rot, Seedling Blight, Seedborne Net Blotch
Flo-Pro-IMZ - Imazalil (3)	0.5-0.8 fl oz/bu	Specific for Common Root Rot
Gaucho - Imidacloprid (4A) ***This is an insecticide***.	1 to 3 fl oz/100 lb	Lower rates (1-1.5 fl oz) controls aphids (Bird Cherry-Oat, English Grain, Greenbug, and Russian Wheat), Hessian Fly, and Wireworms. Higher rates (2-3 oz) reduce the potential spread of Barley Yellow Drawf Virus due to aphid vectors

SUPPLEMENT FUNGICIDES SUGGESTED FOR WHEAT, OATS, BARLEY AND RYE SEED TREATMENTS (CONT'D)

FUNGICIDE TRADE NAME and (Group)	RATE OF FORMULATION	DISEASES CONTROLLED
	BARLEY (cont'd)	
Gaucho XT ***(This is a combination of an insecticide + two fungicides)*** Imidacloprid (4A) Metalaxyl (4) Tebuconazole (3)	3.4 fl oz/100 lb seed	Activity against aphid/BYDV complex, wireworms, barley stripe (suppression), smuts and bunts, early season (fall) root rots, early season (fall) damping-off, and early season (fall) barley leaf rust
Nu-Zone - Imazalil (3)	0.8-1.5 fl oz/bu	Specific for Common Root Rot
Raxil MD-W ***(This is a combination of insecticide + two fungicides)*** Imidacloprid (4A) Tebuconazole (3) Metalaxyl (4)	5 fl oz per 100 lb seed	Common Bunt or Stinking Smut, loose smut; early season Septoria complex; general seed rots; *Pythium* damping-off; early season Rhizoctonia and common root rots; seedborne Fusarium scab; early season Fusarium foot rot; early season suppression of powdery mildew and rust; suppression of wireworm activity on seed and young seedlings.
Raxil MD Tebuconazole (3) Metalaxyl (4)	5-6.5 fl oz/100 lb	Common Bunt or Stinking Smut, loose smut; early season Septoria complex; general seed rots; *Pythium* damping-off; early season Rhizoctonia and common root rots; seedborne Fusarium scab; early season Fusarium foot rot; and early season suppression of powdery mildew and leaf rust and suppression of wireworm activity on seed and young seedlings.
Vitavax Thiram Carboxin (7) Thiram (M)	5.0-6.8 fl oz/100 lb	Loose Smut, Covered Smut, Common Bunt
Terra-Coat LT-2N Pentachloronitrobenzene (14)	2-4 oz/bu	Seed Decay, Seedling Blight, Covered Smut
Vitavax-Captan Carboxin (7) Captan (M)	4 oz/100 lb	Seed Decay, Seedling Blight, Covered and Loose Smut
Vitavax Thiram Lindane Carboxin (7) Thiram (M) Lindane (2A)	6.0 fl oz/100 lb	Loose Smut, Covered Smut, Common Bunt

SUPPLEMENT FUNGICIDES SUGGESTED FOR WHEAT, OATS, BARLEY AND RYE SEED TREATMENTS (CONT'D)

FUNGICIDE TRADE NAME and (Group)	RATE OF FORMULATION	DISEASES CONTROLLED
Drill Box Seed Treatments for Barley:		
Agsco DB-Green + Vitavax Lindane (2A) Maneb (M) Carboxin (7)	2 oz/bu	Seed Decay, Seedling Blight, Covered Smut, Loose Smut and Wireworms
Enhance Captan (M) Carboxin (7)	4 oz/100 lb	Seed Decay, Seedling Blight, Covered Smut and Loose Smut
Enhance Plus Carboxin (7) Lindane (2A) Maneb (M)	2 oz/bu	Covered Smut, Seed Decay, Seedling Blight and Wireworms
Vitavax – Thiram Carboxin (7) Thiram (M)	4 oz/100 lb	Seed Decay, Seedling Blight, Covered Smut and Loose Smut

MOA Group Tables start on page 46 of the handbook.

All seed treatment materials are toxic. Mark treated seed and do not use for feed or food. Avoid inhaling dusts or fumes when treating and always read the product label before applying the chemical.

This section was not revised in 2007.

STORED GRAIN INSECT CONTROL SUGGESTIONS

INSECTS	COMMENTS (INSECTICIDE AND RATE)
Primary Insects (develop inside kernel; cause IDK, Insect Damaged Kernels) Lesser grain borer (serious and common) Rice weevil (on older or high moisture wheat) Granary weevil (rare in OK) Maize weevil (on corn, not common in OK)	PRESTORAGE SUGGESTIONS: **Storage Bin Cleanup** - Remove all grain and debris from bin by sweeping and vacuuming. **Clean-out Fumigant** - Chloropicrin can be used as a "clean-out" fumigant and applied to the boots of elevators, beneath false floors, etc. to kill insects which may be present there. It is a non-flammable liquid fumigant which is much heavier than air. Use 1-2 qt/empty bin for smaller bins, 3-4 qt for >50,000 bushels. Chloropicrin is highly corrosive to most metals. It cannot be used to fumigate feed or seed grains. Phosphine fumigants can be used as a clean-out, but they are not significantly heavier than air and not recommended. Fumigants can be used only by applicators holding the Fumigation certification. **Residual Bin Spray** - Spray inside surface with one of the following formulations:
Secondary Insects (feed on cracked kernels) Indianmeal moth[1] Rusty grain beetle Flour beetles Sawtoothed grain beetle [1] Indianmeal moth adults may be controlled by hanging DDVP Resin strips (Vapona) in the head space over the grain mass. Use 1 strip for each 1,000 cu ft air space over the grain. One treatment usually lasts 3 months. To protect grain specifically from Indianmeal moth larval infestation, apply a top-dressing of the biological insecticide Bacillus thuringiensis (Bt) after binning. Bt is sold under the trade names "Dipel," "Thuricide," "Bactospeine" or "Top-Side." Follow label directions when applying these materials.	Tempo 20WP - 9.5 grams (1 scoopful)/1,000 ft^2. (This formulation is preferred for concrete surfaces) Tempo 2.0 - 8 ml/gal/1,000 ft^2. (Note: Tempo, in either formulation, is considered more effective than other chemicals listed here) Reldan 4E - 0.5 pt/3.0 gal spray. Apply 1 gal/1,000 ft^2. Apply for outside, spraying downward Diatomaceous earth - 0.4-1.0 lb (depending upon formulation)/1000 ft^2. Storcide II is newly registered and replaces Reldan 4E as its stocks are used. Mix 1.8 fl oz inot 1 gal water and spray 1000 ft^2. **GRAIN TREATMENT**: Harvest-time storage treatment, referred to as grain protectants. Apply to the grain as it is being put into storage. Reldan 4E - 11.5 fl oz in 1-5 gal water mixed with 1,000 bu wheat. Not registered for use on corn. Lesser grain borer is not listed on the label. Distribution of Reldan 4E ended in 2005, so only existing stocks can be sold and used until gone. Reldan 3% dust lost its registration and is not available. Storcide II is replacing Reldan 4E; mix 12.4 fl oz on 5 gal water/100 bu wheat. Actellic 5E - Labeled for use on stored corn and grain sorghum (not on wheat). Use at rate of 9.2 to 12.3 fl oz/5 gal water. This will treat 30 tons of grain (1071) bu. Label states that Actellic "aids in suppression" of lesser grain borer. Pyrethrins - dilute one part of spray with 29 parts of water. Apply 4-5 gal/1000 bushels. Gives only short-term knockdown; not highly recommended. Diacon II – is an insect growth regulator that will not kill adults, but stops reproduction because immature stages of insects do not develop fully. It is very safe around people and animals. Various rates are available on the label. Diatomaceous earth (DE) - 0.4 to 2 lb/ton of grain and 1-3 lb/1000 ft^2 as a top-dress. Formulations vary in rates, read labels carefully. Distribution is critical and grain should be less than 13% moisture. A dust mask or other respiratory protection is important when applying product. Treatment of entire grain mass may lower test weight and not be cost-effective. Top and bottom dressing with DE preceded by an empty bin treatment are recommended. Check label directions of the product used. Bacillus thuringiensis (Dipel) - 0.5 lb/5-10 gal of water; apply as a top-dress. Agitation is important. Only works on moths.

This section was not revised in 2007.

STORED GRAIN INSECT CONTROL SUGGESTIONS (CONT'D)

INSECTS	COMMENTS (INSECTICIDE AND RATE)
All stored grain insects.	*****Fumigation may only be conducted by commercial applicators or private applicators who are certified in the fumigation category. Farmers or others who possess only a Private Applicator certification ARE NOT ALLOWED to purchase or apply fumigant pesticides.***** **GRAIN FUMIGANTS**: If insects are found above thresholds of (1/qt) rice weevil or lesser grain borer; red flour beetle, rusty grain beetle and other bran bugs (5/qt), fumigants would be profitable. Solid fumigants which produce phosphine gas are readily available under several trade names including Phostoxin, Fumitoxin, etc. They may be applied to farm-stored grain by the producer. Labels vary significantly, but the following is a guideline for pellets and tablets of phosphine products. All grain fumigants are restricted use pesticides.

	Pellets/1000 bu	**Tablets/1000 bu**
Farm bins	450-900	90-180
Flat storage	300-900	60-180
Vertical concrete	200-375	40-75

Phosphine gas is released from solid metallic phosphide formulations when they react with moisture in the air. Phosphine release varies significantly with temperature. The cooler the temperature and drier the grain, the longer the release, so longer exposure times are required at cooler grain temperatures and/or under dry grain conditions.

Grain Temperature	**Pellets**	**Tablets**
Below 40 F (5 C)	Do not fumigate	Do not fumigate
40-53 F (5-12 C)	8 days (192 hrs)	10 days (240 hrs)
54-59 F (12-15 C)	4 days (96 hrs)	5 days (120 hrs)
60-68 F (15-20 C)	3 days (72 hrs)	4 days (96 hrs)
Above 68 F (20 C)	2 days (48 hrs)	3 days (72 hrs)

There are several safety requirements for using fumigants including:

Placarding
Respiratory protection
Air monitoring
Notification and denotification of local police and fire departments.
Two or more people present

Methyl bromide is a gas and is available in pressurized containers. It is not normally recommended for grain or seed.

When label directions are followed and the application is made correctly, phosphine fumigants should give satisfactory results. The storage facility must be sealed for best results. NEVER FUMIGATE A BIN BY YOURSELF. Follow all safety rules, including the use of an approved respirator.

This section was not revised in 2007.

STORED GRAIN INSECT CONTROL SUGGESTIONS (CONT'D)

Notes on Grain Fumigation

Several new grain fumigant products have recently been registered by EPA and may be available in Oklahoma. These include a product called ECO_2FUME, which is phosphine mixed with carbon dioxide gas dispensed from gas cylinders, and pure phosphine in cylinders, called VaporPH_3os, that is blended with air or carbon dioxide by a special gas regulator. Methods and equipment for phosphine gas released from generating machines have also been registered. A new grain fumigant chemical called sulfuryl fluoride was registered under the name Profume. These new fumigants may offer advantages to some grain and processed food managers, either for more efficient bulk fumigation or as methyl bromide replacements in structural treatments.

When using fumigants, respiratory protection is critical. Before using fumigants we suggest attending an OSU hands-on fumigation workshop.

Notes on Resistance of Certain Stored Grain Insects to Insecticides

Malathion is still registered for use as an empty bin spray and as a grain protectant, but its use is not recommended. Malathion resistance is heavy in case of the red flour beetle and moderate to heavy by the lesser grain borer, and due to product degradation, Malathion is not recommended. Essentially, no resistance to Reldan has been shown by the red flour beetle, whereas light to moderate resistance by the lesser grain borer existed. Lesser grain borer is not listed on the Reldan label it effectiveness against this insects does not last long after application. All organophosphates, such as malathin, Reldan and Actellic, break down with high harvest temperatures and with time while on warm grain.

Farmers and elevator operators are applying too much malathion on grain and empty grain facilities. Malathion simply does not work and its overuse leads to evolution of resistance. Research in Kansas and Oklahoma showed that insect populations became higher in grain treated with malathion than in the untreated grain. The surprising result was probably due to natural enemies of grain pests, such as parasites and predators, being killed by the malathion and thus allowing more pest insect to develop. Over-use of malathion has also led to unacceptably high levels of malathion residues being detected on grain destined for export

Samples of red flour beetle and lesser grain borer taken from the 10 counties were also subjected to phosphine resistance studies. Essentially no resistance by the red flour beetle to phosphine gas was found, while a light to moderate resistance existed in the lesser grain borers collected.

We do not have an easy alternate to the phosphine gases. The tolerance to phosphine is due more to inefficient fumigation practices such as inadequate sealing of the bin and/or repeated fumigations throughout the season, than to resistance. Producers are encouraged to apply the fumigant according to label instructions, especially being sure that adequate sealing is done. Also, be careful that you allow the fumigant adequate time to work under existing temperature and grain moisture conditions.

SORGHUM INSECT CONTROL SUGGESTIONS

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Chinch bug Adults are 1/8 inch long, black with white wings that are folded over the back into an "hour glass" shape. Nymphs are reddish to brown, with a white stripe across their "shoulders." Damage: Feed at base of plants, in between leaf sheath and stem. Chinch bugs often migrate from small grains to sorghum. Feeding may kill small seedlings. Threshold: 2-3 bugs per plant on seedlings. Treat if large numbers are moving in to sorghum from grain. A border spray 30-60 feet wide on the margins of the field may be of value if chinch bug numbers are high in an adjacent wheat field. In areas with heavy, consistent numbers, consider planting a trap crop of sorghum/sudangrass in a 30-60 ft barrier strip around the field, which can be sprayed if migrating numbers are high.	**Planting Time**		
	Cruiser 5FS (4A)	5.1 fl oz/cwt seed	Seed treatments will generally provide 3 weeks of suppression. Use seed treatment if sorghum has suffered regular losses from chinch bug infestations.
	Gaucho 480 (4A)	8 fl oz/cwt seed	
	Poncho 600 (4A)	5.1-6.4 fl oz/cwt seed	
	Post-Plant		Best control with post-plant applications is obtained when insecticide is applied by ground, with nozzles directed at the base of the plants using a minimum of 20-30 gallons of water.
	Asana[r] XL (3)	5.8 to 9.6 fl oz	Do not apply more than 0.15 lb ai/season. 21 day waiting period for grazing or harvest.
	Baythroid[r] XL (3)	2.0 to 2.8 fl oz	14 day waiting period for grazing or harvest.
	Cobalt[r] (3)	13-38 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre
	Furadan[r] 4F (1A)	0.5 to 1 pt	Check table on last page for grazing and harvest restrictions.
	Karate[r] with Zeon (3)	1.92 fl oz	30 day wait for harvest or grazing.
	Warrior[r] with Zeon (3)	3.84 fl oz	
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	1 to 2 pt	30-60 day waiting period for grazing or harvest
	Mustang MAX[r] (3)	3.2 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3)	3.84 fl oz	30 day waiting period for grazing or harvest.
	Prolex[r] 1.25 CS (3)	1.54 fl oz	
	Sevin XLR (1A)	1 to 2 qt	Sevin may cause mite buildup
Corn earworm (Headworm) Up to 1 inch. Color varies from green, to brown to yellow and pink. Damage: Feed in whorl and ripening seed in head. Yield loss from whorl feeding is negligible. Are capable of causing damage to seed in head until grain reaches soft dough stage. Threshold: Two or more larvae per head before hard dough.	Asana[r] XL (3)	5.8 to 9.6 fl oz	Do not apply more than 0.15 lb ai/season. 21 day waiting period for grazing or harvest.
	Baythroid[r] XL (3)	1.3 to 2.8 fl oz	14 day waiting period for grazing or harvest.
	Cobalt[r] (3)	19-38 fl zo	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre
	Karate[r] with Zeon (3)	1.28 to 1.92 fl oz	30 day waiting period for grazing or harvest.
	Warrior[r] with Zeon (3)	2.56 to 3.84 fl oz	
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	2 pt	30-60 day waiting period for grazing or harvest.
	Methomyl[r] (1A)	0.75 to 1.5 pt	14 day waiting period for grazing or harvest.
	Mustang MAX[r] (3)	1.76 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3)	2.56 to 3.84 fl oz	30 day waiting period for grazing or harvest.
	Prolex[r] 1.25 CS (3)	1.02 to 1.54 fl oz	
	Sevin XLR (1A)	1 to 2 qt	0 day waiting period for grazing, 21 days for harvest.
	Tracer (5)	1.5 to 3 fl oz	14 day waiting period for grazing, 7 days for harvest.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Corn leaf aphid Bluish-green, soft bodied aphid with black legs, antennae and cornicles Typically found in whorl. Damage: Feed in whorl; may cause some delay of whorl emergence if numbers are high. Can mechanically transmit Maize Dwarf Mosaic virus disease. Threshold: Corn leaf aphids rarely cause significant yield loss, so no thresholds have been established.	**Planting Time** Cruiser 5FS (4A) Gaucho 480 (4A) Poncho 600 (4A) **Post-Plant** Cobalt^{r} (3) Dimethoate 4E (1B) Lorsban^{r} 4E (1B) (Warhawk, Whirlwind) Mustang MAX^{r} (3)	 5.1 fl oz/cwt seed 8 fl oz/cwt seed 5.1-6.4 fl oz/cwt seed 7-13 fl oz acre 0.5 to 1 pt 0.5 to 1 pt 3.2 to 4.0 fl oz	 Check table on last page for grazing and harvest restrictions. Research indicates that yield losses occur only where corn leaf aphids cause stand loss on seedling plants. Chemical treatments, including seed treatments, are not likely to reduce potential for infection by Maize Dwarf Mosaic Virus, because it can be transmitted within 30 seconds after an aphid begins feeding. Texas research suggests that corn leaf aphids serve as a food source for lady beetles which can help prevent greenbug outbreaks.
Cutworms Robust caterpillars that "roll" up when disturbed, and prefer to live under ground. Damage: Cutworms generally feed at night, and live under the soil during the day. Plants will be cut at or slightly above the soil level. Threshold: Scout fields at seedling emergence. Treat when worms are less than ½ inch long, and skips are noticed.	Asana^{r} XL (3) Baythroid^{r} XL (3) Cobalt^{r} (3) Karate^{r} with Zeon (3) Warrior^{r} with Zeon (3) Lorsban^{r} 4E (1B) (Warhawk, Whirlwind) Mustang MAX^{r} (3) Proaxis^{r} 0.5 CS (3) Prolex^{r} 1.25 CS (3)	5.8 to 9.6 fl oz 1 to 1.3 fl oz 13-38 fl oz 0.96 to 1.28 fl oz 1.92 to 2.56 fl oz 1 to 2 pt 1.3 to 4.0 fl oz 1.92 to 2.56 fl oz 0.77 to 1.02 fl oz	Do not apply more than 0.15 lb ai/season. 21 day waiting period for grazing or harvest. 14 day waiting period for grazing or harvest. 30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre 30 day waiting period for grazing or harvest. 30-60 day waiting period for grazing or harvest. 14 day waiting period for harvest, 45 days for grazing. 30 day waiting period for grazing or harvest
Fall armyworm (Headworm) Large, striped, non-bristled caterpillar up to 1.5 inches. Has a light colored, inverted "Y" on head. Damage: Feed in whorl, and ripening seed in head. Yield loss from whorl feeding is negligible. Can damage seed in head until grain reaches soft dough stage. Threshold: Two or more larvae per head before hard dough stage. Open-headed varieties are less susceptible to attack than tight-headed varieties.	 Cobalt^{r} (3) Karate^{r} with Zeon (3) Warrior^{r} with Zeon (3) Lorsban^{r} 4E (1B) (Warhawk, Whirlwind) Methomyl^{r} (1A) Mustang MAX^{r} (3) Proaxis^{r} 0.5 CS (3) Prolex^{r} 1.25 CS (3) Sevin XLR (1A) Tracer (5)	 13-38 fl oz 1.28 to 1.92 fl oz 2.56 to 3.84 fl oz 1 to 2 pt 0.75 to 1.5 pt 1.8 to 4.0 fl oz 2.56 to 3.84 fl oz 1.02 to 1.54 fl oz 1 to 2 qt 1.5 to 3 fl oz	Check labels, some state that product is only effective on very small (1st and 2nd instars) caterpillars 30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre 30 day waiting period for grazing or harvest. 30-60 day waiting period for grazing or harvest. 14 day waiting period for grazing or harvest. 14 day waiting period for harvest, 45 days for grazing. 30 day waiting period for grazing or harvest. No waiting period for grazing, 21 days for harvest. 14 day waiting period for grazing, 7 days for harvest.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
False chinch bug Adults 1/8 inch, long dirty gray, with brown or black markings, piercing mouthparts. Damage: Feed in groups. Large numbers may cause wilting of heads or small plants. Threshold: 140 or more per head.	Baythroid[r] XL (3) Mustang MAX[r] (3)	1.3 to 2.8 fl oz 3.2 to 4.0 fl oz	14 day waiting period for grazing or harvest. 14 day waiting period for harvest, 45 days for grazing.
Grasshopper 1-2 inches, outer wings leathery, inner wings clear or colored. Enlarged hind legs designed for jumping. Damage: Chew leaves, leaving ragged edges, or completely chewing leaf blade. Damage emerging seed heads, causing yield loss. Threshold: 15-20 per square yard. If nymph populations exceed threshold field borders (25-40 per square yard), treat before they move into sorghum.	Baythroid[r] XL (3) Cobalt[r] (3) Dimethoate 4E (1B) Karate[r] with Zeon (3) Warrior[r] with Zeon (3) Lorsban[r] 4E (1B) (Warhawk, Whirlwind) Mustang MAX[r] (3) Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3) Sevin XLR (1B)	2 to 2.8 fl oz 7-13 fl oz 1 pt 1.28 to 1.92 fl oz 2.56 to 3.84 fl oz 0.5 to 1 pt 3.2 to 4.0 fl oz 2.56 to 3.84 fl oz 1.02 to 1.54 fl oz 0.5 to 1.5 qt	14 day waiting period for grazing or harvest. 30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre Only one post-plant application per season. 30 day waiting period for grazing or harvest. 30-60 day waiting period for grazing or harvest. 14 day waiting period for harvest, 45 days for grazing. 30 day waiting period for grazing or harvest. No waiting period for grazing, 21 days for harvest.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Greenbug Lime-green, soft bodied aphid with darker green stripe down back. Tips of legs, cornicles and most of antennae are black. Damage: Injury can occur at anytime from seedling emergence through soft dough stage. Greenbug feeding causes reddening of leaves, leaves die as populations increase. Threshold: See Thresholds listed at end of publication. Need to treat is dependent upon greenbug numbers, plant size, variety, growing conditions, and the presence of predators and parasites. It is better to base treatment decision on presence of plant damage than on greenbug numbers alone.	**Seed Treatment**		
	Cruiser 5FS (4A)	5.1 fl oz/cwt seed	No waiting period for grazing or harvest.
	Gaucho 480 (4A)	8 fl oz/cwt seed	45 day waiting period for grazing or harvest.
	Poncho 600 (4A)	5.1-6.4 fl oz/cwt seed	Follow all label directions. No waiting period listed.
	Planting Time		
	Counter[r] CR (1B)	"Lock 'n Load" applicator needed	Do not place granules in contact with seed. 50 day waiting period for grazing, 100 days for harvest.
	Post-Plant		
	Dimethoate 4E (1B)	1 pt	Broadcast directly over whorl. Only one post-plant application per season.
	Cobalt[r] (3)	13-38 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre. See additional instructions on label.
	Furadan[r] 4F (1A)	1 pt	Do not feed or graze forage hay or straw to livestock.
	Lorsban[r] 4E (1B)	0.5 to 2 pt	Greenbug resistant varieties are available.
	Malathion 5E (1B)	1.5 pt	7 day PHI for grain. Do not feed or graze forage, hay or straw to livestock.
	Supracide 2E (1B)	2 pt	30 day waiting period for grazing or harvest (24C label)
Lesser cornstalk borer Caterpillar ¾ inches when mature. Slender, blue-green with brown bands around each body segment. Make silken tunnels at feeding site. Damage Tunnels in roots and stems. Occurs in May through June. Threshold Treat before larva bore into stalk.	Karate[r] with Zeon (3) Warrior[r] with Zeon (3)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	30 day waiting period for grazing or harvest.
	Cobalt[r] (3)	13-38 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre. See additional instruvtions on lable.
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	1 to 2 pt	30-60 day waiting period for grazing or harvest.
	Mustang MAX[r] (3)	3.2 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	30 day waiting period for grazing or harvest.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Mites Small, less than 1/100 inches. Cause brown stippling of leaves. Damage: Causes stippling of leaves, severe infestations can kill leaves. Threshold: No threshold established. Treat if majority of plants are infested with large, increasing mite infestations. Control is not be justified after head reaches hard dough stage	**Planting Time**		
	Phorate 20G (1B)	6 oz per 1000 ft-row	Do not place granules in direct contract with seed. Do not feed foliate before grain harvest.
	Post-Plant		
	Comite II (14)	1.5 to 2.25 pt	30 day waiting period for grazing, 60 days for harvest.
	Dimethoate 4E (1B)	1 pt	Only one post-plant application per season.
	Supracide 2E	2 pt	30 day waiting period for grazing or harvest. (24C label).
Panicle feeding bugs Include stink bugs and leaf-footed bugs. Stink bugs: shield shaped bugs ranging from ½ to ¾ inches. Leaf-footed bug: Brown, oblong about ¾ inches with each hindleg leaf-like. Damage: Feed on seed, causing blasted heads, shrunken damaged seed. Most damage occurs before seed reaches hard dough stage. Thresholds: Milk stage: 5 bugs /head. Soft Dough: 9 bugs/head.	Baythroid[r] XL (3)	1.3 to 2.8 fl oz	14 day waiting period for grazing or harvest.
	Cobalt[r] (3)	19-38 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre
	Karate[r] with Zeon (3) Warrior[r] with Zeon (3)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	30 day waiting period for grazing or harvest.
	Mustang MAX[r] (3)	1.8 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	30 day waiting period for grazing or harvest.
	Sevin XLR (1A)	1 to 2 qt	No waiting period for grazing, 21 days for harvest.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Sorghum midge Tiny, fragile orange-bodied fly that is active in early to mid morning. Damage: Damaged heads appear to be "blasted" or "blighted" from high temperatures, infertility, or drought. Damage from sorghum midge generally restricted to sorghum that blooms after August 15. Threshold: Check fields before 11 am, when flies are most active Treat when 25-30% of heads have begun bloom and adults average one or more per head.			Check labels. May need to apply a second treatment 3-5 days after first. Uniform planting date is an option for management.
	Asana[r] XL (3)	2.9 to 5.8 fl oz	Do not apply more than 0.15 lb ai/season. 21 day waiting period for grazing or harvest.
	Baythroid[r] XL (3)	0.9 to 1.3 fl oz	14 day waiting period for grazing or harvest.
	Cobalt[r] (3)	7-13 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre
	Karate[r] with Zeon (3) Warrior[r] with Zeon (3)	1.9 to 2.6 fl oz 2.6 to 3.8 fl oz	30 day waiting period for grazing or harvest.
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	0.5 pt	30-60 day waiting period for grazing or harvest.
	Methomyl[r] (1A)	0.75 to 1.5 pt	14 day waiting period for grazing or harvest.
	Mustang MAX[r] (3)	1.28 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3)	1.92 to 2.56 fl oz 0.77 to 1.02 fl oz	30 day waiting period for grazing or harvest.
Sorghum webworm Fuzzy, reddish to brown worms in head. Damage: Caterpillars feed on the seed, and hollow it out. Open-headed varieties are less susceptible than tight-headed varieties to attack. Threshold: 5 or more larvae per head before hard dough stage.	Baythroid[r] XL (3)	1.3 to 2.8 fl oz	14 day waiting period for grazing or harvest.
	Cobalt[r] (3)	19-38 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre
	Karate[r] with Zeon (3) Warrior[r] with Zeon (3)	1.28 to 1,92 fl oz 2.56 to 3.84 fl oz	30 day waiting period for grazing or harvest.
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	1 pt	30-60 day waiting period for grazing or harvest.
	Mustang MAX[r] (3)	1.8 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	30 day waiting period for grazing or harvest.
	Sevin XLR (1A)	1 to 2 pt	No waiting period for grazing, 21 days for harvest.
	Tracer (5)	1.5 to 3 fl oz	14 day waiting period for grazing, 7 days for harvest.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pest, Damage, and Treatment Threshold	Insecticide Formulation and (MOA Group)	Rate of Product per Acre	Comments
Southwestern corn borer Full grown caterpillars are white with prominent dark spots on body. Damage: Tunnels throughout stalk. May girdle mature stalks. Threshold: Chemical control usually not warranted.	Baythroid[r] XL (3)	1.3 to 2.8 fl oz	14 day waiting period for grazing or harvest.
	Cobalt[r] (3)	19-38 fl oz	30 day wait for applications of 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/Acre
	Karate[r] with Zeon (3) Warrior[r] with Zeon (3)	1.28 to 1.92 fl oz 2.56 to 3.84 fl oz	30 day waiting period for grazing or harvest.
	Lorsban[r] 4E (1B) (Warhawk, Whirlwind)	1 pt	30-60 day waiting period for grazing or harvest.
	Mustang MAX[r] (3)	1.8 to 4.0 fl oz	14 day waiting period for harvest, 45 days for grazing.
	Proaxis[r] 0.5 CS (3) Prolex[r] 1.25 CS (3)	2.56 to 3.84 fl oz 1.02 to 1.54 fl oz	30 day waiting period for grazing or harvest.
	Sevin XLR (1A)	1.5 qt	No waiting period for grazing, 21 days for harvest.
	Tracer (5)	1.5 to 3 fl oz	14 day waiting period for grazing, 7 days for harvest.
White grub Large, "C" shaped grub with a white body and a brown head. Damage: Grubs feed on roots of seedling plants. Damage potential is dependent on planting date, and speed of growth of the plant. Threshold: No treatment is available. An average of one grub per square foot may cause stand loss.	NA	NA	No insecticide is currently registered for white grub control. Re-planting may be the best option.
Wireworm Hard-shelled, smooth, cylindrical, yellowish to brown worms. 2-6 year life cycle. More common in sorghum planted into a sod or grass pasture. Damage: Feed on seed, seedling. Cause stunting and stand loss. Threshold: Seed treatments are available. Treat if field history indicates a problem.	**Seed Treatment**		
	Cruiser 5FS (4A)	5.1 fl oz/cwt seed	Do not feed leftover seed to livestock.
	Gaucho 480 (4A)	8 fl oz/cwt seed	Do not feed leftover seed to livestock.
	Poncho 600(4A)	5.1-6.4 fl oz/cwt seed	Do not feed leftover seed to livestock.
	Planting Time		
	*Counter[r] 15G (1B)	Apply per label.	* Counter 15 G can be used as a planting time treatment in Oklahoma except in the Panhandle. It requires a "Lock 'n Load" applicator, and has the potential to damage plants, and interact with several ALS-inhibiting herbicides. Check label for restrictions.

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

SORGHUM INSECT CONTROL SUGGESTIONS (CONT'D)

Pre-harvest Intervals and grazing restrictions

Asana XL	21 day PHI
Baythroid 2	14 day PHI, 14 days grazing
Cobalt	30 day wait if application is 26 fl oz/A or less, 60 day wait for applications over 26 fl oz/A
Comite II	30 day PHI for silage, 60 days for grain harvest.
Counter CR	100 day PHI for grain, 50 days for grazing
Cruiser 5.1FS	No grazing restriction
Dimethoate	28 day PHI for grain or grazing, do not apply after heading or during pollen shed.
Furadan 4F	75 day PHI for harvest or grazing
Gaucho 480	45 day PHI for harvest or grazing
Karate/Warrior	30 day PHI for harvest or grazing
Lorsban 4E	30-60 day PHI for harvest or grazing, depending on rate applied.
Malathion	7 day PHI for grain. Do not feed or graze forage, hay or straw to livestock.
Methomyl	14 day PHI for harvest or grazing
Mustang MAX	14 day PHI for harvest, 45 days for grazing
Poncho 600	Do not feed to livestock
Proaxis	30 Day PHI for harvest or grazing
Prolex	30 Day PHI for harvest or grazing
Sevin XLR	21 day PHI for harvest, 0 days for forage.
Supracide	30 day PHI for harvest or grazing.
Tracer	7 day PHI for harvest, 14 days for grazing
Thimet G	28 day PHI for harvest or grazing

* Numbers in parentheses (#) that follow the insecticide name are used to designate the mode of action of the insecticide according to the classification system developed by the Insecticide Resistance Action Committee, (IRAC) in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest during a growing season, simply select a registered insecticide with a different number for each application. To further delay resistance from developing, integrate other control methods into your pest management programs.

Treatment Thresholds * For Greenbugs On Sorghum

	When to Treat	
Plant Size	***Texas thresholds***	***Kansas thresholds***
0 to 1 leaf stage	20% of plants visibly damaged	25-50 greenbugs per plant
3 leaf stage	20% of plants visibly damaged	50-100 greenbugs per plant
5 leaf stage	Visible damage on leaves, (red spots, yellow leaves) but before any entire leaves are killed on 20% of plants	150-300 greenbugs per plant
Mid-whorl stage	Visible damage on leaves)red spots yellow leaves), but before any entire leaves are killed on 20% of plants	300-600 greenbugs per plant
Boot to heading	Death of one functional leaf	700-1000 greenbugs per plant
Heading through soft dough	Death of two functional leaves	700-1000 greenbugs per plant

This section was not revised in 2007.

SORGHUM WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Grain Sorghum Herbicides[a]																										
	Winter Weeds					Broadleaf Weeds										Grasses										
Herbicide	Carolina geranium	Common chickweed	Henbit	Brome grass	Italian ryegrass	Black nightshade	Cocklebur	Common ragweed	Giant ragweed	Jimsonweed	Lambsquarters	Morningglory	Pigweed	Smartweed	Velvetleaf	Barnyardgrass	Fall panicum	Giant foxtail	Johnsongrass (seedling)	Johnsongrass (rhizome)	Large crabgrass	Shattercane	Yellow foxtail	Yellow nutsedge	**General or Restricted Use**
Burndown																										
2,4-D	5	7	5	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Expert	7	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
Fallow Master	7	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Field Master	7	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
glyphosate	6	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Gramoxone Max[r]	6	**9**	7	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
RT Master	7	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Surefire	6	**9**	7	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
Soil-applied (EPP,PPI, PRE)																										
Atrazine[r]	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	3	7	0	0	5	0	7	7	Res.
Bicep II Magnum, Cinch ATZ	-	-	-	-	-	**9**	**9**	**9**	7	**8**	**9**	**9**	**9**	**8**	**8**	**9**	**9**	**9**	6	5	**9**	6	**9**	6	Res.
Bullet[r]	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	5	5	**9**	6	**9**	**8**	Res.
Dual II Magnum, Cinch	-	-	-	-	-	**8**	0	5	5	5	6	0	**9**	5	0	**9**	**9**	**9**	6	5	**9**	6	**9**	**8**	Gen.
Guardsman Max	-	-	-	-	-	**9**	**8**	**8**	6	**8**	**8**	**8**	**9**	**8**	6	**9**	**9**	**9**	6	5	**9**	5	**9**	**8**	Res.
Lasso, Micro-Tech, Partner	-	-	-	-	-	**9**	0	5	5	5	7	0	**9**	5	0	**9**	**9**	**9**	5	5	**9**	6	**9**	**8**	Res.
Linex	-	-	-	-	-	7	6	**8**	5	6	**9**	2	**9**	**9**	6	5	5	5	**9**	**9**	5	0	5	0	Gen.
Outlook, Propel	-	-	-	-	-	**9**	0	6	5	5	7	5	**9**	5	0	**9**	**9**	**9**	6	5	**9**	5	**9**	**8**	Gen.
Paramount	-	-	-	-	-	-	4	-	-	-	-	**8**	-	0	-	**9**	7	-	-	0	**9**	-	-	0	Gen.
Prowl (PRE only)	-	-	-	-	-	5	5	5	5	5	**9**	5	**9**	5	6	**9**	**9**	**9**	**8**	4	**9**	**8**	**9**	3	Gen.
Sequence[b]	-	-	-	-	-	**8**	0	5	5	5	6	0	**9**	5	0	**9**	**9**	**9**	6	5	**9**	6	**9**	**8**	Gen.
Post-applied (POST)																										
2,4-D	-	-	-	-	-	**8**	**9**	**9**	**9**	7	**9**	**9**	**9**	7	**8**	0	0	0	0	0	0	0	0	0	Gen.
Aim	-	-	-	-	-	**8**	7	6	2	6	**8**	**8**	**8**	5	**9**	0	0	0	0	0	0	0	0	0	Gen.
Ally + 2,4-D	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**8**	**8**	0	0	0	0	0	0	0	0	0	Gen.
Atrazine+oil[r]	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	5	7	0	0	6	0	7	7	Res.
Banvel, Clarity, Distinct	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	Gen.
Basagran	-	-	-	-	-	5	**9**	7	**8**	**9**	5	7	5	**9**	**9**	0	0	0	0	0	0	0	0	**8**	Gen.
Buctril, Moxy	-	-	-	-	-	**9**	**9**	**9**	7	**9**	**9**	**8**	7	**9**	**8**	0	0	0	0	0	0	0	0	0	Gen.
Buctril + Atrazine[r]	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**8**	**9**	**8**	5	3	4	0	0	3	0	4	4	Res.
Marksman	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	5	7	0	0	6	0	7	7	Res.
Peak	-	-	-	-	-	-	**9**	-	-	-	**8**	**8**	**9**	-	-	0	0	0	0	0	0	0	0	-	Gen.
Permit	-	-	-	-	-	4	**9**	**8**	**8**	7	4	6	**9**	7	**8**	0	0	0	0	0	0	0	0	**9**	Gen.
Shotgun[r]	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	5	7	0	0	6	0	7	7	Res.
Weedmaster	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	Gen.
Yukon	-	-	-	-	-	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	**9**	Gen.

[a] Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions. This information was compiled from weed control ratings from trials conducted in Oklahoma and from universities ratings of products from across the US.

[b] Will also control emerged weeds with better performance than rated here, but cannot be applied POST to grain sorghum or crop injury will occur.

[r] Restricted Use

This section was not revised in 2007.

SORGHUM WEED CONTROL

Rotational Cropping Restrictions in Months with Grain Sorghum Herbicides

Herbicide	Crops							
	Alalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Burndown								
2,4-D	1	1	0	1	1	1	1	1
Expert	a	a	0	b	b	b	b	24
Fallow Master	a	a	a	a	a	a	a	a
Field Master	c	c	0	c	c	0	c	c
glyphosate	0	0	0	0	0	0	0	0
Gramoxone Max[r]	0	0	0	0	0	0	0	0
RT Master	1	1	0	1	1	1	0	1
Surefire	a	a	a	a	a	a	a	a
Soil-applied (EPP,PPI, PRE)								
Atrazine[r]	c	c	0	c	c	0	c	c
Bicep II Magnum, Cinch ATZ	a	a	0	b	b	b	b	24
Bullet[r]	a	a	a	a	a	a	a	a
Dual II Magnum, Cinch	4	a	0	0	0	0	0	4.5
Guardsman Max	d	d	0	b	b	0	b	d
Lasso, Micro-Tech, Partner[r]	a	a	a	a	a	a	a	a
Linex	a	a	a	a	a	a	a	a
Outlook, Propel	a	a	0	0	0	0	0	4
Paramount	24[f]	10	10	10	10	0	10	0
Prowl	b	b	0	0	0	b	0	4
Sequence	4	a	0	0	0	0	0	4.5
Post-applied (POST)								
2,4-D	1	1	0	1	1	1	1	1
Aim	12	12	0	0	12	0	0	0
Ally + 2,4-D	a	a	12[h]	14 to 22[h]	a	10[h]	a	a
Atrazine+oil[r]	c	c	0	c	c	0	c	c
Banvel, Clarity, Distinct	a	a	a	a	a	a	a	a
Basagran	a	a	a	a	a	a	a	a
Buctril, Moxy	1	1	1	1	1	1	1	1
Buctril + Atrazine[r]	b	b	1	b	b	1	1	b
Marksman	c	c	0	c	c	0	c	c
Peak	22	22	1e	22	22	1	22	0
Permit	9	15	1[e]	4	6	2	9	2
Prowl	b	b	0	0	0	b	0	4
Shotgun[r]	c	c	0	c	c	0	c	c
Weedmaster	4	4	10 days[g]	4	4	10 days[g]	4	10 days[g]
Yukon	9	15	1[e]	4	6	2	9	2

[a.] See labeld for specific crop rotation restrictions.
[b.] May be planted the following cropping season.
[c.] If planted the following year, there is a possibility for crop injury.
[d.] May be planted after two complete growing seasons.
[e.] Clearfield corn hybrids can be planted anytime.
[f.] A successful field bioassy must also be conducted.
[g.] Per pt/A applied.
[h.] Per pt/A applied.
[r] Restricted Use.

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
2,4-D Amine Various **POST applications:** 0.5 lb ai /A	**Active Ingredients:** 2,4-D **Similar Products:** Many **MOA:** 4	**POST.** Apply when sorghum is 6 to 15 inches tall. If sorghum is taller than 8 inches to top of canopy, use drop nozzles and keep spray off the foliage.	**Do not** treat during the boot, flowering or dough stage. **Do not** feed or forage fodder for 7 days following application.
Atrazine[r] 4L 4 lbs. ai per gallon **PRE applications:** 0.75 to 1 qt/A **POST applications:** 2.0 qt/A	**Active Ingredients:** Atrazine **Similar Products:** AAtrex 4L AAtrex Nine-O Atra-5 **MOA:** 5	**PRE.** Apply to the soil surface after planting and prior to emergence. This is a 24-C recommendation for the use of AAtrex 4-L and AAtrex Nine-O in Oklahoma. **POST.** Apply when crop is 6-12 inches in height, but before it reaches boot stage.	**Do not** apply through any type of irrigation system. **Do not** graze or feed forage from treated areas for 21 days following application. **Do not** apply more than 5 pts. per acre per year. **Do not** apply to sand or loamy sand. Refer to label for rotational crop information.
Aim 2 EC **POST applications:** 0.5 fl.. oz.	**Active Ingredients:** Carfentrazone **Similar Products:** Avalanche, etc. Aim EW **MOA:** 14	**EPP. Aim may be included with other burndown herbicides like Glyphosate, 2,4-D, to enhance burndown activity and improve control.** **POST.** Apply to emerged and actively growing weeds. Apply from 30 days before planting up through the 6 leaf growth stage. Postemergence broadcast applications with crop oil concentrate are not recommended as increased crop response may occur.	Contact herbicide, coverage is essential for control. Tank mix with other herbicides for broad spectrum control. Apply with NIS at 0.25% v/v. COC is recommended for directed applications only. **Do not** apply this product through any type of irrigation system. **Do not** apply more than 1.0 fl oz. per acre per season. Product may be used up to a maximum of 1.0 oz per acre using drop nozzles for control of larger weed sizes. Refer to label for list of affected weeds. **Do not** apply to sweet sorghum.
Ally + 2,4-D amine 60%DFG (Ally) 3.8 lbs. ai per gallon (2,4-D) **POST applications:** 1/20 oz. /A Ally **plus** 1/4 lb ai /A 2,4-D amine	**Active Ingredient:** Metsulfuron methyl 2,4-D **Other Trade Names:** None **MOA:** 2 & 4	**POST.** Make application when all or a majority of the weeds have germinated and emerged. For best results, spray when weeds are less than 6 inches tall. Make application when crop is 3 to 15 inches in height. If crop is more than 10 inches tall, use drop nozzles and keep spray off the crop foliage. Apply only before the boot stage. **Ally must be applied with 2,4-D amine.**	**Do not** use on grain sorghum grown for seed production or syrup. **Do not** use on forage sorghum. **Do not** feed forage or silage for 30 days after application. **Do not** include a surfactant or crop oil in the tank mix. **Do not** apply this treatment under cold, wet conditions or to crop growing under stress as crop injury may result. **Do not** apply to long season grain sorghum varieties or crops that are planted after July 1, as crop injury or delayed maturity may occur. **Do not** exceed one application per year.
Banvel 4 lbs. ai per gallon **All applications:** 0.5 pt. /A	**Active Ingredients:** Dicamba **Similar Products:** Clarity **MOA:** 4	**EPP.** May be applied to emerged and actively growing weeds at least 15 days prior to planting. **POST.** Must be made after the crop is in the first leaf stage but before it is 15 inches tall. For best performance, make applications when crop is in the 3 to 5 leaf stage and weeds are small (less than 3 inches tall). Use drop nozzles if crop is taller than 8"..	**Do not** apply this product through any type of irrigation system. **Do not** graze or feed treated forage or silage prior to mature grain stage. **Do not** apply to crops grown for seed production. **Do not** make more than one application per year. Refer to label for tank mix applications.

[r] Restricted Use

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Basagran 4 lbs. ai per gallon **POST applications:** 1 to 2 pts /A	**Active Ingredients:** Bentazon **Similar Products:** None **MOA:** 6	**POST.** Apply to actively growing weeds. Make application early, when weeds are small, for most effectiveness. Refer to label for application rates for specific weed growth stages.	**Do not** cultivate within 5 days before and 7 days after application. **Do not** apply to crop that is heading or blooming. **Do not** graze treated fields for at least 12 days after last treatment. **Apply** no more than 2 pts /A per season. **Do not** apply to weeds or crops that are under stress. Refer to label for tank mix applications.
Bicep II Magnum 5.5 lbs. ai per gallon **All applications:** 1.6-2.1 qts. /A	**Active Ingredients:** Atrazine Metolachlor **Similar Products:** Bicep II Magnum FC Bicep Lite II Magnum **MOA:** 5 & 15	**PPI.** Apply to the soil and incorporate into the top 2 inches of the soil within 14 days before planting. Use **PPI** when furrow irrigation is used or when a period of dry weather after application is expected. **PRE.** Apply to soil surface at planting (behind planter) or after planting, but before weed or crop emergence.	Seed **MUST** be treated with Concep or Screen by seed company. **Do not** apply through any type of irrigation system. **PPI. & PRE applications. Do not** use on coarse soils or medium and fine soils with organic matter content less than 1.0%. Apply at a rate of 1.6-2.1 qts. /A on medium and fine soils with organic matter percent greater than 1.0%
Buctril 2.0 lbs. ai per gallon **All applications:** 1-2 pts /A	**Active Ingredients:** Bromoxynil **Similar Products:** Buctril 4EC Connect 20 WSP **MOA:** 6	**PRE.** Apply at a rate of 1-1.5 pts/A before planting until just prior to crop emergence. **POST.** Apply 1 pt/A between the 3 leaf stage but prior to the preboot stage. Apply 1.5 pts /A between the 4 leaf stage but prior to preboot stage. Apply 2 pts/A only through automated irrigation systems with a mechanical transfer loading system.	**Do not** apply more than 1.5 pts/A unless using an automated irrigation system. **Do not** cultivate for 5-7 days after application to ensure best performance. **Do not** cut crop for feed, fodder, or graze within 45 days after application.
Buctril + Atrazine[r] 3 lbs. ai per gallon **All applications:** See table.	**Active Ingredients:** Bromoxynil Atrazine **Similar Products:** None **MOA:** 6 & 5	**PRE.** Apply from before planting to just prior to crop emergence. **POST.** Apply from the 3 leaf stage to just before the boot stage.	**Do not** cut crop for feed or graze within 45 days after application. **Do not** use in sandy or loamy sand soils as excessive crop injury may occur. **Do not** apply at any rate to crop that has reached the boot stage, severe crop injury or loss in crop yield may occur. **Do not** apply this product through any type of irrigation system.

Rates and Application Timing for Buctril + Atrazine[r]

Rate	Application Timing
1.5-3 pts /A	Before planting to just prior to crop emergence.
1.5-2 pts /A	After the 3 leaf stage but prior to preboot, or 12 inches in height.
3 pts /A	After the 4 leaf stage but prior to the preboot, stage, or 12 inches in height.

[r] Restricted Use

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Bullet[r] 4 lbs. ai per gallon **All applications:** See table.	**Active Ingredients:** Alachlor & Atrazine **Similar Products:** Credit Master Landmaster BW Lariat RT Master **MOA:** 15 & 5	**PPI.** Can be applied any time within 7 days prior to planting. **PRE.** Apply within 5 days of last preplant tillage. **All Applications.** Must be made **only** to grain sorghum planted with seed that has been properly treated with seed protectant or a safener.	**Do not** apply more than 1 application per year. **Do not** apply this product through any type of irrigation system. **Do not** graze treated area or feed treated forage to livestock for 70 days following application. **Do not** use this product for preplant incorporated application in coarse soils. When applied under sprinkler irrigation systems on coarse soils, use a minimum of 3 qts/A.

	Bullet[r] Application Rates Per Acre	
Soil Texture Group	**Less than 1.5 % organic matter**	**1.5% or more organic matter**
Coarse	2.5 qts.	2.75 qts.
Medium	2.75 qts.	2.75 to 3.75 qts.
Fine	3 qts.	3 to 4 qts.

[r] Restricted Use

Dual II Magnum 7.64 lbs. ai per gallon **All applications:** 1-1.67 pts /A	**Active Ingredients:** Metolachlor **Similar Products:** Cinch **MOA:** 15	**All applications.** Broadcast 1.0-1.33 pts/A on coarse soils, 1.33-1.5 pts/A on medium soils, or 1.33-1.67 pts/A on fine soils. **PPI.** Apply and incorporate into the top 2 inches of soil within 14 days before planting. **PRE.** Apply during planting (behind the planter) or after planting, but before weeds or crop emerge.	**Do not** apply unless the seed has been properly treated by the seed company with Concep or Screen seed treatment. **Make** only one application per year.
Expert 4.88 lbs. ai per gallon **All applications:** See table.	**Active Ingredients:** Atrazine Metolachlor Glyphosate **Similar Products:** None **MOA:** 5, 15, & 9	**PPI. & PRE.** May be applied up to 30 days before, during or after planting, and before emergence of crop under no-tillage or other reduced tillage practices.	**Do not** apply product after crop emerges. **Seed** must be treated with **Concep III**. **Do not** apply through any type of irrigation system. **Do not** graze or feed forage from treated areas for 60 days after application. **Do not** apply to crops under stress. **Do not** apply product on highly alkaline soils with a pH greater than 8.0 or on eroded areas where calcareous subsoils are exposed.

	Expert Application Rates Per Acre		
Soil Texture	***Less than 1%*** **Organic Matter**	**1% to 1.5% Organic Matter**	***Greater than 1.5%*** **Organic Matter**
Coarse	Do not use	Do not use	Do not use
Medium	Do not use	2.5-3 qts./A*	3 qts./A
Fine	Do not use	2.5-3 qts/A*	3-3.75 qts./A*
***** Use the higher rate within the range for each soil type when product is applied 14-30 days before planting.			

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Fallow Master 2 lbs. ai per gallon **EPP BURNDOWN applications:** 32 to 44 oz. /A	**Active Ingredients:** Glyphosate Dicamba **Similar Products:** GlyKamba **MOA:** 9 & 4	**EPP BURNDOWN.** Product should be applied at least 15 days prior to planting. Refer to label for what weeds are controlled at each rate.	**Do not** apply this product through any type of irrigation system. **Do not** feed or forage treated vegetation within 8 weeks after application. **Delay** planting for 15 days after application of this product.
Gramoxone Max[r] 3 lbs. ai per gallon **EPP & PRE applications:** 1.3 to 2.7 pts /A **POST applications:** 0.7 to 1.3 pts /A	**Active Ingredients:** Paraquat **Similar Products:** Gramoxone Max Gramoxone Super Tres Cyclone Max **MOA:** 22	**PPB & PRE.** Seedbeds should be formed as far ahead of planting as possible to allow maximum weed and grass emergence. Seeding should be done with a minimum of soil disturbance. Refer to label for application rates for specific weed sizes. **POST DIRECTED.** Apply when weeds are actively growing. Apply by directing spray between the rows and using hooded or shielded sprayers to prevent spray contact with crop plants.	**All applications: Do not** apply through any type of irrigation system. **Always** use a nonionic surfactant or crop oil concentrate. **POST. Do not** exceed 2 postemergence-directed applications, or exceed a total of 5.3 pts /A / season. Some crop injury will occur.
Guardsman Max 5 lb ai per gallon **EPP applications:** 4.75 to 5 pts/A **PPI, PRE, & POST applications:** See table.	**Active Ingredient:** Dimethenamid-P Atrazine **Similar Products:** None **<u>Rates may vary due to formulation</u>** **MOA:** 15 & 5	**EPP.** May be applied up to 45 days before planting in minimum and no-till production systems. Not recommended for coarse textured soils. **PPI.** Apply up to 14 days before planting and incorporate 1-2 inches. **PRE.** Apply after planting but before crop or **weed emergence.** **POST.** Apply after crop emergence but before corn exceeds 12 inches in height. Apply before weeds exceed 1.5 inches in height.	Early preplant applications are **not** recommended for use on coarse-textured soils or in areas where average annual rainfall exceeds 40 inches. **Do not** apply more than 4.6 pt/A/season. **Do not** apply more than 2.5 lb atrazine/A in a calendar year. **Do not** apply more than 1.6 lb atrazine/A/application on highly erodible soils with less than 30% residue cover. **Do not** apply more than 2 lb atrazine/A/application on non-highly erodible soils or on highly erodible soils with at least 30% residue cover. **Do not** graze or feed treated plants to livestock within 40 days of treatment. **Do not** harvest sweet corn within 50 days of application.

[r] Restricted Use

PPI, PRE, & POST Applications	Guardsman Max Use Rate as determined by Soil Texture and Organic Matter Content	
	OM Less than 3%	**OM 3% or More**
Coarse	2.5 – 3.0 pints	3.0 – 4.0 pints
Medium or Fine	3.0 – 4.0 pints	4.0 – 4.6 pints
	a. Reduced rates may be used when a POST herbicide application or cultivation is planned. For reduced rates, use 1.5-2.02.0-2.5, and 2.5-3.0pt/A on coarse, medium, and fine soil, respectively.	
	b. For EPP applications use 3.8-4.6pt/A. Do not exceed 3.8 pt/A on highly erodible soils with less than 30% plant residue cover prior to crop emergence.	

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Glyphosate 4 lb ai per gallon **POST applications:** 2 qt. /A	**Active Ingredient:** Glyphosate **Other Trade Names:** *Many* **MOA:** 9	**PPB.** Apply to actively growing weed at least **POST.** Apply at 30% grain moisture or less and at least 7 days prior to harvest. Refer to label for weeds controlled and application rates specific to weed types.	**Do not** apply this product through any type of irrigation system. **Do not** harvest or feed treated vegetation for 8 weeks following application. Following spot treatment, allow 14 days before grazing or harvesting forage. **Do not** use roller applicators. **Do not** feed or graze treated milo fodder. **Do not** ensile treated vegetation.
Lasso[r] 4 lbs. ai per gallon **PRE. applications:** 2.0 to 3.25 qts /A	**Active Ingredients:** Alachlor **Similar Products:** None **MOA:** 15	**PPI.** Apply and incorporate any time within 7 days prior to planting. Irrigation within 10 days following planting may improve weed control. **PRE.** Apply after planting, and within 5 days after last preplant tillage operation. When applied through center pivot irrigation or under sprinkler irrigation on coarse soils, use a minimum of 3 qts /A of product.	**If applied through irrigation system,** apply only through center pivot irrigation systems. **Do not** graze or harvest forage for 70 days following application. **Refer** to label for specific application rates according to soil type and application timing.
Linex 4L 4 lbs. ai per gallon **PRE applications:** 5/8 to 2 pts /A **POST applications:** 1 to 3 pts /A	**Active Ingredients:** Linuron **Similar Products:** Lorox DF **MOA:** 7	**PRE.** Apply 5/8 to 2 pts /A according to type of soil. Refer to label for rates and soil types. **POST.** Apply 1 to 2 pts /A depending on crop and weed sizes. Refer to label for specific rates and weed sizes.	**Do not** graze or feed plants to livestock within 3 months after postemergence application. **Chemigation: If applied through an irrigation system,** apply this product through center pivot, lateral move, end row, side roll, traveler, big gun, solid set, or hand move irrigation systems.
Marksman 3.2 lbs. ai per gallon **EPP applications:** 2 pts. /A max **POST applications:** 2 pts. /A max	**Active Ingredients:** Dicamba Atrazine **Similar Products:** None **MOA:** 4 & 5	**EPP.** Up to 2 pts. /A may be used and must be applied at least 15 days bfore crop planting. **POST.** For best performance, apply when crop is in the 2-3 leaf stage, but no later than 5 leaf of sorghum. Application during periods of rapid growth may result in temporary leaning of plants.	**Do not** apply to weeds under stress as unsatisfactory control may result. **Do not** apply through any type of irrigation system. **Do not** apply to crops grown for seed. **Do not** graze or feed forage, or graze livestock in treated areas for 21 days following application. **Do not** harvest for ensilage or hay for 37 days following application. **Do not** add crop oil if application is made after crop emergence. **Do not** add surfactant unless possible crop injury is acceptable. **Do not** exceed a total of 3.5 pts. per acre, per season.

[r] Restricted Use

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Outlook 6.0 lbs. ai per gallon **All applications:** 20 to 32 fl. oz /A	**Active Ingredients:** Dimethenamid **Similar Products:** Frontier 6.0, Propel **MOA:** 15	**EPP.** Apply up to 45 days before planting. Use the highest rate recommended for the specific soil type. **PPI.** Apply and incorporate into the top 1-2 inches of soil surface up to 2 weeks before planting. **PRE.** Broadcast after planting and before crop emergence. Rainfall, sprinkler irrigation, or shallow mechanical incorporation is required to move product into the upper soil surface.	**Herbigation** applications must be applied only through center pivot, lateral move, solid set, or hand move systems. Refer to label for specific herbigation instructions. **Do not** use on sweet or forage sorghum. **Seed** must be treated with an approved chloroacetamide herbicide safener (i.e. Concep or Screen). **Forage** may be grazed or fed to livestock 60 days or more after application. **Grain and fodder** may be harvested and fed 80 days or more after application. **Do not** apply to grain sorghum after crop emergence. **Refer** to label for specific application rates by soil type.

	Outlook Application Rates Per Acre	
Soil Texture Group	**Less than 3 % organic matter**	**3% or more organic matter**
Coarse	20-24 fl oz	24-28 fl oz
Medium	24-28 fl oz	28-32 fl oz
Fine	28-32 fl oz	32 fl oz

Paramount 75% DF **SOIL applications:** 5.3 ozs. /A **PRE & POST applications:** 8.0 ozs. /A	**Active Ingredients:** Quinclorac **Similar Products:** None **MOA:** 4	**EPP.** Can be applied within 45 days prior to planting. **PRE & POST.** Apply from preemergence to postemergence for control of annual grasses and broadleaf weeds. When applying **POST,** apply when weeds are less than 2 inches tall.	**Do not** apply through any type of irrigation system. **Do not a**llow livestock to graze in treated areas. **Do not** harvest hay from treated areas within 309 days after application. **Do not** feed treated grasses, forage, hay, silage, straw, seed nor seed screenings to livestock.
Peak (Accu-Pak) 57% WDG **POST applications:** 0.5 oz /A	**Active Ingredients:** Prosulfuron **Similar Products:** Peak CustomPak Peak 75 WG **MOA:** 2	**POST.** Complete all applications before crop exceeds 30 inches in height or before head emergence. It is more important to make applications based on the optimum weed heights listed in the label, rather than crop height. Applications made before crop is 5 inches tall increases the likelihood of crop injury.	**Do not** graze or feed forage from treated crops to livestock until 30 days after application. **Do not** harvest silage until 40 days after application. **Do not** harvest grain until 60 days after application. **Do not** apply more than 1.0 oz/A in the cropping season. **Do not** use on sweet sorghum.

This section was not revised in 2007.

SORGHUM WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Permit 75% WSG **POST applications:** 2/3 oz /A	**Active Ingredients:** Halosulfuron **Similar Products:** Sempra Sempra CA **MOA:** 2	**POST.** Make application from the 2-leaf through the layby stage but before grain head emergence. Application at early weed stages gives best control. Apply at rate of 2/3 oz /A in a single application per year. 1.0 oz /A may be applied to yellow and purple nutsedge only. Weeds can range in size from 1 to 12 inches in height at application.	**Do not** apply by air. **Do not** apply through any type of irrigation system. **Do not** graze, harvest, harvest forage, or harvest silage for 30 days after application.
Prowl 3.3 EC 3.3 lbs. ai per gallon **POST applications:** 1.2 to 3.6 pts /A	**Active Ingredients:** Pendimethalin **Similar Products:** Pendimax 3.3 **MOA:** 3	**POST.** Apply from the 4-inch growth stage to as late as the last cultivation of grain sorghum. Refer to label for special instructions concerning postemergence incorporated applications. **Application rates by soil type.** Coarse: 1.2 to 1.8 pts /A Medium: 1.8 to 2.4 pts /A Fine: 1.8 to 3.6 pts /A	**Do not** apply more than once per crop season. **Do not** graze or harvest forage for 21 days following application. Product will not control established weeds.
Sequence 5.25 lb ai per gallon **All applications:** 2.5 to 3.5 pt/A	**Active Ingredients:** Metolachlor & Glyphosate **Similar Products:** None **MOA:** 15 & 9	**EPP.** Apply prior to planting for control of emerged actively growing weeds and soil residual activity. **PRE.** Apply after planting but before crop emergence for control of emerged actively growing weeds and soil residual activity. Contact of sorghum foliage with the herbicide will result in crop injury/death.	**ONLY APPLY IF SEED WAS/WILL BE COMMERCIALLY TREATED WITH CONCEP SAFENER PRIOR TO PLANTING. Do not** exceed 3.75 pt/A on medium soils with less than 3% organic matters or 3.5 pt/A on coarse soils. **PRE applications** must be applied before ground cracking of emerging sorghum plants.
Shotgun[r] 3.25 lbs. ai per gallon **POST applications:** 2.0 pts /A	**Active Ingredients:** Atrazine 2,4-D **Similar Products:** None **MOA:** 5 & 4	**POST.** From the spike to 4-leaf stage, apply with over the top broadcast spray. From 5-leaf to 8-12 inches tall, use drop nozzles to keep spray off of cropleaves. Refer to label for application rates for specific soil types.	**Do not** apply this product through any type of irrigation system. **Do not** exceed maximum yearly amount of atrazine use. **Do not** graze or feed forage from treated areas for 21 days following application. **Do not** make more than one application per growing season.
Weedmaster 3.87 ai per gallon **POST applications:** 1 pt /A	**Active Ingredients:** Dicamba 2,4-D **Similar Products:** Brash Banvel + 2,4-D **MOA:** 4 & 4	**POST.** Apply 1 pt/A in the 3-5 leaf stage (4-8" tall). For best performance apply when weeds are small.	**Do not** apply to crops grown for seed production. **Do not** use surfactants or crop oils for application. **Do not** use if the potential for crop injury is not acceptable. **Do not** make more than one application per growing season. **Do not** apply through any type of irrigation system. **Do not** allow animals being finished for slaughter to graze treated fields within 30 days of slaughter. **Do not** graze lactating dairy animals within 7 days of treatment. **Do not** harvest for hay or silage within 37 days of treatment.
Yukon 67.5% WDG **POST applications:** 4 to 6 oz. /A	**Active Ingredients:** Halosulfuron Dicamba **Similar Products:** None **MOA:** 2 & 4	**POST.** Apply from the 2-leaf stage through 15 inch crop height. Application made when the crop is in the 3 to 5-leaf stage and weeds are small will result in best performance. Use 6 oz /A on Honeyvine Milkweed and Nutsedge for best results. For all other weeds use 6 oz /A for heavy weed infestation.	**Do not** graze or feed treated forage or silage prior to mature grain stage. **Do not** apply to sorghum grown for seed production. **Do not** make more than one application per year.

[r] Restricted Use

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR SOYBEAN INSECT CONTROL

I. STEM AND SEEDLING FEEDERS. For the most part, these insects are not a problem if the grower gets a good stand of beans. Stem and seedling feeders will generally do most of their damage before the soybeans are 12" tall. Thus, growers must be ready to make well-timed applications of insecticides. Isolated infestations can normally be tolerated because soybeans usually compensate if there are at least four plants per row-foot.

Insect	Damage	Insecticide (MOA Group) and Rate Per Acre		Comments
Threecornered Alfalfa Hopper	Adults and nymphs feed on stems. May girdle stems at or above soil level. This frequently causes lodging when the plants get larger.	Asana® XL (3) Battalion 0.2 EC® (3) Cobalt® (1B +3) Sevin XLR+ (1A) Dimethoate4.0 EC (1B) Larvin® (1A) (suppression) Methyl Parathion® (1B) Prolex® (3) Sevin80S (1A) Warrior® (3)	5.8-9.6 oz 7.7 – 11.5 oz 19-38 oz 1.0 qt 1 pt 18.0-30.0 oz 0.75-2.0 pt 0.77-1.28 oz 1.25 lbs 1.92-3.2 oz	Before bloom treatment is suggested if 10-15% of plants are girdled and nymphs are still present. See restrictions at end of section.
Lesser Cornstalk Borer	Girdle stems/roots. Bluish-green worm found at the soil surface or beneath the surface in tubes or sacs that are made of soil particles woven together with silken material.	Lorsban® 4E (1B) Lorsban15G® (1B) Prolex® (3) Warrior® (3) Cobalt® (1B+3)	1.0-2.0 pts 0.5lb/1000 ft. of row 3.84 oz 1.54 oz	This pest can be difficult to control. A second application in 5 days may be necessary for satisfactory control. Suppression only. Do not make more than1 application per season. Suppression only. See restrictions at end of section.

II. FOLIAGE FEEDERS. The economic threshold level or criteria for treatment of defoliators is considered as a group. In sampling populations of these insects, an estimate of percent leaf loss is the best way to assess the damage as a basis for initiating control of defoliators. Research in various states has shown that soybean plants can withstand 35 percent foliage loss up to one week before blooming. After blooming and during pod fill, no more than 15 to 20 percent defoliation should be allowed. After full pod, defoliation of 35 to 40 percent can be tolerated.

Insect	Damage	Insecticide (MOA Group) and Rate Per Acre		Comments
Aphids	Suck plant juices, causes yellowing of leaves and produces sticky honeydew	Methyl Parathion 4EC (1B) Battalion 0.2 EC® (3) Proaxis® (3)	0.75-2.0 pts 11.5 – 14.1 oz 1.92-3.2 oz	Soybean aphid only. Currently, no soybean aphids have been recovered in Oklahoma.
Bean Leaf Beetle	Adults eat round holes in leaves and often feed on small pods.	Ambush® 25W (3) Asana ® XL (3) Battalion 0.2 EC® (3) Cobalt® (1B+3) Baythroid 2E® (3) Decis 1.5EC ® (3) Dimethoate (Cygon) (1B) Lannate ® LV (1A) Larvin ® (1A) Lorsban® 4E (1B) Mustang-MAX ® (3) Penncap-M ® (1B) Pounce® 3.2EC (3) Proaxis® (3) Prolex® (3) Sevin80S (1A) Sevin XLR+ (1A) Warrior® (3)	3.2-6.4 oz 5.8-9.6 oz 11.5-14.1 oz 19-38 oz 1.6-2.8 oz 1.5-1.9 oz 1 pt 0.75-1.5 pt 18.0-30.0 oz 1.0-2.0 pt 2.8-4.0 oz 2-3 pts 2.0-4.0 oz 1.92-3.2 oz 0.77-1.28 oz 0.625-1.25 lb 0.5-1.0 qt 1.92-3.2 oz	Control is suggested if feeding damage is found on 10% of pods. See restrictions at end of section.
Blister Beetles	Usually infest isolated parts of the field.	Baythroid 2E® (3) Cobalt® (1B+3) Proaxis® (3) Prolex® (3) Sevin80S (1A) Sevin XLR+ (1A) Methyl Parathion 4EC (1B) Mustang-MAX ® (3) Warrior® (3).	1.6-2.8 oz 13-26 oz 3.2-3.84 oz 1.28-1.54 oz 0.625-1.25 lb 0.5-1.0 qt 0.75-2.0 pt 2.8-4.0 oz 3.2-3.84 oz	Beetles are generally localized within the field. See restrictions at end of section.

SUGGESTIONS FOR SOYBEAN INSECT CONTROL (CONT'D)

Insect	Damage	Insecticide (MOA Group) and Rate Per Acre		Comments
Fall Armyworm	Infestations may occur from July through September. Identified by inverted "Y" on head capsule.	Battalion 0.2 EC[r] (3) Dimilin2L[r] (15) Intrepid 2F (18) Lannate [r] LV (1A) Larvin [r] (1A) Methyl Parathion[r] 4EC (1B) Mustang-MAX [r] (3) Proaxis[r] (3) Prolex[r] (3) Sevin80S (1A) Sevin XLR+ (1A) Steward 1.25SC (22) Tracer (5) Warrior[r] (3)	11.5-14.1 oz 4 oz 4.0-8.0 oz 0.75-1.5 pt 10.0-30.0 oz 2.0 pt 2.8-4.0 oz 3.2-3.84 oz 1.28-1.54 oz 1.25-1.875 lb 1.0-1.5 qt 9.2 oz 1.5-2.0 oz 3.2-3.84 oz	During late season can be very damaging.
Garden Webworms	Usually occur from July through August on late planted soybeans. They cause webbing on the leaves, terminals, and the worms feed inside the web.	Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Methyl Parathion[r] 4EC (1B) Pounce[r] (3) Proaxis[r] (3) Prolex[r] (3) Warrior[r] (3)	11.5-14.1 oz 13-26 oz 0.75-2 pt 4.0-8.0 oz 3.2-3.84 oz 1.28-1.54 oz 3.2-3.84 oz	Severe infestations may cause stand loss if early infestations occur. See restrictions at end of section.
Beet Armyworm	Striped green caterpillar, with a black spot above second pair of true legs.	Cobalt[r] (1B+3) Larvin 3.2F [r] (1A) Lannate 2.4LV [r] (1A) Prolex[r] (3) Steward 1.25SC (22) Tracer 4SC (5)	13-26 oz 1.5 pt 1.5 pt 1.54 oz 9.2 oz 1.5-2.0 oz	See restrictions at end of section. See restrictions at end of section.
Green Cloverworm	May be found feeding on leaves in June or July, but the biggest population usually occurs in mid-August. Consume whole leaves.	Ambush[r] 25W (3) Asana [r] XL (3) *Bacillus thuringiensis* (B.t.) (e.g. Bactur, Biobit, Dipel, Javelin, Thuricide, etc.) (11B2) Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Dimilin[r] 2L (15) Intrepid 2F[r] (18) Lannate [r] LV (1A) Larvin [r] (1A) Lorsban[r] 4E (1B) Methyl Parathion [r] 4EC (1B) Pounce[r] 3.2EC (3) Proaxis[r] (3) Prolex[r] (3) Sevin 80S (1A) Sevin XLR+ (1A) Tracer (5) Warrior[r] .(3)	3.2-6.4 oz 2.9-5.8 oz See label rates. 7.7-11.5 oz 7-13 oz 2.0-4.0 oz 4.0-8.0 oz 0.4-1.5 pt 10.0-30.0 oz 0.5-1.0 pt 2 pts 2.0-4.0 oz 1.92-3.2 oz 0.77-1.28 oz 0.625-1.25 lb 0.5-1.0 qt 1.0-2.0 oz 1.92-3.2 oz	The B. t. products are bacterial/microbial insecticides. See restrictions at end of section.
Loopers	Mid-late season pests. Long green worms that move with a looping action.	Ambush[r] 25W (3) Asana [r] XL (3) *Bacillus thuringiensis* (e.g. Bactur, Biobit, Dipel, Javelin, Thuricide, etc.) See label rate. (11B2) Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Dimilin[r] 2L (15) Intrepid 2F[r] (18) Larvin [r] (1A) Pounce[r] 3.2 EC (3) Proaxis[r] (3) Prolex[r] (3) Warrior[r] (3)	3.2-12.8 oz 5.8-9.6 oz 11.5-14.1 oz 13-26 oz 4.0 oz 4.0-8.0 oz 18.0-30.0 oz 2.0-8.0 oz 1.92-3.84 oz 0.77-1.54 oz 1.92-3.84 oz	Control suggested when 8 worms (1/2") in length) are found per foot of row or when 150 larvae are collected from100 sweeps. Cabbage looper only. See restrictions at end of section. Soybean looper only

SUGGESTIONS FOR SOYBEAN INSECT CONTROL (CONT'D)

Insect	Damage	Insecticide (MOA Group) and Rate Per Acre		Comments
Grasshoppers	Threat more pronounced during hot, dry weather	Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Baythroid 2E[r] (3) Decis 1.5EC[r] (3) Asana[r] XL (3) Dimethoate 4EC (1B) Dimilin[r] 2L (15) Lorsban 4E[r] (1B) Mustang-MAX[r] (3) Penncap-M[r] (1B) Proaxis[r] (3) Prolex[r] (3) Warrior[r] (3)	11.5-14.1 oz 13-38 oz 2.1-2.8 oz 1.5-1.9 oz 5.8-9.6 oz 1 pt 2.0 oz 0.5-1.0 pt 3.2-4.0 oz 2-3 pts 3.2-3.84 oz 1.28-1.54 oz 3.2-3.84 oz	Treat border areas for small nymphs before adults migrate into fields. Cobalt--See restrictions at end of section. Dimilin for nymphs only.
Velvetbean Caterpillar	Mid-to late-season pest. Long green to brown caterpillar, with light and dark stripes along their backs and sides. They thrash vigorously when disturbed.	Ambush[r] 25W (3) Asana[r] XL (3) Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Dimilin[r] 2L (15) Intrepid 2F[r] (18) Larvin[r] (1A) Lorsban 4E[r] (1B) Lannate LV (1A) Pounce[r] 3.2 EC (3) Proaxis[r] (3) Prolex[r] (3) Sevin 80S (1A) Warrior[r] (3)	3.2-6.4 oz 2.9-5.8 oz 7.7-11.5 oz 7-13 oz 2.0-4.0 oz 4.0-8.0 oz 10.0-30.0 oz 0.5-1.0 pt 0.4-1.5 pt 2.0-4.0 oz 1.92-3.2 oz 0.77-1.28 oz 0.625-1.25 lb 1.92-3.2 oz	Threshold: 3 per sweep or 8/row foot See restrictions at end of section.

II. POD FEEDERS The greatest loss to soybeans is caused by insects that attack pods. Control of corn earworms is suggested if you find two or more per row-foot. Control of stink bugs is suggested when one or more per row-foot is found.

Insect	Damage	Insecticide (MOA Group) and Rate Per Acre		Comments
Corn Earworm(also called the soybean podworm and the cotton bollworm)	Moths usually fly into soybean fields and lay eggs in August. Peak populations generally occur in mid-August. Small worms hatch and start feeding on foliage, later moving to pods. Research has found that one worm will average damaging 20 pods.	Ambush[r] 25W(3) Asana[r] XL (3) Cobalt[r] (1B+3) Lannate LV[r] (1A) Larvin[r] (1A) Lorsban 4E[r] (1B) Methyl Parathion[r] 4EC (1B) Pounce[r] 3.2EC (3) Proaxis[r] (3) Prolex[r] (3) Sevin XLR+(1A) Sevin 80S (1A) Tracer (5) Warrior[r] (3)	6.4-12.8 oz 5.8-9.6 oz 19-38 oz 0.4-1.5 oz 10.0-30.0 oz 1.0-2.0 pt 2 pt 4.0-8.0 oz 1.92-3.2 oz 0.77-1.28 oz 0.5-1.5 qt 0.625-1.875 lb 1.5-2.0 oz 1.92-3.2 oz	Probably most destructive pest of soybeans because of direct yield losses. See restrictions at end of section.
Stink Bugs	Lower quality results from nymphs and adults sucking sap from bean pods and the insertion of digestive juices into the bean which causes deterioration.	Asana[r] XL (3) Baythroid 2E[r] (3) Cobalt[r] (1B+3) Decis 1.5EC[r] (3) Larvin[r] (1A) (suppression) Lorsban 4E[r] (1B) Methyl Parathion 4EC[r] (1B) Mustang-MAX[r] (3) Penncap-M[r] (1B) Proaxis[r] (3) Prolex[r] (3) Sevin XLR+ (1A) Sevin 80S (1A) Warrior[r] (3)	5.8-9.6 oz 0.8-1.6 oz 19-38 oz 1.5-1.9 oz 18.0-30.0 oz 2 pt 0.75-2.0 pt 3.2-4.0 oz 1-3 pts 3.2-3.84 oz 1.28-1.54 oz 1.0-1.5 qt 1.25-1.875 lb 3.2-3.84 oz	Susceptible until maturity. See restrictions at end of section. Southern green stink bug
Spider Mites		Lorsban 4E[r] (1B) Dimethoate 4EC (1B)	1 pt 1 pt	

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR SOYBEAN INSECT CONTROL (CONT'D)

NOTE: **Ambush ®** - Do not make more than two, 12.8-oz applications per season. Can be applied up to 60 days before harvest. Do not graze treated areas or harvest for forage or hay.

Asana ® XL - 21 days to harvest. Do not feed or graze livestock on treated plants. Do not exceed 0.20 lb. ai/A per season.

Baythroid® – 45 days to harvest. Maximum of 4 applications per season. Maximum of 2.8 ounces per 7-day interval or 11.2 ounces per crop season.

Battalion® – 21 days to harvest. Do not allow livestock to graze treated forage, or feed treated hay to livestock. Do not exceed more than 64 ounces per acre in one growing season.

Cobalt® – 30 days to harvest. On determinant soybeans, do not make more than 1application after pod set. Do not apply more than 85 ounces per acre per season. Do not feed or graze livestock in treated areas. Do not make more than 3 applications per year.

Carbaryl (Sevin) - No waiting period before harvest. Possible injury to young foliage may occur if Sevin is applied when foliage is wet, or rain or high humidity is expected.

Decis® – 21 days to harvest. Do not apply more than 8.5 ounces per growing season. Do not graze or feed treated hay to livestock.

Dimethoate - 21 days to harvest and 5 days wait to grazing.

Dimilin ® - 21 days to harvest. No more than 2 applications per season. Do not cut for hay or allow milk or meat animals to graze fields. Do not rotate crops other than soybeans or cotton until 6 months following last application.

Ethyl parathion - 15 day waiting period before harvest.

Intrepid – Do not apply more than 64 fluid ounces (1 lb a.i./acre) per acre per season or make more than 4 applications per season. Do not apply within 7 days of harvest of hay or forage or within 14 days of harvest of seed. Do not apply through any type of irrigation system.

Lannate® (WSP, L, LV) - 14 day waiting period before harvest. Under 0.45 ai/A applied, allow 3 days before grazing forage and 7 days before feeding hay. At 0.45-0.90 lb ai/A applied, allow 10 days before grazing forage and 12 days before feeding hay.

Larvin ® - Do not feed forage, hay, or straw to livestock. Do not apply less than 28 days before harvest.

Lorsban® - Do not apply more than 3 lb. of AI per acre per season. Wait 28 days to harvest. Do not graze treated areas or feed forage to meat or dairy animals within 14 days of treatment.

Lannate® – Pre-harvest interval 14 days for soybeans, 3 days for forage and 12 days for hay. Do not apply more than 4.5 pts/per acre per season. Do not make more than 3 applications per season.

Methyl parathion® - 20 day waiting period to harvest or grazing.

Mustang-MAX® – 21 days to harvest. Do not make applications less than 7 days apart. Do not graze or harvest forage, straw or hay for livestock feed. Do not apply more than 24 ounces per season.

Penncap-M® – 21 days to harvest. Do not make more than 2 applications per season. Do not apply more than 6 pts per acre per year.

Pounce ® - Do not make more than two 8.0-oz applications per season. Do not apply within 60 days of harvest. Do not graze or feed soybean forage. Do not plant rotational crops within 60 days of last application.

Seven XLR + - 21 days to harvest - 14 days to graze or harvest for forage. Do not apply with 2,4-DB herbicide to avoid crop injury. Do not apply more than a total of 6 quarts per acre per crop.

Steward – 21 days to harvest. Minimum interval between treatments is 5 days. Do not apply more than 45 ounces per acre per crop. Do not feed or graze livestock or treated fields.

Tracer – 28 days to harvest. Do not apply more than 6 ounces of Tracer per acre per year. Do not feed treated forage or hay to meat or dairy animals.

Warrior® - 45 days to harvest. Do not apply more that 0.48 pts per acre per season. Do not graze or harvest treated soybean forage straw or hay for livestock feed.

Proaxis® - 45 days to harvest. Do not apply more than 0.48 pts per acre per season. Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. This chemical is Gamma-cyhalothrin, if it is used in the same season as lambda-cyhalothrin (Warrior®), then read the label carefully for use rate limitations.

Prolex® - 45 days to harvest. Do not apply more than 0.19 pts per acre per season. Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. This chemical is Gamma-cyhalothrin, if it is used in the same season as lambda-cyhalothrin (Warrior®), then read the label carefully for use rate limitations.

This section was not revised in 2007.

SOYBEAN WEED CONTROL

Estimated Levels of Weed Control Normally Expected with Soybean Herbicides[a]

	Winter Annuals					Summer Broadleaves										Summer Grasses										
Herbicide	Carolina geranimu	Chickweed	Henbit	Brome grass	Italian ryegrass	black nightshade	cocklebur	common ragweed	giant ragweed	jimsonweed	lambsquarters	morningglory	pigweed	smartweed	velvetleaf	giant foxtail	yellow foxtail	barnyardgrasss	large crabgrass	fall panicum	shattercane	johnsongrass seedling	johnsongrass rhizome	yellow nutsedge	**General or Restricted Use**
Burndown																									
2,4-D	5	7	5	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Clarity	6	**8**	6	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Field Master	7	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
glyphosate (Many formulations)	6	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Gramoxone Max[r]	6	**9**	7	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Res.
RT Master	7	**9**	**8**	**9**	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Gen.
Soil-applied **(EPP, PPI, & PRE)**																									
Authority, Spartan	-	-	-	-	-	**8**	6	6	5	-	**9**	**9**	**9**	**8**	7	7	-	-	-	-	-	2	0	4	Gen.
Domain DF	-	-	-	-	-	7	3	7	3	6	**9**	3	**9**	6	7	**9**	**9**	**9**	**9**	**8**	5	**8**	0	5	
Boundary	-	-	-	-	-	**8**	6	**8**	5	**8**	**8**	5	**9**	**8**	**8**	**9**	**9**	**9**	**9**	**9**	6	6	0	**8**	Gen.
Canopy, Canopy SP	-	-	-	-	-	6	**9**	**9**	**8**	**9**	**9**	**8**	**9**	**9**	**8**	6	6	6	7	7	5	5	0	7	Gen.
Canopy XL	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	6	6	6	7	7	5	5	0	5	Gen.
Command 3ME	-	-	-	-	-	5	6	**8**	5	7	**9**	0	5	7	**9**	**9**	**9**	**9**	**9**	**9**	6	7	5	0	Gen.
Dual II Magnum, Cinch	-	-	-	-	-	**8**	0	5	5	5	6	0	**9**	5	0	**9**	**9**	**9**	**9**	**9**	6	6	0	**8**	Gen.
FirstRate, Amplify	-	-	-	-	-	4	**8**	**9**	**8**	**8**	**9**	**8**	**8**	7	**8**	0	0	0	0	0	0	0	0	0	Gen.
Intrro[r]	-	-	-	-	-	**9**	0	5	5	5	7	0	**9**	5	0	**9**	**9**	**9**	**9**	**9**	6	5	0	**8**	Res.
Outlook, Frontier, Propel	-	-	-	-	-	**9**	0	6	5	5	7	5	**9**	5	0	**9**	**9**	**9**	**9**	**9**	5	6	0	**8**	Gen.
Prowl, Pentagon	-	-	-	-	-	5	5	5	5	5	**9**	5	**9**	5	6	**9**	**9**	**9**	**9**	**9**	**9**	**9**	4	0	Gen.
Scepter	-	-	-	-	-	**8**	**9**	**9**	**8**	**8**	**9**	7	**9**	**9**	7	**8**	**8**	7	6	6	6	7	4	6	Gen.
Sencor	-	-	-	-	-	-	6	**9**	-	**8**	-	5	**9**	**9**	**8**	-	-	**8**	**8**	7	-	5	0	2	Gen.
Sequence[b]	-	-	-	-	-	**8**	0	5	5	5	6	0	**9**	5	0	**9**	**9**	**9**	**9**	**9**	6	6	0	**8**	Gen.
Squadron (PPI only)	-	-	-	-	-	**8**	**9**	**9**	**8**	**8**	**9**	7	**9**	**9**	7	**9**	**9**	**9**	**9**	**9**	**9**	**9**	4	6	Gen.
Treflan HFP (PPI only)	-	-	-	-	-	0	0	5	5	5	**9**	5	**9**	5	0	**9**	**9**	**9**	**9**	**9**	**9**	**9**	6	0	Gen.
Valor WP, Encompass	-	-	-	-	-	7	6	7	-	7	**9**	**8**	**9**	5	7	3	3	4	4	5	0	0	0	5	Gen.
Post-applied **(POST)**																									
Aim	-	-	-	-	-	4	1	3	2	1	4	6	5	3	**9**	0	0	0	0	0	0	0	0	0	Gen.
Assure II	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	0	Gen.
Backdraft	-	-	-	-	-	**8**	**9**	**9**	**9**	**9**	**8**	7	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
Basagran	-	-	-	-	-	5	**9**	6	**8**	**9**	6	6	5	**9**	**9**	0	0	0	0	0	0	0	0	**8**	Gen.
Classic, Skirmish	-	-	-	-	-	3	**9**	7	7	**9**	5	7	**9**	**8**	**8**	0	0	0	0	0	0	0	0	**8**	Gen.
Cobra	-	-	-	-	-	**9**	**8**	**9**	**8**	**9**	5	**8**	**9**	6	7	5	0	0	0	0	0	0	0	0	Gen.
Conclude Xact	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	6	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**8**	8	
Extreme	-	-	-	-	-	**8**	**9**	**9**	**9**	**9**	**8**	7	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
FirstRate, Amplify	-	-	-	-	-	0	**9**	**9**	**9**	**9**	0	**8**	0	**9**	**8**	0	0	0	0	0	0	0	0	-	Gen.
FlexStar, Reflex	-	-	-	-	-	**9**	**9**	**9**	**9**	**9**	7	**8**	**9**	**8**	**8**	6	6	5	5	5	5	5	0	5	Gen.
Frontrow	-	-	-	-	-	-	**9**	**8**	-	-	-	**8**	3	-	7	0	0	0	0	0	0	0	0	6	Gen.
Fusilade DX	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	**8**	**8**	**9**	**8**	**9**	**9**	**9**	**9**	0	Gen.
Fusion	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	**9**	**8**	**9**	**8**	**9**	**9**	**9**	**9**	0	Gen.
glyphosate (RR Varieties only)	-	-	-	-	-	**8**	**9**	**9**	**9**	**9**	**8**	7	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
Harmony GT	-	-	-	-	-	4	6	4	3	4	**8**	4	**9**	**8**	**9**	0	0	0	0	0	0	0	0	0	Gen.
Poast Plus, Poast, Prestige	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**8**	0	Gen.
Pursuit	-	-	-	-	-	**9**	**9**	7	**8**	**9**	6	7	**9**	**8**	**8**	**8**	6	7	7	7	**9**	**8**	5	5	Gen.
Pursuit Plus	-	-	-	-	-	**9**	**9**	7	**8**	**9**	6	7	**9**	**8**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	5	Gen.
Raptor	-	-	-	-	-	**9**	**8**	7	**8**	**8**	**8**	7	**9**	**8**	**9**	**9**	**8**	**8**	7	**8**	**9**	7	6	4	Gen.
Resource	-	-	-	-	-	4	7	7	5	7	7	5	7	4	**9**	0	0	0	0	0	0	0	0	0	Gen.
Scepter	-	-	-	-	-	-	**9**	6	-	0	-	6	8	7	3	0	0	0	0	0	0	0	0	5	Gen.
Select, Conclude Xtra G	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	0	Gen.
Sequence (RR Varieties Only)	-	-	-	-	-	**8**	**9**	**9**	**9**	**9**	**8**	7	**9**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	7	Gen.
Stellar	-	-	-	-	-	**8**	**8**	**9**	7	**8**	7	7	**9**	7	**9**	0	0	0	0	0	0	0	0	0	Gen.
Storm	-	-	-	-	-	**9**	**9**	**9**	**8**	**9**	6	**9**	**9**	**9**	**9**	7	7	0	5	7	5	5	0	**8**	Gen.
Synchrony STS (STS beans only)	-	-	-	-	-	3	**9**	**8**	**8**	**8**	**9**	**8**	-	**9**	**9**	0	0	0	0	0	0	0	0	**8**	Gen.
Ultra Blazer, Blazer, Status	-	-	-	-	-	**9**	7	**9**	**8**	**9**	5	**9**	**9**	**9**	6	7	7	0	5	7	5	5	0	0	Gen.

[a] Rating scale: 0 no control; 5 or less poor; 6 poor-fair; 7 fair; 8 fair-good; 9 good. Ratings assumes the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions. This information was compiled from weed control ratings from trials conducted in Oklahoma and from control rates borrowed from univeristies across the US.

b Will also control emerged weeds with better performance than rated here, but cannot be applied POST to NON-Roundup Ready varieties or injury will occur.

[r] Restricted Use.

This section was not revised in 2007.

SOYBEAN WEED CONTROL (CONT'D)

Rotational Cropping Restrictions in Months with Soybean Herbicides

	Crops							
Herbicide	Alfalfa	Canola	Corn	Cotton	Peanut	G. Sorghum	Soybean	Wheat
Burndown								
2,4-D	1	1	0	1	1	1	1	1
Clarity	a	a	a	a	a	a	a	a
glyphosate (Many formulation	0	0	0	0	0	0	0	0
Gramoxone Max[r]	0	0	0	0	0	0	0	0
RT Master	1	1	0	1	1	1	0	1
Soil-applied **(EPP, PPI, &**								
Authority, Spartan	a	24	10	18	12	10	0	4
Domain DF	12	a	1	a	a	12	0	12
Boundary	4.5	12	8	8	12	12	0	4.5
Canopy, Canopy SP	a	a	a	a	a	a	a	a
Canopy XL	12	30	10	12	30	10	0	4
Command 3ME	12	12	9	0	9	9	0	12
Dual II Magnum, Cinch	4	a	0	0	0	0	0	4.5
FirstRate, Amplify	9	30[f]	9	9	9	9	0	3
Intrro[r]	a	a	a	a	a	a	a	a
Outlook, Frontier	a	a	0	0	0	0	0	4
Prowl, Pentagon	h	h	0	0	0	h	0	4
Pursuit	4	b	18.5[c]	18.5	0	18.5	0	4
Python	4	26[d]	0	18	4	12	0	4
Scepter	18	a	9.5[ac]	18	11	11	0	3[a]
Sencor, Lexone	4	a	4	8	a	a	4	4 to 8[a]
Sequence[b]	4	a	0	0	0	0	0	4.5
Squadron (PPI only)	18	a	9.5[ac]	18	11	11	0	3[a]
Treflan HFP (PPI only)	0	0	14	0	0	14	0	14
Valor WP	12[r]	12[r]	1/2[g]	1/2[g]	0	1/2[g]	0	1/2[g]
Post-applied **(POST)**								
Aim	12	12	0	0	12	0	0	0
Assure II	4	0	4	0	4	4	0	4
Backdraft	18	a	9.5[ac]	18	11	11	0	3[a]
Basagran	a	a	a	a	a	a	a	a
Classic, Skirmish	9	18	8	8	6	9	0	3
Cobra	a	a	a	a	a	a	a	a
Conclude Xact	a	a	a	a	a	a	a	a
Extreme	4	b	18.5[c]	18.5	0	18.5	0	4
FirstRate, Amplify	9	30	9	9	9	9	0	3
FlexStar, Reflex	18	18	10	10	10	18[a]	a	4
Frontrow	30	30	9	9	9	9	0	3
Fusilade DX	0	0	2	0	0	2	0	2
Fusion	0	0	2	0	0	2	0	2
glyphosate (RR Varieties	0	0	0	0	0	0	0	0
Harmony GT	1.5	1.5	0	1.5	1.5	1.5	0	0
Poast Plus, Poast, Prestige	0	0	4	0	0	4	0	4
Pursuit	4	b	18.5[c]	18.5	0	18.5	0	4
Pursuit Plus	4	b	18.5[c]	18.5	0	18.5	0	4
Raptor	-	40	9	18[e]	0	18	9	4
Resource	1	1	0	1	1	1	0	4
Scepter	18	a	9.5[ac]	18	11	11	0	3[a]
Select, Conclude Xtra G	1	1	1	1	1	1	1	1
Sequence (RR Varieties Only)	4	a	0	0	0	0	0	4.5
Stellar	1	1	0	1	1	1	0	4
Storm	a	a	a	a	a	a	a	a
Synchrony STS (STS beans	9	18	7 or 8[a]	8	6	9	0	3
Ultra Blazer, Blazer, Status	a	a	a	a	a	a	a	a

[a.] See labeld for specific crop rotation restrictions.

[b.] Only Clearfield or Sumner Canola varieites can be planted the year following a Pursuit application.

[c.] Clearfield corn hybrids can be planted anytime.

[d.] Must conduct a successful bioassay before planting.

[e] The restriction is 18 months if at least 15 inches of rainfall has been received since the time of application and November 1

[f.] Must conduct a successful field bioassay.

[g.] First listed interval is for up to 2 oz/A rate, second interval is for 2 to 3 oz/A rate.

[h.] Can be planted the following growing season.

[r] Restricted Use.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	**Active Ingredient(s), Similar Products and MOA Group**	**Application Timing(s),** EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	**Special Instructions and Remarks**
2,4-D 3.8 lb ai per gallon **30 Day EPP applications:** 1 to 2 pt/A **15 Day EPP applications:** 0.75 to 1 pt/A	**Active Ingredient:** 2,4-D **Similar Products:** Many **Rates may vary due to formulation** **MOA:** 4	**30 Day EPP.** Apply **not less than 30 days** prior to planting soybeans and when weeds are actively growing **15 Day EPP.** Apply **not less than 15 days** prior to planting soybeans and when weeds are small and actively growing. Use the higher rate on larger weeds and when perennials are present.	**Injury to crops from this herbicide may occur, if you are not prepared to accept some degree of crop injury including possible loss of stand and yield, do not use this product. Do not** apply directly to, or permit to drift onto desirable crops or ornamental plants that are susceptible to 2,4-D herbicide. **Do not** apply preplant to soybeans in fields having a coarse-textured soil with less than 1% OM. **Do not** use in or near a greenhouse. **Do not** apply more than 2.0 pt/A in one season prior to planting soybeans. **Do not** plant soybean less than 1.5 inches deep. Insure that planted seed is completely covered with soil. **Do not** make more than 1 application in a growing season. **Do not** replant fields treated with 2,4-D in the same growing season with crops other than those labeled for 2,4-D preplant use. **Do not** mow or cultivate weeds prior to treating as poor control may result. **Do not** feed treated hay, forage, or fodder or graze treated soybeans.
2,4-DB 2 lb ai per gallon **EPP – PRE applications:** 0.7 – 0.9 pt/A **POST (over the top) applications:** 0.7 – 0.9 pt/A **POST(directed band) applications:** 0.7 – 1.6 pt/A	**Active Ingredients:** 2,4-DB **Similar Products:** Many **Rates may vary due to formulation** **MOA:** 4	**EPP – PRE.** Apply before planting or before crop emergence. Must include a non-ionic surfactant at a rate of 0.5% v/v. **POST (over the top).** Apply only from 7 to 10 days before bloom up to mid-bloom when crop is about knee-high and growing actively. **POST (directed band)** Apply when crop is 8 or more inches tall with nozzles mounted to insure proper placement of spray on only the lower 1/3 of plants. Do not allow spray to contact growing terminals of beans as excessive crop injury will result.	**Do not** use on soybeans that show symptoms of disease such as Phytophthora root rot. **Do not** graze or feed crop hay within 60 days after application. **Do not** harvest crop within 60 days after spray application. **Do not** apply more than 1.6 pt/A per season.
Aim 2 EC **EPP & PRE applications:** 0.5 – 1.6 fl. Oz/A **POST-DIRECTED applications:** 0.5 – 1.6 fl. Oz/A **POST applications:** 0.25 – 0.5 fl. Oz	**Active Ingredient:** Carfentrazone **Similar Products:** Aim EW Avalanche Bulk Pak (Teamwork is the 40 DF formulation **MOA:** 14	**EPP.** Apply up to 30 days before planting for control of emerged weeds when tank mixed with a nonselective burndown herbicide. **PRE.** Apply after planting but before crop emergence in no-till system for control of emerged weeds when tank mixed with a nonselective burndown herbicide. **POST-DIRECTED.** Apply POST-DIRECTED with spray directed toward base of soybean plants. . Avoid contact of soybean foliage with herbicide spray. **POST.** Apply broadcast for control of velvetleaf only, or to aid in control of morninglories, lambsquarter, and other weed species. .	Apply with 0.25% NIS with at least 80% active ingredient strength, or 0.25% NIS plus 0.5 to 1% 28% UAN (or 2 to 4 lb ammonium sulfate) when applied under very dry conditions. **Do not** apply more than 1.6 fl. Oz/A/season. **Do not** feed treated soybean forage or soybean hay. Do not spray later than the third trifoliate stage of soybeans

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Assure II 0.88 lb ai per gallon **EPP applications:** 2 to 5 fl oz/A **POST applications:** 5 to 12 fl oz/A	**Active Ingredients:** Quizalofop **Similar Products:** Matador **MOA:** 1	**EPP.** Apply before planting for control of emerged grasses. Will not provide residual control of grass. **POST.** Apply after crop and weed emergence but before grasses tiller.	**Do not** apply Assure II within 80 days of harvest. **Do not** apply to soybeans after pod set. **Do not** apply more than 18 oz/A per season. **Do not** feed treated soybean forage or soybean hay. **Do not** cultivate within 7 days after application. Optimum timing for cultivation is 7-14 days after application of Assure II. Applications must include 1% v/v petroleum based crop oil concentrate. If perennial grasses regrow, reapply Assure II at 6-7 oz/A.
Authority 75% DF **SOIL applications:** 4 to 5.3 oz/A. Use higher rates when applied EPP, heavy weed pressures, or when soil OM >4%.	**Active Ingredients:** Sulfentrazone **Similar Products:** Spartan 75 DF Spartan 4F Sulfentrazone 75DF **MOA:** 14	**EPP.** Apply up to 30 days prior to planting. **PPI.** Apply up to 30 days prior to planting and incorporate 1 to 2 inches deep. **PRE.** Apply after planting but before crop and weeds emerge.	**Do not** apply aerially. **Do not** feed treated soybean forage or soybean hay. **Do not** apply more than 5.3 oz/A in a season. **Do not** apply if soybeans have emerged. **Do not** apply if there are visible signs of soil cracking due to soybean emergence. For improved velvetleaf or prickly sida control use the 5.3 oz/A rate.
Backdraft 1.5 lb ai per gallon **EPP BURNDOWN & PRE applications:** 1.5 to 2 qt/A **POST applications:** 1.5 to 2 qt/A	**Active Ingredients:** Imazaquin Glyphosate **Similar Products:** Backdraft SL **MOA:** 2 & 9	**EPP BURNDOWN.** Apply in no-till or stale seedbed soybeans as a preplant burndown treatment up to 45 days before planting. **PRE.** Apply after planting but before crop emergence in no-till or stale seedbed soybeans. **POST.** Apply POST to actively growing weeds in Roundup Ready Soybean varieties.	**Apply POST only in Roundup Ready Soybean varieties. Do not** apply products containing chlorimuron ethyl, imazaquin, imazethapyr, or flumetsulam the same year as Backdraft or injury to following crops may occur. **Do not** harvest soybean within 90 days after Backdraft application. **Do not** apply to soybeans once flowering has begun. **Do not** apply more than one Backdraft application in a year. **Do not** graze or feed treated soybean forage, hay, or straw. A nonionic or organo-silicone surfactant and nitrogen-based fertilizer must be used. Avoid drift and contact with desirable plants, because severe injury or plant death may result.
Basagran 4 lb ai per gallon **POST applications:** 1 to 3 pt/A.	**Active Ingredients:** Bentazon **Similar Products:** Rezult B **MOA:** 6	**POST.** Apply POST to actively growing weeds within the size limits on the label.	**Do not** apply more than 2 lb bentazon/A per year. **Do not** apply to soybeans that are stressed due to environmental and/or previous herbicide applications. **Do not** graze or cut treated soybean forage for at least 30 days after treatment. **Do not** cultivate 5 days before or after treatment.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Boundary 7.8 lb ai per gallon **SOIL applications:** See tables.	**Active Ingredients:** Metolachlor Metribuzin **Similar Products:** None **MOA:** 15 & 5	**EPP.** Apply in reduced-till or no-till systems up to 30 days before planting but before soybean emergence. **PPI.** Apply up to 14 days before planting and incorporate into the top 2 inches of soil. **PRE.** Apply after planting but before crop or weed emergence.	**Do not** exceed 3.25 pt/A Boundary per use season. **Do not** grazed or feed treated soybean forage or hay within 40 days of last application. Injury to soybeans or reduced weed control may occur when Boundary is used under the following conditions; (1) soils have a calcareous surface area or a pH of 7.5 or higher, (2) when applied in conjunction with soil-applied organic phosphate pesticides, (3) uneven application or improper incorporation, (4) when applied to any soil with less than 0.5% organic matter, (5) when soil incorporation is deeper than recommended, (6) when soybeans are planted less than 1 ½" deep. **Do not** use on sand soils. **Do not** use on loamy sand soils with less than 2% OM. **Do not** use rates higher than 1.25 pt/A if soil pH is greater than 7.0. Where a rate range is recommended, the higher rates should be used in fields with a history of severe weed pressure, when the time between **EPP** and **PRE** overlay applications approach**es** the maximum 30 days, when **soil OM** content is over 3%, and/or when heavy crop residues are present on the soil surface.

EPP, PPI, & PRE Applications	**Boundary Use Rates (pt/A) in Conventional Tillage Systems**		
	Soil Textural Group	0.5 to 3% OM	Greater then 3% OM[a]
	Coarse	1 to 1.25 pt	1.25 to 1.5 pt
	Medium	1.5 to 1.75 pt	1.75 to 2 pt
	Fine[b]	2 to 2.25 pt	2 to 2.5 pt
	a. For PPI applications use the lower rate in the rate range. b. For this herbicide, silty clay loam soils are classified as fine-textured soils.		

EPP & PRE Applications	**Boundary Use Rates (pt/A) in Reduced-till or No-till Systems[a]**	
	Soil Textural Group	pt/A
	Coarse	1 to 1.75
	Medium	1.75 to 2.5
	Fine[b]	2.25 to 3
	a. Use low rate range for low residue level or soils with less than 3% OM. Use the higher rate range for high residue level or soils with greater than 3% OM..	
	b. For this herbicide, silty clay loam soils are classified as fine-textured soils.	

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Canopy 75% WDG **FALL, EPP, PPI, & PRE applications:** See table	**Active Ingredients:** Chlorimuron Metribuzin **Similar Products:** Canopy SP **Rates may vary due to formulation** **MOA:** 2 & 5	**FALL.** Apply after harvest but before the ground freezes. For control of winter annual broadleaves and grasses. **EPP.** Can be applied no more than 45 days prior to planting. **PPI.** Apply prior to planting and incorporate 1 to 2 inches deep. **PRE.** Apply after planting but before crop emergence.	**Do not** apply after crop emergence. **Do not** apply to soils with pH greater than 6.8. **Do not** apply if there are visible signs of soil cracking due to soybean emergence. **Do not** apply within 14 days of an organophosphate insecticide application. **Do not** apply to metribuzin sensitive varieties. If weeds are emerged at the time of application, 1% v/v COC must be included.

EPP, PPI, & PRE Applications	Canopy Use Rates (oz/A)	
	Soil Textural Group	Soil Organic Matter Content 0.5 to 4%
	Course	4 to 5
	Medium	5 to 6
	Fine	5 to 7

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Canopy XL 56.3% WDG **FALL, EPP, PPI, & PRE applications:** 2.5 to 7 oz/A	**Active Ingredients:** Chlorimuron Sulfentrazone **Similar Products:** None **MOA:** 2 & 14	**FALL.** Apply after harvest but before the ground freezes. For control of winter annual broadleaves and grasses. **EPP.** Can be applied no more than 30 days prior to planting. **PPI.** Apply prior to planting and incorporate 1 to 2 inches deep. **PRE.** Apply after planting but before crop emergence.	**Do not** apply after crop emergence. **Do not** apply to soils with pH greater than 6.8. **Do not** apply if there are visible signs of soil cracking due to soybean emergence. **Do not** apply within 14 days of an organophosphate insecticide application. If weeds are emerged at the time of application, 1% v/v COC must be included.
Clarity 4 lbs ai per gallon **EPP applications:** 4-16 oz/A **PRE HARVEST applications:** 8-64 oz/A	**Active Ingredients:** Dicamba **Similar Products:** Sulfentrazone 75DF **MOA:** 4	**EPP.** A waiting interval of 14 days is required for 8 fl oz/A or less, and 28 days for 16 fl oz/A. These intervals must be observed prior to planting or crop injury may occur. **PRE HARVEST.** Apply to emerged and actively growing weeds after pods have reached mature brown color and 75% leaf drop has occurred. Crop may be harvested 14 days or more after a preharvest application.	**EPP. Do not** cultivate within 7 days after application. **Do not** apply in geographic areas with average annual rainfall less than 25". **POST. Do not** use preharvest-treated soybean for seed unless a germination test is performed with an acceptable result of 95% germination or better. **Do not** feed crop fodder or hay following application. **All applications.** Refer to label for application rates for specific weed problems.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Classic 25% WDG **POST applications:** 0.33 to 0.75 oz/A	**Active Ingredients:** Chlorimuron **Similar Products:** None **MOA:** 2	**POST.** Apply any time after the first trifoliate has opened but no later than 60 days before soybean maturity.	**Do not** graze treated fields or harvest for forage or hay. **Do not** cultivate within 7 days of application. Cultivation approximately 14 days after application will help control suppressed weeds. **Do not** make more than 2 applications of Classic in a single season. **Do not** use on soils with a history of nutrient deficiency, since crop injury may occur. **Do not** tank mix Classic with organophosphate insecticides or apply Classic 14 days before or after an organophosphate insecticide application, as severe crop injury may occur. Applications must include 1% COC or 0.25% NIS. Ammonium nitrogen fertilizer is recommended and required for control of velvetleaf.
Cobra 2 lb ai per gallon **POST applications:** 6 to 12.5 fl oz/A	**Active Ingredients:** Lactofen **Similar Products:** Phoenix **MOA:** 14	**POST.** Apply POST to actively growing weeds. Soybean leaves that are open at the time of application will show some burn, bronzing and speckling. Trifoliate soybean leaves that have emerged but are unopened at the time of application may appear cupped at the tip and/or crinkled along the edges of the leaf.	**Do not** apply later than 45 days before harvest or after growth stage R6 (full seed). **Do not** exceed a total of 25 fl oz/A (0.4 lb ai/A) per season. **Do not** graze green forage or stubble. **Do not** feed treated soybean silage. **Do not** cultivate prior to or during application. Good coverage of young, actively growing weeds is essential for maximum weed control. The use of a spray adjuvant is required. Temporary crop response should be expected following application.
Command 3ME 3 lb ai per gallon **SOIL applications:** 1.3 to 2.67 pt/A	**Active Ingredients:** Clomazone **Similar Products:** Command 4EC **MOA:** 13	**EPP. A**pply up to 30 days before planting. **PPI.** Apply before planting and incorporate no deeper than 1.5 to 2 inches. **PRE.** Apply after planting but before crop and weed emergence.	**Do not** apply more than 1.25 lb ai/A per season. **Do not** graze or feed forage, hay, or straw from a treated field. **Do not** exceed 30 psi spray boom pressure. **Do not** spray if wind is above 10 mph. Leave a 300 foot buffer zone between treated area and sensitive plants.
Command Xtra 4 lb ai per gallon Sulfentrazone 3 lb ai per gallon Clomazone **SOIL applications:** See table.	**Active Ingredients:** Clomazone Sulfentrazone **Similar Products:** None **MOA:** 13 & 14	**EPP**. Apply up to 30 days before planting. **PRE.** Apply after planting but before crop and weed emergence.	**Do not** apply more than one application per season. **Do not** apply to soils classified as sands containing less that 1% organic matter. **Do not** allow livestock to graze on treated soybean vines, or feed treated soybean vines or vine trash to livestock. **Do not** apply aerially. **Do not apply Command Xtra if soybeans are emerging through the soil surface (cracking) or crop injury will result.** Water or fertilizer solutions may be used as a carrier of Command Xtra.

EPP & PRE Applications

Command Xtra Use Rates (fl oz/A)

Soil Texture	Rates of Product fl oz/A: Command Xtra B	Command Xtra G
Sand, Loamy Sand, Clay Sand	8	21.3
Sandy Loam, Loam, Silt Loam, Silty Clay Loam, Clay Loam, Sandy Clay Loam, Silt	9.6	25.6
Clay, Loamy Clay, Sandy Clay, Silty Clay	12	32

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Conclude Xact 6.0 lb ai per gallon **POST applications:** 3 pt/A	**Active Ingredients:** Bentazon Acifluorfen Sethoxydim **Similar Products:** None **MOA:** 6, 14, & 1	**POST.** Apply when crop is in the 2nd to 3rd trifoliate leaf stage of growth. Apply when weeds are small and according to the weed sizes listed in the label.	**Do not** make more than one application per season. **Do not** apply within 75 days of harvest. **Do not** use treated plants for feed or forage. **Do not** apply if rainfall or overhead irrigation is expected soon after application. **Do not** apply through any type of irrigation system.
Conclude Xtra G 0.94 lb ai per gallon **POST applications:** 24 oz/A Conclude Xtra B & 17 oz/A Conclude Xtra G	**Active Ingredients:** Clethodim **Similar Products:** None **MOA:** 1	**POST.** Apply early when crop is in the 2nd to 3rd trifoliate leaf stage of growth. Apply when weeds are small and according to the weed sizes listed in the label.	**Do not** make more than one application per season. **Do not** apply within 60 days of harvest. **Do not** use treated plants for feed or forage. **Do not** apply if rainfall or overhead irrigation is expected soon after application. **Do not** apply through any type of irrigation system.
Domain DF 60% DF **SOIL applications:** 9 to 16 oz/A	**Active Ingredient:** Flufenacet Metribuzin **Similar Products:** Axiom **<u>Rates may vary due to formulation</u>** **MOA:** 15 & 5	**EPP.** May be applied up to 14 days before planting in conservation, minimum or no-tillage crop production systems. If weeds are emerged at application, the addition of COC will provide burndown control of certain broadleaves weeds less than 3 inches in height. **PPI.** Apply up to 14 days before planting and incorporate into the top 1 to 2 inches of soil. **PRE.** Apply after planting but before crop and weed emergence.	**Do not** apply more than 16 ounces of DOMAIN per acre per use season. **Do not** plant soybean less than 1.5 inches deep. **Do not** apply aerially. **Do not** use on cultivars that are sensitive to metribuzin. Injury to soybean varieties may occur when 1) soils have a calcareous surface area or a pH of 7.5 or greater, 2) Domain is applied in conjunction with a soil-applied organophosphate insecticide, 3) Domain is applied unevenly or poorly incorporated into the soil, 4) Domain is applied to soil with less than ½% organic matter, or 5) when heavy rains occur soon after application, especially in poorly drained areas where water may stand for several days. Use of higher rates of Domain is recommended when: 1) weed pressures are heavy, 2) applications are to be made EPP, PPI, and/or 3) on soils with 3% or higher organic matter. Domain is **not recommended** for use on sand soils with less than 1% organic matter or on peat or muck soils with 20% or greater organic matter.
Dual II Magnum 7.64 lb ai per gallon **EPP applications:** 1.33 to 2.0 pt/A **PPI & PRE applications:** See table.	**Active Ingredient:** Metolachlor **Similar Products:** Dual II Magnum SI Dual IIG Magnum Dual Magnum Cinch **<u>Rates may vary due to formulation</u>** **MOA:** 15	**EPP.** May be applied up to 45 days before planting. **PPI.** Apply before planting and incorporated 1 to 2 inches. **PRE.** Apply after planting but before weeds emerge.	See label for soil type restrictions and for split application restrictions. No more than 2.5 pts/A can be applied during any one season. If soil organic matter is 6-20%, 2.5 pts/A may be used. **Do not** graze or feed treated forage for 30 days after applications.

PPI, & PRE Applications	**Dual II Magnum Use Rates (pt/A)**		
	Soil Textural Group	Less than 3% OM	3% or more OM
	Coarse	1.0 to 1.33	1.33
	Medium	1.33 to 1.67	1.33 to 1.67
	Fine	1.33 to 1.67	1.67 to 2.0

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Extreme 2.17 lb ai per gallon **EPP BURNDOWN & PRE applications:** 3 pt/A **POST applications:** 3 pt/A	**Active Ingredient:** Imazethapyr Glyphosate **Similar Products:** None **MOA:** 2 & 9	**EPP BURNDOWN.** Apply in no-till or stale seedbed soybeans as a preplant burndown treatment up to 45 days before planting. **PRE.** Apply after planting but before crop emergence in not-till or stale seedbed soybeans.. **POST.** Apply POST to actively growing weeds, but only in **Roundup Ready Soybean varieties**.	**Apply POST only in Roundup Ready Soybean varieties. Do not** apply products containing chlorimuron ethyl, imazaquin, imazethapyr, or flumetsulam the same year as Extreme because carryover to following crops may occur. **Do not** harvest soybeans within 85 days following a Extreme application. **Do not** apply to soybeans after flower initiation. **Do not** apply more than one Extreme application in a year. **Do not** graze or feed treated soybean forage, hay, or straw. A nonionic or organo-silicone surfactant and nitrogen-based fertilizer must be used. Avoid drift and contact with desirable plants, because severe injury or plant death may result.
FirstRate 84% DF **SOIL applications:** See table. **POST applications:** 0.3 oz/A	**Active Ingredient:** Cloransulam-methyl **Similar Products:** Amplify **MOA:** 2	**EPP.** Apply up to 4 weeks prior to planting. If rainfall is not anticipated, shallow incorporation within the top 2 inches of soil will improve weed control. **PPI.** Apply up to 4 weeks prior to planting and incorporate within the top 1-3 inches of soil. For best results apply no more than 2 weeks prior to planting. **PRE.** Apply after planting but before crop and weed emergence. **POST.** Apply before 50% flowering stage of soybean and before maximum weed stage on label.	**Do not** apply more than 0.75 oz/A as soil applications in a growing season. **Do not** apply more than one soil application per growing season. **Do not** apply more than 0.6 oz/A as POST applications during the same growing season. **Do not** apply more than 1.05 oz/A in one growing season. **Do not** harvest soybeans for forage or hay within 14 days of application. **Do not** harvest soybeans for 65 days after application. Always use COC, NIS, or MSO with POST applications. When velvetleaf is the target, also use UAN or ammonium sulfate with NIS or COC.

EPP, PPI, & PRE Applications	**FirstRate Use Rates (oz/A)[a]**		
	Area of Use	**Soil Organic Matter Levels**	oz/A
	North of Interstate 64	3.0% or less	0.6
	North of Interstate 64	Greater than 3.0%	0.75
	South of Interstate 64	All organic matter levels	0.75
	a. Soil applications of 0.75 oz/A FirstRate on soils with greater than 5% organic matter may result in reduced weed control.		

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Flexstar 1.88 lb ai per gallon **POST applications:** 0.75 to 1.5 pt/A	**Active Ingredients:** Fomesafen **Similar Products:** Reflex **MOA:** 14	**POST.** Apply POST to actively growing weeds after crop emergence but before soybean bloom.	**Do not** cultivate prior to application. Cultivation 1 to 3 weeks after application may assist weed control. **Do not** apply more than 1.6 pt/A (or 0.375 lb ai/A fomesafen) in alternate years. **Do not** apply after soybean bloom. **Do not** overlap spray pattern due to potential injury of rotational crops. **Do not** graze treated areas or harvest forage or hay. **Do not** graze rotated small grain crops or harvest forage or straw. Some bronzing, crinkling, or spotting of soybeans leaves may occur following POST applications, but soybeans soon outgrow these effects and develop normally. Always include a nonionic surfactant (NIS) or crop oil concentrate (COC).
Frontrow 84% WDG **POST applications:** One overpack/5A	**Active Ingredients:** Cloransulam Flumetsulam **Similar Products:** None **MOA:** 2 & 2	**POST.** May be applied any time prior to the 50% flowering stage. Apply to small actively growing weeds and when daytime temps are 70ºF or more. May apply a second application 14 days following first application for control of late germinating weeds.	**Do not** apply using liquid fertilizer as a carrier. **Do not** graze or feed treated forage, hay, or straw to livestock. **Do not** apply through any type of irrigation system. **Do not** harvest crop for 70 days after application.
Fusilade DX 2 lb ai per gallon **POST applications:** 6 to 24 fl oz/A	**Active Ingredients:** Fluazifop **Similar Products:** None **MOA:** 1	**POST.** Apply POST to actively growing weeds after crop emergence but before soybean bloom. Refer to label for application rates for specific areas.	**Do not** apply after soybean bloom. **Do not** apply more than 32 fl oz/A per year. **Do not** graze animals in treated areas. **Do not** cultivate within 7 days before or after application. Cultivation 2 to 3 weeks after application may assist weed control. Always include a nonionic surfactant or crop oil concentrate.
Fusion 2.56 lb ai per gallon **POST applications:** 6 to 12 fl oz/A	**Active Ingredients:** Fluazifop Fenoxaprop **Similar Products:** None **MOA:** 1	**POST.** Apply POST to actively growing weeds after crop emergence but before soybean bloom. Refer to label for application rates for specific areas.	**Do not** apply after soybean bloom. **Do not** apply more than 24 fl oz/A per year. **Do not** graze in treated areas. For sequential applications, allow 2 to 3 weeks after the FUSION application before applying a broadleaf herbicide or mixture. If a broadleaf herbicide or mixture is applied first, apply FUSION when the grass weeds begin to develop new leaves (generally around 7 days). **Do not** cultivate within 7 days before or after application. Cultivation 2 to 3 weeks after application may assist weed control. Always include a nonionic surfactant or crop oil concentrate.
Glyphosate 3 lb ae per gallon **EPP BURNDOWN application:** 20 to 52 fl oz/A **PRE, & POST applications:** 20 to 40 fl oz/A	**Active Ingredient:** Glyphosate **Similar Products:** Many **Rates and required adjutants may vary due to formulation and manufacturer. See appropriate label.** **MOA:** 9	**EPP BURNDOWN.** Apply before planting the crop. **PRE.** Apply after planting but before crop emergence. **POST.** Apply POST only in **Roundup Ready Soybean varieties**.	**Apply POST only in Roundup Ready Soybean varieties. Do not** apply more than 6.0 qt/A for preharvest applications. **Do not** apply more than 1.6 qt/A in any single application. **Do not** apply more than 4 qt/A in a single EPP or PRE application. **Do not** apply more than 2.4 qt/A from crop emergence through harvest. Do not apply more than 1.6 qt/A during flowering. **Do not** harvest soybean within 7 days after application. **Do not** apply aerially. **Do not** apply if wind speed is greater than 10 mph. **Do not** use any other nozzle than low-drift nozzles. **Do not** graze or harvest treated crop for livestock feed within 25 days of last application.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Gramoxone Max[r] 3 lb ai per gallon **EPP BURNDOWN applications:** 0.75 to 1.75 pt/A for 1 to 3 inch weeds. 1.75 to 2 pt/A for 3 to 6 inch weeds. 2 to 2.7 pt/A for 6 inch weeds.	**Active Ingredients:** Paraquat **Similar Products:** Gramoxone Extra Cyclone Max **Rates may vary due to formulation** **MOA:** 22	**EPP BURNDOWN.** Apply before planting for control of existing vegetation. **PRE BURNDOWN.** Apply after planting but before soybean emergence for control of existing vegetation.	**Do not** exceed 4 pt/A/season. **Do not** apply after crop emergence. **Do not** use around home gardens, schools, recreational parks, or playgrounds. Always add NIS or COC to the spray mix. Weeds emerging after application will not be controlled.
Harmony GT XP 75% WDG **POST applications:** 0.083 oz/A	**Active Ingredients:** Thifensulfuron **Similar Products:** None **MOA:** 2	**POST.** Apply anytime after the first trifoliate has opened but no later than 60 days before harvest.	**Do not** graze or harvest for forage or hay. **Do not** cultivate within 7 days of application. **Do not** make more than 1 application of Classic in a single season. **Do not** use on soils with a history of nutrient deficiency, since crop injury may occur. **Do not** tank mix with organophosphate insecticides or apply Harmony GT within 14 days before or after an organophosphate insecticide application, as severe crop injury may occur. Applications must include 1% COC or 0.25% NIS, and ammonium nitrogen fertilizer.
Intrro[r] 4 lb ai per gallon **PPI & PRE applications:** See table	**Active Ingredient:** Alachlor **Similar Products:** None **Rates may vary due to formulation** **MOA:** 15	**PPI.** Apply up to 7 days before planting and incorporate into the top 1 to 2 inches. **PRE. A**pply after planting, within 5 days of last preplant tillage, and before weed emergence.	**Do not** flood irrigate after application of alachlor. **Do not** make more that one application per year or exceed a total of 3 qt/A/year. **Do not** feed forage, hay, or straw from treated soybeans. **Do not** ensile soybeans treated with this product.

PPI Applications	**Intrro[r] Use Rates (qt/A)[a]**		
	Soil Textural Group	Less Than 3% OM	Greater Than 3% OM
	Coarse	2.5	2.5
	Medium	2.5 to 3	2.5 to 3
	Fine	2.5 to 3	3
	a. Use higher rate in the recommended range for areas with heavy weed infestations. Use a minimum of 3 qt/A on coarse soils to control yellow nutsedge.		

PRE Applications	**Intrro[r] Use Rates (qt/A)[a]**		
	Soil Textural Group	Less Than 3% OM	Greater Than 3% OM
	Coarse	2 to 2.25	2 to 2.25
	Medium	2 to 2.75	2 to 2.75
	Fine	2 to 2.75	2.5 to 3
	a. Use higher rate in the recommended range for areas with heavy weed infestations. Use a minimum of 2.5 qt/A on coarse soils and 3 qt/A on medium and fine soils to control black and hairy nightshade. When applied through center pivot irrigation or under sprinkler irrigation systems on coarse soils, use a minimum of 3 qt/A.		

[r] Restricted Use.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Outlook 6 lb ai per gallon **SOIL applications:** See table	**Active Ingredient:** Dimethenamid **Similar Products:** Frontier 6.0, Propel **MOA:** 15	**EPP.** Apply up to 45 days before planting. **PPI.** May be applied up to 2 weeks before planting and incorporated 1 to 2 inches. **PRE.** Apply after planting but before weeds emerge.	**Do not** apply more than 32 oz/A in a year. **Do not** apply to coarse soil classified as sand with less than 3% OM and/or where depth to ground water is 30 feet or less, or where annual irrigation + rainfall exceeds 40 inches. **Do not** graze or feed forage, hay, or straw.

EPP, PPI, & PRE

Outlook Use Rates (fl oz/A)[a]

	Less than 3% Organic Matter	3% or more Organic Matter
Coarse	10 to 14	14 to 18
Medium	14 to 16	16 to 20
Fine	16 to 18	18 to 21

a. Not recommended on soils with CEC values less than 5 or coarse soils with less than 1.5% organic matter.

Poast Plus 1 lb ai per gallon **POST applications:** 1.5 to 2.25 pt/A	**Active Ingredient:** Sethoxydim **Similar Products:** Poast **Rates may vary due to formulation** **MOA:** 1	**POST.** Apply POST to actively growing grass weeds within size limits on label.	**Do not** harvest soybean for at least 75 days after application. **Do not** apply more than 2.5 pt/A per application. **Do not** exceed 5 pt/A in a season. **Do not** cultivate within 5 days before or 7 days after applying Poast. **Do not** graze or feed forage, hay, or straw.
Prowl 3.3 EC 3.3 lb ai per gallon **SOIL applications:** See table.	**Active Ingredient:** Pendimethalin **Similar Products:** Prowl H2O Pendimax **Rates may vary due to formulation** **MOA:** 3	**EPP.** Apply up to 15 days before planting if used alone or up to 45 days before planting if tank mixed w/ Pursuit or Scepter. **PPI.** Apply up to 60 days before planting and incorporate within 7 days. **PRE.** Apply at planting or up to 2 days after planting.	**Do not** apply POST. **Do not** use on peat or muck soils. If replanting is necessary, do not work the soil deeper than the treated zone.

EPP & PPI Applications

Prowl Use Rates (pt/A)

Soil Texture[a]	Soil Organic Matter Content: Less than 3%	Soil Organic Matter Content: More than 3%
Coarse	1.2 to 1.8	2.4
Medium	1.8 to 3	3.0 to 3.6
Fine	2.4 to 3.6	3.6

a. For heavy clay soils, use Prowl 3.3 EC at 3.6 pts/A. The high rates for each soil texture should be used if heavy weed populations are anticipated, extensive crop residues were present prior to seedbed preparation, or in no-till.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

PRE Applications

Prowl Use Rates (pt/A)

Soil Texture	Soil Organic Matter Content [a]	
	Less than 3%	More than 3%
Coarse	1.2 to 1.8	1.8
Medium	1.8 to 2.4	1.8 to 2.4
Fine	1.8 to 2.4	2.4 to 3

a. The high rates for each soil texture above should be used if heavy weed populations are anticipated, extensive crop residues were present prior to seedbed preparation, or in no-till.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Pursuit DG 70% DG **SOIL applications:** 1.44 oz/A **POST applications:** 1.44 oz/A	**Active Ingredient:** Imazethapyr **Similar Products:** Pursuit **MOA:** 2	**EPP.** May be applied up to 45 days before planting. **PPI.** Apply prior to planting and incorporate into the top 1 to 2 inches of soil. **PRE.** Apply after planting but before crop and weed emergence. **POST.** Apply after crop emergence and before or after weed emergence.	**Do not** make more than one application a year. **Do not** apply within 85 days of harvest. **Do not** graze or feed treated forage, hay, or straw. **Do not** apply during or after bloom stage of soybean. **Do not** apply in tank mix with Command or Commence. **PPI applications** are more consistent for control of grass, velvetleaf, jimsonweed, & lambsquarters.
Pursuit Plus EC 2.9 lb ai per gallon **SOIL applications:** 2.5 pt/A	**Active Ingredient:** Imazethapyr Pendimethalin **Similar Products:** None **MOA:** 2 & 3	**EPP.** Apply up to 45 days before planting. Incorporate within 7 days of application if rainfall is not received. **PPI.** Apply up to 45 days before planting. Incorporate prior to planting and within 7 days of application. Incorporate at a depth of 1-2 inches. **PRE.** Apply up to 2 days after planting but before crop and weeds emerge.	**Do not** use more than 1 application per season. **Do not** apply with liquid fertilizer as a carrier. **Do not** apply within 85 days of soybean harvest. **Do not** graze or feed treated soybean forage, hay or straw.
Python 80% WDG **SOIL applications:** See table	**Active Ingredient:** Flumetsulam **Similar Products:** None **MOA:** 2	**EPP.** Apply alone or tank mixed with other labeled herbicides up to 30 days prior to planting. **PPI.** Apply alone or tank mixed with other labeled herbicides up to 30 days prior to planting and incorporated into the top 2-3 inches of soil. **PRE.** Apply after planting but before weeds emerge.	**Do not** make more than one application a year. **Do not** apply more than 0.07 lb of flumetsulam in a single year. **Do not** apply within 85 days of harvest. **Do not** use on peat or muck soils. **Do not** use on soils with pH greater than 7.8. **Do not** apply to soils with >5% OM and <5.9 pH. **Do not** graze or feed treated forage, hay, or straw. **Do not** apply if near freezing temperatures are expected.

EPP, PPI & PRE Applications

Python Use Rates (oz/A)

Soil Textural Group	Ounces per acre
Coarse	0.80 to 1.0
Medium or Fine	0.89 to 1.33

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Raptor 1 lb ai per gallon **POST applications:** 4 fl oz/A when preceeded by a full rate of a soil or grass herbicide or; 5 fl oz/A as a total POST program.	**Active Ingredient:** Imazamox **Similar Products:** None **MOA:** 2	**POST.** Apply **POST** to weeds before they exceed 5 inches in height.	**Do not** make more than one application during a growing season. **Do not** harvest soybeans within 85 days following application of Raptor. **Do not** graze or feed treated soybean forage, hay or straw. If arid conditions occur during the year of application, injury to rotational crops may occur. The addition of an adjuvant AND a nitrogen fertilizer solution is required.
Resource 0.86 lb ai per gallon **POST applications:** 4 to 12 fl oz/A	**Active Ingredient:** Flumiclorac **Similar Products:** None **MOA:** 14	**POST.** Apply POST after weed and crop emergence when weeds are actively growing and until 60 days before harvest.	**Do not** apply with aerial applicator. **Do not** apply RESOURCE within 60 days of harvest. **Do not** apply more than 12 fl oz/A in a single application or more than a total of 16 fl oz/A during a growing season. **Do not** graze treated fields or harvest for forage or hay. **Do not** make more than 2 applications in a season. Apply in a minimum of 15 gallons per acre carrier volume and a spray pressure of 35 to 60 psi. Sequential applications may be made after 14 days have passed from first RESOURCE application. Late POST control of tall velvetleaf may be achieved with RESOURCE plus 1 qt/A of COC or methylated seed oil. Spray grade nitrogen fertilizer (28 to 32% N) or spray grade AMS in addition to COC or methylated seed oil may enhance tall velvetleaf control.
Scepter 70 DG 70% DG **PPI or PRE applications:** 2.8 oz/A **POST applications:** 1.4 or 2.8 oz/A	**Active Ingredient:** Imazaquin **Similar Products:** None **MOA:** 2	**PPI.** Apply alone or tank mixed with other labeled herbicides not more than 30 days before planting and incorporated into the top 1-2 inches of soil. **PRE.** Apply up to 45 days before, during, or after planting but before the crop and weeds emerge. **POST.** Apply **POST** to small, actively growing weeds.	**Do not** harvest soybeans within 90 days following application of Scepter. **Do not** graze or feed treated soybean forage, hay or straw.
Select 2 EC 2 lb ai per gallon **POST applications:** 6 to 16 fl oz/A	**Active Ingredient:** Clethodim **Similar Products:** Conclude Xtra G Prism Volunteer **<u>Rates may vary due to formulation</u>** **MOA:** 1	**POST.** Apply to grasses after crop and weed emergence. Annual grasses that emerge after application will not be controlled. Apply to actively growing grasses at recommended weed heights. **Will not control sedges or broadleaf weeds.** The control of perennial grasses may require more than one application.	**Do not** cultivate within 7 days before of after application as this may reduce weed control. **Do not** mow area for two weeks prior to or after the application. Tank mixes with some POST broadleaf herbicides may result in reduced grass control. Applications must include COC or MSO. **Do not** apply more than 32 fl oz/A (0.5 lb ai/A) per season. **Do not** apply under conditions of drought stress. **Do not** graze treated fields or feed treated forage or hay. **Do not** apply within 60 days of harvest. **Do not** plant any crop for 30 days after application unless registered for use in that crop.
Sencor DF 75% DF **SOIL applications:** 2 to 5.33 oz/A	**Active Ingredient:** Metribuzin **Similar Products:** None **MOA:** 5	**EPP BURNDOWN.** Apply up to 30 days before planting for control of existing vegetation and for residual control. May be tank mixed with other products to increase burndown activity. Apply only by ground equipment when used as a burndown treatment in conservation tillage systems. **PRE.** Apply after planting and before crop and weed emergence.	**Do not** apply to soils with a calcareous surface area or to soils that have a pH of 7.5 or higher. **Do not** apply to sand soils, or to sandy loam or loamy sand soils containing less than 2% OM. **Do not** apply with soil organophosphate insecticide. **Do not** apply to soils with less than 0.5% OM. **Do not** incorporate into soil. **Do not** apply after crop has emerged. Check soybean varietal restrictions before applying this product. **Do not** feed or graze treated vines within 40 days after application.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Sequence 5.25 lb ai per gallon **All applications:** 2.5 to 4 pt/A	**Active Ingredients:** Metolachlor & Glyphosate **Similar Products:** None **MOA:** 15 & 9	**EPP.** Apply prior to planting for control of emerged actively growing weeds and soil residual activity. **Do not** incorporate if applied EPP, or crop injury will result. **PRE.** Apply after planting but before crop emergence for control of emerged actively growing weeds and soil residual activity. **POST only on Roundup Ready Soybean Varieties.** Apply after crop and weeds have emerged for control of emerged actively growing weeds and soil residual activity.	**Do not** graze or feed forage or fodder from Sequence treated crops to livestock for 30 days following application. **Do not** exceed 4 pt/A Sequence as a EPP or PRE application. On coarse soils apply 2.5 to 3.5 pt/A. On medium textured soils apply 3.5 to 4 pt/A. On fine textured soils apply 3.5 to 4 pt/A. **Do not** exceed 2.67 lb ai/A S-metolachlor per crop year. **PRE applications** must be applied before ground cracking of emerging **NON**-Roundup Ready Soybean plants.
Sonalan HFP 3.0 lb ai per gallon **PPI applications:** See table	**Active Ingredient:** Ethalfluralin **Similar Products:** Sonalan 10G **MOA:** 3	**PPI.** Apply and incorporate in the spring before planting or in the fall. Fall application may be made only with dry bulk fertilizer. Refer to label for fertilizer applications. Plant crop no more than 2 inches deep.	**Do not** graze or forage crop grown in treated soil or cut for hay or silage.

Sonalan HFP Application Rates	
Soil Texture	**Pints/Acre**
Coarse	1 ½ – 2
Medium	2 – 2 ½
Fine	2 ½ - 3
General weed control, except groundcherry and nightshade from seed.	

Squadron 2.33 lb ai per gallon **SOIL applications:** 3 pt/A	**Active Ingredient:** Imazaquin Pendimethalin **Similar Products:** None **MOA:** 2 & 3	**EPP.** Apply up to 45 days before planting. Incorporate within 7 days of application if rainfall is not received. **PPI.** Apply up to 45 days before planting and incorporate into the upper 2 inches of soil. Incorporate within 7 days of application if rainfall is not received. **PRE.** Apply after planting but before crop and weeds emerge.	**Do not** apply postemergence (or at cracking) to soybeans. **Do not** apply within 90 prior to harvest. **Do not** graze or feed treated soybean forage, hay, or straw.
Stellar 3.1 lb ai per gallon **POST applications:** 5 - 7 fl oz /A	**Active Ingredient:** Flumiclorac Lactofen **Similar Products:** None **MOA:** 14 & 14	**POST.** Apply to actively growing weeds within the growth stages indicated on the label. Most effective when applied under sunny conditions at temperatures above 70°F. A sequential application can be made after a minimum of 14 days have passed following the first application.	**Do not** apply through any type of irrigation. **Do not** apply by air. **Do not** apply within 60 days of harvest. **Do not** graze animals on treated green forage or stubble. **Do not** utilize treated hay or straw for animal feed or bedding. **Do not** apply more than 10 fl oz /A during a single growing season. **Do not** apply more than two applications during a single growing season.
Storm 4.0 lb ai per gallon **POST applications:** 1.5 pt/A	**Active Ingredient:** Bentazon Acifluorfen **Similar Products:** None **MOA:** 6 & 14	**POST.** Apply early when weeds are small. Refer to label for weed size recommendations.	**Do not** cultivate within 5 days before or 7 days after application. **Do not** apply more than a total of 3 pt/A per season. **Do not** apply sequential applications within 15 days following initial application. **Do not** apply within 50 days of harvest. **Do not** use treated plants for feed or forage. **Do not** graze livestock on treated areas.

This section was not revised in 2007.

SOYBEAN WEED SUGGESTIONS (CONT'D)

Read and follow all label directions before product use.

Trade Name, Formulation, and Application Rate	Active Ingredient(s), Similar Products and MOA Group	Application Timing(s), EPP-early preplant, PPI-preplant incorporated PRE-preemergence, or POST-postemergence	Special Instructions and Remarks
Synchrony STS 42% WDG **Burndown and POST applications:** 0.5 oz/A for STS soybeans **Burndown and POST applications:** 0.25 oz/A for non-STS soybeans	**Active Ingredient:** Chlorimuron Thifensulfuron **Similar Products:** None **MOA:** 2 & 2	**BURNDOWN.** Apply up to 30 days before planting but before soybean emergence. **POST.** Apply any time after the first trifoliate has opened but no later than 60 days before soybean maturity.	Planting bin run seed saved from SYNCHRONY STS treated soybean the previous year is **not recommended**. **Do not** graze treated fields or harvest for forage or hay. **Do not** cultivate within 7 days of application. Cultivation approximately 14 days after application will help control suppressed weeds. Applications of SYNCHRONY STS **on STS soybeans** must include 1% v/v crop oil concentrate. On **non-STS soybeans** add 0.25% NIS. An ammonium nitrogen fertilizer is recommended and required if velvetleaf is present.
Treflan HFP 4 lb ai per gallon **PPI applications:** See table.	**Active Ingredients:** Trifluralin **Similar Products:** Treflan TR-10 Trifluralin HF Trust 10G Trust 4 EC **Rates may vary due to formulation** **MOA:** 3	**PPI.** Apply and incorporate within 24 hours of application. Two incorporation passes, in perpendicular directions, are recommended.	**Do not** apply to wet soils or soils that are subject to prolonged periods of flooding.

PPI Applications	Treflan HFP Use Rates (pt/A)	
	Soil Textural Group[a]	pt/A
	Coarse	1.0
	Medium	1.5
	Fine	2.0
	a. For coarse and medium soils with 2% to 5% organic matter use 1.5 pints. For fine soils with 2% to 5% organic matter use 2.0 pints. For soils with 5% to 10% organic matter use 2.0 to 2.5 pints.	

Ultra Blazer 2.0 lb ai per gallon **POST applications:** 0.5 to 1.5 pt/A	**Active Ingredient:** Acifluorfen **Similar Products:** None **MOA:** 14	**POST.** Apply POST to actively growing weeds.	**Do not** cultivate within 5 days before or 7 days after applying **Ultra Blazer**. **Do not** apply more than a total of 2 pints (0.5 pounds of active ingredient) of Ultra Blazer herbicide per acre, per season in soybeans. **Do not** apply more than 1.5 pints of Ultra Blazer per acre, per application in soybeans. Allow a minimum of 15 days between sequential applications of Ultra Blazer. **Do not** use treated plants for feed or forage. Leaf speckling may occur, but plants generally outgrow this condition within 10 days. Use a minimum of 10 gallons of water per acre as carrier.
Valor WP 51% WP **SOIL applications:** 2.5 to 3.0 oz/A	**Active Ingredient:** Flumioxazin **Similar Products:** Valor, Encompass **Rates may vary due to formulation** **MOA:** 14	**PRE.** Application must be made within 3 days after planting and prior to crop emergence. Application after the crop has begun to crack, or are emerged, will result in severe crop injury.	**Do not** graze treated fields or feed treated forage or hay to livestock. **Do not** incorporate into the soil after application. **Do not** apply more than 3 oz/A during a single growing season.

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Quick Guide to Soybean Diseases

Disease (causal agent)	Symptoms	Control
Root (soilborne) diseases		
Seed rot (*Pythium* spp., *Rhizoctonia solani*, *Phytophthora sojae*, *Fusarium* spp.)	Seeds rot and fail to emerge from the soil resulting in poor stand establishment. Usually a problem resulting from poor quality (low germ or moldy) seed, planting too deep, or from wet and cold soils after planting	Plant high quality seed (>85% germ) when warm soil temperatures favor rapid seed germination and seedling growth. Use a fungicide seed treatment when seed quality or planting conditions are not ideal (See Table 1 below).
Seedling disease – damping off (*Pythium* spp., *Phytophthora sojae*, *Rhizoctonia solani*, *Fusarium* spp.)	Plants wither and die after emergence or are stunted and grow slowly. Dark and firm or watery and soft decay of the roots and stem at or below the soil line.	Plant high quality seed (>85% germ) when warm soil temperatures favor rapid seed germination and seedling growth. Use a fungicide seed treatment when seed quality or planting conditions are not ideal (See Table 1 below).
Phytophthora root rot (*Phytophthora sojae*)	Occurs in heavy, poorly drained soils or in low spots in fields. Wet decay of stem and lower branches near the soil line that turns brown. Plants yellow and wilt. Roots are dark brown and rotted. Infection may occur at any stage of growth but is more common on young plants.	Plant resistant varieties and subsoil to break hard pans and promote drainage. Treat seed and/or soil with products containing metalaxyl or mefenoxam (See Tables 1 and 3 below).
Southern blight (*Sclerotium rolfsii*)	Generally a minor problem on scattered or localized patches of plants in mid to late season. Plants wilt and die. Base of stems covered with white, stringy mold that may extend onto the surrounding soil. Small, mustard seed-like reproductive structures (sclerotia) develop on the white mold.	Crop rotation with non hosts such as corn, sorghum, and cotton will reduce disease levels.
Charcoal rot (*Macrophomina phaseolina*)	Disease associated with hot dry weather in mid to late season. Plants loose vigor, yellow, wilt, and die with leaves remaining attached. Internal discoloration of tap root and upper stem is silver to gray in color. Numerous black, pepper-like sclerotia form under the bark of lower stem and roots.	Maintain adequate soil fertility and irrigate to reduce moisture stress. Avoid excessive seeding rates.
Soybean cyst nematode *(Heterodera glycines)* Root-knot nematode *(Meloidogyne* spp.)	Yield loss is the fist symptom of a nematode problem. Above-ground symptoms consisting of stunting, poor growth, yellowing, general decline, and early maturity may or may not appear after several years. Symptoms may mimic N or K deficiency. Root systems may be stunted or deformed. Symptoms are often irregularly distributed, occurring in patches.	Crop rotation with corn, sorghum and grassy forages should be considered. Nematicides provide control (See Table 3 below) but may not be cost effective. The most efficient control incorporates resistant varieties in a crop rotation. (See Soybean cyst nematode and Root-knot nematode below)

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Quick Guide to Soybean Diseases (Cont'd)

Disease (causal agent)	Symptoms	Control
Foliar (leaf, stem, and pod) diseases		
Bacterial blight (*Pseudomonas glycines*)	Small, angular, water-soaked spots that later turn yellow and then brown as tissue dies. Brown central area of diseased spot is surrounded by a yellow border. Spots fall out and leaf becomes ragged. Infected seed may be shriveled, slightly discolored or may not show any symptoms at all.	Plant resistant varieties, use high quality seed, practice crop rotation to avoid disease build-up, and use tillage to bury diseased crop residue.
Bacterial pustule (*Xanthomonas phaseoli*)	Symptoms are similar to bacterial blight (See above) except that tiny pustules (pimples) may form inside spots on the underside of the leaf.	Plant resistant varieties, use high quality seed of resistant varieties, practice crop rotation to avoid disease build-up, and use tillage to bury diseased crop residue.
Anthracnose (*Colletotrichum dematium* and/or *Glomerella glycines*)	Stem and pod lesions are indefinite brown areas causing premature death of leaves and pods. Dark streaks develop on petioles and leaves prematurely roll and die. Numerous minute black fruiting structures develop on the infected parts. Seed may be stained brown and appear moldy.	Practice crop rotation, incorporate diseased crop residue into soil, and use fungicide seed treatments to prevent seed transmission. Application of a foliar fungicide may provide an economic return (see Foliar diseases below).
Brown spot (*Septoria glycines*)	Most commonly leaf disease in Oklahoma. Most severe on early (April) planted soybeans. Cotyledon, unifoliate, and lower trifoliate leaves develop pinpoint brown spots that may enlarge to ¼ inch in diameter and be surrounded by a yellow border. Heavily spotted leaves turn yellow and drop, leading to significant defoliation in the lower and mid-canopy. Easily confused with soybean rust, but the underside of the spots are flat with no raised pustules (pimples).	Practice crop rotation, incorporate diseased crop residue into soil, and use fungicide seed treatments to prevent seed transmission. Application of a foliar fungicide may provide an economic return (see Foliar diseases below).
Downy mildew (*Peronospora manshurica*)	Symptoms appear on younger (upper) leaves as pale green and then yellow spots. Spots enlarge to up to ½ inch in diameter; the centers die and turn tan colored with a yellow or light green border. In humid weather, tufts of tan colored moldy growth are visible through a hand lens on the undersides of developing spots.	Plant resistant varieties, practice crop rotation, incorporate diseased crop residue into soil, and use fungicide seed treatments to prevent seed transmission.
Frogeye leaf spot (*Cercospora sojina*)	Sporadic disease that may reduce yield. Reddish brown, circular to angular leaf spots are up to 1/4" diameter. The center of the spots turns gray as spots age, but the borders remain dark.	Plant resistant varieties, practice crop rotation, use fungicide seed treatments to prevent seed transmission, and incorporate diseased crop residue into soil. Application of a foliar fungicide may provide an economic return (see Foliar diseases below).

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Quick Guide to Soybean Diseases (Cont'd)

Disease (causal agent)	Symptoms	Control
Foliar (leaf, stem, and pod) diseases (cont'd)		
Cercospora blight/Purple Seed Stain (*Cercospora kikuchii*)	At beginning pod fill, upper leaves exposed to the sun have a light purple, leathery appearance. Affected leaves may drop prematurely. Small sunken, reddish purple spots may develop on pods causing pink to dark purple staining of seeds.	Practice crop rotation, plant high quality seed, use a fungicide seed treatment, harvest promptly, and incorporate disease crop residue into soil. Application of a foliar fungicide may provide an economic return (see Foliar diseases below).
Pod and stem blight, seed decay (*Phomopsis longicolla*)	Plants are infected early in the growing season, but symptoms on the pods and stems do not appear until the plants are mature. Small black reproductive structures (pycnidia) develop in linear rows on mature stems or scattered on the pods. Affected seed may be covered with white mold or may be dull, cracked, or shriveled.	Practice crop rotation, plant high quality seed, use a fungicide seed treatment, harvest promptly, and incorporate disease crop residue into soil. Application of a foliar fungicide may provide an economic return (see Foliar diseases below).
Soybean rust (*Phakospora pachyrhizi*)	Faint pale green to yellow flecks appear on leaves in low and mid canopy during reproductive stages. Spots become angular and brown or reddish brown in color. Spots remain small but become numerous. Rust can easily be confused with brown spot and bacterial leaf spots. Key feature are the raised pustules (pimples) on the undersides of spots visible through a hand lens. Tufts of tan colored spores may also be present.	In 2007, rust was found for the first time in OK. Rust has the potential to cause yield loss. Leaf samples suspected to have rust should be submitted for identification to the local county extension office. A fungicide program for rust control may be economical during reproductive stages in fields where the disease has been identified or threatens. (See Foliar diseases below)
Stem canker (*Diaporthae phaseolorum var. caulivora*)	Reddish brown spots appear at nodes of the main stem during reproductive stages. Spots enlarge into elongated cankers that girdle plants. Leaves develop interveinal yellowing and browning, curl inward, die, and remain attached to stems. Yield losses occur when plants are killed prior to pod fill.	Not a common disease in Oklahoma. Practice crop rotation, incorporate diseased crop residue into soil, and plant resistant varieties.
Soybean mosaic (soybean mosaic virus)	Spread on seed and by aphids. Infected seed may not germinate or produce weak, spindly plants with crinkled unifoliate leaves. Infected older plants are stunted with crinkled or mottled leaves. Seed may be distinctly discolored brown or black as the hilum color bleeds out over the seed.	Yields may be reduced up to 25%. Plant high quality seed or seed from fields free of the virus. Plant resistant varieties.
Bud blight (tobacco ringspot virus or tobacco streak virus)	Spread on seed and by thrips and nematodes. Before flowering, terminal buds and shoots turns brown, curve down, and becomes dry and brittle. Younger leaves often develop a rusty flecking. Plants are dwarfed and produce little seed. After flowering, infection results in poorly filled pods or pods may be shed. Plants may remain green late at the end of growing season.	Plant high quality seed to help avoid seed transmission.

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Seed Treatment

Fungicide seed treatment can be beneficial under Oklahoma conditions, especially with low seeding rates, use of seed with poor germination (85% or lower), under cool and wet conditions associated with early (April) planting dates, and where Phytophthora root rot is a problem. However, yield responses to seed treatments are unlikely to provide an economic return when conditions favor rapid seed germination and seedling growth. In addition, soybean plants are innately able to compensate for a wide range of plant populations, so much so that for some varieties, a field with 50% of a desired plant population may yield as well as a field with a full plant stand. However, early maturing varieties (MG III and IV) tend to branch less than full season varieties (MG V and VI) and yield better where higher plant populations are achieved. Some suggested seed treatment fungicides for prevention of seed rot and seedling diseases are listed below (Table 1). Pre-treated seed can be ordered, or seed treatment fungicides can be purchased for use with slurry or mist-type equipment, auger systems, or planter box applications. Thorough and uniform application to seed is essential for maximum performance. Metalaxyl and mefenoxam provide enhanced (systemic) control of water molds such as *Pythium* and *Phytophthora*. However, they do nor have activity against other seedling disease pathogens and should be applied in combination with another seed treatment fungicide such as captan, thiram, carboxin, or fludioxanil to provide broad-spectrum disease control.

Table 1. Seed treatment fungicides for soybeans.

Disease (Causal Agent)	Common name (MOA Group): Formulation and rate /100 lb Seed	Remarks
Seed rot Seedling disease Damping off Phytophthora root rot	azoxystrobin (11) Protégé FL 0.2 to 0.27 fl oz Dynasty 0.8F 0.15 to 0.46 fl oz	 Slurry or mist type treatment. Slurry or mist type treatment.
	Bacillus subtilis: Kodiak HB 0.3D 4 to 8 oz Kodiak Flowable 0.25 fl oz	Biological treatment that can be used in combination with a fungicide treatment. Planter box treatment. Slurry or mist type treatment.
	captan (M): Captan 400 4F 1.5 to 2.5 fl oz Dyna Shield Captan 4F 1.5 to 2.5 fl oz Captan Moly 50D 3.5 oz Hi Moly/Captan-D 50D 3.3 oz	 Slurry or mist type treatment. Slurry or mist type treatment. Planter box treatment. Planter box treatment.
	captan (M) + carboxin (7) + metalaxyl(4) Bean Guard/Allegiance 41.25D 3.3 oz	 Dry planter box treatment.
	carboxin (7): Vitavax 34 3.3F 3 to 4 fl oz	*Rhizoctonia* only. Slurry or mist type treatment.
	carboxin (7) + thiram (M): Vitavax CT Flowable 12 fl oz RTU-Vitavax-Thiram 6.8 fl oz Vitavax M 12 fl oz Vitavax 200 3.34F 4 fl oz Vitavax M DC 4 oz	 Slurry, mist type, or planter box treatment. Slurry, mist type, or planter box treatment. Slurry, mist type, or planter box treatment. Slurry or mist type treatment. Planter box treatment.
	carboxin (7) + PCNB (14): Vitavax-PCNB 3.36F 4 fl oz	*Rhizoctonia* only. Slurry or mist type treatment.
	cloroneb (14) + metalaxyl (4): Delta-Coat AD 3.24F 5.5 to 7 fl oz	 Slurry, mist type, or planter box treatment.
	cloroneb (14) + mefenoxam (4): Delta Coat XL 3.09F 5.5 to 7 fl oz Catapult XL 3.09F 5.5 to 7 fl oz	 Slurry, mist type, or planter box treatment. Slurry, mist type, or planter box treatment.
	fludioxanil (12): Maxim 4FS 0.08 to 0.16 fl oz	*Rhizoctonia* and *Fusarium* only. Commercial slurry or mist type treatment.
	fludioxanil (12) + mefanoxam (4): Maxim XL 2.7F 0.17 to 0.33 fl oz	 Slurry or mist type treatment.

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Table 1. Seed treatment fungicides for soybeans. (Cont'd)

Disease (Causal Agent)	Common name (MOA Group): Formulation and rate /100 lb Seed	Remarks
Seed rot Seedling disease Damping off Phytophthora root rot cont'd	metalaxyl (4): Allegiance FL 2.65F 0.75 to 1.5 fl oz Allegiance LS 1.63F 1.2 to 2.4 fl oz Apron TL 1F 2 to 4 fl oz Allegiance Dry 12.5D 1.5 to 2 oz	*Pythium* and *Phytophthora* only. Slurry or mist type treatment. Slurry or mist type treatment. Slurry or mist type treatment. Planter box treatment.
	metalaxyl (4) + PCNB (14) + carboxin (7) Prevail 33.1D 3.3 to 6.7 oz	Planter box treatment.
	metalaxyl (4)+carboxin (7) +thiram (M): Stiletto 6.7 fl oz	Slurry, mist type, or planter box treatment.
	metalaxyl (4) + thiram (M) Protector L/Allegiance 6.7 fl oz	Planter box treatment.
	mefenoxam (4): Apron XL LS 3F 0.16 to 0.64 fl oz	*Pythium* and *Phytophthora* only. Slurry or mist type treatment.
	mefenoxam (4) + fludioxonil (12): ApronMaxx RFC 0.52F 1.5 fl oz ApronMaxx RTA 5 fl oz Warden RTA 5 fl oz	 Slurry or mist type treatment. Slurry or mist type treatment. Slurry or mist type treatment.
	thiram (M): 42S Thiram 4F 2 fl oz Thiram 75DF 2.2 oz Thiram Granuflo 75WDG 2.2 oz Protector-D 35D 3.3 oz Protector-L 6.7 fl oz	 Slurry or mist type treatment. Slurry or mist type treatment. Slurry or mist type treatment. Planter box treatment. Planter box treatment.

MOA Group Tables start on page 46 of the handbook.

Soilborne Diseases and Nematodes

Crop rotation with non-host plants should be considered for preventing the build-up of soil-borne diseases and nematodes problems in soybeans, and for reducing pathogen populations in problem fields. Resistant varieties are also available for soilborne problems such as Phytophthora root rot, soybean cyst nematode, and root knot nematode. However, single gene resistance is commonly employed in soybean breeding programs. While single gene resistance initially provides a high level of disease control, repeating cropping of the same resistance gene my lead to a new strain or "race" capable of damaging previously resistant varieties. Nematodes are frequent problems in soybean fields, but often overlooked as a cause of low yield. When nematode problems are suspected, samples should be submitted for analysis to the OSU Plant Disease and Insect Diagnostic Lab through a local OSU County Extension office. Refer to OSU Fact Sheet #7610 "Soil and Plant Sampling for Nematode Analysis" for information on how to sample for nematodes.

Phytophthora root rot: Phytophthora root rot is a problem on finely textured (clay) soils with poor drainage, in fields with hardpans, or in low areas of fields that collect water. The seed rot and damping off phases of Phytophthora root rot may be mistaken for Pythium damping-off. The fungus is highly variable and numerous races have developed in response to the planting of varieties with single-gene (specific) resistance. Once a Phytophthora problem is identified, crop rotation is of little value because the fungus survives indefinitely in soil. Ideally, varieties with single gene (race specific) should be matched to the prevailing race in a problem field. However, race identification is not available in Oklahoma. Variety selection must be based on local variety performance or the selection of varieties with a high probability of success, i.e. the Rps1-c or Rps1-k genes in a high-yielding variety. Tolerant (partially resistant) varieties are also available that are not race specific. However, tolerance is not effective against the disease at the seedling stages and their use should be combined with a seed treatment containing metalaxyl of mefanoxam (See Table 1 above). Mefenoxam can also be applied to soil or in-furrow at planting (See Table 3).

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Soybean Cyst Nematode: Soybean cyst nematode (SCN) is a significant problem in some old soybean fields. The nematode is probably more widespread than thought, because above ground symptoms are usually not distinct. SCN should be suspected where yields have declined for no other obvious reasons. SCN is best managed by planting resistant varieties in a crop rotation program with non-host crops to limit nematode reproduction. The goal is to reduce nematode numbers below damaging levels. Rotational crops should be summer crops that are grown during periods where nematodes are active. Non-host crops include alfalfa, corn, cotton, forage grasses, and sorghum. Avoid other legumes such as southern peas, beans, and forage legumes. Resistant soybean varieties use mainly two sources of resistance genes, one from "Peking" the other from "PI 188788". Most SCN-resistant varieties use PI 188788 as source of resistance. A third source of resistance, "Hartwig" (marketed with a CsytX, trademark) is available in a few varieties and may be effective in more fields. Cyst nematode populations are highly variable and a particular source of resistance may perform better in one area than another. Seed dealers can recommend varieties that perform best in a particular area. However, repeated cropping of a resistant variety with the same source of resistance can lead to development of new races of the nematode for which the resistance is no longer effective. A certain percentage of cyst nematodes will reproduce on resistant varieties. If sources of resistance are not rotated, these individuals will increase and produce a race shift. The same SCN-resistant variety should not be planted in the same field for two consecutive years. If possible, rotate sources of resistance. Inclusion of susceptible varieties may also be beneficial for countering race shifts. Table 1 lists some rotation sequences recommended for growing soybeans where SCN is a problem. A listing of the sources of the resistance used in SCN-resistant varieties has been maintained yearly at http://www.ag.uiuc.edu/%7Ewardt/cover.htm by the University of Illinois.

Table 2. Some suggested crop rotation sequences for soybean cyst nematode using resistant (R) and susceptible (S) soybean varieties.

Year	Rotation A	Rotation B	Rotation C
1	Non-host crop	Non-host crop	Non-host crop
2	Soybean (R)	Soybean (R)	Non-host crop
3	Non-host crop	Non-host crop	Soybean (S)*****
4	Soybean (R) – different source from year 2	Soybean (S)*****	Non-host crop
5	Non-host crop	Repeat cycle	Non-host crop
6	Soybean (R) – different source from year 4 or (S)*****		Soybean (S)*****
7	Repeat cycle		Repeat cycle

***** A soil test should be done to ensure egg counts are blow damaging levels (300 eggs per 100 cc soil for sandy soils; 1,200 eggs/100 cc soil for clay soils) before planting a susceptible variety.

Root-knot nematode: Root-knot nematode (RKN) may not be as widely distributed as SCN, but can cause very severe yield losses where it occurs. It is generally found at damaging levels in sandy soils. Selection of resistant varieties to manage RKN is the simplest method of control. There are several well-adapted varieties available that have high levels of RKN resistance. Growing a RKN-resistant variety for one to three years usually lowers the RKN population significantly. It should be noted that growing the same RKN resistant variety continuously for several years might result in a RKN population capable of damaging the resistant variety. Rotation to non-host crops is a good method of control, but because southern, northern, and peanut root-knot nematodes occur in Oklahoma, it is difficult to select a non-host crop where the species of nematode is not known. Only grass crops such as corn, grain sorghum, and forage grasses are non-hosts for the southern RKN. In fields with northern and peanut RKN, cotton or the grass crops are suggested.

Table 3. Fungicides for control of soilborne diseases of soybeans.

Disease (causal agent)	Common name (MOA group): Formulation and rate/ 1000 ft row	Remarks
Phytophthora root rot (*Phytophthora sojae*) Pythium damping off (*Pythium* spp.)	mefenoxam (4): Ridomil Gold 4E 0.08 to 0.28 fl oz Ridomil Gold 2.5G 1.5 to 6 oz	At planting treatment. Apply the high rate as a surface application in a 7-inch band and incorporate or water into soil, or apply any of the rates in furrow.

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Foliar Diseases

Foliar diseases are generally a minor problem except for frogeye leaf spot and soybean rust. Frogeye leaf spot is a sporadic disease that can reduce yields significantly. Soybean rust was identified in Oklahoma for the first time in 2007 and has the potential to reduce yields by up to 50%. Other foliar diseases such as anthracnose, pod and stem blight, and Cercospora blight have adverse effects on seed quality and may reduce yields when rainfall and humidity are high during reproductive stages, and where harvest is delayed by wet weather. Consider a foliar fungicide program when yield potential is high, soybeans are grown under irrigation, soybeans are grown for seed, and when early maturing varieties are grown (Group III and IV). Use the point system for forecasting the need for a fungicide program on soybeans (See OSU Extension Facts no. 7632). The expected price of soybeans should also be considered in making a decision on whether or not to use foliar fungicides. Generally a single application from growth stage R3 to R5 is sufficient for control of diseases that affect seed quality. Rust is potentially damaging and a fungicide program should be beneficial for high yielding soybeans when rust becomes severe. Because rust will not overwinter in Oklahoma, it will likely be a sporadic problem affecting soybeans in years where airborne spores move into the state and weather is favorable for rust development. Currently Oklahoma and surrounding states are part of a national network for monitoring rust development and spread. The current status of rust development in Oklahoma and other soybean growing states can be followed at http://www.sbrusa.net/. Consider a fungicide application for soybean rust when soybeans are at growth stages R1 to R5, yield potential is good (>25 bu/A) and when rust threatens or is identified in the field.

Table 4. Fungicides for control of foliar diseases of soybeans

Disease (causal agent)	Common name (MOA group): Formulation and rate/A	Remarks
Anthracnose Brown spot Frogeye leaf spot Pod and stem blight Cercospora blight Seed quality diseases Soybean rust	azoxystrobin (11): Quadris 2.08F 6.0 to 15.4 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (see OSU Extension Facts no. 7632). For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.
	myclobutanil (3): Laredo EC 2E 4 to 8 fl oz	For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.
	propiconazole (3): Tilt 3.6E 4 to 6 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (see OSU Extension Facts no. 7632). For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.
	propiconazole (3) + azoxystrobin (11): Quilt 1.66F 14 to 20.5 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (see OSU Extension Facts no. 7632). For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.
	propiconazole (3) + trifloxystrobin (11): Stratego 2.08E 7 to 10 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (see OSU Extension Facts no. 7632). For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.

SUGGESTIONS FOR DISEASE CONTROL ON SOYBEANS

Table 4. Fungicides for control of foliar diseases of soybeans (cont'd)

Disease (causal agent)	Common name (MOA group): Formulation and rate/A	Remarks
Anthracnose Brown spot Frogeye leaf spot Pod and stem blight Cercospora blight Seed quality diseases Soybean rust (cont'd)	pyraclostrobin (11): Headline 2.08F 6 to 12 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (see OSU Extension Facts no. 7632). For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.
	tetraconazole (3): Domark 230 ME 1.9E 4 to 5 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (see OSU Extension Facts no. 7632). For **soybean rust**, apply from growth stages R1 to R5 when rust threatens. A second application may be made from 14 to 21d after the first if needed.
	thiophanate-methyl (1): Topsin 70W 0.5 to 1.0 lb T-Methyl 70W 0.5 to 1.0 lb Thiophanate Methyl 85WDG 0.4 to 0.8 lb Topsin 4.5F 10 to 20 fl oz T-Methyl 4.5F 10 to 20 fl oz	Apply at first sign of frogeye leaf spot during R growth stages or from growth stage R3 to R5 for seed quality protection. Use: Point System Guide for Forecasting Fungicide Need (See OSU Extension Facts no. 7632).

MOA Group Tables start on page 46 of the handbook.

VETCH INSECT CONTROL SUGGESTIONS

INSECT AND TIME OF TREATMENT	INSECTICIDE (MOA Group) AND AMOUNT PER ACRE	MINIMUM DAYS FROM APPLICATION TO HARVEST	COMMENTS
Pea aphid In spring	Malathion 57EC (1B) 1.5 - 2.0 pt	7	
Vetch Bruchid Lygus bugs In spring	Malathion 57EC (1B) 1.5 - 2.0 pt	7	For best results in controlling bruchids, spray when they move into the field. Apply chemicals when 10 to 25% of the blooms have fallen if bruchids are present. Generally, the pods will be about 0.25 inch long at that time. Check field 6-8 days later and if bruchids are still present, make another application.

MOA Group Tables start on page 46 of the handbook.

HOME FRUIT SPRAYS

Home fruit growers seldom have the time or equipment to follow a complete spray schedule as utilized by commercial fruit growers for effective insect and disease control. Therefore, this simplified guide is prepared for the convenience of home fruit growers. For a detailed and graphic depiction of fruit tree growth stages and additional suggestions for pest management consult OSU Fact Sheet No. 7319, "Home Tree Fruit Production and Pest Management."

MANY CHEMICAL MANUFACTURERS OFFER GENERAL PURPOSE HOME FRUIT SPRAYS THAT ARE FAIRLY SATISFACTORY. However, some of the pesticides are not necessary in every spray and for those who desire to mix their own sprays the following schedules are provided as a guide. When mixing your own sprays, one should first add the chemical material to a little water in a clean container. Smooth out all the lumps before you pour the materials into the sprayer. Straining the spray mixture through a screen when filling the sprayer helps prevent spray nozzle clogging. In **all** instances **follow label directions!** The label is the law.

APPLE AND PEAR			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Dormancy - Apply when trees are dormant and temperature is above 40°F.	Scale, aphids, mites, cankerworms	Superior Summer Oil 3 tbs Microthiol Special (mites only) 6-12 tbs	Tree wraps and tanglefoot can help supplement control of cankerworm.
	Fire Blight	Monterey Liqui-Cop (M) 2-4 tsp	Make application when buds are silvery but before most have turned green. Phytotoxicity may occur from late applications. Discontinue use when green-tip is ½ inch.
Green Tip to ½ inch Green Leaf.	Fire Blight	Hi-Yield Copper Fungicide (M) See Remarks	**Apple:** Apply 2 2/3-5 1/3 tsp between silver-tip and green-tip. Discontinue use after ½ inch green leaf. **Pear:** Apply at 1/3 tsp at 5 day intervals throughout the bloom period.
		Bonide Liquid Copper (M) 0.5 – 2.0 fl oz	Apply beginning at silver-tip and continue on a 3 – 5 day schedule until petal fall.
	Scab, Powdery Mildew, Sooty Blotch, Bitter Rot, Black Rot, and Fly Speck	Hi-Yield Lime Sulphur Spray (M) See Remarks Gordon's Bordeaux Mixture Fungicide (M) 6-7 tbs	**Blotch**. Apply 2 1/2 fl. oz. per gallon of water. Apply in pre-bloom and petal fall stages and 10 days later. **Leaf Spot**. Apply 9 1/2 to 13 fl. oz. per gallon of water in delayed dormant stage or 4 teaspoons per gallon of water in growing season. **Powdery Mildew**. Apply 3.2 fl. oz. per gallon of water. Apply in pre-pink, pink and calyx stages. **Scab**. Apply 2 to 2 1/2 fl. oz. per gallon of water in delayed dormant, pre-pink and pink stage. Caution: Use on Delicious Apples may result in injury. No time limitation. Apply in Spring and/or early Summer, repeat as needed.
	Aphids, mites, scale insects	Superior Summer Oil 3 tbs	

HOME FRUIT SPRAYS (CONT'D)

APPLE AND PEAR (cont'd)			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Prebloom (may be omitted on pears)	Scab, Powdery Mildew, Sooty Blotch, Bitter Rot, Black Rot, and Fly Speck	Hi-Yield Lime Sulfur Spray (M) See Remarks	See Remarks at Green Tip to ½ inch Green Leaf.
		Gordon's Bordeaux Mixture Fungicide (M) 6-7 tbs	See Remarks at Green Tip to ½ inch Green Leaf.
	Aphids, mites, cankerworm	Superior Summer Spray Oil 3 tbs	Use of tanglefoot, a sticky barrier, can aid in control of cankerworm. Aphids may also be controlled with insecticidal soaps, pressurized sprays of water and interplantings of aromatic plants such as garlic, chives, petunia, or anise.
Bloom (To protect bees, do not use insecticides during this period.)	Scab, Powdery Mildew, Sooty Blotch, Bitter Rot, Black Rot, and Fly Speck	Gordon's Bordeaux Mixture Fungicide (M) 8-12 tbs	See Remarks at Green Tip to ½ inch Green Leaf.
	Fire Blight	Ferti-lome Fire Blight Spray (M) ½ tsp	Apply in foliar and blossom sprays. Make first spray at the start of blossoming period. Continue spray applications every 3 to 4 days during bloom time. Apply additional sprays every 5 to 7 days after blossom period when weather conditions favor spread of Fire Blight. Do not apply when fruit is visible.
		Bonide Liquid Copper (M) 0.5 – 2.0 fl oz	See remarks at Pre-bloom

HOME FRUIT SPRAYS (CONT'D)

APPLE AND PEAR (cont'd)				
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*)**	**RATE PER GALLON**	**REMARKS**
Petal Fall	Scab, Sooty Blotch, Bitter Rot, Black Rot, and Fly Speck	Bonide Captan 50 WP (M)	2 tbs	Spray 1 to 2 pints for small/dwarf trees, 1 to 2 quarts per medium-size tree, and 1 to 3 gallons for large/mature trees. Apply at 10 to 14 day intervals from petal fall to harvest. For Frog-eye Leaf Spot also apply during the prebloom and bloom periods on a 10 to 14 day schedule. Not labeled for pear.
		Gordon's Bordeaux Mixture Fungicide (M)	8-12 tbs	See Remarks at Green Tip ½ inch Green Leaf.
		Hi-Yield Lime Sulfur Spray (M)	See Remarks	See Remarks at Green Tip ½ inch Green Leaf.
		Bonide Copper Spray Or Dust (M)	½ - ¾ oz	Begin to apply at petal fall and repeat through 4th cover spray.
	Fire Blight	Ferti-lome Fire Blight Spray (M)	½ tsp	See Remarks at Bloom.
		Bonide Liquid Copper (M)	0.5 – 2.0 fl oz	See Remarks at Pre-bloom
	Codling Moth, Leafrollers.	Javelin[1]	0.5-1.0 tbs	Javelin and Dipel are B.t. compounds *(Bacillus thuringiensis* subsp. *kurstaki)*. Not for control of plum curculio.
		Dipel ES	1-4 tsp	
	Plum Curculio	Imidan 70W	1-2 tsp	This compound is sensitive to alkaline hydrolysis; therefore, check the pH of the tank mix and add a buffering agent if necessary to adjust the pH to 5.0 or lower. Do not attempt to acidify solutions containing copper compounds.

HOME FRUIT SPRAYS (CONT'D)

APPLE AND PEAR (cont'd)				
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*)**	**RATE PER GALLON**	**REMARKS**
Early Cover (through June).	Scab, Sooty Blotch, Bitter Rot, Black Rot, and Fly Speck	Bonide Copper Spray or Dust (M)	½ - ¾ oz	See Remarks at Petal Fall.
		Gordon's Bordeaux Mixture Fungicide (M)	8-12 tbs	See Remarks at Green Tip to ½ inch Green Leaf.
		Hi-Yield Captan 50WP (M)	2 tbs	Spray 1 to 2 pints for small/dwarf trees, 1 to 2 quarts per medium-size tree, and 1 to 3 gallons for large/mature trees. Apply at 10 to 14 day intervals from petal fall to harvest. For Frog-eye Leaf Spot also apply during the prebloom and bloom periods on a 10 to 14 day schedule. Not labeled for pear.
		Hi-Yield Lime Sulfur Spray (M)	See Remarks	See Remarks at Green Tip to ½ inch Green Leaf.
Summer Cover (July and August).	Scab, Sooty Blotch, Bitter Rot, Black Rot, and Fly Speck	Gordon's Bordeaux Mixture Fungicide (M)	8-12 tbs	See Remarks at Green Tip to ½ inch Green Leaf.
		Copper Spray or Dust (M)	½ - ¾ oz	See Remarks at Petal Fall.
		Hi-Yield Captan 50WP (M)	2 tbs	See Remarks at Early Cover.
		Hi-Yield Lime Sulfur Spray (M)	See Remarks	See Remarks at Green Tip to ½ inch Green Leanf.
	Codling Moth, Plum Curculio, Leafrollers	Imidan 70W	1 tsp	Pick up fallen fruit after harvest to reduce plum curculio.
	Mites	Kelthane T/O	1 tsp	Organic methods for control include hosing off plants with pressurized spray or using a sticky slurry of flour and buttermilk.

HOME FRUIT SPRAYS (CONT'D)

PEACH, PLUM, NECTARINE			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Dormancy	Peach Leaf Curl (peach, nectarine)	Bonide Liquid Copper Concentrate (M)	Apply at leaf fall and repeat in late dormant up to bud swell and at pink bud. Do not apply after pink bud.
		Ortho Garden Disease Control (M) 2 ¼ tsp	Do not apply between fruit formation and harvest. (1) Spray at leaf fall in late autumn. (2) Reapply 1 to 2 more times in mid to late winter before buds begin to swell. Additional directions for Shothole, to prevent fruit infections: (3) Also apply 1 to 2 weeks after petal fall when fruit just begins to form.
		Hi-Yield Lime Sulfur Spray (M) 12 ½ - 15 fl oz	
		Gordon's Bordeaux Mixture Fungicide (M) 12 tbs	Apply when tree is dormant – Spring or Fall.
	Blossom Brown Rot	Monterey Liqui-Cop (M) 3-4 tsp	Apply as a dormant or delayed dormant* spray. Do not apply at or after full bloom.
	Scale insects	Lime-Sulfur[2] See label	Do not apply Lime-Sulfur during high temperatures, or injury to foliage may occur.
		or Dormant Oil (Superior grade 70, See viscosity). 8 tbs	Apply Dormant Oil when trees are dormant and air temperature is above 40°F to prevent injury to trees. See label.
	Bacterial Spot	Monterey Liqui-Cop (M) 2 tsp	Apply as dormant spray and/or use ¼ tsp. as a post bloom spray. Apply twice during the season, but do not use later than 3 weeks prior to harvest. Do not use at rates above those recommended. NOTICE: Slight loss of leaves may occur from post bloom use.

HOME FRUIT SPRAYS (CONT'D)

PEACH, PLUM, NECTARINE (cont'd)			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Prebloom (Blossom buds show pink).	Peach Leaf Curl (peach, nectarine)	Bonide Liquid Copper Concentrate (M) 7-10 tsp	Apply at leaf fall and repeat in late dormant up to bud swell and at pink bud. Do not apply after pink bud.
	Brown Rot and Scab	Hi-Yield Captan 50WP (M) 2tsp	Apply at pink, full bloom, petal fall, shuck shed, cover and preharvest stages. Spray 1 to 2 pints for small/dwarf trees, 1 to 2 quarts per medium size tree, and 1 to 3 gallons for large/mature trees. Repeat applications at 7 to 14 day intervals as needed to maintain cover. Continue applications through harvest if conditions favor Brown Rot.
		Hi-Yield Lime Sulfur Spray (M) See Remarks	**NECTARINES: Brown Rot, Leaf Spot, Shothole**. Apply 4 teaspoons per gallon of water. Apply 3 to 5 times at weekly intervals before Harvest. Leaf Curl. Apply 7 3/4 fl. oz. per gallon of water. Apply in early Winter and late dormant period. **Powdery Mildew**. Apply 4 to 6 teaspoons per gallon of water. Apply when Disease appears.**PEACHES: Brown Rot, Leaf Spot**. Apply 4 teaspoons per gallon of water. Apply 3 to 5 times at weekly intervals before Harvest. **Brown Rot Blossom Blight**. Apply 1 to 2 fl. oz. per gallon of water. Apply in pre-bloom, early bloom and full bloom stages. **Leaf Curl, Scab, Shothole.** Apply 12 1/2 to 15 fl. oz. per gallon of water. Apply in dormant season. **Powdery Mildew**. Apply 9 1/2 fl. oz. per gallon of water at green tip stage. Use 1/2 fl. oz. per gallon of water on Summer foliage.
		Bonide Liquid Copper Concentrate (M) 7-10 tsp	Apply at leaf fall and repeat in late dormant up to bud swell and at pink bud. Do not apply after pink bud.
		Monterey Liqui-Cop (M) 3-4 tsp	Apply as a dormant or delayed dormant spray. Do not apply at or after full bloom.
		Ortho Garden Disease Control (M) 2 ¼ tsp	(1) Spray when buds begin to show color. (2) Reapply at full bloom. (3) If cool, moist weather continues, make a 3rd application at petal fall. (4) Apply once more when fruit just begins to form.
		Hi-Yield Copper Fungicide (M) 2 2/3-4 tsp	Full cover spray at pink bud. Application at this time affords some control of Leaf Curl and Coryneium Blight.

HOME FRUIT SPRAYS (CONT'D)

PEACH, PLUM, NECTARINE (cont'd)			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Bloom (Do not apply insecticides during this period).	Brown Rot and Scab	Hi-Yield Lime Sulfur Spray (M) 4 tsp	See Remarks at Prebloom.
		Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom.
		Hi-Yield Captan 50WP (M) 2 tbs	Apply at pink, full bloom, petal fall, shuck shed, cover and preharvest stages. Spray 1 to 2 pints for small/dwarf trees, 1 to 2 quarts per medium size tree, and 1 to 3 gallons for large/mature trees. Repeat applications at 7 to 14 day intervals as needed to maintain cover. Continue applications through harvest if conditions favor Brown Rot.
	Mites	Microthiol Special 6-12 tbs	
Petal Fall - 50 to 75% of flower petals have fallen.	Brown Rot and Scab	Hi-Yield Captan 50WP (M) 2 tbs	See Remarks at Prebloom.
		Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom.
		Hi-Yield Lime Sulfur Spray (M) 4 tsp	See Remarks at Prebloom.
	Plum Curculio	Malathion 57EC (Not for nectarines) 1-2 tsp	See label. Some formulations may not have a specific label for each plant.
		Imidan 70W 1 tsp	
	Oriental Fruit Moth	Javelin[1] 0.5-1 tsp	Javelin may be used for control of the Fruit Moth. Javelin is a B.t. compound *(Bacillus thuringiensis* subsp. *kurstaki)*. Not for control of plum curculio.
	Bacterial Spot	Monterey Liqui-Cop (M) ¼ tsp	Apply as dormant spray and/or use ¼ tsp. as a post bloom spray. Apply twice during the season, but do not use later than 3 weeks prior to harvest. Do not use at rates above those recommended. NOTICE: Slight loss of leaves may occur from post bloom use.
	Plum Gouger	Sevin[3] 1 tbs	

HOME FRUIT SPRAYS (CONT'D)

PEACH, PLUM, NECTARINE (cont'd)			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Shuck-split (about 10 days after petal fall).	Brown Rot and Scab	Hi-Yield Captan 50WP (M) 2 tbs Hi-Yield Lime Sulfur Spray (M) 4 tsp Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom. See Remarks at Prebloom. See Remarks at Prebloom.
	Plum Curculio and Oriental Fruit Moth	Imidan 70W 1 tsp Malathion (not for nectarines) 1-2 tsp	See label. Some formulations may not have a specific label for each plant.
	Plum Gouger	Sevin[3] liquid 1 tbs	Pick up fallen fruit to reduce insect populations.
First and Second Cover	Brown Rot and Scab	Hi-Yield Captan 50WP (M) 2 tbs	See Remarks at Prebloom.
	Plum Curculio and Oriental Fruit Moth	Imidan 70W 1 tsp Malathion 1-2 tsp Sevin[3] liquid 1 tbs	Pick up fallen fruit to reduce plum curculio numbers.
	Bacterial Spot	Hi-Yield Copper Fungicide (M) ½ tsp Hi-Yield Lime Sulfur Spray (M) 4 tsp	Post bloom application applied at first and second cover sprays. See Remarks at Prebloom.
Summer Cover (July and August).	Brown Rot and Scab	Hi-Yield Captan 50WP (M) 2 tbs Hi-Yield Lime Sulfur Spray (M) 4 tsp	See Remarks at Prebloom. See Remarks at Prebloom.
Summer Cover (cont'd)	Oriental Fruit Moth	Malathion 1-2 tsp	

HOME FRUIT SPRAYS (CONT'D)

PEACH, PLUM, NECTARINE (cont'd)			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Preharvest	Brown Rot and Scab	Hi-Yield Captan 50WP (M) 2 tbs	See Remarks at Prebloom.
		Hi-Yield Lime Sulfur Spray (M) 4 tsp	See Remarks at Prebloom.
	Green June Beetle	Sevin[3] 1 tbs	See label.
Leaf Fall	Peach Leaf Curl	Monterey Liqui-Cop (M) 3-4 tsp	
		Hi-Yield Copper Fungicide (M) 2 2/3–5 1/3 tsp	Use the highest rate when rainfall is very heavy and disease pressure is high. May be used with agricultural spray oil.
		Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Dormancy.
CHERRIES			
Dormancy	Scale insects.	Superior Summer Oil 8 tbs	Apply in spring when trees are dormant and temperature is above 40°F. See label.
Bud Swell	Leaf Spot and Brown Rot	Ortho Garden Disease Control (M) 2 ¼ tsp	Do not apply between fruit formation and harvest. (1) Spray when buds begin to show color. (2) Reapply at full bloom. (3) If cool, moist weather continues, make a 3rd application at petal fall.
Prebloom	Leaf Spot and Brown Rot	Monterey Liqui-Cop (M) 2-3 tsp	Apply when buds show white (popcorn stage) and at full bloom.
		Hi-Yield Lime Sulfur Spray (M) 2 fl oz	**Brown Rot Blossom Blight**, Leaf Spot, Scab. Apply 2 fl. oz. per gallon of water. Apply in pre-bloom, early bloom and full bloom stages. **Brown Rot (Fruit)**. **Leaf Spot, Powdery Mildew**. Apply 4 teaspoons per gallon of water. Apply 3 to 5 sprays at weekly intervals just before Harvest.
		Ortho Garden Disease Control (M) 2 ¼ tsp	See remarks at Bud Swell
		Hi-Yield Copper Fungicide (M) 2 2/3-4 tsp	**Brown Rot Blossom Blight:** Apply a full cover spray at popcorn stage and a second application at full bloom.

HOME FRUIT SPRAYS (CONT'D)

CHERRIES (cont'd)			
TIMING OF APPLICATION	**PESTS**	**MATERIAL (MOA Group*) RATE PER GALLON**	**REMARKS**
Bloom	Mites	Microthiol Special 6-12 tbs	
	Leaf Spot and Brown Rot	Hi-Yield Copper Fungicide (M) 2 2/3-4 tsp	See Remarks at Prebloom.
		Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom
		Hi-Yield Lime Sulfur Spray (M) 2 fl oz	See Remarks at Prebloom
Petal Fall	Leaf Spot and Brown Rot	Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom
		Hi-Yield Lime Sulfur Spray (M) 2 fl oz	See Remarks at Prebloom.
	Plum Curculio	Imidan 70W 1 tsp	See label.
		Methoxychlor 50W 2 tbs	
First Cover (about 10 days after Petal Fall Spray).	Leaf Spot and Brown Rot	Hi-Yield Lime Sulfur Spray (M) 2 fl oz	See Remarks at Prebloom
		Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom
	Plum Curculio	Same as Petal Fall.	See label.
Second Cover (about 10-12 days after First Cover Spray).	Leaf Spot and Brown Rot	Hi-Yield Lime Sulfur Spray (M) 2 fl oz	See Remarks at Prebloom
		Ortho Garden Disease Control (M) 2 ¼ tsp	See Remarks at Prebloom
Post-Harvest	Leaf Spot and Brown Rot	Hi-Yield Lime Sulfur Spray (M) 2 fl oz	See Remarks at Prebloom

[1]Javelin has a 12-hour restricted-entry interval.
[2]This rate is listed for the Green Fire Spray. Other products may have different rates. Refer to labels.
[3]Do not apply Sevin earlier than 30 days after full bloom, and do not apply to trees with mite infestations.
*MOA Group Tables start on page 46 of the handbook.

HOME FRUIT SPRAYS (CONT'D)

Stone fruits - Peaches, Nectarines, Plums, Apricots, etc.

Peachtree borer control - Control of peachtree borers must begin when planting young trees, and continue for the life of the planting. Avoid any mechanical injury to the tree trunk (mowers, weedeaters, etc.); this attracts the borers. Control consists of one or more of the following approaches:

1. Locate and remove the larvae with a knife or flexible wire.
2. **Chlorpyifos (Dursban)**: sales for all uses around homes ended in 2001. **Diazinon**: sales and distribution for lawn, garden and turf use products ended August, 2003. **Dimethoate (Cygon)**: cannot use this product on residential sites or public areas. **Lindane**: sales for use around homes has ended.
3. **For all of these borer products, it is legal to use existing products for residential uses – if it is in the possession of the end-users (homeowners) it can be used according to label instructions**

Additional materials that may be used by the homeowners for fruit and nut tree pests include the following:

Bayer Advanced Tree and Shrub Insect Control (Imidacloprid 1.47%) is labeled on apple, crabapple, loquat, mayhaw, oriental pecan, pecan and quince.

Boren – miner Killer (2.5% permethrin) is labeled for borers(lesser peachtree, peach twig) on peach trees. Also for peach twig borer on pecans.

Ortho Bug-B-Gone Multi Purpose Garden Dust (0.25% permethrin) is labeled for lesser peachtree borer and peach twig borer and fruit and nut trees.

Ortho Diazinon Ultra (22.4% diazinon) is labeled for use against twig borers on fruit and nut trees.

Spectracide Bug Stop Multi-purpose Insect Control Concentrate (2.5% permethrin) is labeled against peach twig borers on fruit and nut trees.

Pyganic 1.4 EC (1.4% pyrethrins) is labeled for nearly all pests on all home garden crops and fruit and nut trees.

HOMEOWNERS CHART FOR APPROXIMATE AMOUNT OF SPRAY TO ADEQUATELY COVER FRUIT TREES

Height in Feet	Spread in Feet	Gallons per Application
5 - 8	3 - 6	0.5 - 1.0
8 - 10	4 - 8	1.0 - 2.0
10 - 15	8 - 15	4.0 - 6.0
15 - 20	15 - 25	8.0 - 10.0

Either the height or the spread of the tree may be used to determine the amount of spray material to be used. These amounts are for newly full leaf; less spray is needed for the dormant spray when no leaves are on the tree.

DAYS TO HARVEST FROM LAST APPLICATION FRUIT
(Read and follow directions on pesticide label)

Pesticide	Apple	Apricot	Cherry	Nectarine	Pear	Peach	Plum
Dimethoate	**28**	*	*	*	**28**	*	*
Dipel ES	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Imidan	**7**	**14**	**7**	**14**	**7**	**14**	**7**
Javelin	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Malathion	**3**	**7**	**3**	**7**	**1**	**7**	**3**
Methoxychlor	**7**	*	**7**	*	**7**	**21**	**7**
Sevin[5]	**1**	**3**	**1**	**3**	**1**	**1**	**1**

* Indicates material is not cleared for use on that crop, not recommended in Oklahoma, used only in early season sprays, or used only during dormancy of tree or vine. Read the label before using the product on these plants.

For further information on home fruit production and pest control see:

EPP 7319	Home Tree Fruit Production and Pest Management
EPP 7615	Fire Blight of Fruit Trees and Certain Ornamentals
EPP 7617	Powdery Mildews of Ornamental and Fruit, Shade and Nut Trees
EPP 7611	Cedar-Apple Rust
EPP 7639	Leaf Curl of Peaches and Nectarines
EPP 7641	Common Diseases of Stone Fruit Trees and Their Control
EPP 6210	Apple and Peach Varieties for Oklahoma
EPP 6216	Soil for Fruit Trees
EPP 6222	Home Fruit Planting Guide
EPP 7450	Safe Use of Pesticides in the Home and Garden

COMMERCIAL APPLE INSECT AND DISEASE CONTROL

Read and follow all label directions

In the following tables, the quantity of materials to mix to apply to apples is the amount of spray volume needed to cover one acre of well pruned, standard size trees. In Oklahoma, application rates will vary from 25-200 gallons per acre. Effectiveness of spray volumes will be determined by several factors including: tree sizes, tree densities, canopy density, and nozzle type. Irrespective of the amount of liquid per acre applied, use the amount of chemical per acre listed below as a guide for mixing. Numerous insecticides are labeled for use and are effective against insect and mite pests on apples. See the list of labeled insecticides for materials we have been able to determine are labeled for current use. However, registrations and use patterns are constantly changing and all recommendations should be offered with the advice to READ THE LABEL of any and all pesticides to be used on any crop.

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL[1] (MOA GROUP)	PER ACRE	COMMENTS
DORMANT: Apply when trees are dormant and temperature is above 40°F.	San Jose Scale Forbes Scale European red mite Apple aphid	Superior Summer Oil[2] (*) Microthiol Special (M) (Mites only) Apollo SC (10) Battalion 0.2EC[r] (3) Beleaf 50SG (9C) Lorsban 4E (1B)	See label 10-20 lbs 4-8 oz 14.1 oz 2.0-2.8 oz 1.5 pts	For scale insect control apply a minimum of 150 gallons of liquid per acre. Delayed dormant application Suppression of aphids. Aphids only.
GREEN TIP:	Scab	Bayleton 50DF (3) Flint (11) Nova 40 W (3) Rubigan EC (3) Sovran (11) Topsin-M 70W (1) Ziram 76DF (M4)	2-8 oz 2-3 oz 5-8 oz 8-12 oz 4-6.4 oz 1-1.5 lb 6-8 lb	
	Powdery Mildew	Bayleton 50DF (3) Nova 40W (3) Rubigan EC (3) Topsin-M 70W (1) Ziram 76DF (M4)	2-8 oz 5-8 oz 8-12 oz 1-1.5 lb 6-8 lb	
	Cedar Apple Rust	Bayleton 50DF (3) Nova 40W (3) Rubigan EC (3) Ziram 76DF (M4)	2-8 oz 5-8 oz 8-12 oz 6-8 lb	
	Scale or Mites	Battalion 0.2EC[r] (3) Superior Oil or highly refined summer oil (*) Pasada 1.6F (4A) Provado 1.6 F (4A) Danitol 24EC[r] (mites only) (3) Zeal (10B) Apollo SC (mites only) (10) Savey 50WP (mites only) (10A) Acramite 50WS (mites only) (25)	7.0-14.1 oz See label 8 oz 8 oz 16.0-21.33 oz 2-3 oz 4 oz 3 oz 0.75-1.0 lb	Scale only. If application is delayed until tight cluster to pink, reduce oil to ½-1 gal per 100 gal. Superior Oil, Pasada, Provado and Danitol kill overwintering eggs of mites.

COMMERCIAL APPLE INSECT AND DISEASE CONTROL (CONT'D)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL[1] (MOA GROUP)	PER ACRE	COMMENTS
PREBLOOM: When flower buds first show pink.	Scab	Same as Green Tip		
	Powdery Mildew	Same as Green Tip		
	Cedar Apple Rust	Same as Green Tip		
	Cankerworm	Asana XL (3)	4.8-14.5 oz	
	Aphids	Assail 70WP (4A)	1.1-1.7 lbs	
		Ambush 2EC[r] (3)	6.4-25.6 oz	
		Battalion 0.2EC[r] (3)	7.0-14.1 oz	Aphids only.
		Beleaf 50SG (9C)	2.0-2.8 oz	Aphids only.
		Danitol 2.4EC[4] (3)	10.66-21.33 oz	
		Dimethoate 4EC (1B)	2-4 pt	
		Lannate LV[r] (1A)	2 pt	
		Lorsban 4E[r] (1B) (No preharvest interval, because labeled use is prior to fruiting.)	1.5 pt	
		Mustang-Max[r] (3)	1.28-4.0 oz	
		Pasada 1.6F (4A)	8 oz	
BLOOM STAGE: When the first blossoms open. To protect bees do not use insecticide during the bloom stage.	Fireblight	Agri-Strep	See label	
	Scab, Powdery Mildew, Cedar Apple Rust	Same as Green Tip		
	Codling moth	Do not apply insecticides.		See footnote 3
		Isomate CT or	400	
		Checkmate CM	200	
PETAL FALL: When most of the petals have fallen. Sevin should not be applied until 30 days after full bloom **to avoid thinning of fruit**.	Scab, Powdery Mildew, Cedar Apple Rust	Same as Green Tip		
	Codling Moth, Plum Curculio	Ambush 25W[r] (3)	6.4-25.6 oz	
		Asana XL [r] (3)	4.8-14.5 fl oz	
		Assail 70WP (4A)	1.7-3.4 lbs	
		Battalion 0.2EC[r] (3)	7.0-14.1 oz	
		Calypso 4F (4A)	4-8 oz	
		Danitol 2.4EC[r] (3)	16.0-21.33 oz	
		Dimethoate 4EC (1B) (codling moth)	1 pt	
		Entrust (5)	2-3 oz	
		Guthion 50WP[r] (1B)	2-3 lb	
		Imidan 70WP[6] (1B)	2.13-5.33 lb	
		Intrepid 2F (18)	10-16 oz	Javelin, Intrepid and Entrust are for codling moth and other caterpillar pests only.
		Javelin (11B2)	0.5-4.0 lb	
		Lannate LV[r] (1A)	2 pt	
		Mustang-Max[r] (3)	1.28-4.0 oz	
		Pounce 3.2EC[r] (3)	4-8 oz	
		Rimon 0.83EC (15)	30-50 oz	
		Warrior[r] (3)	2.56-5.12 oz	
FIRST COVER: Two weeks after petal fall.	Scab, Cedar Apple Rust, Powdery Mildew	Same as Green Tip		

COMMERCIAL APPLE INSECT AND DISEASE CONTROL (CONT'D)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED		COMMENTS
		MATERIAL[1] (MOA GROUP)	PER ACRE	
FIRST COVER: Two weeks after petal fall. (cont'd)	Codling Moth	Assail 70WP (4A)	1.7-3.4 lbs	
		Asana XL[r] (3)	4.8-14.5 fl oz/A	
		Battalion 0.2EC[r] (3)	7.0-14.1 oz	
		Calypso 1.4F (4A)	4-8 oz	
		Danitol 2.4EC[r] (3)	16.0-21.33 oz	
		Dimethoate 4Ec (1B)	1 pt	
		Guthion 50WP[r] (1B)	3 lb	
		Imidan 70WP[6] (1B)	2.13-5.33 lb	
		Intrepid 2F (18)	12-16 oz	
		Javelin (11B2)	0.5-4.0 lb	
		Lannate LV[r] (1A)	2 pt	
		Mustang-Max[r] (3)	1.28-4.0 oz	
		Rimon 0.83 EC (15)	20-50 oz	Rimon is effective for leafrollers.
		Seize 35 WP (7D)	4-5 oz	See label for specific rates.
		Thiodan 3EC (2A)	6 pt	
	Aphids	Asana XL (3)	4.8-14.5 oz	
	Scale	Beleaf 50SG (9C)	2.0-2.8 oz	Aphids only.
		Danitol 2.4EC[r] (3) (aphids only)	10.66-21.33 oz	
		Dimethoate 4EC (1B)	2 pt	
		Mustang-Max[r] (3)	1.28-4.0 oz	Aphids only.
		Pasada 1.6F (4A)	8 oz	
		Provado 1.6F (4A)	8 oz	
		Seize 35WP (7D)	3-5 oz	
SECOND COVER: Ten days after first cover.	Black Rot (Frog Eye Leaf Spot), Sooty Blotch, Bitter Rot, Flyspeck	Benlate 50WP (1)	6-12 oz	
		Captan 50WP (M4)	4-8 lb	
		Flint (11)	2-3 oz	
		Sovran (11)	4-6.4 oz	
		Topsin-M 70W (1)	1-1.5 lb	
		Ziram 76DF (M4)	6-8 lb	
	Codling Moth Aphids	Same as First Cover.		
THIRD COVER: Ten days after second cover.	Sooty Blotch, Scab, Bitter Rot	Same as Second Cover.		
	Codling Moth	Same as First Cover plus Sevin[4]	1 lb	
FOURTH COVER: Ten days after third cover. About June 1.	Bitter Rot	Same as Second Cover.		
	Codling Moth	Same as First Cover plus Sevin.[4]	1 lb	
	Mites	Abacus[r] (6)	10-20 oz	For best results use Abacus[r] with horticultural spray oil, not a dormant oil. Limited to a period extending from petal fall through six weeks following petal fall.
		Acramite 50WS (25)	0.75 - 1.0 lbs	
		Agri-Mek[5] 0.15 EC (6)	10-20 oz	
		Carzol SP (1A)	1-1.5 lb	
		Dicofol 4E (20)	4 pt	
		Kelthane 35W (20)	4-8 lb	
		Onager 1EC (10A)	12-24 oz	
		Pyramite 60 WP (21)	4.4-13.2 oz	
		Summer oil*	½-1% solution	
		Wettable Sulfur (M)	5-15 lb	
		Vendex 50WP[r] (12B)	1-2 lb	
		Zeal (10B)	2-3 oz	
FIFTH AND LATER COVERS: At 10 day intervals until 2 weeks before harvest.	Codling Moth	Same as First Cover plus Sevin.[4]	1 lb	
	Mites	Same as Fourth Cover Sprays.		

* Horticultural oils are physical toxicants which act as suffocant and entrapment insecticides.

[r] Restricted Use Pesticide. MOA Group Tables start on page 46 of the handbook.

COMMERCIAL APPLE INSECT AND DISEASE CONTROL (CONT'D)

[1] Check Table 1 for date of last application prior to harvest.

[2] Scale insects may not be a problem if trees were regularly sprayed in cover applications with Guthion in the previous year. Horticultural oils act as suffocant and entrapment insecticides.

[3] Mating disruption dispensers are only recommended in orchards with low codling moth populations and not in blocks of less than 5 acres. Isomate CT releases pheromone for a minimum of 100 days, but Checkmate CM dispensers release pheromone for only 75 days. Two applications of Checkmate CM per season should be made.

[4] Avoid use of Sevin from bloom to 30 days after full bloom, unless fruit thinning is desired, then follow directions on the label. Avoid use of Sevin in areas exhibiting heavy mite infestation.

[5] Do not exceed 20 fl oz per acre per application or 40 fl oz per acre in a growing season. Do not make more than 2 applications per growing season. Do not apply in less than 40 gals of water per acre. If second application is needed, do not re-treat within 21 days. See label for additional precautions about certain varieties.

[6] Imidan is very sensitive to alkaline hydrolysis; therefore, check the pH of the tank mix and add a buffering agent if necessary, to adjust the pH to 6.0 or lower. Do not attempt to acidify solutions containing copper compounds.

TABLE 1 LIMITATIONS
NUMBER OF DAYS BEFORE HARVEST

DAYS FROM LAST APPLICATION TO HARVEST

CHEMICALS**	DAYS	CHEMICALS**	DAYS
Abacus[r]	28	Lorsban 50W[r]	28
Acramite 50WS	7	Mustang-Max[r]	14
Agri-Mek	28	Nova	14
Agri-Strep	50	Omite	7
Ambush[r]	Do not apply after petal fall.	Onager	28
Apollo SC	45	Pasada	7
Asana XL[r]	21	Pounce[r]	Do not apply after petal fall.
Battalion[r]	21	Provado	7
Bayleton	45	Pyramite 60WP	25
Beleaf	21	Rimon	14
Calypso	30	Rubigan EC	30
Captan	0	Savey WP	Do not apply after pink stage.
Carzol SP	7	Sevin	3
Danitol 2.4EC	14	Sovran	30
Dimethoate 4EC	28	Summer Oil	0
Dicofol	7	Thiodan	21
Flint	30	Topsin-M 70W	0
Guthion 50W[r]	14	Vendex[r]	14
Imidan	7	Wettable Sulfur	7
Javelin	0	Zeal	28
Kelthane	7	Ziram	14
Lannate LV	14		
Lorsban 4E[r]14	14		

**See labels for other limitations.
[r] Restricted use pesticide.

MITES. The most important mites of this region are red spider mites and twospotted spider mites. Red mites pass the winter as somewhat spherical eggs of a bright red to orange color on twigs and smaller branches of the tree. Twospotted mites generally over winter as orange, hibernating females in protected locations of cover crops or other debris. They then migrate to the foliage of the trees in the spring and summer. Mites overwintering on the tree may be controlled by delayed dormant oil sprays. In the event control is not satisfactory, one should rotate between Kelthane, Omite or Guthion sprays.

WOOLY APPLE APHID. The winter is spent as eggs and young nymphs on elm trees. After two spring generations on elm, they migrate to apples, usually in late June or early July. Several generations are produced on apples during the remainder of the summer. These aphids are purplish and characteristically covered with white, waxy secretion. Their presence can be detected by visual observations of the scaffold limbs. They are usually found where there are wounds from pruning or at the base of water sprouts. Chemicals, such as Guthion, applied to control other aphids usually suppress populations of this pest as well.

For detailed information on using pesticides safely, see OSU Extension Fact Sheet 7451, "Agricultural Pesticide Storage;" Fact Sheet 7454, "Check Your Pesticide Labels;" and Fact Sheet 7457, "Toxicity of Pesticides."

COMMERCIAL PEAR INSECT AND DISEASE CONTROL

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL[1] (MOA GROUP)	PER ACRE
DORMANT: Apply when trees are dormant and temperature is above 40°F and will remain above 40°F for 24 hrs after application.	San Jose Scale Forbes Scale	Dormant spray oil[2] * Provado 1.6F (4A) Lorsban 4E[r] (1B) Seize 35WP (7D)	See label 8-20 oz 1-5 pts 4-5 os
GREEN TIP: 0.5 inch green tip.	Scale Scab	Lorsban 4E[r] (1B) Provado 1.6F (4A) Rubigan 1E (3) Ziram 76DF (M4)	1.5 pts 8-20 oz 9 oz 6-8 lb
PREPINK: When flower buds first show pink.	Scab Mites Aphids	Same as Green Tip Apollo SC (10) Brigade 2EC[r] (3) Savey 50WP[3] (10A) Battalion 0.2EC[r] (3) Beleaf 50SG (9C) Dimethoate 4EC (1B) Guthion 50WP[r] (1B) Mustang-Max[r] (3)	 4-8 oz 3.8-12.8 oz 3-6 oz 14.1 oz (suppression only). 2.0-2.8 oz 0.5-1.0 pt 3 lb 1.28-4.0 oz
BLOOM STAGE: When first blossoms open. Do not use insecticides during bloom stage.	Fireblight	Agri-Strep Aliette WDG (M4)	See label 2.5-5.0 oz
PETAL FALL: When most of the petals have fallen.	Scab Codling Moth, Plum Curculio	Rubigan 1E (3) Ziram 76DF (M4) Ambush 25W (3) Asana XL[r] (3) Battalion 0.2EC[r] (3) Brigade 2EC[r] (3) Calypso (4A) Danitol 2.4EC (3) Entrust (5) Guthion 50WP[r] (1B) Imidan 70WP (1B) Intrepid 2F (18) Javelin (codling moth only) (11B2) Mustang-Max[r] (3) Pounce 3.2EC[r] (3) Seize 35WP (7D) Warrior 1EC[r] (3)	9 oz 6-8 lb 12.8-25.6 oz 4.8-14.5 oz 7.0-14.1 oz 2.6-12.8 oz 4-8 oz 16.0-21.33 oz 2-3 oz 3 lb 2.13-5.33 lb 12-16 oz 0.5-4.0 lb 1.28-4.0 oz 8-16 oz 4-5 oz 2.56-5.12 oz
FIRST COVER. Two weeks after petal fall.	Scab Aphids Codling Moth	Same as Petal Fall Spray. Beleaf 50SG (9C) Brigade 2EC[r] (3) Dimethoate 4EC (1B) Mustang-Max[r] (3) Pasada 1.6 F (4A) Provado 1.6F (4A) Same as Petal Fall.	 2.0-2.8 oz 2.6-12.8 oz 0.5-1.0 pt 1.28-4.0 oz 20 oz 20 oz (Do not apply more than 40 oz/A per year of Provado and/or Pasada).
SECOND COVER. Ten days after first cover.	Scab Codling Moth	Same as Petal Fall Spray. Same as Petal Fall Spray above.	
THIRD COVER. Ten days after second cover.	Scab Codling Moth Leafhoppers	Same as Petal Fall Spray. Same as Petal Fall Spray above plus Sevin (1A)	 1 lb
FOURTH COVER: Ten days after third cover - June 1.	Codling Moth	Same as Petal Fall Spray plus Sevin	1 lb

COMMERCIAL PEAR INSECT AND DISEASE CONTROL (CONT'D)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL[1] (MOA GROUP)	PER ACRE
FOURTH COVER: Ten days after third cover - June 1.	Mites	Abacus[r] (6)	10-20 oz
		Agri-Mek 0.15EC (6)	10-20 oz
		Acramite (25)	0.75-1.0 lb
		Apollo SC (10)	4-8 oz
		Carzol 92S (1A)	1-4 lb
		Dicofol 4E (20)	4 pts
		Kelthane 35W (20)	4-8 lb
		Onager 1EC (10A)	12-24 oz
		Pyramite 60WP (21)	4.4-13.2 oz
		Savey 50WP[3] (10A)	4-6 oz
		Vendex 50WP[r] (12B)	1-2 lb
		Vydate 2L (1A)	6-8 pts Do not apply within 30 days of bloom. Can cause fruit thinning.
		Zeal (10B)	2-3 oz
FIFTH AND LATER COVERS: At 10 day intervals until 2 weeks before harvest.	Codling Moth	Same as Petal Fall Spray plus Sevin[4]	1 lb
	Mites	Same as Fourth Cover. (see list above)	

*Horticultural oils are physical toxicants, which act as suffocant and entrapment insecticides.
[r] Restricted Use Pesticide.
MOA Group Tables start on page 46 of the handbook.
[1] Check Table 1 for date of last application prior to harvest.
[2] Scale Insects may not be a problem if trees were regularly sprayed in cover applications with Guthion in the previous years.
[3] Do not apply more than 6 oz of Savey WP per acre per season.
[4] Avoid use of Sevin in areas exhibiting heavy mite infestations.

TABLE 1 LIMITATIONS
NUMBER OF DAYS BEFORE HARVEST

DAYS FROM LAST APPLICATION TO HARVEST

CHEMICALS**	DAYS	CHEMICALS**	DAYS
Abacus[r]	21	Intrepid	14
Acramite	7	Javelin	0
Agri-Mek	28	Kelthane	7
Agri-Strep	30	Mustang-Max[r] (3)	14
Aliette WDG	14	Onager	28
Ambush[r]	Do not apply after bud burst.	Pasada	7
Apollo SC	21	Provado	7
Asana XL[r]	28	Pyramite 60WP	7
Battalion 0.2EC[r] (3)	21	Rubigan 1E	30
Beleaf 50SG (9C)	21	Savey WP	28
Brigade 2EC[r] (3)	14	Sevin	3
Calypso	30	Thiodan	7
Carzol 92SP	7	Topsin-M 70W	0
Danitol 2.4EC	14	Vendex 50WP[r]	14
Dicofol	7	Vydate 2L	14
Entrust	7	Zeal	28
Guthion[r]	14	Ziram 76DF	14
Imidan	7		

**See label for other limitations.
[r] Restricted Use Pesticide.

MITES. The most important mites of this region are European red mites and twospotted mites. Red mites pass the winter as somewhat spherical eggs of a bright red to orange color on twigs and smaller branches of the tree. Twospotted mites generally overwinter as orange, hibernating females in protected locations of cover crops or other debris. They then migrate to the foliage of the trees in the spring and summer. Mites overwintering on the tree may be controlled by delayed dormant oil sprays. In the event control is not satisfactory, one should rotate between Kelthane and other sprays. Kelthane use on pears will be based on tree size. See label for instructions.

WOOLY APPLE APHID. The winter is spent as eggs and young nymphs on elm trees. After two spring generations on elm, they migrate to pears, usually in late June or early July. Several generations are produced on pears during the remainder of the summer. These aphids are purplish and characteristically covered with white, waxy secretion. Their presence can be detected by visual observations of the scaffold limbs. They are usually found where there are wounds from pruning or at the base of water sprouts. Chemicals, such as Guthion, applied to control other aphids usually suppress populations of this pest as well.

For detailed information on using pesticides safely, see OSU Extension Fact Sheet 7451, "Agricultural Pesticide Storage;" Fact Sheet 7454, "Check Your Pesticide Labels;" and Fact Sheet 7457, "Toxicity of Pesticides."

COMMERCIAL PEACH-NECTARINE INSECT AND DISEASE CONTROL

In the following table, the quantity of materials to use to apply to peaches and nectarines is given as amount per acre, which is the amount of spray volume needed to cover one acre of well pruned, standard size trees. Determine the amount of water being used per acre on your trees then add the rate of the chemical listed below in the rate/acre column to the amount of water. Always read the label carefully for any restrictions. In Oklahoma, applications are commonly made using 20 to 150 gallons per acre. How effective this range in spray volumes will be is determined by several factors including: tree sizes, tree densities, canopy density, and type of nozzles. Airblast sprayers normally require amounts on the higher end of this scale. Irrespective of the amount of liquid per acre applied; use the amount of chemical per acre as a guide for mixing.

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED		COMMENTS
		MATERIAL (MOA GROUP)	PER ACRE	
LATE FALL: Apply in October-November when the temperature is above 40°F.	Peach Leaf Curl	Bravo Ultrex (M4) Kocide DF (M4)	2.8-3.8 lb 8-16 lb	Apply amount of chemical in a minimum of 150 gallons per acre.
DORMANT: Apply when the trees are dormant and the temperature is above 40°F. Apply fungicides in spring before buds begin to swell.	San Jose Scale	Esteem 0.86EC (7D) Lorsban 4E[r] (1B) (Can also be used with oil). Pasada 1.6F (4A) Superior oil* Seize 65WP (7D)	13-16 oz 1.5 pt 4.0-8.0 oz 2-4 gal 4-5 oz	For Peach leaf curl and/or scale insect control apply a minimum of 150 gallons of liquid per acre.
	Forbes Scale	Dormant oil* Lime Sulfur[1] (M4) Superior oil*	4.5-6 gal See label 2-4 gal	Oils can be applied before buds break. If buds are just beginning to open (1-5% bud swell), adjust rates downward (e.g., 1.5 gals/A).
	Peach Leaf Curl	Bravo Ultrex (M4) Kocide DF (M4) Ziram 76DF (M4)	2.8-3.8 lb 12-24 lb 3.75-6 lb	
PRE-BLOOM OR EARLY BLOOM: Flower buds show pink.	Tarnished plant bug Peach twig borer	Asana XL[r] (3) Beleaf 50SG (9C) Dipel ES (11B2) Javelin WG (11B2) Lorsban 4E[r] (1B) Mustang-Max[r] (3) Pasada 1.6F (4A) Pounce 3.2 EC[r] (3) (peaches only) Thiodan 50WP (2A)	4.8-14.5 oz 2.0-2.8 oz 1-4 pt 0.25-4 lb 1.5 pt 1.28-4.0 oz 4.0-8.0 oz 4-16 oz 1 lb	Plant bugs and aphids only. Javelin is for Peach twig borer only. Pasada is for tarnished plant bug, san jose scale, green june beetles and aphids. Can cause suppression of stink bugs and plum curculio.
	Stink bug	Mustang-Max[r] (3) Thiodan 50WP (2A)	1.28-4.0 oz 1 lb	
	Brown Rot, Blossom Blight	Abound (11) Bravo Ultrex (M4) Captan 50WP (M4) Elite 45DF (3) Funginex (3) Indar 75 WSP (3) Nova 40W (3) Orbit (3) Rovral 4F (2) Topsin-M 70W (1) Vanguard W (9) Ziram 76DF (M4)	6.2-9.2 oz 2.8-3.8 lb 4-8 lb 4-8 oz See label 2 oz 6 oz 4 oz 1-2 pt 1.5-2.25 lb 5 oz 4.5-8 lb	DO NOT make more than 2 applications per season

COMMERCIAL PEACH-NECTARINE INSECT AND DISEASE CONTROL (CONT'D)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL (MOA GROUP)	PER ACRE	COMMENTS
FULL BLOOM: 50% - 100% bloom.	Brown Rot, Blossom Blight	Same as PRE-BLOOM OR EARLY BLOOM		
PETAL FALL SPRAY: Apply when 50 to 75% of the petals have fallen. Insecticide and fungicide materials may be combined starting with Petal Fall and continuing through cover sprays (read and follow all label directions).	Plum Curculio	Asana XL^{r} (3) Imidan 70WP (1B) Mustang-Max^{r} (3) Pounce^{r2} (3) (peaches only) Warrior^{r} 1EC (3)	4.8-14.5 oz 2.125-4.25 lb 1.28-4.0 oz 4-16 oz 2.56-5.12 oz	See notes on monitoring for plum curculio at end of section.
	Tarnished plant bug	Ambush^{r} 2E (3) (peaches only) Asana XL^{r} (3) Beleaf 50SG (9C) Lannate LV^{r} (1A) (peaches only) Mustang-Max^{r} (3) Pasada 1.6F (4A) Phaser 50W (2A) Pounce 3.2EC^{r2} (3) (peaches only) Thiodan 50W (2A)	6.4-25.6 oz 4.8-14.5 oz 2.0-2.8 oz 3-6 pts 1.28-4.0 oz 4.0-8.0 oz 1 lb 4-16 oz 2 lbs	
	Brown Rot and Scab	Abound (11) Bravo Ultrex (M4) Captan 50WP (M4) Elite 45DF (3) Funginex (3) Indar 75 WSP (3) Nova 40W (3) Orbit (3) Rovral 4F (2) Topsin-M 70W (1) Ziram 76DF (4)	6.2-9.2 oz 2.8-3.8 lbt 4-8 lb 6 oz See label 2 oz 6 oz 4 oz 1-2 pts 1.5-2.25 lb 4.5-8 lb	 Brown rot only Brown rot only Brown rot only Brown rot only DO NOT make more than 2 applications per season.
SHUCK-SPLIT: Apply when approximately three-fourths of shucks have split and are shedding about 7-10 days after Petal Fall. (cont'd)	Plum Curculio or Oriental fruit moth* (see footnote at end of section)	Intrepid 2F (18) Ambush 2E^{r} (3) (peaches only) Asana XL^{r} (3) Imidan 70WP (1B) Mustang-Max^{r} (3) Pounce 3.2EC^{r2} (3) (peaches only) Warrior^{r} 1EC (3)	10-16 oz 6.4-25.6 oz 4.8-14.5 oz 2.125-4.25 lb 1.28-4.0 oz 4-12 oz 2.56-5.12 oz	Intrepid is for oriental fruit moth and other caterpillar pests only.
	Tarnished plant bug	Ambush 2E^{r} (3) (peaches only) Asana XL^{r} (3) Beleaf 50SG (9C) Lannate LV^{r} (1A) (peaches only) Mustang-Max^{r} (3) Pasada 1.6F (4A) Pounce 3.2EC^{r2} (3) (peaches only)	6.4-25.6 oz 4.8-14.5 oz 2.0-2.8 oz 3-6 pt 1.28-4.0 oz 4.0-8.0 oz 4-12 oz 	
	Stink bug	Lannate LV^{r} (1A) (peaches only) Phaser 50W (2A) Thiodan 50W (2A)	3-6 pt 1 lb 2 lbs	

COMMERCIAL PEACH-NECTARINE INSECT AND DISEASE CONTROL (CONT'D)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL (MOA GROUP)	PER ACRE	COMMENTS
SHUCK-SPLIT: Apply when approximately three-fourths of shucks have split and are shedding about 7-10 days after Petal Fall.	Brown Rot and Scab	Abound (11)	6.2-9.2 oz	
		Bravo Ultrex (M4)	2.8-3.8 lb	Bravo Ultrex should not be applied after shuck split.
		Captan 50WP (M4)	4-8 lb	
		Elite 45DF (3)	4-6 oz	Brown rot only
		Funginex (3)	See label	Brown rot only
		Indar 75 WSP (3)	2 oz	
		Nova 40W (3)	6 oz	Brown rot only
		Orbit (3)	4 oz	Brown rot only
		Topsin-M 70W (1)	1.5-2.25 lb	
		Ziram 76DF (M4)	4.5-8 lb	
	Bacterial Leaf and Fruit Spot	Mycoshield	See label	
SECOND AND LATER COVER SPRAYS: Apply at 10-14 day intervals.	Peach twig borer (PTB) or Oriental fruit moth* (OFM)	Ambush 2E^{r} (3) (peaches only)	6.4-25.6 oz	
		Asana XL^{r} (3)	4.8-14.5 oz	
		Dipel ES (11B2)	1.25-2.5 oz	
		Entrust (5)	1-4 pts	
		Imidan 70WP (1B)	2.125-4.25 lb	
		Intrepid 2F (18)	8-16 oz	
		Javelin WG (11B2)	0.25-4 lb	
		Lannate LV^{r} (1A) (peaches only) (OFM only)	3-6 pt	
		Lorsban 4E^{r} (1B) (PTB only)	1.5 pt	
		Mustang-Max^{r} (3)	1.28-4.0 oz	
		Pounce 3.2EC^{r2} (3) (peaches only)	4-12 oz	
		Sevin 4F (1A)	4-5 qts	
		Warrior^{r} 1EC (3)	2.56-5.12 oz	
	Tarnished plant bug	Ambush 2E^{r} (3) (peaches only)	6.4-25.6 oz	
		Asana XL^{r} (3)	4.8-14.5 oz	
		Beleaf 50SG (9C)	2.0-2.8 oz	
		Lannate LV^{r} (1A) (peaches only)	3-6 pt	
		Mustang-Max^{r} (3)	1.28-4.0 oz	
		Pasada 1.6F (4A)	4.0-8.0 oz	
		Pounce 3.2EC^{r2} (3) (peaches only)	4-12 oz	
		Sevin 4F (1A)	4-5 qts	
	Peach tree borer	Asana XL (3)	4.8-14.5 oz	See discussion at end of section.
		Lorsban 4E^{r} (1B)	3 qts	
		Mustang-Max^{r} (3)	1.28-4.0 oz	
		Thiodan or Phaser (2A)	1 qt	
		Warrior^{r} 1EC (3)	2.56-5.12 oz	
Read label and follow instructions regarding maximum number of spray applications permitted near harvest.	Brown Rot and Scab	Abound (11)	6.2-9.2 oz	
		Captan 50WP (M4)	4-8 lb	
		Funginex (3)	See label	Brown rot only
		Indar 75 WSP (3)	2 oz	
		Nova 40W (3)	6 oz	Brown rot only
		Orbit (3)	4 oz	Brown rot only
		Topsin-M 70W (1)	1.5-2.25 lb	
		Ziram 76DF (M4)	4.8-8 lb	
Apply weekly.	Bacterial Leaf and Fruit Spot	Mycoshield	See label	

COMMERCIAL PEACH-NECTARINE INSECT AND DISEASE CONTROL (CONT'D)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED MATERIAL (MOA GROUP)	PER ACRE	COMMENTS
JUNE AND SUMMER SPRAYS	Mites	Apollo SC (10) Acramite 50WS (25) Onager 1EC (10A) Pyramite 60WP (21) Carzol SP (1A) Vendex 50WP[r] (12B)	2-8 oz 0.75-1.0lb 12-24 oz 4.4-13.2 oz 1 lb 1-2 lb	Rates of Apollo below 4oz/A are not recommended unless associated with an IPM program and when adequate beneficials are present
PRE-HARVEST (3 weeks before harvest)	Brown rot	Indar 75 WSP (3) Nova 40W (3) Orbit (3) Topsin-M 70W (1)	2 oz 6 oz 4 oz 1.5-2.25 lb	7-10 day interval 7-14 day interval 1-2 applications 1-2 applications
HARVEST	Green June Beetles	Pasada 1.6F (4A) Sevin 4F (1A)	4.0-8.0 oz 4-5 qts	See label for additional restrictions.

[r] Restricted Use Pesticide.
[1] Do not apply during periods of high temperature or injury to foliage may occur.
[2] Do not apply more than 3.0 pounds active ingredient per acre per season.
* Isomate-M or Checkmate-M pheromone dispensers may be used for oriental fruit moth (OFM) control, but must be attached to trees before first adult flight. Hang in branches at 400 ties/A.

MOA Group Tables start on page 46 of the handbook.

GREATER PEACHTREE BORER CONTROL: Thiodan 3EC, 1 qt in 100 gallons of water or Lorsban 4E, 3 qts in 100 gallons of water. Only need to spray once with Lorsban in mid-May and with Thiodan applied once in late May and again post-harvest during first week of September. Spray the trunks thoroughly from the large branches to the ground line (1.5 to 2 feet). Endosulfan (Thiodan or Phaser) or Asana or Warrior applications in September are also effective in controlling Lesser Peachtree Borer. Do not spray the fruit or leaves with Lorsban.

Lorsban 4E may also be used as a preplant dip application for nonbearing peach trees at the equivalent application rate of 3 qts/100 gallons of water. Dip trees several inches above the grafting bud scar and plant immediately.

For detailed instructions see Fact Sheet 7319, “Home Tree Fruit Production and Pest Management.”

ORIENTAL FRUIT MOTH: The earliest indication of injury by this insect is similar to that of the peach twig borer and consists of a "dying-back" of new growth in the spring. The worms found burrowing in the twigs are pinkish or creamy-white with brown heads. One larvae/10 terminals/tree should be considered an economic infestation. Later generations of the worm enter the fruit near the stem before the fruit ripens. The fruit may look perfect at the time of harvest, but breaks down shortly after packing.

PLUM CURCULIO: Early detection of this important pest should be conducted using pyramid or screen traps to monitor for adult weevils. The construction and utility of these traps for this purpose are outlined in OSU Fact Sheet #7190 - "Monitoring Adult Weevil Populations in Pecan and Fruit Trees in Oklahoma."

BACTERIAL SPOT: The disease attacks the leaves, fruits and stems. There is a varietal difference in susceptibility.

For detailed information on using pesticides safely, see OSU Extension Fact Sheet 7450, "Pesticides Can Be Used Safely," and OSU Extension Fact Sheet 7457, "Toxicity of Pesticides."

POST HARVEST: Scholar Fungicide is labeled to be used for control of post harvest diseases.

COMMERCIAL PEACH-NECTARINE INSECT AND DISEASE CONTROL (CONT'D)

TABLE 1 LIMITATIONS
NUMBER OF DAYS BEFORE HARVEST
Days from last application to harvest

CHEMICALS*	PEACHES	NECTARINES	CHEMICALS*	PEACHES	NECTARINES
Abound	0	0	Lorsban[r]	14	14
Ambush[r]	5	–	Mustang-Max[r]	14	14
Apollo SC	21	21	Mycoshield	21	–
Asana XL[r]	14	14	Nova 40W	0	0
Beleaf 50SG	14	14	Onager	28	28
Bravo Ultrex	N/A	N/A	Orbit	0	0
Captan	0	0	Pasada	0	0
Carzol	21	14	Pounce[r]	7	–
Dipel	0	0	Phaser 50W	30	30
Elite 45 DF	0	0	Pyramite 60WP	7	7
Entrust	14	14	Rovral 4F	**	**
Esteem	14	14	Seize	14	14
Funginex 6.5%	0	0	Sevin	3	
Imidan 70WP	14	14	Thiodan 50WP	30	30
Indar 75 WSP	0	0	Thiodan 3EC	21	21
Intrepid 2F	7	7	Topsin-M	1	1
Intrepid	7	7	Vendex 50WP[r]	14	14
Javelin	0	0	Warrior[r]	14	14
Kocide	N/A	N/A	Ziram	14	14
Lannate LV[r]	4	–			

[r] Restricted Use Pesticide.
* See label for other limitations.
** Rovral may not be applied after petal fall
N/A = These fungicides may not be applied after shuck split.

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL

PEST/PROBLEM	MATERIAL (MOA GROUP)	RATE/ACRE	COMMENTS
Bud Swell			
European red mite and/or scale insects (if present)	Superior oil (70-sec.)*	4 gal	Apply just before buds show green.
	Danitol 2.4EC (3)	10.7-21.3 oz	Scout at least twice weekly as bud swell occurs.
Bud Break to Bloom			Leaves and shoots are produced.
Black rot			Early sprays for black rot are advised if this disease has been a problem in previous years.
	Dithane DF, M-45 or WSD (M4)	1.4-4 lb	Mancozeb (Dithane, Manzate) would be the fungicide of choice, for these early stages because it is a general protectant.
	Dithane F-45 (M4)	1.2-3.2 qt	
	Manzate 75DF, 80WP (M4)	1.5-4.0 lb	
	Nova 40WP (3)	3 -5 oz	Nova and Elite are both triazoles.
	Elite 45DF (3)	4.0 oz	
	Abound 2.08F (11)	11-15.4 fl oz	See special comments at the end regarding use of strobilurins (Abound, Sovran, Flint, Pristine).
	Sovran 50WG (11)	3.2-6.4 oz	
	Flint 50WG (11)	2.0 oz	Do not apply Flint to Concord or other American type grapes as injury may occur.
	Pristine (11, 7)	6-10.5 oz	Do not apply Pristine to concord or other American type grapes as injury may occur.
Powdery mildew			On varieties that are highly susceptible to powdery mildew, a fungicide for powdery mildew control might be needed in these early sprays. Primary infections of powdery mildew can occur during this period.
	Nova 40WP (3)	3-5 oz	Nova and Elite are both triazoles.
	Elite 45DF (3)	4 oz	
	Rubigan EC (3)	2-6 fl oz	Refer to Rubigan label for information on recommended rates.
	Procure 50WS (3)	4-8 oz	
	Sulfur (M4)	See label	See special comments at end.
	Abound 2.08F (11)	11-15.4 fl oz	See special comments at end regarding use of strobilurins
	Sovran 50WG (11)	3.2-6.4 oz	(Abound, Sovran, Flint, Pristine).
	Flint 50WG (11)	1.5-2.0 oz	Do not apply Flint to Concord or other American type grapes as injury may occur.
	Pristine (11, 7))	6-10.5 oz	Do not apply Pristine to concord or other American type grapes as injury may occur
	Quintec 2.08F (13)	3-4 oz	
	Edura 70WG (7)	4.5 oz	
Ten-Inch Shoot			When new shoots are about 10 inches long.
Rose chafer	Danitol 2.4EC (3)	10.7-21.3 oz	
	Sevin 50WP (1A)	4 lb	
	Sevin 80S (1A)	2.5 lb	
European red mite (if present)	Vendex 50WP^{r} (12B)	1-2.5 lb	
	Kelthane 50WP (20)	2.5 lb	
Apple Twig Borer	Diazinon 50WP^{r} (1B)	2 lb	In southern Oklahoma, where mesquite trees are nearby, this pest may attack canes in March and April

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL (CONT'D)

PEST/PROBLEM	MATERIAL (MOA GROUP)	RATE/ACRE	COMMENTS
Pre-Bloom			Just before bloom.
Rose chafer Grape berry moth	Same as for 10-inch shoot spray (if needed)		Insects are often a problem in vineyards at this stage. The use of pheromone traps for grape berry moth will indicate their presence and help determine the need for control.
Bloom			When caps begin to fall.
Black rot Powdery mildew	Same as bud break to bloom		If wet weather persists during bloom a fungicide application at mid-bloom (7-10 days after caps begin to fall will be necessary). See Comments at end.
Downy mildew			Downy mildew is not common in Oklahoma.
	Ridomil Gold Copper (4)	2 lb	
	Ridomil Gold MZ (4, M4)	2.5 lb	
	Abound 2.08F (11)	11-15.4 fl oz	See comments at end regarding use of strobilurins (Abound, Sovran, and Pristine).
	Sovran (11)	3.2-6.4 oz	
	Pristine (11, 7)	6-10.5 oz	Do not apply Pristine to concord or other American type grapes as injury may occur
Grape phylloxera (leaf form)			Control the root gall form of grape phylloxera by using rootstocks derived from American grapes. Native American grapes (Eastern U.S.) are nearly immune to this pest.
	Thionex 3EC (2A)	1.33 qt	Apply Thionex at the correct rate per acre at bloom, and repeat 10 to 14 days later. Since bees do not pollinate grapes there is no danger to bees at this time unless they are working on other blooming plants in the area being sprayed. Mow before spraying to eliminate blooms on weeds. Note: Concord, Baco Noir, Chancellor, Colobel, Cascade, and other cultivars may have severe injury if treated with Thiodan.
	Danitol 2.4EC (3)	10.7 -21.3 oz	Refer to product label. Although the product label does not list phylloxera, data indicate that Danitol also is effective against the leaf form of grape phylloxera if applied during bloom.
	Assail WP (4A)	1.1 oz	

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL (CONT'D)

PEST/PROBLEM	MATERIAL (MOA GROUP)	RATE/ACRE	COMMENTS
Shatter			When unfertilized berries fall from clusters; about 7 to 10 days after bloom or 7 to 10 days after last spray.
Black rot Downy mildew Powdery mildew	Same as bud break to bloom		See comments at end.
Grape berry moth Leafhopper Rose chafer Grape mealybug Grape rootworm Redbanded leafroller Japanese beetles	Brigade 2EC[r] (3) Guthion 2L [r] (1B) Mustang-Max[r] (3) Sevin 50WP (1A) Sevin XLR (1A) Methoxychlor 50WP (2A) Imidan 70WP (1B)	3.2-6.4 oz 3-4 pt 4 oz 4 lb 2 qt 6 lb 1.33-2.13 lb	For leafhopper control only. It is important to monitor for all insect pests after petal-fall. Pheromone traps offer help in determining the presence of redbanded leafroller and grape berry moth. Berry moth emergence begins late May and June; there may be three generations per year. Guthion may be mixed with Sevin or Methoxychlor for better control of berry moth.
	Diazinon 50 WP[r] (1B)	1-2 lb	Examining the underside of grape leaves will indicate if leafhoppers are present. Check insecticide labels for more information on specific insects.
	Diazinon AG500[r] (1B) Provado Solupak 75WP (4A)	1-2 pt 0.75-1.0 oz	A maximum of 2.0 oz of Provado may be applied per acre per season. Provado is labeled for use against leafhoppers and mealybugs.
	Danitol 2.4EC (3)	5.3-10.7 fl oz	Danitol is labeled for use against leafhoppers, grape berry moth, Japanese beetles, and redbanded leafroller. Higher rates (up to 21.3 oz/A) may be used to control the latter three pests.
	Applaud 70 WP (16)	0.54-0.71 lb	Leafhoppers and mealybug control.
	Pyramite 60WP (21)	4.4-6.6 oz (1-1.5 bags)	Pyramite is labeled for use against leafhoppers and mites.
	Ecozin 3EC (18) Isomate GB (See comments)	8.0-10.0 oz 400 ties	Isomate GBM is useful for grape berry moth only. See comments on Grape Berry Moth at end of this section. This strategy should be considered only for vineyards that are at least 5 acres in size.
	Deliver (11B2) Spintor 2 SC (5) Intrepid 2F (18)	0.5-1.5 lb 4-8 oz 4-8 oz	B. t. product for caterpillar pests only. Spintor and Intrepid are also for caterpillar pests only. Ineffective against beetles.
Mites	Abacus[r] (6) Brigade 2EC[r] (3) Vendex 50WP [r] (12B) Kelthane 50WP (20) Fujimite 5EC (21) Onager 1EC (10A) Nexter 75WP (21)	8.0-16.0 oz 6.4 oz 1-2.5 lb 2.5 lb 2 pt. 12-24 oz 4.4-13.2 oz (1-3 bags)	Plus a nonionic surfactant. One application per year.
	Acramite 50WS (25) Agri-Mek 0.15EC (6) Pyramite 60WP (21) Danitol 2.4EC (3) Zeal (10B)	0.75-1.0 lb 8.0-10.0 oz 4.4-13.2 oz 10.7-21.3 oz 2.0-3.0 oz	Plus a nonionic surfactant. See label for specific pest rates. One application per season.

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL (CONT'D)

PEST/PROBLEM	MATERIAL (MOA GROUP)	RATE/ACRE	COMMENTS
First Cover to Veraison (Berry coloring)			First cover should follow shatter by 10-14 days. Refer to label for application timing and harvest restrictions.
Black rot Powdery mildew Downy mildew	Same as bud break to bloom		Sprays for black rot control may be stopped after berries turn color (reach 6-8% sugar). See other comments at end.
Mites	Same as shatter sprays		
Grape berry moth Rose chafer Leafhopper Redbanded leafroller Grape rootworm Grape mealybug	Brigade 2EC[r] (3) Dimethoate 4EC (1B) Guthion 50WP[r] (1B)	3.2-6.4 oz 0.5-1.0 pt 1.5-2 lb	For leafhoppers only. See comment on insect control at shatter. Do not use Guthion more than three times in one season.
	Sevin 50WP (1A)	4 lb	Do not use Sevin with copper-lime.
	Sevin 80S (1A)	2.5 lb	
	Methoxychlor 50WP (2A)	6 lb	
	Imidan 70WP (1B)	1.33-2.13 lb	
	Diazinon 50WP[r] (1B)	2 lb	
	Intrepid 2F (18)	4-8 oz	See notes under shatter section.
	Diazinon AG500[r] (1B)	1-2 pt	
	Danitol 2.4EC[r] (3)	5.3-10.7 fl oz	Danitol is labeled for use against leafhoppers, grape berry moths, mites and Japanese beetle.
	Pyramite 60WP (21)	4.4-13.2 oz (1-1.5 bags)	Pyramite is labeled for use against leafhoppers and mites. See label for pest specific rates.
	Provado Solupak 75WP (4A)	0.75-1 oz	A maximum of 2.0 oz of Provado may be applied per acre per season. Provado is labeled for use against leafhoppers and mealybugs.
Veraison to Harvest			Refer to label directions for timing of applications and harvest restrictions.
Black rot			As berries reach full size and sugar content starts to increase, they become resistant to infection by the black rot fungus. In general, berries are no longer susceptible to black rot after veraison (6-8% sugar content).
Botrytis bunch rot			This spray is critical in vineyards or on varieties where Botrytis bunch rot has been a problem. See comments on Botrytis bunch rot at end of this section.
	Rovral 4F (2)	1.5-2 pt	Do not apply within 7 days of harvest.
	Vangard WG (9)	10 oz	Vangard cannot be applied within 7 days of harvest.
	Elevate 50WG (17)	1.0 lb	Elevate can be applied up to and including the day of harvest (0 day PHI).
	Abound 2.08F (11)	11-15.4 fl oz	Abound, Sovran and Flint cannot be applied within 14 days of harvest. See additional comments at the end.
	Sovran 50WG (11)	3.2-6.4 oz	
	Flint 50WG (11)	1.5-4.0 oz	Do not apply Flint to Concord grapes or other American type grapes or crop injury may occur.
Grape berry moth Grape leafhopper Japanese beetle Green June beetle Rose chafer Grape root borer	Same as first cover to veraison See recommendations at end of section.		Continue to monitor for insect and mite pests, and apply insecticide as needed. Refer to product label for specific insects, rates, and harvest restrictions.
Mites	Same post bloom to veraison		

[r] Restricted Use Pesticide.

MOA Group Tables start on page 46 of the handbook.

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL (CONT'D)

RESIDUE REMINDER: VISIBLE FILMS OF SPRAY RESIDUE ARE UNATTRACTIVE ON FRESH FRUIT AND DIFFICULT TO REMOVE.

POST HARVEST Powdery mildew	Same as earlier sprays. Check label for specifics.		Post-harvest leaf damage predisposes vines to winter injury and reduces fruit set in the following season.

*Horticultural oils are physical toxicants which act as suffocant and entrapment insecticides.

GRAPE ROOT BORER

It is generally difficult to evaluate damage from the grape root borer. Injury is most often associated with a slow decline of vineyards, when it can be associated at all. If grape root borer is not a problem, there is no reason to risk destroying the natural control processes (predators, parasites, diseases). Treat with an insecticide only if necessary. If you believe that this insect is affecting your vineyard's performance, you may wish to begin the following program. Sampling is critical for several reasons: 1) The control program is relatively expensive; and 2) Use of an insecticide can create as well as solve problems.

Immediately After Harvest

Sample - 10 vines/acre (but not less than 50 vines).
Examine - A circular site (3 ft in diameter) around the base of each plant, concentrating on the inner 1 ft, looking for shed pupal skins of the grape root borer moth. If pupal skins are found beneath 5% of the vines examined, apply an insecticide next year.

35 Days Before Harvest

If previous year's sample indicates a need to spray, apply Lorsban 4E, following label instructions. Older vines are more likely to be infested. Apply an insecticide as late as the label permits, but before harvest.

GREEN JUNE BEETLE, JAPANESE BEETLE AND ROSE CHAFERS

As the crop reaches maturity, these beetle pests may become more of a problem, particularly feeding on ripened fruit. When soil conditions are moist before or slightly after veraison, and organic matter in surrounding area is high then these beetles can be quite common and difficult to control. Careful attention to beetle infestation 1 month prior to harvest should be given to keep populations in check. Use of Danitol up to 21 days before harvest can decrease populations. Rotation to Sevin insecticide up to 7 days before harvest will further aid in control.

GRAPE BERRY MOTH - Mating Disruption Strategy

A new use of pheromones is for insect control using the strategy of mating disruption; this expands the use of sex-attractant pheromones beyond their traditional role in insect monitoring.

The pheromone is imbedded in 8-inch long plastic twist-ties. The atmosphere of the vineyard is saturated with the scent of the pheromone by attaching twist-ties to vines, with 400 twist-ties per acre. The pheromone confuses the male moths so that they are unable to locate and mate with females. Females are unaffected by the pheromone and can lay unfertilized eggs, but these eggs are unable to develop. This strategy should be considered only for vineyards that are at least 5 acres in size.

For grape berry moth, the product is called Isomate-GBM, manufactured by Shinetsu Chemical Company and distributed by Pacific Biocontrol of Davis, California. It is distributed in the Midwest by Great Lakes IPM, Vestaburg, Michigan (phone 517-268-5693).

GRASSHOPPERS

Grasshopper control can be and should be concentrated very early in the season before populations migrate into vineyard borders. Young, unwinged nymphs may cause severe defoliation of border plants and progress into vineyards if left unchecked. If treatment is directed outside the vineyard, in pasture areas then applications of Dimilin early in the season can prevent buildup of populations. When controlling grasshoppers inside the vineyard, then careful use of labeled compounds is the only recourse. Some level of effective control has been obtained using NOLO® Bait, a biological control agent containing tiny protozoan spores. This product is slow acting and does not store well, so use it early and often enough to be effective and to deplete your supply.

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL (CONT'D)

BOTRYTIS BUNCH ROT

Use Rovral 50 WP at the rate of 1.5 to 2 lb per acre, Vangard 75WG at 10 oz/A , or Elevate 50 WG at 1 lb/A. Botrytis bunch rot is most commonly a problem on tight-clustered French hybrid and *Vitis vinifera* cultivars. Proper timing and thorough spray coverage are essential for good control. Direct the spray toward the fruit, and use a minimum of 100 gal/A of water. Include a spreader-sticker with Rovral, especially at the 1.5 lb rate. NOTE: Removal of leaves around clusters on mid- or low-wire cordon-trained vines before bunch closing has been shown to reduce losses caused by *Botrytis.*

SULFUR

There are many formulations of sulfur labeled for use on grapes. Sulfur is available in dry flowable (DF) and flowable (F) formulations, as well as wettable powder (WP) and dusts (D). The dry flowable and flowable formulations greatly reduce the applicator's exposure as compared to wettable powders and dusts. Use rates are different for different formulations. See the label for specific use rates. Some grape varieties, such as Concord and other Labrusca (American) types, are extremely sensitive to sulfur. Do not apply when temperature during or immediately following application will exceed 85°F. Sulfur looses efficacy for powdery mildew control at temperatures below 65°F.

STROBILURINS

ABOUND FLOWABLE

Abound is in the same general class of chemistry as Sovran, Flint, and Pristine (strobilurin) and is registered for control of black rot, downy mildew, powdery mildew, and Phomopsis cane and leaf spot. Abound is excellent for control of black rot and downy mildew, and provides good control of powdery mildew. Abound is recommended at the rate of 11 to 15.4 fl oz per acre. In University tests, the rate of 11 to 12 fl oz provided good control of the above mentioned diseases.

NOTE: Abound Flowable is very phytotoxic to apples of the variety McIntosh or varieties related to McIntosh. Do not use the same sprayer to apply Abound to grapes that will be used to apply other materials to apples. Do not allow spray to drift from grapes to apples.

SOVRAN 50 WG

Sovran 50 WG is in the same general class of chemistry as Abound Flint, and Pristine (strobilurin). It is registered for control of black rot, powdery mildew, Phomopsis cane and leaf spot, and downy mildew. The Sovran label gives different use rates for control of different diseases. For black rot and Phomopsis cane and leaf spot the rate is 3.2 to 4.8 oz/A; for powdery mildew the rate is 3.2 to 4.8 oz/A and for downy mildew the rate is 4.0 to 6.4 oz/A. Sovran is excellent for control of black rot and powdery mildew, but is less effective than Abound for downy mildew control. Under heavy disease pressure, Sovran may not provide adequate control of downy mildew even at the higher rate. Unlike Abound, Sovran is not phytotoxic on certain apple varieties. Sovran has a 14 day PHI. See label for further information and certain use restrictions.

FLINT 50 WG

Flint 50 WG is in the same general class of chemistry as Abound, Sovran, and Pristine (strobilurin). It is registered for control of black rot, powdery mildew and downy mildew. The Flint label provides different use rates for control of different diseases. For powdery mildew the rate is 1.5 to 2.0 oz/A; for black rot the rate is 2.0 oz/A and for downy mildew the rate is 4.0 oz/A. Flint is excellent for control of black rot and powdery mildew, but is not highly effective against downy mildew, and is not recommended for control of downy mildew. Unlike Abound, Flint is not phytotoxic to certain apple varieties; however, Flint is very phytotoxic to Concord grapes. The label states **"Do not apply Flint to Concord grapes or crop injury may occur."** See label for further information and certain use restrictions.

PRISTINE 38 WDG

Pristine 38 WDG contains a combination of two active ingredients (pyraclostrobin, 12.8% and boscalid 25.2%). Pyraclostrobin is in the same general class of chemistry as Abound, Sovran, and Flint (strobilurin). Boscalid is a new class of chemistry with excellent activity against powdery mildew and good activity against Botrytis. With increasing resistance in powdery mildew to the sterol inhibiting fungicides (Nova, Rubigan, Procure, Elite) and the strobilurin fungicides (Abound, Sovran, and Flint), the addition of a new powdery mildew fungicide (boscalid) is timely. Pristine will probably be an important component in our resistance management programs for powdery mildew. Pristine is registered for control of anthracnose, black rot, downy mildew, powdery mildew, and Phomopsis cane and leaf spot, and "suppression only" of Botrytis gray mold. Pristine is registered for use at the rates of 6-10.5 oz per acre. A maximum of 6 applications may be made per season. Pristine has a 14-day preharvest interval and 24-hour re-entry interval. The label also states **"Do not use on Concord, Worden, Fredonia, or related varieties due to possible foliar injury."**

COMMERCIAL GRAPE INSECT AND DISEASE CONTROL (CONT'D)

RESISTANCE MANAGEMENT FOR STROBILURIN FUNGICIDES

Do not apply more than 3 sequential sprays of Abound, Sovran, Flint, or Pristine before alternating with a fungicide that has a different mode of action. For wine and table grapes, do not make more than 4 applications of a strobilurin fungicide per acre per year. For all other types of grapes, do not make more than 3 applications of a strobilurin fungicide per acre per year. Always read the label.

IMPORTANT NOTE ON POWDERY MILDEW:

In some locations, the powdery mildew fungus has developed resistance to the sterolinhibiting fungicides (Nova, Rubigan, Elite, and Procure) and the strobilurin fungicides (Abound, Sovran, and Flint). All of these materials were highly effective for control of powdery mildew when they were first introduced. In the vineyards where these materials have been used for several years, reduced sensitivity or resistance may be present. For this reason, it is recommended that these materials not be used alone when powdery mildew needs to be controlled. In order to provide adequate control of powdery mildew, they should be mixed with sulfur, JMS Stylet Oil, Quintec, Endura, or potassium salts. Pristine is a combination of a strobilurin fungicide plus Endura; therefore it can be used alone. Sulfur is an inexpensive and very effective fungicide for powdery mildew control. On sulfur tolerant varieties, the use of sulfur should be considered.

ADDITIONAL PESTICIDE INFORMATION

Insecticides	REI	PHI	Signal Word	Fungicides	REI	PHI	Signal Word
Abacus[r]	12 hrs	28 days	Warning	Abound	4 hours	14 days	Caution
Acramite	12 hrs	14 days	Caution	Elevate 50WG	4 hours	0 days	Caution
Agri-Mek	12 hrs	28 days	Warning	Elite 45DF	12 hours	14 days	Warning
Applaud 70 WP	12 hrs	30 days	Caution	Endura	12 hours	14 days	Warning
Assail	12 hrs	7 days	Caution	Flint 50WG	12 hours	14 days	Caution
Brigade 2EC[r]	12 hrs	30 days	Warning				
Danitol	24 hrs	21 days	Warning	Mancozeb, Dithane, Manzate	24 hours	66 days	Caution
Deliver	4 hrs	0 days	Caution	Nova 40W	24 hours	14days	Warning
Diazinon[r]	24 hrs	28 days	Caution	Pristine	24 hours	14 days	Caution
Dimethoate 4EC	4 days	28 days	Warning	Procure 50WS	12 hours	7 days	Caution
Ecozin	12 hrs	0 days	Warning	Quintec	12 hours	14 days	Caution
Fujimite	12 hrs	14 days	Warning	Ridomil Gold Copper	48 hours	66 days	Danger
Guthion[r]	21 days	21 days	Danger	Ridomil Gold MZ	48 hours	42 days	Caution
Imidan	24 hrs	14 days	Warning	Rovral 4F	48 hours	7days	Caution
Intrepid 2F	4 hrs	30 days	Caution	Rubigan 1EC	12 hours	30 days	Warning
Kelthane WP	12 hrs	7 days	Warning	Sovran 50WG	12 hours	14 days	Caution
Mustang-Max[r]	12 hrs	1 day	Warning				
Nexter	12 hrs	7 days	Warning	Sulfur	24 hours	14 days	Caution
Onager	12 hrs	28 days	Caution	Vanguard WG	12 hours	7 days	Caution
Provado	12 hrs	0 days	Caution				
Pyramite	12 hrs	7 days	Warning				
Sevin 4F	12 hrs	7 days	Caution				
Spintor 2SC	4 hrs	7 days	Caution				
Thionex	24 hrs	7 days	Danger				
Vendex[r]	48 hrs	28 days	Danger				
Zeal	12 hrs	14 days	Caution				

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL

The amount of insecticide or fungicide to use is given in per gal amounts for the home or backyard grower and in per 100 gal/acre amounts for the commercial grower. The home or backyard grower can determine the amount of spray needed to cover their plants completely by filling their sprayer with water and then spraying their plants until the water is almost ready to drip off the leaves. Determine how much water was used and add the correct amount of chemical from the appropriate table below. Commercial growers should calibrate their sprayers by spraying a measured area, measure the amount of water needed to refill the tank. Divide this amount by the fraction of an acre sprayed to get the gallons applied per acre. Mix the amount of chemical desired per acre with water to give this much spray material.

BLACKBERRIES*

For commercial growers, use the rate/acre column regardless of the amount of water you are spraying per acre. Read and follow all label directions. For home gardeners, if no rate is given then the product(s) are not recommended for home use.

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED [2]		
		MATERIAL[1] (MOA Group)	PER GAL	PER ACRE
DORMANT: February - before bud break. Remove and destroy dead canes. This is a critical spray for good disease control especially if these diseases have been a serious problem	Anthracnose Cane Blight Spur Blight (raspberries only)	Lime-sulfur (M4) Kocide 50WP (M4)	See label 2 lbs	12-24 gal 4 lbs
PRE-BLOOM: Just before blossoms open. To protect bees do not use insecticides during bloom.	Leafhoppers Aphids Leafrollers	Malathion 25W (1B) Guthion 50WP[r4] (1B) Atrapa 8E (1B) Brigade 2EC[r] (3) Mustang-Max[r] (3)	2 tbs – – – –	4 lb 0.5-0.63 lb 2 pts 3.2-6.4 oz 4 oz
	Raspberry crown borer[3]	Brigade 2EC[r] (3)	–	6.4 oz 2 qt/100 gal/A
	Phytophthora Root Rot	Aliette 80WDG (21) Ridomil Gold EC (4) (raspberries only)	See label	See label
Fungicide applications prior to bloom should not be necessary unless these diseases have been a serious problem	Anthracnose, Cane Blight and Spur Blight (raspberries only) Rusts, Powdery Mildew and Leaf Spots	Abound (11) Cabrio (11) Pristine (11, 7) Nova 40W (3) Captan 80 WDG (M4)	– – – 1.25-2.5 oz 2.5 lb	6.2-15.4 oz 14 oz 18.5-23 oz
BLOOM THROUGH HARVEST		Same as Pre-Bloom		
ANYTIME AFTER HARVEST (Sept. 15-Oct. 1)	Cane Borers Raspberry Crown Borer[5] Rusts, Powdery Mildew	Remove and burn infested canes. Brigade 2EC[r] (3) Capture 2EC[r] (3) Nova 40WP (3)	 – – –	 6.4 oz 6.4 oz 2.5 oz

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

[1] See Table 1 for date of last application prior to harvest.

[2] tbs = tablespoon; lb = pound; gal = gallon.

[3] Apply 2-4 qt/acre in a minimum of 100 gal of water as a drench to the crown area and lower canes. Drench will kill borers already hatched in soil. Not recommended for homeowners.

[4] Guthion is a highly toxic insecticide. It should be used by commercial grower only.

[5] Raspberry crown borer is a significant pest of caneberries in Oklahoma and will eventually cause the demise of plants if left uncontrolled. Seasonal treatment each year is recommended. Capture applied in late October or early November as a soil drench to the lower canes and soil around the canes will provide excellent control if adequate (50-100 gallons/acre) water is applied with the material. This is a restricted use chemical, not recommended for home-owners.

* All diseases, information and fungicide treatments are applicable to both blackberries and raspberries unless otherwise noted.

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL (CONT'D)

STRAWBERRIES

Read and follow all label directions. For commercial growers, use the rate per acre column, regardless of the amount of water you are spraying per acre. For home gardeners, if no rate is given then the product is not recommended for home use.

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED [2]		
		MATERIAL[1] (MOA Group)	PER GAL	PER ACRE
PRE-BLOOM: Just before bloom (separation of blossom buds). Timing is important in controlling the strawberry weevil. To protect bees do not use insecticides during bloom.	Strawberry Root Weevil	Malathion 25W (1B) or	4-6 tbs	4-6 lb
		Sevin 50W (1A) or	2-4 tbs	2-4 lb
		Malathion 57% EC (1B)	0.66-0.2 tbs	1.5-2.5 pt
		Brigade WSB^{r} (3)	–	8.0-32.0 oz
	Phytophthora diseases	Ridomil Gold EC (4)	–	1 pt
		Aliette 80 WDG (21)	–	2.5-5 lb
BLOOM	Botrytis Blossom Blight and Fruit Rot	Topsin M WSB (1)	–	¾-1lb
		Elevate 50WG (17)	–	1.5 lb
		Switch (9)	–	11-14 oz
		Captan 50WP (M4)	–	6lb
	Anthracnose	Abound (11)	–	6.2-15.4 oz
		Cabrio (11)	–	14 oz
		Pristine (11, 7)	–	18.5-23 oz
		Switch (9)	–	11-14oz
		Captan 50WP (M4)	–	6lb
	Leaf Spots	Nova 40W (3)	–	2.5-5 oz
		Cabrio (11)	–	14 oz
		Pristine (11, 7)	–	18.5-23 oz
		Topsin M WSB (1)	–	¾-1 lb
	Powdery Mildew	Abound (11)	–	6.2-15.4 oz
		Cabrio (11)	–	14 oz
		Pristine (11, 7)	–	18.5-23 oz
		Nova 40W (3)	–	2.5-5 oz
		Procure 50WS (3)	–	4-8 oz
		Topsin M WSB (1)	–	¾-1 lb
POST BLOOM: After the blossoms have fallen.	Aphids	Brigade WSB^{r} (3)	–	8.0-32.0 oz
		Guthion 2L^{r} (1B)	–	2 pts
		Lannate LV^{r} (1A)	–	1.5-3.0 pts
		Malathion 25W (1B) or	2.5 tbs	2.5 lb
		Malathion 57% EC (1B)	0.66 tbs	1.5 pts
		Pasada 1.6F (4A)	–	3.75 oz
		Thiodan 3EC (2A)	–	1.3 qt
		Atrapa 8E (1B)	–	2 pts
	Leafrollers	Danitol 2.4EC (3)	–	10.66 oz
	Spittlebugs	Javelin (B.t.) (11B2)	0.24-1.4 tsp	0.5-4.0 lbs
	Sowbugs	Guthion 2L^{r} (1B)	–	2 pts
		Malathion 25W (1B) or	4-6 tbs	4-6 lb
		Sevin 50W (1A) or	2-4 tbs	2-4 lb
		Malathion 57% EC (1B)	0.66-1.5 tbs	1.5-2.5 pts
	Lygus Bugs	Brigade WSB^{r} (3)	–	8.0-32.0 oz
		Danitol 2.4EC (3)	-	16.0-21.33 oz
		Malathion 25W (1B) or	4-6 tbs	4-6 lb
		Malathion 57% EC (1B)	0.66-1.5 tbs	1.5-2.5 pts

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL (CONT'D)

STRAWBERRIES (Cont'd)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED [2]		
		MATERIAL[1] (MOA Group)	PER GAL	PER ACRE
	Mites	Abacus[r] (6)	–	16.0 oz
		Acramite 50WS (25)	–	0.75-1.0 lb
		Atrapa 8E (1B)	–	2 pts
		Agri-mek 0.15 EC (6)	–	16 fl oz
		Brigade WSB[r] (3)	–	16.0-32.0 oz
		Danitol 2.4EC (3)	–	16.0-21.33 oz
		Dicofol 4E (20)	–	2 pts
		Kelthane 35WP (20) or	0.5 tbs	0.9 lb
		Kelthane MF (20)	1 tsp	2 pts
		Vendex 50WP [r] (12B)	–	1.5-2 lb
		Zeal (10B)	–	2-3 oz
	Leaf Diseases, Anthracnose, Powdery Mildew and Fruit Rot	Same as Bloom. Subsequent applications may be necessary. Check label for recommendations and restrictions near harvest.		

MOA Group Tables start on page 46 of the handbook.

[1] See Table 1 for date of last application prior to harvest. If no number is provided then that chemical cannot be used on that crop

[2] tbs = tablespoon; tsp = teaspoon; pt = pint; qt = quart; lb = pound; gal = gallon.

[3] Nova is highly effective for control of powdery mildew and leaf blight. Captan and Thiram will not control powdery mildew.

BLUEBERRIES

For commercial growers, use the rate/acre column regardless of the amount of water you are spraying per acre. Read and follow all label directions. For home gardeners, if no rate is given, then the product is not recommended for home use.

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED[2]		
		MATERIAL[1] (MOA Group)	PER GAL	PER ACRE
DELAYED DORMANT: Just before bud break	Scale insects	Superior Oil or	4 tbs	3 gal
		Lime sulfur (M4)	7 tbs	5 gal
	Phomopsis Twig Blight	Lime sulfur (M4)	7 tbs	5 gal
	Phytophthora Root Rot	Ridomil Gold EC (4)		3.6 pt
		Alliette 80WDG (21)		5 lb
PRE-BLOOM: Just before blossoms open	Leafrollers	Javelin (B.t.) (11B2)	0.12-0.5 tsp	0.5-4.0 lb
		Mustang-Max[r] (3)	–	4 oz
		Sevin 50W (1A)	2-4 tbs	2-4 lb
	Blossom weevil	Sevin 50W (1A)	2-4 tbs	2-4 lb
	Phomopsis Twig Blight and Mummy Blight (shoot phase)	Ziram (76DF, Granuflo) (M4)	2 tbs	3lb
MID-BLOOM: Do not use chemical insecticides during bloom.	Leafrollers	Dipel, Javelin or	2 tsp	2 qt
		Mustang-Max[r] (3)	–	4 oz
		Thuricide (11B2)	1.5 tsp	1 lb
	Phomopsis Twig Blight, Anthracnose and Mummy Blight	Abound (11)		6.2-15.4 oz
		Cabrio (11)		14 oz
		Pristine (11, 7)		18.5-23 oz
		Switch (9)		11-14 oz
		Ziram (76DF, Granuflo) (M4)	2 tbs	3 lb
	Anthracnose and Mummy Blight	Captan (50W, 80WDG, 4L) (M4)	–	See label
FIRST POST-POLLINATION: (about May 25 to June 1)	Leafrollers	Javelin (B.t.) (11B2)	0.12-0.5 tsp	0.5-4.0 lb
	Leafhoppers	Mustang-Max[r] (3)	–	4 oz
	Leaf Miners	(Leafrollers only)		
	Cherry Fruitworm	Lannate LV[r] (1A)	1 tsp	1.5-3 pt
	Aphids	Sevin XLR Plus (1A)	1 tbs	1.5-2 qt
	Plum Curculio	Atrapa 8E (1B)	–	2 pts
	Phomopsis Twig Blight Anthracnose, and Mummy Berry	Same as Mid-Bloom Spray.		

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL (CONT'D)

BLUEBERRIES (Cont'd)

APPLICATION AND TIMING	PESTS INVOLVED	AMOUNT OF MATERIALS NEEDED [2]		
		MATERIAL[1] (MOA Group)	PER GAL	PER ACRE
SECOND POST-POLLINATION: 7-12 days after First Post-Pollination Spray	Leafrollers Leafhoppers Leaf Miners Cherry Fruitworm Phomopsis Twig Blight and Blight, Anthracnose	Same as First Post-Pollination Spray. Same as First Post-Pollination Spray		
ADDITIONAL COVER SPRAYS: Apply every 7-12 days as needed.	Leafrollers Leaf Miners Fall Webworms	Guthion 50WP[r] (1B) Javelin (B.t.) (11B2) (Not for Leaf Miners or Leafhoppers)	0.5 tsp 0.12-0.5 tsp	1.5 lb 0.5-4.0 lb
MAGGOTS: When flies start to lay eggs (about June 28). Repeat every 10 days through harvest.	Blueberry Maggot	Malathion 25WP (1B) Sevin XLR Plus (1A) Lannate LV[r] (1A)	2 tbs 1 tbs –	4 lb 1.5-2 qt .75-1.5 pts
POST-HARVEST: When 2/3 leaves have dropped. Repeat after 14 days.	Phomopsis Twig Blight	Lime sulfur (M4)	7 tbs	5 gal

MOA Group Tables start on page 46 of the handbook.

[1] See Table 1 for date of last application prior to harvest.

[2] tbs = tablespoon; tsp = teaspoon; pt = pint; qt = quart; gal = gallon; lb = pound.

[r] Restricted Use Pesticide.

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL (CONT'D)

TABLE 1. DAYS WAITING TIME - LAST APPLICATION BEFORE HARVEST

Number of Days Before Harvest

CHEMICAL	BLACKBERRIES	STRAWBERRIES	BLUEBERRIES
Abacus[r]	–	3	–
Abound	0	0	0
Acramite	--	1	--
Agri-mek 0.15 EC	–	3	–
Aliette 80 WDG	60	0	0
Atrapa 8E	1	3	1
Brigade 2EC[r]	3	–	–
Brigade WSB[r]	0	0	–
B.t. (Dipel, Javelin, Thuricide)	0	0	0
Cabrio	0	0	0
Captan	0	0	0
Dicofol 4E	–	2	–
Elrvate 50WG	0	0	–
Guthion[r]	14	5	–
Imidan 50WP or 70WP	–	–	–
Javelin	0	0	0
Kelthane	–	2	–
Lannate LV[r]	–	3 (Fresh)	3
	–	10 (Processing)	–
Lorsban 4E[r]	–	21	–
Malathion	1	3	1
Nova 40W	0	0	–
Pasada	–	7	–
Pristine	0	0	0
Procure 50WS	1	1	–
Ridomil Gold EC	60 (raspberries only)	–	–
Sevin	7	–	–
Switch	0	0	0
Thiodan 3EC	–	1	–
Topsin M WSB	1	1	–
Vendex 50WP[r]	–	4	–
Zeal	–	1	–
Ziram	–	–	14

[r] Restricted Use Pesticide.

*Guthion 2L - up to 3 oz - 0 days; above 3 oz - 7 days. Application by backpack or hand wand sprayers is prohibited. Re-entry period is 4-5 days, 5 days if area receives less than 24 inches of annual rainfall.

Publications that may be helpful: Fact Sheet 6213, Weed Management in Small Fruit Crops; Fact Sheet 6214, Growing Strawberries in the Home Garden; Fact Sheet 7612, Plant Disease Diagnostic Service; Fact Sheet 6239, Commercial Blackberry Production; Fact Sheet 6215, Home Culture of Blackberries.

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL (CONT'D)

CULTURAL CONTROL METHODS

With more chemicals being removed from the market, growers must have successful ways of controlling disease and insects through cultural means. Disease and insects may be controlled or the effects of these pests can be reduced using cultural methods. The methods to consider are site selection, maintaining good soil conditions, sanitation, and purchase of healthy, and where available, resistant varieties.

A well chosen site includes good air drainage to reduce spring frost damage, circulation, and adequate soil water drainage. Sites with these qualities improve plant growth and decrease plant susceptibility to insects and disease. Orienting rows for good sun exposure and natural air movement will dry leaves and fruit quickly. Raised beds improve soil drainage and reduce infections by root diseases. Proper site selection to decrease plant stresses, such as cold injury and buffeting by winds, can reduce attack by insects and diseases. New plantings located near old established areas may have greater risks of insect and disease populations from the old sites than plantings on isolated areas. Destroying native plant species in the immediate area that harbor harmful insects or diseases can reduce pest problems.

An important disease and insect control procedure is the planting of adapted, healthy, disease and insect resistant varieties. Plants should be purchased from reliable sources, and only healthy looking stock planted. Variety selection should be based on adaptation to the area, such as cold hardiness, heat tolerance, adaptation to soils, and ability to produce acceptable yields of high quality fruit. Varieties will vary in the degree of susceptibility to an insect or disease. The nursery, supplier or county agent should have a recent list of adaptive and resistant cultivars that are available for planting in Oklahoma.

Maintaining proper soil moisture and fertilization can insure healthy plants. These plants will be more resistant to disease and insect damage than plants over or under fertilized or watered. Annual leaf analysis and soil analysis can be used to determine fertilization rates. Rainfall and soil moisture should be monitored to determine when to irrigate plants. Tensiometers, watermarks or some other form of measuring soil moisture may be used to determine when irrigation is necessary in larger plantings. This may not be necessary in smaller plantings where rainfall and stress of plants can be monitored directly.

Sanitation is important in controlling some insects, and especially in controlling diseases. Diseased and dead branches should be removed and when necessary, entire plants should be removed to reduce overwintering sites for insects and pathogens. These infected materials should be burned or removed from the site. Unharvested fruit, leaf litter and prunings should be removed to decrease the spread and population increase of insects and diseases. Pruning equipment should be disinfected before, during and after use to avoid transmitting disease during pruning. A solution of 10% chlorine bleach and 90% water is a good disinfectant.

Weed control is essential for plant growth and production. Economic losses due to weeds are sometimes greater than those caused by insects or diseases. Weeds compete directly with crops for nutrients, water and light and serve as hosts for insects and diseases. Weeds may also interfere with pesticide application, harvesting and air circulation in planting. To control weeds, an integrated program using cultural practices (such as pulling or hoeing weeds) along with herbicides is the most effective. Suitable herbicides for weed control in small fruit plantings are listed in Fact Sheet 6243, "Weed Control in Small Fruit Crops."

The above cultural practices along with timely applications of pesticides will produce high quality fruit. It is usually necessary to use each of these cultural methods along with pesticides to attain good control leading to healthier plants, higher quality fruit and greater yields.

Following is a list of specific cultural methods for controlling various insects and diseases in blueberry, strawberry and blackberry production. These methods can be used alone or in conjunction with insecticides and fungicides to limit the spread of insects and diseases.

BLUEBERRY

Red and necrotic ringspot and blueberry stunt
Plant disease-free stock. Remove and burn diseased plants. Control insects which may be vectors of disease.

Phytophthora root rot
Limit movement of soil and water to lessen disease damage.

Anthracnose
No cultural method of control.

Botrytis, blossom and fruit rots
Insure good air circulation and sun exposure to quickly dry wet leaves.

Phomopsis twig and cane blight
Prune and burn diseased wood.

Stem canker (various fungi)
Purchase disease-free stock. Purchase resistant varieties. Remove dead and dying branches 6-8 inches below diseased wood.

COMMERCIAL BLACKBERRY, STRAWBERRY AND BLUEBERRY INSECT AND DISEASE CONTROL (CONT'D)

CULTURAL CONTROL METHODS (CONT'D)

BLUEBERRY (CONT'D)

Climbing cutworm
Hand pick off of blossom when they become numerous enough to warrant control.

Blueberry bud mite
Selectively prune out old canes to reduce populations. Choose non-susceptible varieties.

Fall webworm
Destroy webs by hand.

STRAWBERRY

Strawberry weevil
Use the same bed less than three years. Plow under old beds immediately after harvest. Renovate existing beds by mowing or removing foliage and mulch.

Mites
Purchase mite-free stock. Isolate new plantings from established plantings. Make sure plants are healthy and well-watered. Use a water hose to wash mites from plants.

Lygus bugs
Control weeds in and near planting to reduce host plants from insects and disease.

Weeds or alfalfa that have been growing should not be removed during the strawberry blossom period, because the insects will move into the strawberries.

Leaf spot
Plant disease-free stock.

Powdery mildew
Kill or burn leaves which mycelia are on. Purchase resistant varieties.

Leaf scorch
Frequent renewal of plantings. Purchase resistant varieties.

Anthracnose
Remove plant debris and mulch. Purchase resistant varieties, where available. Use only enough fertilizer to establish plants, but do not over fertilize them. If any signs of anthracnose occur, discontinue all applications of nitrogen and potassium.

BLACKBERRY

Anthracnose
Remove and burn old canes.

Cane boreres
Remove and burn infested canes.

COMMERCIAL PECAN INSECT AND DISEASE CONTROL

Pecans are native to Oklahoma. Records reveal that Native Americans were the first to know of pecan trees and respect the value of this nut crop.

Today, more and more pecan growers are realizing that a full management cultural program must be employed if consistent, high quality, profitable pecan crops are to be expected. In the modern pecan tree management program, attention is given to (1) annual fertilization, (2) reduction of weed and grass competition plus irrigation where practical, (3) relieving over-crowding of trees, and (4) controlling insects and diseases.

The influx of insects and incidences of diseases in recent years has made the application of sprays to control these pests a very important factor in pecan production. In many seasons, insect and disease control will be the difference between a good pecan crop and no crop.

Even with the best chemicals and the most modern equipment, insect and disease control is not an easy job. Approximately seven months are required for growth and development of a pecan crop. At some time during this period, weather conditions are likely to be favorable for numerous pests.

To apply an effective pesticide spray to pecan trees, follow these rules:

- Use an effective chemical(s)
- At the proper rate (concentration)
- Apply thoroughly
- At the proper time.

When one or more of these four rules is not carried out properly, the spray effectiveness is reduced or could totally fail.

The amount of spray applied to an individual tree or acre of trees may vary greatly depending on the type of equipment used and the manner in which it is operated. Most pecan growers in Oklahoma use ground machines calibrated to deliver 100 gallons of spray per acre. Each year, sprayer output should be calibrated and recorded with notes on pressure settings, tractor speed, and rpm's.

Regardless of the gallonage of spray applied, the amount of chemical (pesticide) applied to an acre should remain the same.

Suggested chemical rates in this publication are given as rate/acre.

Variable tree size and spacing complicate estimates of quantity of spray solution needed. These decisions must be made on an individual basis. An acre equivalent of pecan trees is approximately 30 square feet of cross sectional trunk area. This figure is derived by measuring tree trunks at 4.5 feet above ground, calculating and totaling the area. When this total reaches 30 the number of trees is one acre equivalent.

Number of trees per acre equivalent can be estimated from the following table:

Tree diameter	Trees per acre equivalent
13"	30
19"	15
23"	10

For additional information on calculating cross sectional trunk area consult OSU Fact Sheet EPP-6208.

If the label requires 1 pound of chemical per acre and if the average tree size is 23 inches in diameter then 10 trees should receive 1 pound of chemical. The chemical should be dissolved in adequate water to wet the entire tree canopy. The amount of water required can vary depending on the amount of tree canopy and other conditions. Native trees that have been crowded for example, may not have canopy normally associated with the trunk size. In those cases grower judgment must be utilized to determine if the volume of water utilized is adequate to cover the leaves. It is better to apply too much water than an inadequate amount.

Adequate spray solution must be applied to insure coverage of the entire tree canopy. Larger trees require more solution. Manufacturers' recommendations for gallons vary from 100 to 600 gallons per acre. Refer to the chemical label for any manufacturers' recommendations on gallons per acre to apply.

COMMERCIAL PECAN INSECT AND DISEASE CONTROL (CONT'D)

PEST/TIME TO SPRAY	INSECTICIDE (MOA GROUP) AND FORMULATION[1]	AMOUNT OF MATERIAL NEEDED[2] PER ACRE	COMMENTS
PHYLLOXERA (GALLS) Apply from bud break to when new shoot growth is 2 inches long. Controls are not effective when typical symptoms appear (July).	Asana XL[r] (3) Centric 40 WG (4A) Cobalt[r] (1B+3) Hero[r] (3) Lorsban 4E[r] (1B) Malathion 57 EC (1B) Mustang-Max[r] (3) Pasada 1.6F (4A) Provado 1.6F (4A) Proaxis[r] (3) Warrior 1EC[r] (3)	4.8-14.5 oz 2-2.5 oz 26-57 oz 10.3 oz 2.0-4.0 pts 1.2 pts 3.2-4.0 oz 3.5-7.0 oz 3.5-7.0 oz 2.56-5.12 oz 2.56 – 5.12 oz	Make one or two applications. For best results with Lorsban, apply 1 pt/100 gal at budbreak and the same 7-10 days later. When applying all sprays, thoroughly wet the foliage. Do not apply more than 28 oz of Pasada or Provado per acre per year. Do not apply more than 0.96 pints per acre per year post bloom (Proaxis or Warrior).
PECAN NUT CASEBEARER[3] First Generation May 20 to June 10 when eggs appear (when tips of nuts turn brown). Second Generation July 15-25.	Ammo 2.5 EC[r](3) Asana XL[r](3) Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Hero[r] (3) Javelin WG (11B2) Malathion 57 EC (1B) Confirm 2F (18) Imidan 70WSB[4](1B) Proaxis[r](3) Spintor 2 SC (5) Lorsban 4E[r] (1B) Penncap-M[r](1B) Intrepid 2F (18) Dipel ES (11B2) Mustang-MAX[r](3) Warrior 1 EC[r] (3)	3-5 oz 4.8-14.5 oz 12.8 – 21.1 oz 19-57 oz 10.3 oz .25-4.0 lb 1.2 pts 8.0-16.0 oz 1-3.125 lbs 2.56-5.12 oz 4-10 oz 1.5-4 pts 3-8 pts 4-8 oz 1-4 pts 3.2-4.0 oz 2.56-5.12 oz	1 or 2 applications. If second application is needed, apply 7 to 10 days after the first. With adequate monitoring for casebearer eggs, one application of the biological control agent, *Bacillus thuringiensis* (found in Javelin and Dipel) or the insect growth regulator, (found in Confirm or Intrepid) can provide safe effective control while preserving beneficial organisms. Under high insect pressure use 2.0-2.5 pts per 100-300 GPA (Lorsban)
HICKORY SHUCKWORM July 1 - July 7 A repeat application two weeks later may be needed.	Ammo 2.5 EC[r] (3) Asana XL[r] (3) Battalion 0.2 EC[r] (3) Cobalt[r] (1B+3) Confirm 2F (18) Hero[r] (3) Mustang-MAX[r] (3) Sevin 80S (1A) Intrepid 2F (18) Spintor 2SC (5) Warrior 1EC (3) Penncap-M 2E (1B) Imidan 70WSB[4] (1B) Proaxis[r] (3)	3-5 oz 4.8-14.5 oz 12.8 – 21.1 oz 26-57 oz 8.0-16.0 oz 10.3 oz 3.2-4.0 oz 2.5-6.25 lbs 4-8 oz 4-10 oz 2.56-5.12 oz 3-8 pts 1-3.125 lbs 2.56-5.12 oz	Shuckworm can continue to be a problem through shell hardening and may not peak until half-shell hardening (about the time of weevil emergence).
PECAN WEEVIL [5] Late July, early August or when weevils appear, but before shuck split.	Ammo 2.5 EC[r] (3) Battalion 0.2 EC[r] (3) Hero[r] (3) Imidan 70WSB[4] (1B) Sevin 80S (1A) Mustang-MAX[r] (3) Asana XL[r] (3) Penncap-M 2E [r] (1B) Warrior 1EC[r] (3) Proaxis[r] (3)	3-5 oz 12.8 – 21.1 oz 10.3 oz 1-3.125 lbs 2.5-6.25 lbs 3.2-4.0 oz 4.8-14.5 oz 3-8 pts 2.56-5.12 oz 2.56-5.12 oz	The majority of weevils emerge immediately after a heavy rain (1"-2") and populations can continue emerging from late July to mid-Oct. depending on rainfall and/or soil type. Pecans are most susceptible to injury from weevils during the dough stage till shuck split.
APHIDS When they appear	Admire 2F (4A) Ammo 2.5 EC[r] (3) Asana XL [r] (3) Battalion 0.2 EC[r] (3) Centric 40 WG (4A) Cobalt[r] (1B+3) Dimethoate 4E (1B) Di-Syston 15 G[r] (1B) Hero[r] (3) Mustang-MAX[r] (3) Pasada 1.6F (4A) Provado 1.6F (4A)	16.0-32.0 oz 3-5 oz 4.8-14.5 oz 12.8 – 21.1 oz 2-2.5 oz 19-57 oz 0.66 pt 10-20 lbs 10.3 oz 3.2-4.0 oz 3.5-7.0 oz 3.5-7 oz	Chemigation into root zone or subsurface side-dress shanked into root zone near emitter line. (Admire only) Higher rate for Black Pecan Aphid (Centric) Do not use less than 26 ounces of Cobalt for black pecan aphid. Soil application in May. Work granules into upper 2-3 inches of soil. For yellow aphids. For yellow aphids. Do not make a foliar application of Provado after a soil application of Admire in the same yr

COMMERCIAL PECAN INSECT AND DISEASE CONTROL (CONT'D)

PEST/TIME TO SPRAY	INSECTICIDE (MOA GROUP) AND FORMULATION[1]	AMOUNT OF MATERIAL NEEDED[2] PER ACRE	COMMENTS
APHIDS (cont'd)	Proaxis[r] (3)	2.56-5.12 oz	
	Pasada 1.6F (4A)	7.0-14.0 oz	For black aphids.
	Provado 1.6F (4A)	7-14 oz	For black aphids.
	Lorsban 4E[r6] (1B)	1-4 pts	Avoid controlling sub-economic infestations of aphids early in the season. This destroys beneficials and may cause flare-ups of mite populations.
	Malathion 57EC (1B)	1-2 pts	
	Mustang-MAX[r] (3)	3.2-4.0 oz	
	Warrior 1EC[r] (3)	2.56-5.12 oz	
WEBWORM OR WALNUT DATANA When caterpillars appear feeding on leaves (June to late August)	*Bacillus thuringiensis* products:		
	Dipel ES (11B2)	0.25-4.0 lb	1 or 2 applications.
	Cobalt[r] (1B+3)	19-57 oz	Fall webworm only. Cobalt is not labeled for webworms.
	Javelin WG (11B2)		1 or 2 applications.
	Spintor 2 SC (5)	4-10 oz	
	Confirm 2F (18)	8.0-16.0 oz	
	Intrepid 2F (18)	4-8 oz	
	Sevin 80S (1A)	2.5-6.25 lbs	Follow label directions.
TWIG GIRDLER When damage first occurs -late August or early Sept.	Sevin 80S (1A)	2.5-6.25 lbs	Dedicated sanitation of orchard floor (sticks) can dramatically reduce twig girdler and pruner populations
STINK BUGS and LEAF-FOOTED BUG (True Bugs)	Battalion 0.2 EC[r] (3)	12.8 – 21.1 oz	
	Cobalt[r] (1B+3)	26-57 oz	
	Mustang-MAX[r] (3)	3.2-4.0 oz	
	Penncap-M[r] (1B)	2-4 pts	In areas where legume crops are grown near pecan, true bug management can involve use of trap crops to draw these insects into small plantings of row crops (e.g. pear millet) where control can be implemented on a much smaller scale.
MITES During hot, dry periods—late in season.	Acramite 4SC (25)	12-16 oz	1 application per year.
	Onager 1EC (10A)	12-24 oz	1 application per year.

MOA Group Tables start on page 46 of the handbook.

COMMERCIAL PECAN INSECT AND DISEASE CONTROL (CONT'D)

SPRAY SCHEDULE FOR VARIETIES SUSCEPTIBLE TO SCAB

APPLICATION AND TIMING *	COMMON NAME (Fungicide MOA Group**)	FORMULATION: RATE/ACRE	PRE-HARVEST INTERVAL	COMMENTS
PRE-POLLINATION	Azoxystrobin (11)	Abound: 6.2 – 12.3 oz	45 days	Do not apply more than two (2) consecutive applications of QoI (strobilurin) fungicides without alternating to a non-QoI labeled fungicide. Do not make more than three (3) applications of QoI fungicides in one season.
	Trifloxystrobin (11)	Gem 500 SC: 2.9 – 3.8 oz	60 days	Same as previous.
	Pyraclostrobin (11)	Headline: 6 -7 oz	14 days	Same as previous.
	Pyraclostrobin (11) + Boscalid (7)	Pristine: 10.5 – 14.5 oz	14 days	Same as previous.
	Kresoxim-methyl (11)	Sovran 2.4 – 3.2 oz	45 days	Same as previous.
	Propiconazole (3)	Bumper 41.8 EC: 4.0 oz Propimax EC: 4.0 oz	21 days (DO NOT apply after shuck split)	DO NOT apply more than four (4) applications of Propimax EC in one growing season. Do not graze livestock in treated areas or use cover crops for feed.
	Propiconazole (3) + Triphenyltin hydroxide (30)	Orbit 45WP Agpak/Super Tin 80WP Agpak[r]: 4.0 oz + 3.75 oz	30 days	Also has activity on Powdery mildew. Do not exceed 6 applications in areas WEST of Interstate 35, or 9 applications for areas EAST of Interstate 35 in one season. Do not graze livestock in treated areas or use cover crops for feed.
	Propiconazole (3) Azoxystrobin (11)	Quilt: 14.0 – 27.5 oz	45 days (DO NOT apply after shuck split)	Do not apply more than two (2) consecutive applications of QoI (strobilurin) fungicides without alternating to a non-QoI labeled fungicide. Do not make more than three (3) applications of QoI fungicides in one season. Do not graze livestock in treated areas or use cover crops for feed.
	Propiconazole (3) + Trifloxystrobin (11)	Stratego: 10.0 oz	30 days (DO NOT apply after shuck split)	Do not apply more than two (2) consecutive applications of QoI (strobilurin) fungicides without alternating to a non-QoI labeled fungicide. Do not make more than three (3) applications of QoI fungicides in one season. Grazing restrictions may apply.
	Fenbuconazole (3)	Enable: 8.0 oz	28 days (DO NOT apply after shuck split)	Also has activity on Powdery mildew. Do not apply more than 1.5 qt per acre per season. Do not graze livestock in treated areas or use cover crops for feed.
	Fenbuconazole (3) + Triphenyltin hydroxide (30)	Enable 75WSP + Agritin[r]: 1.31 oz/3.75 oz	30 days (DO NOT apply after shuck split)	Also has activity on Powdery mildew. Do not exceed eight (8) applications during one season. Do not graze livestock in treated areas or use cover crops for feed.
	Thiophanate-methyl (1)[7]	Topsin M WSB: 1.0 lb Topsin M 70 WP: 0.5 – 1.0 lb	DO NOT apply after shuck split	Follow Resistance Management Guidelines. Do not apply more than 3 lbs. per acre per season.
	Ziram (M)	Ziram 76 DF: 6.0 – 8.0 lb Ziram Granuflo: 6.0 – 8.0 lb	55 days	Do not graze livestock in treated areas or use cover crops for feed.
COVER SPRAYS	Same as Pre-pollination except:			
	Propiconazole (3)	Bumper 41.8 EC: 6.0 oz Propimax EC: 6.0 oz	21 days (DO NOT apply after shuck split)	Do not graze livestock in treated areas or use cover crops for feed. DO NOT apply more than four (4) applications of Propimax EC in once growing season.
	Kresoxim-methyl (11)	Sovran 3.2 – 4.8 oz	45 days	Do not apply more than two (2) consecutive applications of QoI (strobilurin) fungicides without alternating to a non-QoI labeled fungicide. Do not make more than three (3) applications of QoI fungicides in one season.

* All Fungicides should be sprayed according to the schedule indicated by the label and/or by the aid of the OSU Pecan Scab Model.
** Fungicide MOA groups begin on page 56.
[r] Restricted Use Pesticide

COMMERCIAL PECAN INSECT AND DISEASE CONTROL (CONT'D)

[1] See table at end for pre-harvest intervals and grazing restrictions.
[2] Gal = gallon; lb = pound; pt = pint; qt = qt; oz = ounces.
[3] The insecticides listed for casebearer control may be safely combined with some of the fungicides for scab control. Check label instructions for each product prior to use.
[4] Imidan insecticidal activity is reduced when spray solution has a pH of 7 or higher. The pH of the spray solution can be corrected by adding a suitable buffering or acidifying agent (e.g., AG44M). The pH should be adjusted to 5.0 if possible, to incrase residual activity.
[5] Pecan Weevil: This insect is a serious problem in most sections of the state. The damage may be observed in two ways: (1) shedding of the immature pecans because of the feeding punctures of the adult weevils; and/or (2) mature pecans with a hole cut into the side. The presence of adult weevils may be found by shaking or jarring the branches of the pecan trees to dislodge the weevil or by spraying a tree or a portion of a tree which has been known to be infested with weevils. A sheet or tarp placed on the ground under the tree will collect weevils when they are dislodged. The most dependable method of monitoring pecan weevil populations is to use wire cone emergence traps, pyramid traps or circle traps. Their use and utility are in Fact Sheet 7190, *Monitoring Adult Weevil Populations in Pecan and Fruit Trees in Oklahoma*. A good rain following a dry spell in August or September usually results in the emergence of large numbers of weevils from soil, and a spray should be made 2-3 days after the rain.
[6] When Lorsban or Guthion are used for aphid control they should be combined with a synthetic pyrethroid (e.g., Asana XL, Ammo or Centric) for best results.
[7] Widespread resistance to benzimidazole throughout the state restricts the use of fungicides such as Topsin M to new orchards. These fungicides must be alternated with other kinds of fungicides to help prevent development of resistance.

Recommended Intervals Between Last Application, Harvest and Other Restrictions

Chemical	Interval Between Last Application and Harvest and Other Restrictions
Acramite	Only one application per year. 14 day pre-harvest interval.
Admire	Do not apply more than 32.0 oz/acre/season. Do not apply after July 15.
Asana[r], Ammo[r]	21 days. Do not feed or graze livestock on treated orchard floors.
Battalion[r]	Do not apply more than 105.6 ounces of Battalion per acre per season. Allow 7 days between applications. Do not apply within 21 days of harvest.
Centric	14 days to harvest. Do not use less than 50 gallons of mixed spray material per acre when applied by ground equipment. Do not exceed 5.0 oz/acre per season.
Cobalt[r]	28 days to harvest. Do not graze in treated areas.
Confirm	14 days to harvest. Do not graze livestock in treated areas or feed cover crops grown in the treated area to livestock.
Dimethoate	Do not apply within 21 days of harvest. Do not graze livestock in treated areas.
Dipel	No grazing restrictions. 0-day waiting period.
Di-Syston[r]	Do not harvest nuts within 80 days of treatment.
Guthion[r]	Do not apply after shuck split. Allow 21 days before grazing livestock.
Hero[r]	Do not apply within 21 days to harvest. Do not graze livestock on cover crops in treated areas.
Imidan	Do not apply within 14 days of harvest. Do not graze livestock on cover crops in treated areas.
Intrepid	14 days. Do not apply more than 16 oz/acre/application or 64 oz per acre/season.
Lorsban[r]	Do not apply more than 4 qts/A (4lbs A.I./A) /season and do not graze livestock in treated areas. Do not apply within 28 days of harvest. Allow for a buffer zone when spraying near water using the following guidelines: orchard air-blast sprayer allow 50 foot buffer; Aerial application allow 150' buffer.
Malathion, Sevin, Javelin	No grazing restrictions. Sevin has a 14-day waiting period before harvest.
Mustang-MAX [r]	Do not apply within 7 days of harvest. Do not graze livestock on cover crops in treated areas. Other restrictions relating to use around bodies of water, may be found on the label.
Onager	Do not graze or feed livestock on cover crops growing in treated area. Do not apply within 28 days of harvest.
Pasada	7 day pre-harvest interval. Do not graze in treated areas.
Penncap-M [r]	Do not apply after shuck split. Do not graze or feed cover crops within 15 days after application. Do not apply more than 64 pts per acre per year.
Proaxis[r]	Do not apply within 14 days of harvest
Provado	Do not graze in treated areas. 0 days waiting between application and harvest.
Spintor	14 days. Do not apply treatments less than 14 days apart. Do not apply more than 29 total ounces per acre/crop/year. Product is toxic to bees and aquatic invertebrates.
Thiodan	Do not graze cattle in treated groves and do not apply after shuck split.
Warrior [r]	14 days. Do not apply more than 1.28 pts/A/year.

[r] Restricted Use Pesticide.

SMALL FRUITS WEED CONTROL SUGGESTIONS

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE and (MOA Group)	COMMENTS
STRAWBERRIES*			
Annual grasses and broadleaf weeds	Preemergence	Devrinol 50DF (napropamide) 4 lbs ai/a (15)	Do not apply from bloom to harvest. Apply late fall through early spring to established berries after enough daughter plants have pegged down. Soil must be wetted to a depth of 2 to 4 inches after application.
Annual grasses and broadleaf weeds	At Transplanting or PPI and Fall and Early Spring for established	Dacthal W-75 (DCPA) 6-9 lb ai/acre	Do not apply after 1st bloom through harvest
Annual grasses and broadleaf weeds	Preemergence	Sinbar (terbacil) 0.8-1.6 lb ai/a (5)	Do not apply within 110 days of harvest. Rate depends on soil texture. Runner production and plant stand may be reduced.
Annual broadleaves, especially winter annuals	Preemergence	Goal 2XL (oxyfluorfen) 0.25-0.5 lb si/s (14)	Fallow bed preparation only: Apply alone or with Roundup a minimum of 30 days before transplanting. Fallow bed should be worked thoroughly to a depth of 2.5 in prior to planting.
Annual broadleaves	Postemergence	Aim 2EC (carfentrazone) 0.031 lb ai/a (14)	Apply with hooded shields between rows during growing season to actively growing weeds. Always add nonionic surfactant or crop oil. Max 6.1 fl oz per year. Minimum 14 days between applications. No pre-harvest interval.
Annual grass and broadleaf weeds, suppression of perennials	Postemergence	Gramoxone Max^{r} (paraquat) 0.47 lb ai/a + nonionic surfactant or crop oil concentrate (22)	Apply between plant rows using shields to prevent spray contact with strawberry plants. Apply when weeds are actively growing and are between 1 and 6 inches tall. Do not apply more than 3 times per year or within 21 days of harvest.
Annual and perennial grasses	Postemergence	Poast (sethoxydim) 0.3-0.5 lb ai/a + crop oil concentrate (1)	Apply to actively growing grasses. Do not apply within 7 days of strawberry harvest.
Annuals and some perennial grasses and broadleaves	Postemergence	Roundup Ultra (glyphosate) 1-5 lb ai/a (9)	Apply as pre-plant broadcast application or in fall for control of roots and rhizomes of perennial weeds or as a directed spray or wiper application to actively growing weeds in established plantings.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE and (MOA Group)	COMMENTS
STRAWBERRIES* (Cont'd)			
Annual and perennial grasses	Postemergence directed spray	Select 2EC (clethodim) 0.125 lb ai/a + crop oil concentrate (1)	Apply as a directed spray to actively growing grasses before tillering. Always add crop oil. Rainfast in 1 hour.
Annuals and suppression of perennials	Postemergence directed spray	Scythe (pelargonic acid) Rate depends on spray mixture concentration	Non selective, contact activity. Controls emerged green vegetation. Avoid contact with leaves.
r Restricted Use Pesticide			
* Read and follow label directions, precautions and limitations. If label information contradicts information presented here, the label information takes precedence.			
Additional information may be found in the following OSU Cooperative Extension Service Publications:			
Calibrating a Low Pressure Ground Sprayer			Fact Sheet 1216
Weed Management in Small Fruit Crops			Fact Sheet 6243
Use of Plastic Mulch and Row Covers in Vegetable Production			Fact Sheet 6034
Direct questions or comments to: Department of Horticulture and Landscape Architecture (405) 744-5404			

MOA Group Tables start on page 46 of the handbook.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE and (MOA Group)	COMMENTS
BLACKBERRIES* AND RASPBERRIES*			
Annual grass and broadleaf weeds	Preemergence	Casoron 4G (dichlobenil) 4 lbs ai/a (20)	Apply in early spring before weeds germinate or after cultivation and incorporate thoroughly. Do not apply during crop shoot emergence. Do not apply to new plantings.
Annual grass and broadleaf weeds	Preemergence	Princep 4L (simazine) 2-4 lbs ai/a (5)	Apply in the early spring before bud break, or as a split application in the fall and spring. Do not apply during fruiting. Use ½ rate on plantings established less than 6 months.
Annual grass and broadleaf weeds	Preemergence	Devrinol 50 DF (napropamide) 4 lb ai/a (15)	Apply in the fall or early spring prior to weed emergence. For new and established plantings.
Annual grass and broadleaf weeds	Preemergence	Surflan A.S. (oryzalin) 2-6 lb ai/a (3)	May be applied through certain sprinkler irrigation systems (see label). Duration of weed control is dependent on rate and frequency of application. Irrigation or rainfall of ½ to 1 inch is needed to move the herbicide into the weed germination zone.
Annual grass and broadleaf weeds	Preemergence	Solicam DF (norflurazon) 2-4 lb ai/a (12)	Apply fall to early spring while crop is dormant and before weed emergence begins. Do not use on plants less than 18 months old. Raspberries are sensitive. Rate depends on soil texture.
Annual grasses and broadleaf weeds	Preemergence	Sinbar 80WP (terbacil) 0.8-1.6 lbs ai/a (5)	Treat bushes established one year or more. Rate depends on soil texture. Do not apply within 70 days of harvest. Crop injury may result from use on low organic matter soils.
Annual grasses and certain broadleaves	Preemergence	Snapshot 2.5TG (isoxaben+trifluralin) 2.5-4 lbs ai/a (3, 21)	For use in non-bearing crops. May only be used on crops that will not be harvested within 1 year of application. Not effective on germinated weeds.
Annual broadleaf	Preemergence	Gallery 75DF (isoxaben) 0.5-1 lb ai/a (21)	For use in non-bearing crops. Do not apply to new plantings before soil near the plants has settled. Rate depends on weed species.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE and (MOA Group)	COMMENTS
BLACKBERRIES* AND RASPBERRIES* (Cont'd)			
Annual and perennial grasses	Postemergence	Fusilade DX (fluazifop-butyl) 0.25-0.375 lb ai/a + nonionic surfactant or crop oil concentrate (1)	Do not apply to crops to be harvested within 1 year of application (nonbearing). Apply to annual grasses at 2 inches to 8 inches tall before tillering. Apply to perennial grass by growth stage depending on species.
Annual and perennial grasses	Postemergence	Poast (sethoxydim) 0.28-0.47 lb ai/a + crop oil concentrate (1)	Do not apply within 45 days of harvest. Rate depends on grass species and height.
Annual and perennial grasses	Postemergence	Select 2EC (clethodim) 0.125 lb ai/a + crop oil concentrate (1)	Use in non-bearing plantings. Do not spray directly on crop plants.
Annual grasses and broadleaf, suppression of perennials	Postemergence directed spray	Gramoxone Max^{r} (paraquat) 0.63-0.94 lb ai/a + nonionic surfactant or crop oil concentrate (22)	Apply before emergence of new canes or shoots to avoid injury. Apply as coarse directed spray to thoroughly wet weeds and avoid drift injury.
Annual broadleaves	Postemergence	Aim 2EC (carfentrazone) 0.031 lb ai/a (14)	Apply with hooded shields between rows during growing season to actively growing weeds. Always add nonionic surfactant or crop oil. Max 6.1 fl oz per year. Minimum 14 days between applications. Fifteen day pre-harvest interval.
Annual and perennial	Postemergence directed spray	Roundup (glyphosate) 1-5 lbs ai/a (9)	Do not use within 14 days of harvest. Spot treat before budbreak. Avoid contact with canes and leaves
Annuals and suppression of perennials	Postemergence directed spray	Scythe (pelargonic acid) Rate depends on spray mixture concentration (no resistance group #)	Non selective, contact activity. Controls emerged green vegetation. Avoid contact with canes and leaves.

MOA Group Tables start on page 46 of the handbook.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE and (MOA Group)	COMMENTS
BLUEBERRIES*			
Perennial and annual	Preemergence	Casoron 4G (dichlobenil) 4-6 lbs ai/a (20)	Do not apply until 4 weeks after transplanting. Apply in early spring as a surface application over the row or broadcast. Incorporate shallowly immediately after application.
Annual grass and broadleaf weeds	Preemergence	Princep 4L (simazine) 2-4 lbs ai/a (5)	Apply in the early spring or as a split application in the fall and spring. Do not apply during fruiting. Use ½ rate on plantings established less than 6 months.
Annual grass and broadleaf weeds	Preemergence	Devrinol 50DF (napropamide) 4 lbs ai/a (15)	Apply fall or early spring before weeds emerge. Moisture needed for activation. For new and established plantings.
Annual grass and broadleaf weeds	Preemergence	Solicam DF (norflurazon) 2-4 lbs ai/a (12)	Do not use within 6 months of establishment. Apply from fall to early spring before weeds emerge. Rate depends on soil texture.
Annual grass and broadleaf weeds	Preemergence	Surflan A.S. (oryzalin) 2-6 lb ai/a (3)	Apply spray directly to soil after existing weeds are killed by tillage or contact herbicide. Duration of weed control depends on rate and frequency of application. 1/2 to 1 inch of irrigation or rainfall is needed for activation.
Annual grass and broadleaf weeds	Preemergence	Sinbar 80WP (terbacil) 1.6-3.2 lbs ai/a (5)	Treat bushes established one year or more. Rate depends on soil texture. Crop injury may result from use on low organic matter soils.
Annual grasses and broadleaves and yellow nutsedge	Preemergence	Velpar (hexazinone) 1 lb ai/ac (5)	Apply to pruned blueberries in the spring before leaf emergence as a directed soil application. Some clones are susceptible to injury. Use on plantings established at least 3 years.
Annual broadleaf	Preemergence	Gallery 75DF (isoxaben) 0.5-1 lb ai/a (21)	For use in non-bearing crops. Do not apply to new plantings before soil near the plants has settled. Rate depends on weed species.
Winter annual and perennial grasses and broadleaf weeds	Preemergence Postemergence	Kerb^{r} 50WP (pronamide) 1-2 lbs ai/a (15)	Apply in late fall or early winter under cool temperatures above freezing. Do not apply until blueberry roots are well established. Follow with irrigation.
Annual and perennial grasses and broadleaf weeds	Postemergence	Roundup (glyphosate) 1-5 lb ai/a (9)	Apply as directed spray or spot treat before budbreak. Do not allow spray to contact foliage. Do not apply within 14 days of harvest.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE and (MOA Group)	COMMENTS
BLUEBERRIES* (Cont'd)			
Annual and perennial grasses	Postemergence	Fusilade DX (fluazifop-butyl) 0.25-0.375 lb ai/a + nonionic surfactant or crop oil concentrate (1)	For nonbearing crops only. Do not apply to crops to be harvested within 1 year of application. Apply as a directed spray. Two applications usually necessary to control perennial grasses.
Annual and perennial grasses	Postemergence	Poast (sethoxydim) 0.3-0.5 lb ai/a + crop oil concentrate (1)	Do not apply within 30 days of harvest. Apply as a directed spray. Two applications usually necessary to control perennial grasses.
Annual and perennial grasses	Postemergence	Select 2EC (clethodim) 0.125 lb ai/a + crop oil concentrate (1)	Use in non-bearing plantings. Do not spray directly on crop.
Annual broadleaves	Postemergence	Aim 2EC (carfentrazone) 0.031 lb ai/a (14)	Apply broadcast at base of trunks during dormant stage or with hooded shields between rows during growing season. Always add nonionic surfactant or crop oil. Pre-harvest interval is 1 day.
Annual grass and broadleaf weeds, suppression of perennials	Postemergence directed spray	Gramoxone Max[r] (paraquat) 0.48- 1 lb ai/a + nonionic surfactant or crop oil concentrate (22)	Apply before emergence of new canes or shoots to avoid injury. Apply as coarse directed spray to thoroughly wet weeds and avoid drift injury
Annual and perennial grasses and broadleaf	Postemergence directed spray	Rely (glufosinate) 0.75-1.25 lb ai/a (10)	Do not allow spray to contact desirable foliage. Do not exceed 3 lb ai/year.
Annual and perennial grasses and broadleaf	Postemergence directed spray	Scythe (pelargonic acid) Rate depends on spray mixture concentration (no resistance group #)	Non selective, contact activity. Controls emerged green vegetation. Avoid contact with canes and leaves.

[r] Restricted Use Pesticide.

MOA Group Tables start on page 46 of the handbook.

* Read and follow label directions, precautions and limitations. If label information contradicts information presented here, the label information takes precedence.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	MOA GROUP	COMMENTS
GRAPES*				
Annual grass and broadleaf weeds	Preemergence	Karmex Diuron 80% (diuron) 1.6-4.8 lbs ai/a	(7)	Apply in spring prior to weed seed germination. Apply only in vineyards established 3 or more years with trunk diameters of 1.5 inches or more as band treatment to grape rows. Proper rates depend on soil texture.
Annual grass and broadleaf weeds	Preemergence	Princep (simazine) 1.98-4.77 lbs ai/a	(5)	Apply between harvest and early spring before weeds emerge. Plants must be established at least 3 years. Proper rate depends on soil texture.
Annual grass and broadleaf weeds	Preemergence	Devrinol 50 DF (napropamide) 4 lbs ai/a	(15)	Apply in the fall or early spring prior to weed emergence. Do not apply to frozen ground. Incorporate into soil by shallow cultivation or irrigation within 24 hours of application. Rainfall or irrigation is necessary for activation. May be applied to new planted vines. Do not apply within 35 days of harvest.
Annual grass and broadleaf weeds	Preemergence	Surflan 4AS (oryzalin) 2-6 lbs ai/a	(3)	Surface apply after existing weeds are killed by tillage or contact herbicide. One-half inch to 1 inch of rain or irrigation is required to move the herbicide into the weed germination zone. Duration of weed control is dependent on rate of application.
Winter annual grass and broadleaf weeds, some perennials	Preemergence Postemergence	Kerb 50W [r] (pronamide) 1-4 lbs ai/a	(15)	Apply in late fall after the fruit is harvested but prior to leaf drop and soil freeze up. Do not apply to vines less than 1 year old or within 6 months of spring transplanting or within 1 year of fall transplanting.
Annual broadleaf weeds	Preemergence Postemergence (weeds less than 4-leaf stage)	Goal 2XL (oxyfluorfen) 0.5-2 lbs ai/a	(14)	Apply in early spring when grapevines are dormant, before buds start to swell. Vines must be staked or trellised prior to application. Do not apply to vines established for less than 3 years unless vines are on a trellis at least 3 ft above the soil surface. Rate varies with application timing - see label.
Annual grass and broadleaf weeds	Preemergence	Treflan 4L (trifluralin) 0.5-2 lbs ai/a	(3)	Apply and incorporate prior to planting, or any time within 60 days before harvest. Rate depends on soil texture and amount of rainfall.
Annual grass and broadleaf weeds	Preemergence	Prowl 3.3EC (pendimethalin) 1.98-3.96 lb ai/a	(3)	Apply directly to ground under vines. For newly planted and first year vines, apply only when dormant. Do not apply within 1 year of harvest. Rate determines duration of control.
Annual grasses and broadleaf weeds and suppression of yellow nutsedge	Preemergence	Solicam DF (norflurazon) .98-3.93 lbs ai/a	(12)	Not within 2 years of establishment. Apply fall to early spring before weed emergence. Use lower rates on coarse soils. Rate depends on soil type. Do not use on sandy or gravelly soils. Do not use within 60 days of harvest.
Annual broadleaves and suppression of grasses	Preemergence Postemergence	Chateau 51 WDG (flumioxazin) 0.2-0.4 lbs ai/a	(14)	Do not apply after bloom unless with hooded or shielded application. Apply alone or tank mix with Roundup or Gramoxone. Do not incorporate. Do not allow drift to contact foliage or green bark. Always add crop oil or surfactant. Pre-harvest interval is 60 days.
Annual and perennial grasses	Postemergence	Fusilade DX (fluazifop-butyl) 0.09-0.375 lbs ai/a	(1)	Do not apply to crops to be harvested within 1 year of application. Apply as directed spray with appropriate crop oil, surfactant, or adjuvant. Growth stage and rates of application vary with location in state. Consult label.
Annual and perennial grasses	Postemergence	Poast 1.5 EC (sethoxydim) 0.18-0.47 lb ai/a + crop oil concentrate	(1)	Do not apply to crops to be harvested within 50 days of application. Apply to annual grasses up to 12 inches in height. Rate depends on grass species and height.
Annual and perennial grasses	Postemergence	Select 2EC (clethodim) 0.125 lb ai/a + Non-ionic surfactant at 0.25% v/v	(1)	Use in non-bearing planting. Rate depends on grass species and size. Direct spray at the base of plant near ground.

SMALL FRUITS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	MOA GROUP	COMMENTS
GRAPES*				
Annual and perennial broadleaf, grass and sedges	Post emergence	Touchdown (glyphosate) 0.18-3.75 lbs ai/a + surfactant	(9)	Use for site preparation. Do not allow spray to contact crop plants. Not within 14 days of harvest.
Annual grass and broadleaf weeds, suppression of perennials	Postemergence	Gramoxone Max [r] (paraquat) 0.66-1.0 lb ai/a + nonionic surfactant or crop oil concentrate	(22)	Apply as a coarse directed spray to thoroughly wet weeds and avoid drift injury. Treat when sucker growth is no more than 8 inches long. Avoid contact with desirable foliage.
Annual grass and broadleaf weeds, suppression of perennials	Postemergence	Roundup (glyphosate) 0.375-5 lbs ai/a	(9)	Apply as directed spray in established vineyards or for site preparation prior to transplanting. Do not treat within 14 days of harvest or when green vegetation, canes, or shoots are in spray zone. Rate varies depending on weed species and height. Do not allow spray or drift to contact immature wood or foliage.
Annual grass and broadleaf weeds, suppression of perennials	Postemergence	Rely (glufosinate) 0.75-1.5 lb ai/a	(10)	Do not apply within 14 days of harvest. Directed spray. Can be used for sucker control on mature vines - see label.
Annual Broadleaves	Postemergence	Aim 2EC (carfentrazone) 0.031 lb ai/a	(14)	Apply broadcast at base of trunks during dormant stage or with hooded shields between rows during growing season. Always add nonionic surfactant or crop oil. Tank mix with Roundup or Gramoxone for broader weed control. Pre-harvest interval is 3 days.
Broadleaf weeds	Preemergence	Gallery 75DF (isoxaben) 0.5-1 lb ai/a	(21)	For use in non-bearing crops. Apply late summer to early spring. Do not apply before soil settles in new plantings (newly planted vines).
Grasses and broadleaf weeds	Preemergence	Snapshot 2.5TG (premixes)	(3, 21)	For use in non-bearing crops. See labels for uses.
Annual and perennial grasses and broadleaf	Preemergence	Casoron 4 G (dichlobenil) 4-6 lbs ai/a	(20)	Rate and timing depend on weed species.
Annual and perennial grasses and broadleaf	Postemergence	Scythe (pelargonic acid) Rate depends on spray mixture concentration (no resistance group #)		Non selective, contact activity. Controls emerged green vegetation.

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

*Read and follow label directions, precautions and limitations. If label information contradicts information presented here, the label information takes precedence. Most herbicides have grazing restrictions and should not be used in pecan orchards that will be grazed. In general, any herbicide may be legally used in a tank mix, as long as the timing, rates, soil conditions, etc. do not violate the label instructions for each of the materials in the tank mix. However, THE USER ASSUMES ALL RISKS ASSOCIATED WITH TANK MIXES NOT SPECIFICALLY MENTIONED ON THE LABELS FOR THE MATERIALS IN THE MIX. It is advisable to check the compatibility of materials before application. Other brand names of several listed materials are available.

TREE FRUIT AND NUT CROPS WEED CONTROL SUGGESTIONS

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	MOA GROUP	COMMENTS
APPLES*, PEACHES*, AND PECAN*				
Annual grass and broadleaf weeds	Preemergence	Karmex (Direx or Diuron 80%) 1.6-3.2 lbs ai/a	(7)	Use as a single application directed spray in the spring under trees established one year or more for apples or three years or more for peaches and pecans. Apply to a clean soil before the weeds germinate. Do not apply to soils with less than ½ percent organic matter for pecans or 1 % for peaches and apples. Do not treat apple cultivars grafted on full-dwarfing rootstocks. Do not use within 20 days of harvest on peaches. Avoid contact with fruit or foliage. Do not graze. Do not use where subsoil or roots are exposed.
		Princep Caliber 90 (simazine) 1.58-3.96 lbs ai/a	(5)	One application per year. Use as a directed spray in the spring in orchards established 1 or more years for apples and peaches, 2 years for pecan. Do not graze or apply when pecans on ground. Apply before weeds germinate, or tank mix with paraquat to kill germinated weeds. Do not use on gravelly, sand, or loamy sand soil.
		Solicam DF (norflurazon) 1.97-3.93 lbs ai/a	(12)	Directed spray, late fall to early spring prior to weed emergence or tank mix with paraquat. May be used in newly planted apple orchards. Pecan and peach trees must be established at least 18 months before use. Avoid contact with fruit or foliage. Do not apply when nuts or fruit are on the ground at harvest or within 60 days of harvest. Must have rainfall or irrigation within 4 weeks.
		Surflan (oryzalin) 2-6 lbs ai/a	(3)	Work all trash and established weeds into the soil before applying Surflan. Apply the spray directly to the ground prior to weed emergence or tank mix with paraquat to kill germinated weeds. Do not graze or feed forage. MAY BE USED IN NEWLY PLANTED ORCHARDS. Requires rainfall.
		Prowl 3.3 EC (pendimethalin) 1.98-3.96 lb ai/a	(3)	Apply directly to ground under trees. Can be used on newly transplanted trees after ground has settled. Do not apply within one year of harvest. Rate determines duration of control.
Winter annual grass and broadleaf weeds, some perennials	Preemergence Postemergence	Kerb 50W [r] (pronamide) 1-4 lbs ai/a	(15)	Apply in late fall. Do not apply to trees established less than 1 growing season. See label. Apples and peaches only.
Annual grass and broadleaf weeds, suppression of perennials	Postemergence	Gramoxone Max[r] (paraquat) .625-1.0 lbs ai/a	(22)	Use as directed spray with a nonionic surfactant to kill small emerged weeds. Read the label first for special precautions when using this compound. Up to three retreatments may be used in peach. May be used as burn down with certain approved preemergence. Avoid contact with green tree stems, fruit, or foliage. Do not apply when nuts are on the ground or within 14 days of harvest on peaches. Do not graze.
Broadleaf weeds	Preemergence	Gallery 75DF (isoxaben) .5-1.0 lb ai/a	(21)	Apply before germination of broadleaf weeds or immediately after cultivation. Can be tank mixed with Surflan to control grasses. Do not apply to newly transplanted trees until rainfall settles soil. Apply to non-bearing trees only.
Annual grass and broadleaf weeds. Suppression of perennials.	Postemergence	Rely (glufosinate) .75-1.5 lbs ai/a	(10)	Apple and pecan only. Not within 1 year of transplanting. Not within 14 days of harvest. Do not graze or hay. Directed spray. Avoid contact with desirable vegetation. Controls suckers on mature trees. Retreatment required to control perennials. Label specifies tank mixes.

TREE FRUIT AND NUT CROPS WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE(S) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	MOA GROUP	COMMENTS
APPLES*, PEACHES*, AND PECAN* (Cont'd)				
Annual and perennial weeds	Postemergence	Roundup (glyphosate) 0.375-5 lb ai/a	(9)	Rate and time of application vary so consult the label. Avoid contact with foliage or green bark in apples and pecans, and avoid contact with any part of the tree in peaches. Shielded boom sprayer or wiper application advisable. The addition of 2% dry ammonium sulfate by weight or 17 lbs per 100 gal of water may increase performance. Preharvest interval pecan 3 days; peach 17 days; apple 1 day. See label.
Annual and perennial grasses	Postemergence	Poast (sethoxydim) .18 - .47 lbs ai/a	(1)	Apple and pear cannot be treated within 14 days of harvest, pecan within 15 days, peach 25 days. No grazing. Apply as directed spray with crop oil. Two applications generally required for control of perennial grasses.
		Fusilade DX (fluazifop-butyl) 0.094-0.375 ai/a	(1)	For nonbearing apples not to be harvested within one year. Peaches can be treated up to 14 days before harvest and pecans up to 30 days before harvest. No grazing. Apply as directed spray with appropriate crop oil, surfactant or adjuvant. Growth stage and rates vary with location in state. Two applications generally required for control of perennial grasses. Consult label.
Annual grasses, some perennial grasses, and broadleaf weeds	Postemergence	(MSMA) 2 lbs ai/a	(17)	Can apply up to 3 times per year. Apply when weeds are small and temperature is 80 F or above. Do not allow spray to contact leaves, stems or bark of trees. Do not graze or use around trees from which crop will be harvested within one year following application. Not for pecan.
Broadleaf weeds	Postemergence	Weedar 64 (dimethylamine salt of 2,4-D) 1.42 lbs ai/a	(4)	Study label carefully for proper application methods and weather conditions. Trees must be established for at least one year. Preharvest interval pecan 60 days; peach 40 days; and apple 14 days. Do not graze or feed cover crops.

[r] Restricted Use Pesticide

MOA Group Tables start on page 46 of the handbook.

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The following publications may be useful in planning a weed control program:

Guide to Effective Weed Control	PSS 2750
Calibrating a Low Pressure Ground Sprayer	BAE 1216
Weed Control in Pecans, Apples and Peaches	CR 6242

HOUSEHOLD PEST CONTROL SUGGESTIONS

Before using an insecticide within the home, read the precaution statement at the end of this section.
***NOTE:** An asterisk is used to indicate products for commercial applicators.

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Ants (indoors) Spring and summer	Bayer Advanced Home Pest Control Indoor & Outdoor Baygon 2% bait Catalyst* - 0.5% spray Combat Bait (0.9 hydramethylnon) Cynoff EC/WP* - 0.1% spray DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.015 to 0.03% spray Demon EC/WP* - 0.1% spray Dragnet FT* - 0.5%spray Drione Dust* - per label Dupont Advion Ant Gel Bait* - per label Kicker* - 0.25 to 4.25 oz/gal Ortho Ant-B-Gon bait – per label Ortho Home Defense MAX – per label Ortho Roach, Ant & Spider Killer – per label Pestab* - 0.015 to 0.03% spray Suspend SC* - 0.01 to 0.03% spray	Best control will result if the nest and/or entrance point is located and treated. For **carpenter ants** - properly labeled dust formulations applied to nest areas will generally provide the best control. For control of ants **outside**, see the section on Turfgrass. See EPP 7312 for comments on carpenter ants.
For Pharaoh ant	Suspend SC* - 0.01 to 0.03% spray Tempo Sc Ultra* - per label Boric acid bait methoprene (pharorid) bait or Hydramethylnon (MaxForce or Combat®) ant bait	Boric acid plus mint apple jelly (or Karo syrup) makes an effective bait. (3 tsp of boric acid plus 10 oz of jelly).
Bees Carpenter, or Honey bees (as swarming/nesting in a building)	Astro* - 0.5% spray Bee-Wasp Killer aerosols - various trade names Cynoff EC/WP/WBS* - 0.2% spray DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.015 to 0.03% spray Demon EC/WP/MAX/TC* - 0.2% spray Dragnet FT* - 0.5% spray Drione Dust* - per label Kicker* - per label Pestab* - 0.015 to 0.03% spray Pyrethrins 1% dust or 0.05 - 0.5% spray Resmethrin 0.25 - 3% spray Sevin 50 WP - 2 tbs/gal of water Sevin 5% dust Suspend SC* - 0.03% to 0.06% spray Talstar P* - 0.02 – 0.06% spray Tempo Sc Ultra* – 0.05%	**Outdoors:** Spray or dust into opening where bees have established their nest. Treat after dark when bees are calm and temperature is lower. See EPP 7317, Honey Bees, Bumble Bees, Carpenter Bees, and Sweat Bees for more information. Swarms of honey bees on shrubs or other structures can be hived by experienced beekeepers (they may charge a fee). For carpenter bees – plug nesting holes with wooden dowels or expandable styrofoam (aerosol) after treatment. For carpenter bees (per label directions). **NOTE:** Reportedly, two tablespoons of liquid detergent per gallon of water used as a spray to saturate honey bees, bumble bees and most wasp species works well as an alternative control measure.
Bedbugs All year	Bayer Advanced Home Pest Control Indoor & Outdoor DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - per label Dragnet FT* - 0.5% spray Drione* - dust - per label Kicker* - per label Pestab* - per label Pyrethrins - per label Resmethrin - 0.3% spray per label Suspend SC* - 0.03 to 0.06% spray Tempo Sc Ultra* - 0.025 - 0.05% spray	**Thoroughly but lightly spray springs, slats and bed frames, cracks and crevices around doors, window casings, base-boards and to mattress tufts and seams. NOTE: For heavy infestations it is recommended that a professional pest control firm be secured to treat the building.**

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Boxelder bugs and Redshouldered bug (outside - before they enter the home) Late summer or early fall	Astro* - 0.5% spray Bayer Advanced Home Pest Control Indoor & Outdoor Catalyst* - 0.5% (as spot, crack, and crevice only) Cynoff EC/WP* - 0.1% spray DeltaDust* - 0.05% (deltamethrin) DeltaGard Granules* - per label Demand CS/EZ* - per label Demon EC/WP/MAX/TC* - 0.1% spray Dragnet FT* - 0.5% spray Drione* - dust - per label Orthene Turf, Tree & Ornamental - per label Ortho Home Defense MAX – per label Pestab* - per label Sevin 50% WP - 8 to 10 tbs/gal of water Suspend SC* - per label Tempo Sc Ultra* -0.025 – 0.05% spray	Problem originates from outside. Bugs enter buildings in search of suitable overwintering sites. Removal of female boxelder and golden rain trees from close proximity to the house will help reduce problem. Also plug openings around windows, doors, etc. and caulk cracks and other points of entry. **Outside**: treat ground cover, tree trunk and foundation walls starting when bugs are first seen (which is frequently March/April and again in Sept.). Repeated treatments directed at the clusters of bugs will likely be needed to control the pest. **Inside:** The best results are obtained by vacuuming or sweeping up the insects.
Carpet beetles All year	Bayer Advanced Home Pest Control Indoor & Outdoor Catalyst* - 0.5% spray DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.015 to 0.03% spray Dragnet FT* - 0.5% spray Kicker* - per label Malathion 57% EL - 6 oz/gal of water Ortho Home Defense MAX – per label Ortho Roach, Ant & Spider Killer – per label Pestab* - 0.015 to 0.03% spray Pyrethrin - 1% spray Resmethrin - 3% spray Suspend SC* - 0.01 to 0.03% Tempo Sc Ultra* - 0.025 – 0.05% spray	Thoroughly clean at regular intervals. Vacuum rugs before treatment (both sides where possible). Spray infested mats or rugs lightly. Dry clean furs, blankets, and other garments. Naphthalene or paradichlorobenzene balls, flakes or crystals in air tight containers will help protect woolens and other stored materials. **NOTE:** Read labels carefully before applying any product on a carpet. **Specifically check for comments on potential staining**.
Centipedes and Millipedes Spring through summer	**Outside** Astro* - 0.5% spray Cynoff EC/WP - 0.1% spray DeltaDust* - 0.05% (deltamethrin) DeltaGard Granules* - per label Demand CS/EZ* - 0.015 to 0.03% spray Demon EC/WP/MAX/TC* - 0.1% spray Dragnet FT* - 0.5% spray Drione* - dust - per label Kicker* - per label Pestab* - 0.015 to 0.03% spray Sevin 50% WP - 2 tbs/gal of water Suspend SC* - 0.01 to 0.03% spray Tempo Sc Ultra* - 0.025 - 0.05% spray **Inside** - see comments	Treat outside around foundation and out into lawn. Remove all mulch compost, lumber, and piles of debris. Granules should be applied as a 5 ft band next to house foundation. **NOTE:** Millipedes and centipedes can be difficult to control. One cannot count on residuals to provide total control. Usually best results are obtained with treatments (which may mean repeated applications) that actually hit or come in direct contact with these pests. **Inside**: Some reduction will be seen by treating door thresholds, baseboards, cracks and crevices with ready-to-use spray or aerosols that contain Malathion and Ortho's Total Flea Killer, Ortho's Flying Insect Killer, Ortho Home and Garden Insect Killer, Ortho Flea-B-Gon Flea Killer or DeltaDust.
Clothes moths All year	DeltaDust* - 0.05% (deltamethrin) Kicker* - per label Malathion 57% EL - 6 oz/gal of water Pyrethrins - aerosol/spray - per label Suspend SC* - 0.03 to 0.06% spray Tempo Sc Ultra* - 0.025 - 0.05% spray	Apply to cracks and crevices in closets. Larval stages feed upon wool, mohair, fur, silk, feathers and nonsynthetic carpets. Good housekeeping and thorough cleaning help reduce chance of infestations. Apply Malathion as a residual treatment in closets and other areas as noted on label. Properly labeled Methoxychlor can be sprayed directly on clothing. Also, Paradichlorobenzene flakes or crystals at 1 lb per 100 sq ft of storage area can be used as for carpet beetles. **NOTE:** Check labels for possible stain warning statements for materials you apply to clothing. **NOTE:** Remove all susceptible garments before treatment. Dry clean before storage.
Cockroaches **NOTE: See Roaches**		

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Clover mites Spring through early fall	Delta Guard Granules* - per label Demand CS/EZ* - per label Ortho Lawn & Garden Insect Killer – per label Pestab* - per label Pyrethrins or Allethrin per label **Outside:** See section of Turf Pests	Larger, reddish-brown mite with long front legs. If crushed, leaves an orange-colored stain. Problem originates outside the home. See section on Turfgrass for controls outside. Also, keep grass and shrubs from direct contact with house. Good weed control in turf and a vegetation free border of 18 inches around the house will help.
Crickets	Astro* (outdoors) – 0.5% spray Bayer Advanced Home Pest Control Indoor & Outdoor Baygon 2% bait Catalyst* - 0.5% spray Cynoff/EC/WP* - 0.1% spray DeltaDust* - 0.05% (deltamethrin) DeltaGard Granules* - per label Demand CS* or Pestab* - per label Demon EC/WP/MAX/TC* - 0.1% spray Dragnet FT* - 0.5% spray Drione* - dust - per label Kicker* per label Niban Granular Bait* Ortho Home Defense MAX – per label Ortho Roach, Ant & Spider Killer – per label Suspend SC* - 0.03 to 0.06% spray Talstar P* - 0.02 – 0.06% spray Tempo Sc Ultra* 0.025 – 0.05% spray	Apply to possible hiding places (cracks and crevices in the home). Larger (older) crickets can be difficult to control. Need to try to control with band/lawn treatments to keep crickets from entering home (e.g., Malathion, Sevin or Yardex sprays outside). Use Niban bait per label directions. Other Ortho products for crickets include: Hi-Power Indoor Insect Fogger; Home & Garden Insect Killer, and Ortho Ant Stop/Ant Killer.
Drain flies (also called sewer flies or moth flies) All year	Dragnet FT* - 0.5% spray Kicker* - per label Pyrethrins or Resmethrins (aerosol sprays)	Space sprays will help control adults. However, one needs to clean up breeding areas, e.g., clean gelatinous film from drains and sinks, and flush with boiling water. A lye solution flushed down drains will help kill larvae. Clean garbage containers regularly. Do not allow wet lint to accumulate under washing machine/dryer. Avoid accumulation of moist debris/organic matter.
Fleas All year	Aerosols and self-release bombs that contain Pyrethrins. Astro* - per label (outdoors) Bayer Advanced Home Pest Control Indoor & Outdoor (outdoor) DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.03% spray (outdoors only) Demon EC/WP/MAX/TC - 0.1% outdoor use only Ortho Home Defense MAX – per label Pestab* - 0.03% spray (outdoors only)	Pets and generally the lawn or kennel area need treatment. See the sections on Pets and Turfgrass for flea control suggestions in lawns and kennels.

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Fleas (cont'd) All year	Dragnet FT* - (indoors) 1.6 oz/gal of water (1 gal of spray over 800 to 1,600 sq ft) Drione* - dust - per label Kicker* - per label Methoprene (Precor/Vigren) room fogger Petcor - pyrethrin plus methoprene as an on-animal spray Precor 1% EC Pyrethrins - 0.1% to 0.25% spray Sevin 5% dust - per label Sevin 50WP - 1 tsp/gal Suspend SC* - 0.03 to 0.06% spray Talstar P* - 0.02 – 0.06% spray Tempo Sc Ultra* – 0.025 – 0.05% *Americare products:* Flea and Tick Lawn Spray Advanced Outdoor Flea Spray Flea and Tick Shampoo Plus Flea Kill Mist *Basus products:* House and Kennel Aerosol Spray Flea and Tick Spray for Dogs *EctoGuard products:* House and Carpet spray, fogger and pet spray	**NOTE:** For heavy flea infestations in the home or yards, it is often advisable to employ a pest control company. Also, before applying any insecticide on a carpet, read the product label carefully for comments or warnings about potential staining. Vacuum carpet thoroughly prior to treatment and discard the used vacuum cleaner bag. **NOTE:** (1) The methoprene foggers aid in control of larvae (not for control of adults unless label states it contains an adulticide). If only a methoprene fogger is used, an adulticide treatment may be needed in 7 to 14 days. (2) Insect Growth Regulators - products containing methoprene and fenoxycarb are highly recommended as part of a flea control program. **Apply Ortho, Americare, Basus and EctoGuard products per the label(s) and note precaution statements.**
Flies Adults Spring to fall (hard freeze) Fly Larvae	Cynoff EC/WP/* - 0.1% spray Demand CS/EZ* - per label Demon EC/WP/MAX/TC* - 0.1% spray Kicker* per label Ortho Flying Insect Killer Ortho Home Defense MAX – per label Pestab* - per label Pyrethrins as aerosol bombs/sprays Suspend SC* - 0.03% to 0.06% spray Tempo Sc Ultra* - 0.025 – 0.05% spray Dimethoate 4E per label	These materials will help kill adult flies but elimination of larval breeding sites and entry points will be needed for lasting control. Also, commercial fly baits and sticky traps may be helpful to control adults. Per label. Treat garbage bins/areas, animal excrement and practice good sanitation around the home. Remove all rotting organic material from around the property.
House Plant Pests (e.g., spider mites, mealybugs, whiteflies, aphids and thrips)	Bayer 3-in-1 Insect, Disease & Mite Control Concentrate DeltaDust - per label Insecticidal soap (e.g., Safer's) Merit 75WP* - per label Neem products (e.g., Safer, Bioneem or Neemis) - per label Ortho Rose & Flower Insect Killer – per label Ready-to-use sprays or aerosols that contain: Pyrethrins + Piperonyl butoxide or Rotenone or Resmethrin	Repeat applications may be needed at 5 to 7 day intervals until control is achieved. **NOTE:** Use caution on young plants and new growth and check label for plants that can be treated. Read label carefully before purchase of a chemical to insure it can be used on plant(s) to be treated. **NOTE:** Commercial applicators can use Tempo 2 or 20WP* for plantscapes (such as hotels, shopping malls, office buildings, etc.) where plants are grown.
Lice (e.g., head or pubic lice)	Inside treatments normally not required.	Lice and their eggs (nits) are reported to be killed within 10 minutes when infested clothing/bedding is laundered in 125°F or hotter water. For information on control of lice on the body, call your physician, county health officials and/or ask your pharmacist for a properly labeled medicated shampoo, ointment or lotion.

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Mites	DeltaDust* - 0.05% (deltamethrin) Suspend SC* - per label TAME 2.4EC^{r}* - per label	Mites occasionally are found indoors because rodents or birds build nests inside, under or close to structures. Some blood-feeding species will feed on humans. Animal nests should be removed, and following thorough cleaning the cracks and crevices around the infested area should be treated. See section on turf for clover mite control outdoors. See earlier entry on clover mites.
Mosquitoes Gnats and midges (Adults) Spring and summer	Bayer Advanced Mosquito Killer Plus Outdoor Fogger Cynoff EC/WP Power Spray* - per label Demand CS/EZ* - 0.015 to 0.03% spray Demon EC/WP/MAX/TC* - 0.1% spray Kicker* - per label Malathion 57% EL - 5 tbs/gal water Ortho Flying Insect Killer Ortho Home Defense MAX – per label Ortho Mosquito-B-Gon Tree & Shrub Pestab* - 0.015 to 0.03% spray Pyrethrins - aerosol bombs/sprays Sevin - 1% spray Suspend SC* - 0.03 to 0.06% Tempo Sc Ultra* - 0.025 – 0.05% spray Trumpet EC* - per label	Cynoff, Commodore*, and Demon* are labeled for <u>outdoor</u> mosquito control for commercial applicators only. **<u>outdoors</u>**: **NOTE:** Refer to EPP 7012 for more detail on mosquito control. For adults, spray screens, shrubs and around doors and windows with space sprays of Malathion or Pyrethrins.
Mosquito larvae	Altosid* - per label as liquid, pellets, or briquets. Bacterial insecticide (*Bacillus thuringiensis* var. *israelensis* - apply per label Bayer Advanced Mosquito Preventer Granules Malathion 57% EL - 13 oz per acre	Treat temporary rain pools, intermittently flooded areas, stagnant water, etc. Drain or fill low areas where water collects and empty or remove artificial containers (old tires, tin cans, etc.). Mosquito Dunks - B.t.i. product is available for use in breeding sites. Other B.t.i. products: Bactimos, Vectobac, and Teknar.
Pantry pests (Pests of stored food products, e.g., flour beetles, weevils, mealworms/moths, bran bugs, etc.) All year	Bayer Advanced Home Pest Control Indoor & Outdoor Catalyst* - 0.5% spray DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.015 to 0.03% spray Dragnet FT* - 0.5% spray Drione* dust - per label Gentrol 4% EL - 0.06% dilution (hydroprene - IGR) Kicker* - per label Ortho Home Defense MAX – per label Pestab* - 0.015 to 0.03% spray Pyrethrins - aerosol bombs/sprays Resmethrin - 0.25% ready-to-use spray or fogger Suspend SC* - 0.01 - 0.03% spray Tempo ScUltra* - 0.025 – 0.05% spray	Remove and destroy infested material (e.g., flour, cereal, pepper, spices, nuts, mixes, grits, or dry pet food, etc.) Read label carefully for directions on where treatment can be placed and before treating remove food and utensils from storage shelves, drawers, etc. <u>Heat treatment</u> - Infested material can be heated in the oven in a shallow/flat container at 130° - 150°F for one-half hour, or use a preheat setting of 30 to 45 seconds in a microwave oven. Then remove and store in a container with a tight fitting lid. Prolonged exposure of infested material to <u>freezing</u> <u>temperatures</u> (as in a deep freeze for 7 to 10 days) also helps reduce these pests.
Powder post beetles (Lyctids) All year	Demon TC at 0.1 to 0.25% Dragnet FT* - 0.5% spray Suspend SC* at 0.06% Tempo Sc Ultra* - 0.025 – 0.05% spray Tribute* - per label	Due to the limited products available to homeowners that will provide adequate control of powder post beetles, it is suggested that people consider hiring a pest control firm to treat heavy infestations. See Note #6 at end of section.

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Roaches (cockroaches or waterbugs) All year	Avert bait* - placements per label (Abamectin B1 - mixture of avermectins) Bayer Advanced Home Pest Control Indoor & Outdoor Baygon 2.0% bait* BioPath* (microbial bait stations) Catalyst* - 0.5% spray Cynoff EC/WP* - 0.1 to 0.2% spray DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.015 to 0.06% spray Demon EC/WP/MAX/TC* - See label Dragnet FT* - 0.5% spray Drione Dust - per label Dupont Advion Cockroach Gel Bait* - per label Gentrol - 0.06% dilution (hydroprene - IGR) Kicker* - per label Hydramethylnon (e.g. Combat or MaxForce) bait stations - per label directions. Niban Granular bait* Ortho Home Defense MAX – per label Ortho Roach, Ant & Spider Killer – per label Pestab* - 0.015 to 0.06% spray Silica gel powders Suspend SC* - 0.03-0.06% spray Tempo Sc Ultra* - 0.025 – 0.05% spray **Note on Ultrasonic Devices**: Research at OSU and some other institutions has not shown these devices to be effective or practical.	**NOTE:** Roach Sticky Traps can help with roach control and as indicators of roach problems. BioPath is a biocontrol bait station containing a fungus to control cockroaches. Use per label directions. Products containing Hydroprene (Gentrol - with Gencor), a growth regulator, can be helpful in controlling cockroach populations. Use Niban bait per label direction (made by Nisus Corp.) Use precautions to keep chemical out of food, spices, and off of dishes or eating utensils. Treat cracks and crevices and all potential hiding places. Make food and water sources inaccessible to roaches through good sanitation. There are some products labeled for roach control that contain **boric acid**; however, although effective they are slow in killing action. Sanitation/clean-up will help reduce problems with cockroaches.
Scorpions Summer	**Inside the Home**: Bayer Advanced Home Pest Control Indoor & Outdoor Cynoff* - per label directions DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.06% spray Demon EC/WP/MAX/TC - per label Dragnet FT* - 0.5% spray Ortho Home Defense MAX – per label Pestab* - 0.06% spray Suspend SC* - 0.03 to 0.06% spray Talstar P* - 0.02 – 0.06% spray Tempo Sc Ultra* - 0.025 – 0.05% spray **Attics or Crawl Spaces**: DeltaDust* - 0.05% (deltamethrin) Drione* - dust - per label **Outside the Home**: Astro*[r] – 0.5% spray DeltaDust* - 0.05% (deltamethrin) DeltaGard Granules* - per label Demand CS/EZ* - 0.06% spray Dragnet FT* - 0.5% spray Drione* - dust - per label Malathion 50 or 57% EL - 6 oz/gal of water Pestab* - 0.06% spray Sevin 50% WP - 2 tbs/gal of water Suspend SC* 0.03 to 0.06% Talstar P* - 0.25 – 0.5 oz/100 square feet Tempo Sc Ultra* - 0.025 – 0.05% spray	Clean up cluttered areas outside (such as accumulations of lumber, boxes, rags, bricks, etc.) and inside (as closets, basements and enclosed porches, etc.). Treat baseboards, moldings and cracks and crevices where scorpions can hide indoors. Outside make band treatments around the foundation wall and out into the lawn (may need retreatment every 10-14 days). If treatment is needed underneath a house's crawl space, one is advised to employ a pest control firm. Scorpions can be difficult to control.

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Silverfish or firebrats	Catalyst* - 0.5% spray Cynoff EC/WP* - 0.1% spray DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - 0.015 to 0.03% spray Demon EC/WP/MAX/TC* - 0.1% spray Dragnet FT* - 0.5% spray Drione* - dust - per label Malathion 57% EL - 6 oz/gal of water Niban Granular Bait* Ortho Home Defense MAX – per label Pestab* - 0.015 to 0.03% spray Products containing Resmethrin - per label Silica gel powders (aerogel) Suspend SC* - 0.01 to 0.03% spray Tempo Sc Ultra* - 0.025 – 0.05% spray **Attic** DeltaDust* - 0.05% (deltamethrin) Drione* - dust - per label Niban Granular Bait*	Treat cracks, crevices, moldings, etc., in closets, storerooms, pantry, water tank closets, and basement. Also treat baseboards, window frames and other hiding areas throughout the house. In most cases the attic needs to be treated with a fogger or duster. Use Niban Bait per label directions (made by Nisus Corp.). If one does not have the necessary equipment or a respirator, they may want to have a pest control firm treat the attic.
Slugs and Snails Spring through fall	Deadline Bug Bait	Generally only accidentally wander into homes. Usually problem is from outdoors or underneath crawl space homes because of excessive moisture. Heavy mulch and continuous damp conditions favor build-up of these pests. **NOTE:** A 50% dilution of vinegar and diluted ammonia is reported to kill slugs.
Spiders All year	Astro*- per label Bayer Advanced Home Pest Control Indoor & Outdoor Catalyst* - 0.5% spray - per label Cynoff EC/WP* - 0.1 to 0.2% spray DeltaDust* - 0.05% (deltamethrin) DeltaGard Granules* - per label Demand CS/EZ** - per label Demon EC/WP/MAX/TC* - per label Dragnet FT* - 0.5% spray Drione* - dust - per label Ortho Home Defense MAX – per label Pestab* - per label Products containing Resmethrin - per label Suspend SC* - 0.03 to 0.06% spray Tempo Sc Ultra* - 0.025 – 0.05% spray	Clean up debris and cluttered areas in and around the outside of home. Also, clean out attics, basements and closets. Treat cracks and crevices of baseboards, moldings, etc. and all potential hiding areas. Band treatment around outside foundation wall and out into the lawn will help keep spiders from wandering into the home.

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

PEST AND TIME MOST PREVALENT	INSECTICIDE AND FORMULATION	COMMENTS
Termites	Several termiticide products the pest control companies currently use for treatments directly to soil, or for above-ground applications inside wall voids, include (by manufacturer): *BAYER* Premise* Premise Foam* Premise Granules* *BASF* Termidor 80 WG* Termidor SC* Phantom* Subterfudge* *DOW* Sentricon Termite Bait System* Hex-Pro Termite Bait System* *ENSYSTEX* Exterra Termite Bait System* *ENVIRONMENTAL SCIENCE* DeltaDust* - 0.05% (deltamethrin) Suspend SC* - 0.06% Tribute* (fenvalerate) *FMC* Firstline Termite Bait System* Dragnet* Talstar Professional Insecticide* Prevail* Transport Termiticide* *SPECKOZ* Permethrin TC *SYNGENTA* (Demand CS*) for above the ground use only. Demon MAX/TC* (cypermethrin) **NOTE:** Read comments and Note 4 following this section.	Termiticide is applied to the soil by trenching, or trenching and rodding, Borate products for surface treatments to wood: Nisus Corp. - BoraCare* & Tim-Bor* Incide Technologies - Board Defense* (around the exterior and interior of foundation walls, piers, etc.), and drilling through concrete patios, walkways, and garage floors, etc., that are adjacent to foundations, to form a continuous barrier to prevent termite movement from the soil to structural timbers. However, experience and specialized equipment are required to make thorough treatment for termites. Therefore, it is recommended that a licensed pest control company be employed to treat a structure for termites.
Ticks (Brown dog ticks inside) Tick activity is primarily from late spring to early fall.	Bayer Advanced Home Pest Control Indoor & Outdoor Cynoff EC/WP* - per label DeltaDust* - 0.05% (deltamethrin) Demand CS/EZ* - per label Demon EC/WP/MAX/TC* - 0.2% spray Dragnet FT* - 0.5% spray Drione Dust - per label Kicker* - per label Ortho Home Defense MAX – per label Pestab* - per label Suspend SC* - 0.03 to 0.06% spray Tempo Sc Ultra* - 0.025 – 0.05% spray	Apply to cracks and crevices or areas where ticks are observed in the building. Pets, the lawn and kennel areas should also be treated. For tick control on animals, see the section on Pets. For tick control outside as in the lawn, see the section on Turfgrass.
Wasps Late spring to early fall	Aerosol bombs or sprays - as those containing Pyrethrins, Tetramethrin, Baygon, or Resmethrin. Astro* (outdoors) – 0.5% spray Bayer Advanced Home Pest Control Indoor & Outdoor Cynoff EC/WP* - 0.2% DeltaDust* - 0.05% (deltamethrin) Demon EC/WP/MAX/TC* - 0.2% spray Demand CS/EZ* - 0.015-0.03% spray Dragnet FT* - 0.5% spray Drione* - dust - per label Kicker* - per label Ortho Hornet & Wasp Killer Pestab * - 0.015 – 0.03% spray Suspend SC* - 0.03 - 0.06% spray Tempo Sc Ultra* - 0.025 – 0.05% spray	Apply chemical directly to nests or resting wasps. If possible, make treatment after dark. Remove nest when no activity is observed. See EPP 7305, Stinging Wasps and Bees, for more information.

HOUSEHOLD PEST CONTROL SUGGESTIONS (CONT'D)

NOTE:

1. *Products marked with an asterisk are suggested for commercial applicators.
2. CAUTION - when using an insecticide within the house, you should always consider the possibility of damage to woodwork, tile, carpet or fabric. If in doubt about the possible damaging effects of a chemical on household items, and the product label does not specifically caution about possible damage, one should select an inconspicuous area and spray a small area or portion of a fabric and observe for damage. Also, be sure to consider the safety of children and pets (dogs, birds, fish, etc.) before using an insecticide inside the home.
3. EPP 7312, 7012, 7305, 7306, 7301, 7303, and 7001 can be used by homeowners to supplement this section.
4. Other comments on termites:
   A. Since subterranean termites nest in the soil and cannot survive long when they are cut off from their nest, control is a matter of constructing a barrier between the soil and the building. This barrier can be structural, chemical or both.
   B. Never leave wood in contact with soil. All outside steps, porches, and floor props should be put on at least 6 inches of concrete.
   C. Buildings should be checked **periodically** for termites or their damage. Look for termite tubes that may have been built over concrete or brick surfaces and check for damaged wood. Use an ice pick, screwdriver or pocket knife to check wood for termite damage.
   D. USDA Home and Garden Bulletin No. 64, entitled "Subterranean Termites - Their Prevention and Control in Buildings," provides basic information on how and where to treat for termites. The bulletin tells how to treat existing structures (slab and crawl space) and how to pre-treat new construction. Some extension offices have copies of the bulletin or they can be ordered from the Superintendent of Documents, U.S. Printing Office, Washington, D.C. 20402. Also, OSU Circular E-918 contains a section on subterranean termites in which biology and life cycle information is presented.
   E. Commercial use of chlordane was canceled as of April 15, 1988. Homeowner-use products containing chlordane can be used up for termite control on the individual's private residence (as long as the product is used according to label instructions).
   F. Swarmer (winged, sexual forms) termites emerge/swarm most commonly from April to early June (especially following rainy periods); however, historical records show that swarming termites have been reported during every month of the year. **NOTE:** Also, swarmers/winged forms commonly will swarm from weeks to a few months after a building is treated for termites (because some of them are isolated up in the upper structure above the soil and also it is thought that moisture associated with the actual chemical treatment may continue to stimulate the termites to emerge).
5. Some of the chemicals may appear as follows on product labels:
   Baygon - Propoxur or 2-(1-Methylethoxy) phenyl methylcarbamate.
6. Powderpost Beetles - For new construction, use kiln dried lumber (minimum of 8 hours at 130° to 140°F and 80% relative humidity); or use wolmarized, pressure-treated wood (with chromated copper arsenate).

This section has not been revised since 2006.

INSECT CONTROL SUGGESTIONS FOR ORNAMENTALS - TREES, SHRUBS AND FLOWERS (FOR HOMEOWNERS)

INSECT AND TIME MOST PREVALENT	INSECTICIDE, FORMULATION AND MIXING INSTRUCTIONS	COMMENTS
Ants Spring and summer (See Turf Section for control suggestions for Red Imported Fire Ants)	Bayer Advanced Power Force Multi-Insect Killer (cyfluthrin) – apply per label Ortho Bug-B-Gon Max Garden and Landscape Insect Killer (esfenvalerate) – per label Maxforce Carpenter Ant Bait Gel (fipronil) – per label Ortho Orthene Fire Ant Killer (acephate) – 1 tsp per mound Ortho Bug-B-Gon Multi-Purpose Insect Killer Ready Spray (permethrin) – per label	Apply to soil along sidewalks, around foundations of buildings, or in lawns and plant beds (spot spray or drench ant hills). See section on turfgrass for other suggestions.
Aphids (Plant lice) During growing season	Insecticidal Soap - 49% or 50.5% - 5 to 6 tbs per gal of water (check label for mixing instructions) or 2% ready-to-use spray Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 2 tbs per gal of water Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – per label Neem products (e.g., Safer's Bioneem or Neemisis) - per label Orthene Orthenex Garden Insect and Disease Control (resmethrin + acephate) – per label	Aphids secrete honeydew (sticky, sugar-like material that often spots cars parked under infested trees). Aphids generally attack the tender terminals and leaves. Leaves may twist and curl and become distorted. **NOTE:** Carefully read label of malathion products for phytotoxicity statements. **NOTE:** Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia. Also, light infestations of aphids can often be removed from foliage by using forced water spray from a high pressure hose.
Bagworms May through September	*Bacillus thuringiensis* (B.t.) var. *kurstaki* – bacterial insecticide (e.g., Javelin or Dipel) – apply per label Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – per label Ferti-Lome Borer, Bagworm, Leafminer and Tent Caterpillar Spray (spinosad) Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control – 2 tbs per gal of water Bayer Advanced 2-in-1 Insect Control Plus Fertilizer Plant Spikes (imidacloprid) – per label Sevin 50% WP (carbaryl) - 2 tbs per gal of water (See note at end of section on Sevin 50W)	Apply chemical early while worms/bags are still small (e.g., late May or early June). When worms are larger repeat spraying may be needed in 7 to 10 days. Common pests on cedars, arborvitae, and sometimes feed on bald cypress, elms, pines, willows, maples, sycamores, and other trees. **NOTE:** Carefully read label of malathion products for phytotoxicity statements.
Borers flat-headed round-headed wood borers and shot-hole borers	Bayer Advanced Tree & Shrub Insect Control (imidacloprid) – apply per label	Use as drench around base of trunk for roundheaded and flatheaded borers only. Determine rate based on the trunk diameter or height of shrub.
Spring through fall Iris Borer **NOTE:** For elm bark beetle see twig girdlers Bark beetles in pines (Bark borers)	<u>Ash/Lilac borer - in Ash</u> - Acecap 97 Systemic Insecticide Implants or Bonide Systemic Insecticide Bullets (acephate) – apply per label <u>In Lilac</u> - Hi-Yield Indoor/Outdoor Broad Use Insecticide (permethrin) can be used by commercial applicators in ash and lilac. Beneficial nematodes (e.g., Ecomask and Scanmask, IPM Labs) – dissolve medium in water; apply to moist soil using hose-end sprayer, pump sprayer, or watering can after iris leaves are almost fully expanded but before flowering; repeat approx. 1 week later.	As a preventative measure, it is helpful to treat trees periodically and burn infested twigs or limbs. Also insure health of trees with proper watering and fertilizer. Entomophagous nematodes (*Steinernema* and *Heterorhabditis* species) are tiny roundworms and are available in garden supply catalogues, garden centers, and online. Levels of control vary, but nematodes function best at soil temperatures between 60° and 93°F. See OCES Fact Sheet HLA 6434 for more information about beneficial nematodes.

This section has not been revised since 2006.

INSECT CONTROL SUGGESTIONS FOR ORNAMENTAL - TREES, SHRUBS AND FLOWERS (FOR HOMEOWNERS) (CONT'D)

INSECT AND TIME MOST PREVALENT	INSECTICIDE, FORMULATION AND MIXING INSTRUCTIONS	COMMENTS
Boxelder Bug Best control is achieved if one treats for the young nymphs in early summer.	Bayer Advanced Power Force Multi-Insect Killer – apply per label Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – per label Acephate products (e.g., Orthene Turf, Tree and Ornamental Spray) – 1.5 tsp per gal of water	Residual sprays on surfaces for fall migrations do little or no good. The adults are extremely difficult to kill. **NOTE:** Carefully read label of malathion products for phytotoxicity statements.
Caterpillar/worm pests: cankerworms, webworms, tent caterpillars, leafrollers/tiers, and sawflies. Spring through summer	Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – apply per label Bayer Advanced Power Force Multi-Insect Killer – per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Ortho Bug-B-Gon Max Garden and Landscape Insect Killer – per label Sevin 50% WP (carbaryl) - 2 tbs per gal of water Ferti-Lome Borer, Bagworm, Leafminer and Tent Caterpillar Spray (spinosad) Spectracide BugStop Multi-Purpose Insect Control (permethrin) – per label *Bacillus thuringiensis* (B.t.) var. *kurstaki* – bacterial insecticide (e.g., Javelin or Dipel) – per label Neem products (e.g., Safer's Bioneem or Neemisis) - per label	**NOTE:** Carefully read label of malathion products for phytotoxicity statements. **NOTE:** Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia. Check label of specific product before use to insure it's labeled for use on the plants to be treated. See note at end of section on Sevin 50W. B.t. is a bacterial insecticide, labeled for webworms, tent caterpillars, and cankerworms. It stops worms from feeding, but has a delayed killing action.
Cutworms (In flowers) Early spring	Ortho Bug-Geta Plus Snail, Slug and Insect Killer (carbaryl + metaldehyde) granules – 1 lb per 2,000 sq ft. Bayer Advanced Power Force Multi-Insect Killer – per label	Ortho Bug-Geta Plus is recommended for use with a spreader (see label).
Elm leaf beetle, willow leaf beetle, elm calligrapha beetle (Leaf feeding beetles) Late spring to late summer **NOTE:** Elm bark beetle (Dutch elm disease vector - see twig girdler.)	Bayer Advanced Tree & Shrub Insect Control (imidacloprid) – apply per label Bayer Advanced Power Force Multi-Insect Killer – per label Di-Syston 15G (disulfoton) – 2.5 oz per inch of trunk diameter (read comments) Acecap 97 Systemic Insecticide Implants or Bonide Systemic Insecticide Bullets (acephate) – apply per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control – 3 tbs per gal of water Sevin 50% WP - 2 tbs per gal of water	Use as a drench around base of trunk. Determine rate based on the trunk diameter or height of shrub. For elm leaf beetle – Di-Syston 15G should be applied by a commercial applicator. Apply in late March or early April and water in thoroughly; observe all precautions on label. **NOTE:** Di-Syston as 1-2% granules may be available for homeowner use in some areas. Acephate is labeled for Siberian and Chinese elms. Do not apply acephate products to American elm. For best control of elm and willow leaf beetles, apply chemical right after eggs hatch (as a general rule this will be during the last week in May or the first of June). See note at end of section on Sevin 50W.
Flea beetles (flowers) Summer	Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control – 3 tbs per gal of water Spectracide Triazicide Once and Done Insect Killer (cyhalothrin) – apply per label Sevin 50% WP - 2 tbs per gal of water	See note at end of section on Sevin 50W.

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INSECT CONTROL SUGGESTIONS FOR ORNAMENTALS - TREES, SHRUBS AND FLOWERS (FOR HOMEOWNERS) (CONT'D)

INSECT AND TIME MOST PREVALENT	INSECTICIDE, FORMULATION AND MIXING INSTRUCTIONS	COMMENTS
Galls During growing season.	Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – apply per label Dormant oil 97% (e.g., Gordon's Dormant Oil Spray) - per label (Superior oil grade of 60 or 70 or one specifying unsulfonated residue of 91or 92%) Dormant lime sulfur (e.g., Bonide Lime Sulfur Spray) – per label	**NOTE:** Carefully read label of malathion products for phytotoxicity statements. The chemicals listed, if applied in early spring (bud swell), then again at bud break, and again when leaves are about half grown, will help reduce gall problems. These materials will not generally provide direct control of gall forming insects. However, they help tree health by reducing problems with scale insects and killing overwintering eggs of many pests, if applied in late winter or just before spring growth starts. **NOTE:** Do not apply dormant oil or lime to actively growing plants. Do not apply dormant oil to broadleaf evergreens, maple, mountain ash, or beech.
Grasshoppers June to fall	Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 2 tbs per gal of water Sevin 50% WP (carbaryl) – 3-4 tbs in 3 gal of water (See comments at end of section on Sevin 50W)	**NOTE:** read label for specific mixing instructions based on the product purchased and read label carefully for specific plants that can be treated as well as phytotoxicity statements.
HOUSE PLANT PESTS		See Section on Household Pests
June beetles (May beetles or June bugs)	Spectracide Triazicide Once and Done Insect Killer (cyhalothrin) – apply per label Bayer Advanced Power Force Carpenter Ant and Termite Killer Plus (cyfluthrin) – 0.5 tsp per gal of water Sevin 50% WP - 2 tbs per gal of water (See comments at end of section on Sevin 50W)	Sometimes foliage feeders on American elm and a few other trees. Trees growing close to street or yard lights are generally most attractive to the beetles.
Lace bugs Spring through Summer	Bayer Advanced Tree & Shrub Insect Control (imidacloprid) – apply per label Insecticidal Soap - 49% or 50.5% - 5 to 6 tbs per gal of water (check label for mixing instructions) or 2% ready-to-use spray Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Ortho Houseplant and Garden Insect Killer (bifenthrin) Neem products (e.g., Safer's Bioneem or Neemisis) – per label Sevin 50% WP - 2 tbs per gal of water	Use as a drench around base of trunk. Determine rate based on the trunk diameter or height of shrub. Common on sycamores, elms and some oaks, pyracantha, and occasionally azaleas. Do not use acephate on American elm. **NOTE:** See comments on Sevin 50W at end of section. Also, small infestations can often be washed off plants/foliage with strong water pressure (stream of water).
Leafhoppers and Treehoppers	Bayer Advanced Tree & Shrub Insect Control – apply per label Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – apply per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Neem products (e.g., Safer's Bioneem or Neemisis) – per label Sevin 50% WP - 2 tbs per gal of water	Use as a drench around base of trunk for trees and shrubs. Determine rate based on the trunk diameter or height of shrub. **NOTE:** Carefully read label of malathion products for phytotoxicity statements. Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia. **NOTE:** See comments on Sevin 50W at end of section.
Leafminers Spring through Summer	Bayer Advanced Tree & Shrub Insect Control – apply per label Ferti-Lome Borer, Bagworm, Leafminer and Tent Caterpillar Spray (spinosad) Green Light 50% Malathion Insect Spray – per label Neem products (e.g., Safer's Bioneem or Neemisis) – per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water	Use as a drench around base of trunk for trees and shrubs. Determine rate based on the trunk diameter or height of shrub. Seldom cause extensive damage. Prune and burn twigs or leaves where possible. **NOTE:** Carefully read label of malathion products for phytotoxicity statements. Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia.

This section has not been revised since 2006.

INSECT CONTROL SUGGESTIONS FOR ORNAMENTALS - TREES, SHRUBS AND FLOWERS (FOR HOMEOWNERS) (CONT'D)

INSECT AND TIME MOST PREVALENT	INSECTICIDE, FORMULATION AND MIXING INSTRUCTIONS	COMMENTS
Millipedes During growing season	Ortho Bug-Geta Plus Snail, Slug and Insect Killer (carbaryl + metaldehyde) granules – 1 lb per 2,000 sq ft. Ortho Bug-B-Gon Multi-Purpose Insect Killer Ready Spray (permethrin) – per label	Heavy mulch and continuous damp conditions favor build-up of millipedes. Apply spray to soil surface in beds and around plants.
Mites Spider mites, Cyclamen Spring to early fall	Insecticidal Soap (e.g., Garden Safe Insecticidal Soap Concentrate) – apply per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Kelthane (e.g., Hi-Yield Kelthane Spray) – per label Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – per label Oil - see Scales next page Ortho Bug-B-Gon Multi-Purpose Insect Killer Ready Spray – per label	Frequently, 2 or more applications at 7-day intervals will be needed to reduce mite populations. Mites can be difficult to control, thus, consider alternating chemicals at the different treatment intervals. Do not interplant marigolds with other plants because spider mites frequently build up on marigolds and move to adjacent plants. **NOTE:** Check label carefully to insure that the chemical you intend to use is labeled for use on the specific plant(s) to be treated.
Puss caterpillar/IO moth and other "stinging caterpillars" Late summer and fall	Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – per label Sevin 50% WP - 2 tbs per gal of water (See comments on Sevin 50W at end of section)	Spray foliage thoroughly. This caterpillar has some tiny stinging spines underneath the fluffy, long, flowing body hair. **NOTE:** Carefully read label of malathion products for phytotoxicity statements.
Scale (e.g., brown elm scale, obscure scale, and San Jose scale) During growing season	Bayer Advanced Tree & Shrub Insect Control – apply per label Malathion products (e.g., Spectracide Malathion Insect Spray Concentrate or Green Light 50% Malathion Insect Spray) – per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Orthene Orthenex Garden Insect and Disease Control (resmethrin + acephate) – per label	Use as a drench around base of trunk for trees and shrubs. Determine rate based on the trunk diameter or height of shrub. Treat 2 to 3 times at 7- to 10-day intervals. Additional treatments may be needed later in the summer. **NOTE:** Carefully read label of malathion products for phytotoxicity statements. Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia.
	Insecticidal Soap - 49% or 50.5% - 5 to 6 tbs per gal of water (check label for mixing instructions) or 2% ready-to-use spray Dormant oil 97% (e.g., Gordon's Dormant Oil Spray) - per label (Superior oil grade of 60 or 70 or one specifying unsulfonated residue of 91or 92%) Summer or Growing Season Oil – check label for mixing instructions for oil use during growing season.	Check label for specific mixing instructions and listing of plants that can be treated. **NOTE:** Do not apply dormant oil to actively growing plants. Do not apply dormant oil to broadleaf evergreens, maple, mountain ash, or beech. Growing season oil can be used during growing season alone or mixed with an insecticide (see above list).
Soil Insects (e.g., white grubs, wireworms, termites, etc.) During growing season	Sevin - 50% WP – apply per label (See comments on Sevin 50W at end of section)	To help reduce problems of these pests feeding on the roots of flowers and shrubs, drench or thoroughly water in, then work into top 4" to 6" of soil.

This section has not been revised since 2006.

INSECT CONTROL SUGGESTIONS FOR ORNAMENTALS - TREES, SHRUBS AND FLOWERS (FOR HOMEOWNERS) (CONT'D)

INSECT AND TIME MOST PREVALENT	INSECTICIDE, FORMULATION AND MIXING INSTRUCTIONS	COMMENTS
Thrips Spring and summer	Bayer Advanced Tree & Shrub Insect Control (imidacloprid) – apply per label Insecticidal Soap (e.g., Garden Safe Insecticidal Soap Concentrate) – per label Neem products (e.g., Safer's Bioneem or Neemisis) – per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Sevin 50% WP - 2 tsp per gal of water (See comments on Sevin 50W at end of section)	Use as drench around base of trunk for trees and shrubs. Determine rate based on the trunk diameter or height of shrub. For flower thrips (e.g., aster, carnations, chrysanthemums, daisy, marigold, rose, etc.), may need to spray 2 to 3 times at 7- to 10-day intervals. **NOTE:** Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia.
Twig girdler **NOTE:** Smaller European elm bark beetle	Only restricted use pesticides are currently available for control of elm bark beetle and the disease it vectors, Dutch Elm Disease. Consult a certified arborist or other tree care professional for control options.	There are 2 or 3 generations with overlapping broods. Adults emerge in spring from under bark of dead or dying elms and feed on tender bark in twig crotches. Beetles emerging from late April to the end of June are the ones most likely to vector Dutch Elm Disease.
Webworms/Tent Caterpillars (See Caterpillars)		
Whiteflies Summer through early fall	Bayer Advanced Tree & Shrub Insect Control (imidacloprid) – apply per label Bonide Systemic Insect Control or Ortho Orthene Systemic Insect Control (acephate) – 3 tbs per gal of water Orthene Orthenex Garden Insect and Disease Control (resmethrin + acephate) – per label Ortho Bug-B-Gon Multi-Purpose Insect Killer Ready Spray – per label Alternatives (including botanical insecticides; see Note 2 at end of section): Neem products (e.g., Safer's Bioneem or Neemisis) - per label Insecticidal Soaps Pyrethrins + piperonyl butoxide or Pyrethrin or Pyrethrin + Rotenone; Spray, oil (e.g., Volck or Sunspray Ultra Fine) **NOTE:** YELLOW WHITEFLY STICKY TRAPS used per directions help control and detect whiteflies in greenhouses. See note 3 below.	Use as drench around base of trunk for trees and shrubs. Determine rate based on the trunk diameter or height of shrub. Insure thorough coverage, wetting plants to the dripping point. Try to insure coverage of the underside of leaves and penetrate dense foliage. Repeat applications frequently needed. **NOTE:** Do not use acephate products on American elm, crabapple, red or sugar maple, cottonwood, redbud, or weigelia.

See the following OSU Fact Sheets for additional information: EPP-7168 - Galls, EPP-7306 - Ornamental and Lawn Pests, EPP-7645 - Nantucket Pine Tip Moth, and EPP-7315 - Shade Tree Borers.

NOTES:

1. Sevin 50W - Not all Sevin (Carbaryl) labels allow for homeowner use or labels may state "for non-residential use only on trees and ornamentals." The non-residential use only restricts the use of those products only to areas like: shelter belts, forests, parks, recreational areas, etc. One should read the Sevin product label carefully prior to purchase to see if these restrictions apply.

2. Botanical Insecticides - Some organic gardeners prefer to use botanicals. Materials that may be available in your area or from garden supply catalogues for these individuals are: Rotenone, Ryania, Sabadilla, Neem products and natural pyrethrum (Apply any of these per label directions).

3. If you cannot find traps locally, try one of these: Hummert International (St. Louis, MO) 1-800-392-9113; Florist Products, Inc. (Schaunburg, IL) 1-800-828-2242; or Siemer Distributors (E. St. Louis, MO) 1-800-593-3030.

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL)

Pesticides are essential for the prevention of disease on some ornamental plants. However, good cultural practices should also be followed to minimize disease. These cultural practices include the following:

• Resistance - Many ornamental plant varieties are resistant to a specific plant disease. Use them whenever possible.
• Exclusion - Avoid introducing plant pathogens into the planting site. Use disease-free seed and transplants. Do not transport soil on tools or equipment from diseased areas to disease-free areas. Rotate annual plant species to avoid build-up of pathogens in the soil.
• Eradication - Removal of diseased plants or plant parts from a landscape will help prevent spread of the disease to healthy plants.
• Sanitation - Plant residue management consisting of removal, incorporation, or burning of old plant parts, weeds, and trash is important for reducing survival of pathogens and resulting inoculum available for spread in the next growing season.

Fungicides are effective in prevention and control of plant diseases only when they are present on plants prior to infection. Because fungicides are subject to weathering, they must be reapplied at regular intervals during the period of pathogen activity in order to keep plants adequately protected. Chemicals should be applied only in the prescribed manner as recommended by the manufacturer. Read the label carefully and follow directions.

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registration in effect on the date of this publication. Some of the pesticides listed in this publication have restricted use labels or are not packaged for home ornamental use. Therefore, these pesticides are listed separately.

Some fungicides can be applied by multiple methods. However, application rates listed are for foliar spray only. Many of the compounds listed are produced by many different companies. In addition, other similar products may have different rates. Do not use on ornamentals intended for food production.

NOTE: The user of this information assumes all risks for personal injury or property damage.

COMMON NAME INDEX

[1] Aluminum Tris
[2] Azoxystrobin
[3] Chlorothalonil
[4] Copper Hydroxide
[5] Copper Sulphate
[6] Fenarimol
[7] Jojoba oil
[8] Mancozeb
[9] Mefenoxam
[10] Myclobutanil
[11] Pentachloronitrobenzene
[12] Potassium Bicarbonate
[13] Potassium phosphate
[14] Propiconazole
[15] Streptomycin Sulfate
[16] Sulfur
[17] Tebuconazole
[18] Thiophanate-methyl
[19] Triadimefon
[20] Trifloxystrobin
[21] Triforine

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Arborvitae (*Thuja*)					
Twig Blight *Phomopsis juniperovora*	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	3336 F (Cleary) [18] Champion® WP (Nufarm) [4] Heritage (Syngenta) [2] Phyton-27 [5] Protect™ DF (Cleary) [8]	16-24 fl oz 1 ½ lbs 1-4 oz 13-25 fl oz 1-2 lbs	Apply fungicide when new growth is present.
Cercospora Blight *Cercospora sequoiae*	Advanced Garden™ Disease Control (Bayer) [17] Copper Spray or Dust (Bonide) [1] [5] Remedy (Bonide) [12]	1 ½ tbsp 4 ½ oz 2 ½ tbsp	3336 F (Cleary) [18] Camelot (Prescription Treatment) [4] Dithane T/O (Dow) [8] Fore (Dow) [8] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Kocide 2000 (Griffin) [4] Phyton-27 [5] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3]	12-16 fl oz 3 pts 1.5 lbs 1.5 lbs 20 fl oz 1-4 oz ¾-2 lb 15-25 fl oz 1-2 lbs 2 ¼ lbs	Apply fungicide when new growth is present.
Ash *(Fraxinus)*					
Anthracnose *Gloeosporium aridum*	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	3336 F (Cleary) [18] Daconil Ultrex® (Syngenta) [3] Dithane T/O (Dow) [8] Fore (Dow) [8] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary)	12-16 fl oz 1 ½ lbs 1.5 lbs 1.5 lbs 20 fl oz 4-8 oz 1-2 lbs 2 ¼ lbs	Apply at bud break.
Fungal Leaf Spots *Cercospora*	Advanced Garden™ Disease Control (Bayer) Fung-Away Systemic Fungicide (Green Light) [19] Garden Disease Control (Ortho) [3] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10] Remedy (Bonide) [12]	1 ½ tbsp 1-4 fl oz 1 ½ tsp 4 fl oz 1 fl oz 2 ½ tbsp	3336 F (Cleary) Daconil Ultrex® (Syngenta) [3] Dithane T/O (Dow) [8] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Protect™ DF (Cleary) [8]	12-16 fl oz 1 ½ lbs 1.5 lbs 20 fl oz 1-4 oz 1-2 lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Aster (*Aster*)					
Botrytis Petal Blight and	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Phyton-27 [5]	13-20 fl oz	Avoid sprinkler irrigation.
	Remedy (Bonide) [12]	2 ½ tbsp			
Stem Rot	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	3336 F (Cleary) [18]	8-16 fl oz	
Botrytis cinerea	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Eagle 40WP (Dow) [10]	3-6 oz	Begin treatment when symptoms appear.
Erysiphe cichoracearum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	3336 F (Cleary) [18]	12-24 fl oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Phyton-27 [5]	15-25 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Systhane® WSP (Dow) [10]	4 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Leaf Spots	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Remove and destroy any infected plant debris. Spray foliage as indicated by labels.
Septoria sp.	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Camelot (Prescription Treatment) [4]	3 pts	
Ascochyta sp.	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage	2-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Aster (*Aster*) (cont'd)					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	See labels for particular rust species covered and spray intervals.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow) [10]	4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 ¼ tbsp			
Azalea (*Rhododendron*)					
Petal Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	Begin sprays when disease is first noticed or as blooms are opening, depending upon spray used. See label for timing.
Ovulinia azaleae	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
			Eagle 40WP (Dow) [10]	3-6 oz	
			Fungo Flo (Scotts) [18]	10 fl oz	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
			Terraclor® 400 (Crompton) [11]	1 ½ pts / 150 sq ft.	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Azalea (*Rhododendron*) (cont'd)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	Spray as soon as disease appears.
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Compass® (Bayer) [20]	1-4 oz	
	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Phyton-27 [5]	13-15 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Azalea (*Rhododendron*) (cont'd)					
Phytophthora Dieback *Phytophthora* sp.	Aliette® (Monterey) [1]	1-2 tbsp	Camelot (Prescription Treatment) [4] 3336 F (Cleary) [18] Aliette® WDG (Bayer) [1] Alude (Cleary) [13] Daconil Ultrex® (Syngenta) [3] Dithane T/O (Dow) [8] Fore (Dow) [8] Heritage Kocide 2000 (Griffin) [4] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3] Subdue® MAXX® (Syngenta)	3 pts 12-24 fl oz 2 ½ - 5 lbs 1-2 qts 1 ½ lbs 1.5 lbs 1.5 lbs 1-2 oz ¾-2 lb 1-2 lbs 2 ¼ lbs ¾-1 ¼ fl oz	Where subsoils are known to be poorly drained, planting on raised beds should be considered.
Barberry (*Berberis*)					
Anthracnose *Gloeosporium berberidis*	Advanced Garden™ Disease Control (Bayer) [17] Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 ½ tbsp 1 fl oz	3336 F (Cleary) [18] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3]	12-16 fl oz 20 fl oz 4-8 oz 1-2 lbs 2 ¼ lbs	Apply at bud break. Gather and destroy fallen infested leaves.
Rust *Puccinia graminis*	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17] Fung-Away Systemic Fungicide (Green Light) [19] Garden Disease Control (Ortho) [3] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10] RosePride® Rose & Shrub Disease Control (Ortho) [21] Sulfur Plant Fungicide (Bonide) [1] [16]	8 tbsp 1-4 fl oz 1 ½ tsp 4 fl oz 1 fl oz 1 tbsp 2-2 1/4 tbsp	3336 F (Cleary) [18] Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4] Eagle 40WP (Dow) [10] Heritage (Syngenta) [2] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3] Systhane® WSP (Dow) [10]	12-16 fl oz 2 oz 3-6 oz 1-4 oz 1-2 lbs 2 ¼ lbs 4 oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Barberry (*Berberis*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as disease appears.
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
Phyllactinia corlea	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Eagle 40WP (Dow) [10]	3-6 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Bacterial Leaf Spot	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz			
Basswood or Linden (*Tilia*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply at bud break. Gather and destroy fallen infested leaves.
Gnomonia tiliae	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	3336 F (Cleary) [18]	12-16 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
			Fungo Flo (Scotts) [18]	20 fl oz	
Leaf Blight or Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Heritage (Syngenta) [2]	1-4 oz	
Cercospora microsora	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Basswood or Linden (*Tilia*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Damage to the trees is slight, therefore, only valued specimens need to be treated.
Microsphaera ulni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
Phyllactinia corylea	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Heritage (Syngenta) [2]	1-4 oz	
Uncinula clintonii	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Begonia (*Begonia*)					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Compass® (Bayer) [20]	1-4 oz	Apply when disease first appears. Remove diseased and fading flowers. Reduce humidity.
Botrytis cinerea	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Phyton-27 [5]	13-20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Bacterial Leaf Spot	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Aliette® WDG (Bayer) [1]	2-4 lbs	
Xanthomonas begoniae	Aliette® (Monterey) [1]	1 ½ - 2 tbsp	Alude (Cleary) [13]	2-4 pts	
			Camelot (Prescription Treatment) [4]	3 pts	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	15-30 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Begonia (*Begonia*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	Begin spraying as soon as symptoms appear.
Oidium, Erysiphe	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	3336 F (Cleary) [18]	12-24 fl oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Phyton-27 [5]	15-30 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Rubigan AS (Gowin) [6]	3-5 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow) [10]	4 oz	
Damping-Off and Tuber Rot	None		Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	Remove and destroy diseased plants. For a preventative, use sterilized potting soil.
Pythium spp.			Alude (Cleary) [13]	1-2 qts	
Fusarium spp.			(Pythium & Phytopthora only)		
Rhizoctonia spp.			Banrot 40 WP (Scotts) [18]	4-8 oz	
			Heritage (Syngenta) [2] (*Rhizoctonia* only)	1-4 oz	
			Subdue® MAXX® (Syngenta) [9] (*Pythium* and *Phytophthora* only)	¼ fl oz	
			Terraclor® 400 (Crompton) [11] (*Rhizoctonia* only)	6-12 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Birch (*Betula*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply at bud break. Use sanitation practices (gather and destroy fallen infested leaves).
Gloeosporium betularum	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Canker *Nectria galligena*	None		None		Prune and destroy infected branches. In thick stands, removal of trees with trunk cankers is recommended.
Boxwood (*Buxus*)	-	-	-	-	-
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Kocide 2000 (Griffin) [4]	¾-2 lb	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			3336 F (Cleary) [18]	12-16 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
Nectria Canker *Pseudonectria rousseliniana*	None		None		Prune and destroy infected branches.
Dieback	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz		See label	Cut and burn infected material. Spray twice in spring and twice in summer.
Phoma conidiogena	Remedy (Bonide) [12]	2 ½ tbsp			
Huponectria buxi					
Root Rot	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	Where subsoils are known to be poorly drained, planting on raised beds should be considered.
Phytophthora cinnamomi			Alude (Cleary) [13]	1-2 qts	
P. parasitica			Banrot 40 WP (Scotts) [18]	6-12 oz	
			Subdue® MAXX® (Syngenta) [9]	1-2 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Caladium (*Caladium*)					
Tuber Rots various fungi and bacteria	None		3336 F2 Banrot 40 WP (Scotts) [18] Compass® (Bayer) [20]	16-24 fl oz 6-12 oz 1-4 oz	
Calendula (*Calendula*)					
Powdery Mildew *Erysiphe cichoracearum* *E. polygoni*	Advanced Garden™ Disease Control (Bayer) [17] Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17] Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12] Dusting Sulfur (Ferti-lome) [1] [16] E-rase™ RTU [1] (Monterey) [7] Fung-Away Systemic Fungicide (Green Light) [19] Garden Disease Control (Ortho) [3] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10] Liquid Systemic Fungicide (Ferti-lome) [14] Orthenex® Insect & Disease Control Concentrate (Ortho) [21] Remedy (Bonide) [12] RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 ½ tbsp 8 tbsp 2 tsp 4 tbsp Ready-to-Use 1-4 fl oz 1 ½ tsp 4 fl oz 1 fl oz 1 tbsp 1 fl oz 2 ½ tbsp 1 tbsp	3336 F (Cleary) [18] Banner Maxx (Syngenta) [14] Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Rubigan AS Spectro 90 WDG (Cleary) [3]	12-24 fl oz 5-8 oz 2 oz 10 fl oz 1-4 oz 3-5 fl oz 2 ¼ lbs	Avoid overwatering. Avoid high humidities and overcrowding when storing tubers.
Leaf Spot *Cercospora calendulae*	Advanced Garden™ Disease Control (Bayer) [17] Dusting Sulfur (Ferti-lome) [1] [16] Fung-Away Systemic Fungicide (Green Light) [19] Garden Disease Control (Ortho) [3] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10] Remedy (Bonide) [12]	1 ½ tbsp 4 tbsp 1-4 fl oz 1 ½ tsp 4 fl oz 1 fl oz 2 ½ tbsp	3336 F (Cleary) [18] Eagle 40WP (Dow) [10] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3] Systhane® WSP (Dow) [10]	12-16 fl oz 3-6 oz 20 fl oz 1-4 oz 1-2 lbs 2 ¼ lbs 4 oz	Start spray application as soon as symptoms appear.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Carnation (*Dianthus*)					
Alternaria Leaf, Stem and Petal Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	
Alternaria dianthi	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
Botrytis cinerea	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F[2]	8-18 fl oz	Remove plant debris between crop cycles and during production. Space plants to improve circulation.
Botrytis cinerea	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	13-20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Septoria	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Heritage	2-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Carnation (*Dianthus*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary)	12-24 fl oz	Start spray application as soon as symptoms appear.
Oidium sp.	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Systhane® WSP (Dow) [10]	4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Rust	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	3336 F (Cleary) [18]	12-16 fl oz	Begin at first sign of symptoms.
Uromyces dianthi	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Heritage (Syngenta) [2]	1-4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Catalpa (*Catalpa*)					
Leaf Spots	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora catalpae	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Purchase disease free plants resistant to powdery mildew. Prune out diseased terminals. Destroy dead leaves that harbor the fungus.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Fungo Flo (Scotts) [18]	10 fl oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Heritage (Syngenta) [2]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Wilt *Verticillium albo-atrum*	None		None		Water and fertilize well which may allow the tree to produce new wood outside the infected area.

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Cedar, Eastern Red (*Juniperus virginia*)					
Cedar Apple Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	For more information refer to OSU Fact Sheet 7611 - Cedar Apple Rust. Apply weekly in July and August.
Gymnosporangium juniperi-virginianae	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Camelot (Prescription Treatment) [4]	3 pts	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Heritage (Syngenta) [2]	1-4 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Twig or Phomopsis Blight	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	3336 F[2]	16-24 fl oz	Remove and destroy infected parts. Space plants to provide good air movement. In nurseries, provide good soil drainage and ditch irrigation. See labels.
Phomopsis juniperovora	Remedy (Bonide) [12]	2 ½ tbsp	Banner Maxx (Syngenta) [14]	5-8 fl oz	
			Camelot (Prescription Treatment) [4]	3 pts	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
Cercospora Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	See labels for application rate and timing.
Cercospora sp.	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Chrysanthemum (*Chrysanthemum*)					
Ascochyta Stem and Ray Blight	Broad Spectrum Liquid Fungicide (Ferti-lome) [3]	6 tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Mycosphaerella ligulicola	Garden Disease Control (Ortho) [3]	1 ½ tsp	Banner Maxx (Syngenta) [14]	8-12 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Eagle 40WP (Dow) [10]	3-6 oz	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Botrytis Blight	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	Remove plant debris between crop cycles and during production. Space plants to improve circulation.
Botrytis cinerea	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Broad Spectrum Liquid Fungicide (Ferti-lome) [3]	6 tbsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	15-25 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Crown Gall	None		Phyton-27 [5]	15-25 fl oz	
Agrobacterium tumefaciens			Protect™ DF (Cleary) [8]	1-2 lbs	
Stem Rot	None		3336 F (Cleary) [18]	8-16 fl oz	
Rhizoctonia spp.			Banrot 40 WP (Scotts) [18]	6-12 oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Terraclor® 400 (Crompton) [11]	6-12 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Chrysanthemum (*Chrysanthemum*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	Purchase disease free plants resistant to powdery mildew. Prune out diseased terminals. Destroy dead leaves that harbor the fungus.
Erysiphe cichoracearum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	3336 F (Cleary) [18]	8-16 fl oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Phyton-27 [5]	15-25 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Rubigan AS (Gowin) [6]	3-5 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Pythium Root Rot	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	Plant in pasteurized soil or soilless mix free of the pathogen. Apply fungicides according to label.
Pythium spp.			Alude (Cleary) [13]	1-2 qts	
Phytophthora spp.			Banrot 40 WP (Scotts) [18]	6-12 oz	
			Subdue® MAXX® (Syngenta) [9]	½-1 fl oz	
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	3336 F (Cleary) [18]	8-16 fl oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Systhane® WSP (Dow) [10]	4 oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Cotoneaster (*Cotoneaster*)					
Root Rot *Pythium* sp.	None		Aliette® WDG (Bayer) [1] Alude (Cleary) [13] Subdue® MAXX® (Syngenta) [9]	2 ½ - 5 lbs 1-2 qts 1-2 fl oz	Where subsoils are known to be poorly drained, planting on raised beds should be considered.
Leaf Spot *Entomosporium maculatum*	Advanced Garden™ Disease Control (Bayer) [17] Garden Disease Control (Ortho) [3] Fung-Away Systemic Fungicide (Green Light) [19] Remedy (Bonide) [12] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 ½ tbsp 1 ½ tsp 1-4 fl oz 2 ½ tbsp 4 fl oz 1 fl oz	Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3] 3336 F (Cleary) [18]	1-2 lbs 2 ¼ lbs 12-16 fl oz	
Fire Blight *Erwinia amylovora*	Aliette® (Monterey) [1]	1 ½ tbsp	Aliette® WDG (Bayer) [1] Alude (Cleary) [13]	2 ½ lbs 1¼ qts	
Cottonwood (*Populus*)					
Leaf Spots *Septoria* sp.	Advanced Garden™ Disease Control (Bayer) [17] Fung-Away Systemic Fungicide (Green Light) [19] Garden Disease Control (Ortho) [3] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10] Remedy (Bonide) [12]	1 ½ tbsp 1-4 fl oz 1 ½ tsp 4 fl oz 1 fl oz 2 ½ tbsp	Heritage 2-4 oz 3336 F (Cleary) [18] Daconil Ultrex® (Syngenta) [3] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3]	 12-16 fl oz 1 ½ lbs 1-2 lbs 2 ¼ lbs	
Cytospora Canker *Cytospora chrysoperma*	None		None		Dead and dying or infected branches should be removed. Water and fertilize the tree to increase its vigor.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Cottonwood (*Populus*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Start spray application as soon as symptoms appear.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Systhane® WSP (Dow) [10]	4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Marssonina Leaf Spot	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Marssonina sp.	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Wetwood	None		None		No control known.
Various fungi, yeasts and bacteria					

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Cottonwood (*Populus*) (cont'd)					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Melampsora medusae	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Banner Maxx (Syngenta) [14]	16 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Heritage (Syngenta) [2]	1-4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Crabapple, Flowering (*Malus*)					
Cedar Apple Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Best controlled with resistant varieties.
Gymnosporangium juniperi- virginianae	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Alamo (Syngenta) [14]	See label	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Banner Maxx (Syngenta) [14]	2-4 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Liquid Systemic Fungicide (Ferti-lome) [14]	1/2 tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Rubigan AS (Gowin) [6]	4-12 fl oz	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Crabapple, Flowering (*Malus*) (cont'd)					
Scab	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Alamo (Syngenta) [14]	See label	Best controlled with resistant varieties. Rake and destroy fallen leaves.
Venturia inaequalis	Garden Disease Control (Ortho) [3]	1 ½ tsp	Banner Maxx (Syngenta) [14]	8-12 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Eagle 40WP (Dow) [10]	3-6 oz	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Rubigan AS (Gowin) [6]	4-12 fl oz	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow)	4 oz	
Perennial Canker *Cytospora* spp.	None		None		Control of leaf disease should help control dieback. Prune and burn all dead branches.
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Remove and destroy diseased plant parts. Prune to increase air circulation.
Podosphaera spp.	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Alamo (Syngenta) [14]	See label	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Compass® (Bayer) [20]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Liquid Systemic Fungicide (Ferti-lome) [14]	1 ½ tbsp	Heritage (Syngenta) [2]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Rubigan AS (Gowin) [6]	4-12 fl oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Crape Myrtle (*Lagerstroemia*)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Most serious during spring and fall months. Spray when disease first appears and at intervals on labels.
Erysiphe lagerstroemia	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Phyton-27 [5]	20-30 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Rubigan AS (Gowin) [6]	6-10 fl oz	
	Liquid Systemic Fungicide (Ferti-lome) [14]	3 tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Dahlia (*Dahlia*)					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	Remove plant debris between crop cycles and during production. Space plants to improve circulation.
Botrytis cinerea	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	13-20 fl oz	
			Protect™ DF (Cleary)	1-2 lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Dahlia (*Dahlia*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Apply when disease symptoms first appear.
Erysiphe polygoni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
E. cichoracearum	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Phyton-27 [5]	15-25 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Rubigan AS (Gowin) [6]	3-5 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Botrytis Blight	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
Botrytis cinerea	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Phyton-27 [5]	13-20 fl oz	
Daylily *(Hemerocallis)*					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Puccinia hemerocallidis	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 ¼ tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Dogwood (*Cornus*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as symptoms appear.
Septoria cornicola	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage	2-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Elsinoe corni	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Camelot (Prescription Treatment) [4]	3 pts	
	Liquid Systemic Fungicide (Ferti-lome) [14]	1 tbsp	Compass® (Bayer) [20]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Eagle 40WP (Dow) [10]	3-6 oz	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow)	4 oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Dogwood (*Cornus*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as symptoms appear. Repeat according to label directions.
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
Phyllactinia corylea	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Compass® (Bayer) [20]	1-4 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Phyton-27 [5]	20-30 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Rubigan AS (Gowin) [6]	8 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Systhane® WSP (Dow) [10]	4 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Elm (*Ulmus*)					
Dutch Elm Disease	None		Alamo (Syngenta) [14]	See label	Only use on a tree that appears to be less than 15% diseased. Remove dead and diseased limbs within 10 days after treatment. For more information refer to OSU Fact Sheet 7602 "Dutch Elm Disease."
Ceratocystis ulmi			Phyton-27 [5]	See label	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Elm (*Ulmus*) (cont'd)					
Blackspot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply as soon as leaves unfurl in the spring. Gather and destroy diseased leaves in the fall.
Stegophora ulmea	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Fore (Dow) [8]	1.5 lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora sphaeriaeformis	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Wetwood various bacteria, fungi and yeasts	None		None		

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Euonymus (*Euonymus*)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Remove and destroy diseased plant parts. Prune to increase air circulation.
Oidium euonymijaponici	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
Microsphaera alni	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Eagle 40WP (Dow) [10]	3-6 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Rubigan AS (Gowin) [6]	6-10 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F[2]	10-20 fl oz	
Gloeosporium frigidum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Camelot (Prescription Treatment) [4]	3 pts	
	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Compass® (Bayer) [20]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Geranium (*Pelargonium*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Gloeosporium frigidum	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray when symptoms first appear. Also, remove and destroy infected leaves.
Erysiphe polygoni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
Sphaerotheca humuli)	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Eagle 40WP (Dow) [10]	3-6 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Botrytis Gray Mold	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	Spray when symptoms first appear.
Botrytis cinerea	Broad Spectrum Liquid Fungicide (Fertilome) [3]	6 tbsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Phyton-27 [5]	15-20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Geranium (*Pelargonium*) (cont'd)					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Puccinia spp.	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Fore (Dow) [8]	1.5 lbs	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 ¼ tbsp	Heritage (Syngenta) [2]	1-4 oz	
			Phyton-27 [5]	25-40 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Root and Crown Rot	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	Plant in pasteurized soil or soilless mix free of the pathogen. Apply fungicides according to label.
Pythium spp.			Alude (Cleary) [13]	1-2 qts	
Phytophthora spp.			Banrot 40 WP (Scotts) [18]	6-12 oz	
			Subdue® MAXX® (Syngenta) [9]	½-1 fl oz	
Bacterial Blight	Aliette® (Monterey) [1]	1 ½ - 2 tbsp	Aliette® WDG (Bayer) [1]	2-4 lbs	Avoid overhead irrigation. Disinfect tools between cuttings.
Xanthomonas			Alude (Cleary) [13]	2-4 pts	
Pseudomonas spp.			Phyton-27 [5]	50 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Gladiolus (*Gladiolus*)					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	Do not plant infected corms.
Botrytis cinerea	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Corm Rots and Decay *Rhizopus* spp. *Curvularia* spp. *Fusarium* spp. *Penicillium* spp.	None		3336 F (Cleary) [18]	12-16 fl oz	
Leaf Spots *Curvularia* spp.	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Avoid overhead irrigation. Spray when symptoms first appear.
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Hackberry (*Celtis*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as disease is first noticed.
Uncinula parvula	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
U. polychaeta	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	4-8 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Systhane® WSP (Dow) [10]	4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Root Rot *Gnoderma* sp.	None		None		Trees should be maintained in a vigorous state. Once the disease is established, no controls are available. Avoid bark injuries.

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Hawthorn (*Crateagus*)					
Leaf Spots, Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F[2] See label		Grow resistant varieties. Remove and destroy infected leaves.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Banner Maxx (Syngenta) [14]	2-4 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Heritage (Syngenta) [2]	1-4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Rubigan AS (Gowin) [6]	4-12 fl oz	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Grow resistant varieties. Remove and destroy infected plant material and debris. Avoid overhead irrigating.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Rubigan AS (Gowin) [6]	4-12 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Fire Blight	Aliette® (Monterey) [1]		Camelot (Prescription Treatment) [4]	3 pts	
Erwinia amylovora		1 ½ tbsp	Kocide 2000 (Griffin) [4]	¾-2 lb	
Pseudomonas spp.			Alude (Cleary) [13]	1¼ qts	
			Aliette® WDG (Bayer) [1]	2 ½ lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Hickory *(Carya)*					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Gnomonia	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fore (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Holly (*Ilex*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Remove and destroy infected leaves.
Elsinoe ilicis	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage (Syngenta) [2]	4-8 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary)	2 ¼ lbs	
Purple Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane TO[2]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Holly (*Ilex*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as disease is first noticed.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Systhane® WSP (Dow) [10]	4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Twig Dieback	Remedy (Bonide) [12]	2 ½ tbsp	3336 F[2]	16-24 fl oz	Prune all infected material and destroy.
Phomopsis sp.			Protect™ DF (Cleary) [8]	1-2 lbs	
Hollyhock *(Althaea)*					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	High humidity favors the development of this disease.
Colletotrichum malvarum	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Compass® (Bayer) [20]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane TO[2]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Hollyhock *(Althaea)* (cont'd)					
Cercospora	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Dithane TO[2]	1.5 lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Prune to improve air circulation and increase available sunlight.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Phyton-27 [5]	15-25 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply at first sign of disease and destroy infected plant parts.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Hollyhock *(Althaea)* (cont'd)					
Puccinia malavacearum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Dusting Sulfur (Ferti-lome) [1]	4 tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Fungicide (Safer®) [1]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Phyton-27 [5]	15-25 fl oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Honey Locust *(Gleditsia)*					
Nectria Canker	None		None		Prune and destroy infected branches. Sanitation.
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Melasmia sp.	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Honeysuckle *(Lonicera)*					
Herpobasidium Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
Herpobasidium deformans	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp			
Leaf Spot	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary)	12-16 fl oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Honeysuckle *(Lonicera)* (cont'd)					
Cercospora	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Apply as soon as disease is first noticed.
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
Erysiphe polygoni	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Hydrangea *(Hydrangea)*					
Botrytis Gray Mold	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F[2]	16-24 fl oz	
Botrytis cinerea	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Phyton-27 [5]	13-25 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Hydrangea *(Hydrangea)* (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Plant resistant varieties.
Erysiphe polygoni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Phyton-27 [5]	13-25 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Rubigan AS (Gowin) [6]	3-5 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Cercospora and Septoria Leaf Spots	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary)	12-16 fl oz	Begin treatment when disease is first noticed.
Cercospora hydrangeae	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
Septoria hydrangeae	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Systhane® WSP (Dow) [10]	4 oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Iris (*Iris*)					
Bacterial Soft Rot *Erwinia carotovora*	None		Phyton-27 [5]	15-20 fl oz	Destroy infected rhizomes. Do not replant in a soil where disease has occurred.
Leaf Spot *Didymellina macrospora*	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Start applications when disease first appears and repeat according to label directions. For further information, see OSU Fact Sheet 7608.
	Broad Spectrum Liquid Fungicide (Ferti-lome) [3]	6 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Crown Rot *Sclerotium rolfsii*	None		Heritage	0.2-0.9 oz	Avoid crowding plants. Remove infected material.
			Terraclor® 400 (Crompton) [11]	See label	
Black Rot *Sclerotinia sclerotiorum*	None		Terraclor® 400 (Crompton) [11]	6-12 fl oz	
			3336 F (Cleary) [18]	8-16 fl oz	
Ivy, English (*Hedera*)					
Bacterial Leaf Spot *Xanthomonas polygoni*	Aliette® (Monterey) [1]	1 ½ - 2 tbsp	Camelot (Prescription Treatment) [4]	3 pts	Use sanitation when possible. Avoid overhead irrigation.
	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Aliette® WDG (Bayer) [1]	2-4 lbs	
			Kocide 2000 (Griffin) [4]	¾-2 lbs	
			Phyton-27 [5]	15-50 fl oz	
			Alude (Cleary) [13]	2-4 pts	
			Champion® WP (Nufarm) [4]	1 ½ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Ivy, English (*Hedera*) (cont'd)					
Leaf Spots	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Phyllosticta concentrica	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Ivy, Boston and Virginia Creeper (*Parthenocissus*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	If practical, remove and destroy infected leaves.
Cercospora spp.	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
Unicinula necator	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Heritage (Syngenta) [2]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Lilac (*Syringa*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply spray when symptoms first appear.
Cercospora lilacis	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Compass® (Bayer) [20]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
Leaf Blights	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp			
Cladosporium herbarum	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz			
Herterosporium syringae	Remedy (Bonide) [12]	2 ½ tbsp			
Bacterial Blight	None		Kocide 2000 (Griffin) [4]	¾-2 lb	Sanitation will help reduce the incidence of the disease.
Pseudomonas syringae			Phyton-27 [5]	13-25 fl oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	10-20 fl oz	Apply as soon as disease appears.
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 fl oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Lily (*Lilium*)					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	16-24 fl oz	Do not spray stressed plants. Start application as soon as symptoms appear.
Botrytis elliptica	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	13-20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Bulb Rots *Fusarium oxysporum* *Penicillium cyclopium* *P. corymbiferum*	None		3336 F (Cleary) [18] Spectro 90 WDG (Cleary) [3]	16-24 fl oz 2 ¼ lbs	Soak cleaned bulbs for 15-30 min in warm dip (80-85°F), preferably within 48 hrs after digging. Dry bulbs after treatment.
Magnolia (*Magnolia*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Gloeosporium	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
Septoria magnoliae	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fore (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as symptoms appear.
Microsphaera ulni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Magnolia (*Magnolia*) (cont'd)					
Phyllactinia corylea	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Heritage (Syngenta) [2]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Maple (*Acer*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Rake and remove infected leaves and twigs in the fall.
Gloeosporium apocryptum	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Root Rots *Ganoderma lucidum*	None		None		
Phyllosticta Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	
Phyllosticta minima	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fore (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Maple (*Acer*) (cont'd)					
Verticillium Wilt *Verticillium* sp.	None		None		Avoid injury to the root systems. Water and fertilize properly to reduce the chance of infection.
Marigold (*Tagetes*)					
Botrytis Blossom Blight *Botrytis* sp.	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	16-24 fl oz	Avoid overhead irrigation.
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Compass® (Bayer) [20]	1-4 oz	
			Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	13-20 fl oz	
			Phyton-27 [5]	13-20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Alternaria Leaf Spot *Alternaria* sp.	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Marigold (*Tagetes*) (cont'd)					
Fusarium Wilt *Fusarium* sp.	None		None		Remove and burn infected material. Sterilize soil used for flats or for later planting with heat or a fumigant. Rotate planting.
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Eagle 40WP (Dow) [10]	3-6 oz	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 ¼ tbsp	Systhane® WSP (Dow) [10]	4 oz	
Stem Rot and Wilt *Phytophthora cryptogea*	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	
			Alude (Cleary) [13]	1-2 qts	
			Banrot 40 WP (Scotts) [18]	4-8 oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Subdue® MAXX® (Syngenta) [9]	½-1 fl oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Mimosa (*Albizzia*)					
Fusarium Wilt *Fusarium oxysporum*	None		None		Remove and destroy infected plants to protect other plantings of this tree.
Mulberry (*Morus*)					
Leaf Spots	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Spray as soon as symptoms appear.
Cercospora moricola	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Powdery Mildew	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	3336 F (Cleary) [18]	12-24 fl oz	
Phyllactinia corylea	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
Uncinula geniculata	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Narcissus and Daffodil (*Narcissus*)					
Basal and Bulb Rots *Fusarium oxysporum* *Penicillium* sp.	None				Soak cleaned bulbs for 15-30 min. in warm dip (80-85°F) preferably within 48 hrs after digging. Dry bulbs after treatment.
Botrytis Blight *Botrytis* sp.	Advanced Garden™ Disease Control (Bayer) [17] Garden Disease Control (Ortho) [3] Immunox® Multi-Purpose Fungicide (Spectracide) [10] Remedy (Bonide) [12]	1 ½ tbsp 1 ½ tsp 1 fl oz 2 ½ tbsp	Daconil Ultrex® (Syngenta) [3] Dithane T/O (Dow) [8] Fore (Dow) [8] Fungo Flo (Scotts) [18] Heritage (Syngenta) [2] Protect™ DF (Cleary) [8]	1 ½ lbs 1.5 lbs 1.5 lbs 20 fl oz 4-8 oz 1-2 lbs	
Oak (*Quercus*)					
Actinopelte Leaf Spot *Actinopelte dryina*	Advanced Garden™ Disease Control (Bayer) [17] Copper Spray or Dust (Bonide) [1] [5] Fung-Away Systemic Fungicide (Green Light) [19] Garden Disease Control (Ortho) [3] Garden Fungicide (Safer®) [1] [16] Immunox® Multi-Purpose Fungicide (Spectracide) [10] Liquid Systemic Fungicide (Ferti-lome) [14] Remedy (Bonide) [12]	1 ½ tbsp 4 ½ oz 1-4 fl oz 1 ½ tsp 4 fl oz 1 fl oz 3 tbsp 2 ½ tbsp	Camelot (Prescription Treatment) [4] Daconil Ultrex® (Syngenta) [3] (red oak only) Dithane T/O (Dow) [8] Fore (Dow) [8] Kocide 2000 (Griffin) [4] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3]	3 pts 1 ½ lbs 1.5 lbs 1.5 lbs ¾-2 lb 1-2 lbs 2 ¼ lbs	Remove and destroy fallen leaves.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Oak (*Quercus*) (cont'd)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Rake and destroy infected leaves in the fall.
Gnomonia quercina	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	(red oak only)		
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Phyton-27 [5]	35 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary)	2 ¼ lbs	
Leaf Blister	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
Taphrina sp.	Garden Disease Control (Ortho) [3]	1 ½ tsp	(red oak only)		
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Wetwood	None		None		
various bacteria, fungi and yeasts					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray as soon as symptoms appear.
Phyllactinia corylea	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Eagle 40WP (Dow) [10]	3-6 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Oak (*Quercus*) (cont'd)					
Shoestring Root Rot *Armillaria mellea*	None		None		Avoid injury to the root system and trunk. Severely infected trees rarely recover. Remove and destroy these trees.
Pachysandra (*Pachysandra*)					
Volutella Blight *Volutella pachysandrae*	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply at the first sign of disease. Destroy severely affected plants.
	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	2 ½ lbs	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Pecan (*Carya*)					
Powdery Mildew *Microsphaera alni*	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Pecan (*Carya*) (cont'd)					
Scab	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Banner Maxx (Syngenta) [14]	8-12 oz	Plant resistant varieties.
Cladosporium caryigenum	Garden Disease Control (Ortho) [3]	1 ½ tsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Peony (*Paeonia*)					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	
Botrytis paeoniae	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
Phytophthora Blight	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	
			Alude (Cleary) [13]	1-2 qts	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Heritage	1-2 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
Periwinkle (*Catharanthus*)					
Root Rot	None		Terraclor® 400 (Crompton) [11]	6-12 fl oz	
Rhizoctonia solani					
Root Rot and Blight	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	3336 F (Cleary) [18]	8-16 fl oz	
Phytophthora spp.			Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	
			Alude (Cleary) [13]	1-2 qts	
			Heritage	1-2 oz	
			Phyton-27 [5]	15-20 fl oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Petunia (*Petunia*)					
Crown Rot	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	
Phytophthora parasitica			Alude (Cleary) [13]	1-2 qts	
			Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Subdue® MAXX® (Syngenta) [9]	½-1 fl oz	
Flower Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	8-16 fl oz	Maintain low relative humidity.
Botrytis sp.	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Phyton-27 [5]	13-20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary)	2 ¼ lbs	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Phyton-27 [5]	15-25 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Petunia (*Petunia*) (cont'd)					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow) [10]	4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 ¼ tbsp			
Phlox (*Phlox*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
			Eagle 40WP (Dow) [10]	3-6 oz	
			Fore (Dow) [8]	1.5 lbs	
			Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Phlox (*Phlox*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Use resistant varieties. Remove dead leaves.
Erysiphe cichoracearum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
Sphaerotheca humili	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Phyton-27 [5]	15-25 fl oz	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Rubigan AS (Gowin) [6]	3-5 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow)	4 oz	
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow) [10]	4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Photinia (*Photinia*)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Remove and destroy infected leaves. Avoid overhead irrigation.
Podosphaera leucotricha	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
Spaerotheca pannosa	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Eagle 40WP (Dow) [10]	3-6 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Rubigan AS (Gowin) [6]	6-10 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Cytospora Dieback *Cytospora* sp.	None		None		Sanitation. Control of leaf spot disease may help protect against dieback.
Entomosporium Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Plant resistant varieties.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Photinia (*Photinia*) (cont'd)					
Entomosporium maculatum	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Liquid Systemic Fungicide (Ferti-lome) [14]	3 tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Dithane T/O (Dow) [8]	1.5 lbs	
			Eagle 40WP (Dow) [10]	3-6 oz	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow)	4 oz	
Rust	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow) [10]	4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Pine (*Pinus*)					
Needle Blight *Dothistroma septospora*	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4] Kocide 2000 (Griffin) [4]	3 pts ¾-2 lb	For more information on diseases of conifers refer to OSU Extension Fact Sheet 7618 "Common Diseases of Conifers in Oklahoma." Fungicides most effective when applied in mid-May and again in mid-June. Read and follow label directions.
Tip Blight *Sphaeropsis sapinea*	Copper Spray or Dust (Bonide) [1] [5] Remedy (Bonide) [12]	4-6 tsp 2 ½ tbsp	3336 F (Cleary) [18] Banner Maxx (Syngenta) [14] Camelot (Prescription Treatment) [4] Fungo Flo (Scotts) [18] Phyton-27 [5] Protect™ DF (Cleary) [8] Spectro 90 WDG (Cleary) [3]	16-24 fl oz 5-8 oz 3 pts 20 fl oz 10-13 fl oz 1-2 lbs 5 ¾ lbs	For Tip Blight, prune and destroy infected material. Fungicides most effective when applied in late March to early April - make 2 applications one week apart. Read and follow label directions.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Pine (*Pinus*) (cont'd)					
Needle rust	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	This disease usually causes little damage to the pine trees. The alternate hosts are in the Aster family. Infection of the pine needles occurs in late summer to early fall.
Coleosporium sp.	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp			
Fusiform Rust	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	Spray seedlings before infection. Repeat according to label.
Cronartium fusiforme	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp			
Pine Wilt Pinewood Nematode	None		None		Remove infected tree as soon as possible.
Potentilla *(Potentilla)*					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Privet (*Ligustrum*)					
Phomopsis Gall *Phomopsis* sp.	None		None		Prune out and destroy galls. Where this disease is a problem, soil sterilization may help eliminate the disease.
Cercospora Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora sp.	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Remove and destroy infected leaves. Avoid overhead irrigation.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Systhane® WSP (Dow) [10]	4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Pyracantha (*Pyracantha*)					
Scab	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	
Fusicladium pyracanthae	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Kocide 2000 (Griffin) [4]	¾-2 lb	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Fireblight	Aliette® (Monterey) [1]	1 ½ - 2 tbsp	Aliette® WDG (Bayer) [1]	2 ½ lbs	
Erwinia amylovora	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Alude (Cleary) [13]	1¼ qts	
	Fire Blight Spray® (Ferti-lome) [15]	1 tsp	Camelot (Prescription Treatment) [4]	3 pts	
			Champion® WP (Nufarm) [4]	1 ½ lbs	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	20-40 fl oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Remove and destroy infected leaves. Avoid overhead irrigation.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Rhododendron (See Azalea)					

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Rose (*Rosa*)					
Bacterial Crown Gall *Agrobacterium tumefaciens*	Fire Blight Spray® (Ferti-lome) [15]	1 tsp	None		Remove and destroy all infected plant materials.
Black Spot *Diplocarpon rosae*	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Apply when disease symptoms first appear, and repeat according to label directions. Remove and destroy infected leaves. For more information, see OSU Fact Sheet 7607.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Broad Spectrum Liquid Fungicide (Ferti-lome) [3]	6 tbsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Liquid Systemic Fungicide (Ferti-lome) [14]	2 tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Remedy (Bonide) [12]	2 ½ tbsp	Phyton-27 [5]	20-35 fl oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1tbsp	Spectro 90 WDG (Cleary) [3]	1 ½ lbs	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Systhane® WSP (Dow) [10]	4 oz	

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Rose (*Rosa*) (cont'd)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Daconil Ultrex® (Syngenta) [3]	1 lbs	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fore (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	1 ½ lbs	
			Systhane® WSP (Dow) [10]	4 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Apply when disease symptoms first appear.
Sphaerotheca humilli	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
S. pannosa	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Champion® WP (Nufarm) [4]	1 ½ lbs	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Liquid Systemic Fungicide (Ferti-lome) [14]	1 tbsp	Phyton-27 [5]	35-50 fl oz	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Rubigan AS (Gowin) [6]	6-10 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	1 ½ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Systhane® WSP (Dow) [10]	4 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Rose (*Rosa*) (cont'd)					
Downy Mildew	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Aliette® WDG (Bayer) [1]	2 ½ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Alude (Cleary) [13]	1¼ - 2½ quarts	
			Compass® (Bayer) [20]	1-4 oz	
Rose Mosaic Rose Mosaic Virus	None		None		
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Liquid Systemic Fungicide (Ferti-lome) [14]	2 tbsp	Heritage (Syngenta)	1-4 oz	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Protect™ DF (Cleary)	1-2 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Spectro 90 WDG (Cleary) [3]	1 ½ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1tbsp	Systhane® WSP (Dow) [10]	4 oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp			
Snapdragon (*Antirrhinum*)					
Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora antirrhina	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Compass® (Bayer) [20]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp			

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Snapdragon (*Antirrhinum*) (cont'd)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Compass® (Bayer) [20]	1-4 oz	Maintain low humidity. Avoid overhead irrigation.
Colletotrichum antirrhini	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Kocide 2000 (Griffin) [4]	¾-2 lb	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			3336 F (Cleary) [18]	12-16 fl oz	
			Champion® WP (Nufarm) [4]	1 ½ lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
Root and Crown Rot	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	Plant in pathogen free soil.
Pythium spp.			Alude (Cleary) [13]	1-2 qts	
Phytophthora sp.			Banrot 40 WP (Scotts) [18]	4-8 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Subdue® MAXX® (Syngenta)	½-1 fl oz	
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Puccinia antirrhini	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Dusting Sulfur (Ferti-lome) [1] [16]	4 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Eagle 40WP (Dow) [10]	3-6 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Liquid Systemic Fungicide (Ferti-lome) [14]	2 tbsp	Heritage (Syngenta) [2]	1-4 oz	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Phyton-27 [5]	13-25 fl oz	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 1/4 tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
			Systhane® WSP (Dow) [10]	4 oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Snapdragon (*Antirrhinum*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Spray at first sign of disease.
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Compass® (Bayer) [20]	1-4 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Eagle 40WP (Dow) [10]	3-6 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Sweetgum (*Liquidamber*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Gloesporum nervisequum	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Heritage (Syngenta) [2]	4-8 oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
Sycamore (*Platanus*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Removing fallen leaves and twigs from the site will reduce disease.
Gnomonia platani	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Alamo (Syngenta) [14]	See label	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Phyton-27 [5]	35 fl oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Sycamore (*Platanus*) (cont'd)					
Leaf Spots	Advanced Garden™ Disease Control (Bayer)	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Septoria platanifolia	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
Cercospora platanicola	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage	2-4 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Remedy (Bonide) [12]	2 ½ tbsp			
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Eagle 40WP (Dow) [10]	3-6 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Trumpet Vine (*Campsis*)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
Erysiphe cichoracearum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Eagle 40WP (Dow) [10]	3-6 oz	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Trumpet Vine (*Campsis*) (cont'd)					
Microsphaera alni	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Fungo Flo (Scotts) [18]	10 fl oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Heritage (Syngenta) [2]	1-4 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Tulip (*Tulipa*)					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	16-24 fl oz	
Botrytis tulipae	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Camelot (Prescription Treatment) [4]	3 pts	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Kocide 2000 (Griffin) [4]	¾-2 lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
Bulb Rots *Fusarium oxysporum* *Penicillium* sp.	None		3336 F (Cleary) Spectro 90 WDG (Cleary) [3]	16-24 fl oz 2 ¼ lbs	Soak cleaned bulbs for 15 to 30 min in a warm dip (80-85°F), within 48 hrs of digging. Dry bulbs after treatment.

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Viburnum (*Viburnum*)					
Downy Mildew	Aliette® (Monterey) [1]	1 ½ tbsp	Aliette® WDG (Bayer) [1]	See label	
	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	Alude (Cleary) [13]	1¼ - 2½ quarts	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Dithane T/O (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Fore (Dow) [8]	1.5 lbs	
			Heritage	1-2 oz	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Apply as soon as disease appears and then at label intervals.
Microsphaera alni	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Eagle 40WP (Dow) [10]	3-6 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow) [10]	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Ramularia Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Compass® (Bayer) [20]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Viburnum (*Viburnum*) (cont'd)					
Rust	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Eagle 40WP (Dow) [10]	3-6 oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Protect™ DF (Cleary) [8]	1-2 lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Sulfur Plant Fungicide (Bonide) [1] [16]	2-2 ¼ tbsp	Systhane® WSP (Dow) [10]	4 oz	
Vinca *(Vinca)*					
Botrytis Blight	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Fungo Flo (Scotts) [18]	20 fl oz	
Botrytis cinerea	Garden Disease Control (Ortho) [3]	1 ½ tsp	Phyton-27 [5]	13-20 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp			
Phytophthora Blight	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	Aliette® WDG (Bayer) [1]	2 ½ - 5 lbs	
Phytophthora parasitica			Alude (Cleary) [13]	1-2 qts	
			Heritage	1-2 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Subdue® MAXX® (Syngenta) [9]	½-1 fl oz	
Walnut (*Juglans*)					
Anthracnose	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	Rake and destroy leaves and debris in the fall.
Gnomonia leptostyla	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Banner Maxx (Syngenta) [14]	8-12 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
			Dithane T/O (Dow) [8]	1.5 lbs	
			Fore (Dow) [8]	1.5 lbs	
			Fungo Flo (Scotts) [18]	20 fl oz	
			Heritage (Syngenta) [2]	4-8 oz	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	

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DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Walnut (*Juglans*) (cont'd)					
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	
	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	8 tbsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]		Eagle 40WP (Dow) [10]	3-6 oz	
	E-rase™ RTU [1] (Monterey) [7]	2 tsp Ready-to-Use	Fungo Flo (Scotts) [18]	10 fl oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Systhane® WSP (Dow)	4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Willow (*Salix*)					
Twig Blight	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	3336 F (Cleary)	16-24 fl oz	
			Kocide 2000 (Griffin)	¾-2 lb	
Yew (*Taxus*)					
Twig Blight	Copper Spray or Dust (Bonide) [1] [5]	4 ½ oz	3336 F (Cleary)	16-24 fl oz	Prune out and destroy infected material. Repeat application twice, one week apart.
Sphaeropsis sp.	Remedy (Bonide) [12]	2 ½ tbsp	Camelot (Prescription Treatment)	3 pts	
Phyllostictina hysterella			Phyton-27 [5] 10-13 fl oz		
			Protect™ DF (Cleary)	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	5 ¾ lbs	
Physiological Diseases Dieback	None		None		Unfavorable soil conditions seem to be responsible for this disease. Check pH and drainage of the soil. (Proper pH is around 6.5).

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Yucca (*Yucca*)					
Brown Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	Remove and destroy infected leaves. Avoid overhead watering. No chemical control approved by EPA.
Coniothyrium concentricum	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			
Cercospora Leaf Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-16 fl oz	
Cercospora sp.	Blackspot Powdery Mildew Control (Ferti-lome) [1] [4]	1 ½ tsp	Camelot (Prescription Treatment) [4]	3 pts	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Champion® WP (Nufarm) [4]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Fungo Flo (Scotts) [18]	20 fl oz	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Kocide 2000 (Griffin)	¾ lb	
	Remedy (Bonide) [12]	2 ½ tbsp	Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
Gray Leaf Spot and Tip Necrosis	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	None		
Cytosporina sp.	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz			
	Garden Disease Control (Ortho) [3]	1 ½ tsp			
	Garden Fungicide (Safer®) [1] [16]	4 fl oz			
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz			
	Remedy (Bonide) [12]	2 ½ tbsp			

This section was not revised in 2007.

DISEASE CONTROL GUIDE FOR ORNAMENTALS TREES, SHRUBS, VINES AND FLOWERS (HOME AND COMMERICAL) (CONT'D)

CROP AND DISEASE	HOME ORNAMENTAL CONTROL	RATE PER GALLON	COMMERCIAL CONTROL	RATE PER 100 GALLON	REMARKS
Zinnia (*Zinnia*)					
Leaf Blight and Spot	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	Camelot (Prescription Treatment) [4]	3 pts	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Dithane T/O (Dow) [8]	1.5 lbs	
	Garden Fungicide (Safer®) [1] [16]	4 fl oz	Fore (Dow) [8]	1.5 lbs	
	Remedy (Bonide) [12]	2 ½ tbsp	Heritage (Syngenta) [2]	1-4 oz	
			Kocide 2000 (Griffin)	¾ lb	
			Protect™ DF (Cleary) [8]	1-2 lbs	
			Spectro 90 WDG (Cleary)	2 ¼ lbs	
Powdery Mildew	Advanced Garden™ Disease Control (Bayer) [17]	1 ½ tbsp	3336 F (Cleary) [18]	12-24 fl oz	Apply when disease symptoms first appear and repeat according to label directions.
Erysiphe cichoracearum	Advanced™ All-In-One Rose & Flower Care Concentrate (Bayer) [17]	16 tbsp	Banner Maxx (Syngenta) [14]	5-8 oz	
	Bi-Carb Old Fashioned Fungicide (Monterey) [1] [12]	2 tsp	Bayleton® 50 WSP Turf and Ornamental Fungicide (Bayer) [4]	2 oz	
	Broad Spectrum Liquid Fungicide (Ferti-lome) [3]	9 tbsp	Daconil Ultrex® (Syngenta) [3]	1 ½ lbs	
	E-rase™ RTU [1] (Monterey) [7]	Ready-to-Use	Eagle 40WP (Dow) [10]	3-6 oz	
	Fung-Away Systemic Fungicide (Green Light) [19]	1-4 fl oz	Fungo Flo (Scotts) [18]	10 fl oz	
	Garden Disease Control (Ortho) [3]	1 ½ tsp	Heritage (Syngenta) [2]	1-4 oz	
	Immunox® Multi-Purpose Fungicide (Spectracide) [10]	1 fl oz	Phyton-27 [5]	13-25 fl oz	
	Orthenex® Insect & Disease Control Concentrate (Ortho) [21]	1 fl oz	Rubigan AS (Gowin) [6]	3-5 fl oz	
	Remedy (Bonide) [12]	2 ½ tbsp	Spectro 90 WDG (Cleary) [3]	2 ¼ lbs	
	RosePride® Rose & Shrub Disease Control (Ortho) [21]	1 tbsp			
Stem Rots	Aliette® (Monterey) [1]	1 ½ - 3 tbsp	3336 F (Cleary) [18]	8-16 fl oz	
Phytophthora cryptogea			Aliette® WDG (Bayer) [1] (*Phytophthora* only)	2 ½ - 5 lbs	
Rhizoctonia solani					
Fusarium			Alude (Cleary) [13]	1-2 qts	
			Heritage	1-2 oz	
			Protect™ DF (Cleary) [8] (*Phythophthora* only)	1-2 lbs	
			Subdue® MAXX® (Syngenta) [9] (*Phythophthora* only)	½-1 fl oz	
			Terraclor® 400 (Crompton) [11]	6-12 fl oz	
			Banrot 40 WP (Scotts)	4-8 oz	
[1] Organic pesticide					

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES
INSECT AND MITE CONTROL SUGGESTIONS

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Ants: Includes red imported fire ants. For more detailed control options: See CR-7309: Treatment Options for Controlling Red Imported Fire Ants	**Baits**			Follow specific label instructions, as some products are not registered for specific uses. Baits may be applied as a broadcast, or mound treatment. Apply when ants are foraging.
	abamectin (Varsity)	Apply per label	6	
	fenoxycarb (Award)	Apply per label	7B	
	fipronil (Chipco Choice)	Apply per label	2B	
	hydramethylnon (Amdro Pro)	Apply per label	20A	
	S-methoprene (Extinguish)	Apply per label	7A	
	spinosad (Justice)	Apply per label	5	
	Sprays and Granulars			Check registration for specific site uses. Some not registered for nurseries.
	bifenthrin (Talstar®)	21.7 to 43.5 fl oz	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 W®)	Apply per label	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	50 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	permethrin (Astro)	Apply per label	3	
	thiamethoxam (Flagship 25 WG)	Apply per label	4A	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Aphids (Plant lice)	abamectin (Avid 0.15 EC)	8 fl oz	6	Used for suppression only.
	acephate (Orthene T, T&O WSP)	1 to 2 packs	1B	Observe phytotoxicity precautions.
	acetamiprid (Tri-Star 70 WSP)	1 pack	4A	Use non-ionic spreader sticker.
	azadirachtin (Azatin)	12 to 16 fl oz	18B	Controls immature stages only.
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlothianidin (Celero 16 WSG)	2 to 4 oz	4A	
	chlorpyrifos (Dursban 50 W®)	0.5 to 1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	diazinon (AG 500®)	1 pt	1B	
	dimethoate (4E)	Apply per label	1B	Observe phytotoxicity precautions.
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	Used for suppression only.
	disulfoton (Di-Syston 15 G®)	Apply per label	1B	For use on firs only.
	endosulfan (Thionex 50 W)	1 lb	2A	
	fenpropathrin (Tame®)	5.33 to 10.66 fl oz	3	Must be tank mixed with Orthene T,T&O.
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	imidacloprid (Marathon II)	1.7 fl oz	4A	May also be applied as a soil injection.
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon)	1.5 pt	1B	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	Do not apply when buds are fully open and shoots are elongating. Observe phytotoxicity precautions.
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	pymetrozine (Endeavor)	2.5 to 5.0 oz	9B	
	pyriproxyfen (Distance)	6 to 8 fl oz	7C	Used for suppression only. Does not control adults.
	thiamethoxam (Flagship 25 WG)	2 to 4 oz	4A	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES
INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Bagworm	acephate (Orthene T, T&O WSP)	1 to 2 packs	1B	Observe phytotoxicity precautions.
	azadirachtin (Azatin)	10 to 16 fl oz	18B	
	Bacillus thuringiensis var. *kurstaki* (Biobit, Dipel DF, Dipel Pro, Javelin WG)	Apply per label	11B2	
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 W®)	0.5 to 1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	50 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	diazinon (AG 500®)	1 pt	1B	
	dimethoate (4E)	35 fl oz	1B	Observe phytotoxicity precautions.
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon)	2 pt	1B	
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	spinosad (Conserve SC)	6 fl oz	5	
Borers Make sure label specifically lists the type of borer you are trying to control. See: EPP-7315 Shade Tree Borers	bifenthrin (Onyx)	6.4 to 12.8 fl oz	3	Apply to lower branches and trunk prior to adult emergence.
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	Apply per label	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 W®)	Apply per label	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	Apply per label	3 + 4A	Applied as a soil drench or injection.
	dinotefuran (Safari 20 SG)	Apply per label	4A	Applied to soil as drench or in irrigation equipment.
	endosulfan (Thionex 50 W)	1 to 2 lb	2A	Dogwood and lilac borers only. Treat in early June and repeat 10 to 14 days later.
	imidacloprid (Marathon II)	Apply per label	4A	Soil injection only.
	permethrin (Astro)	Apply per label	3	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Boxelder bug/Red-shouldered bug	acephate (Orthene T, T&O WSP)	3 packs	1B	Observe phytotoxicity precautions.
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 W®)	0.5 to 1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	50 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	disulfoton (Di-Syston G®)	Apply per label	1B	
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
Caterpillars Make sure label specifically lists the type of caterpillar you are trying to control.	acephate (Orthene T, T&O WSP)	Apply per label	1B	Observe phytotoxicity precautions.
	acetamiprid (Tri-Star 70 WSP)	2 to 4 packs	4A	Use higher rate when insect pressure is high.
	azadirachtin (Azatin)	10 to 16 oz	18B	
	Bacillus thuringiensis var. *kurstaki* (Biobit, Dipel DF, Dipel Pro, Javelin WG)	Apply per label	11B2	
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 WSP®)	0.5 to 1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	50 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	diazinon (AG 500®)	1 to 3 pt	1B	
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon)	2 pt	1B	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	Do not apply when buds are fully open and shoots are elongating. Observe phytotoxicity precautions.
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	spinosad (Conserve SC)	6 fl oz	5	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES
INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Elm leaf beetle	acephate (Orthene T, T&O WSP)	4 packs	1B	Observe phytotoxicity precautions.
	Bacillus thuringiensis var. *tenebrionis* (Novodor)	Apply per label	11C	
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 WSP®)	1 to 2 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	
	disulfoton (Di-Syston G®)	Apply per label	1B	
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	imidacloprid (Marathon II)	1.7 fl oz	4A	May also be applied as a soil injection.
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	Controls larvae only.
	spinosad (Conserve SC)	6 fl oz	5	
Japanese beetle	acephate (Orthene T, T&O WSP)	4 packs	1B	Observe phytotoxicity precautions.
	acetamiprid (Tri-Star 70 WSP)	3 to 6 packs	4A	Tank mix with a surfactant; use higher rate when insect pressure is high.
	bifenthrin (Onyx) (Talstar®)	6.4 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	
	fenpropathrin (Tame®)	10.66 fl oz	3	
	imidacloprid (Marathon II)	1.7 fl oz	4A	May also be applied as a soil injection.
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon)	1.5 pt	1B	
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Lace bugs	acephate (Orthene T, T&O WSP)	1 to 2 packs	1B	Observe phytotoxicity precautions.
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 WSP®)	0.5 to 1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	dimethoate (4E)	17.5 fl oz	1B	Observe phytotoxicity precautions.
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	
	disulfoton (Di-Syston G®)	Apply per label	1B	
	fenpropathrin (Tame®)	5.33 to 10.66 fl oz	3	May be tank mixed with Orthene T,T&O.
	imidacloprid (Marathon II)	1.7 fl oz	4A	May also be applied as a soil injection.
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon)	1 pt.	1B	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	thiamethoxam (Flagship 25 WG)	2 to 4 oz	4A	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Leafminers/ Needleminers Make sure label specifically lists the type of leafminer or needleminer you are trying to control.	abamectin (Avid 0.15 EC)	8 fl oz	6	
	acephate (Orthene T, T&O WSP)	2 packs	1B	
	acetamiprid (Tri-Star 70 WSP)	5 to 6 packs	4A	Use higher rate when insect pressure is high.
	abamectin (Avid)	4 to 8 fl oz	6	
	azadirachtin (Azatin)	10 to 16 fl oz	18B	Controls immature stages only.
	bifenthrin (Onyx) (Talstar®)	6.4 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 W®)	2 lb	1B	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	diazinon (AG 500®)	1 pt	1B	
	dimethoate (4E)	8.3 to 17.5 fl oz	1B	Observe phytotoxicity precautions.
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	
	fenpropathrin (Tame®)	Apply per label	3	
	imidacloprid (Marathon II)	1.7 fl oz	4A	May also be applied as a soil injection.
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	Controls adults only.
	malathion (Fyfanon)	Apply per label	1B	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	Observe phytotoxicity precautions.
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	pyriproxyfen (Distance)	Apply per label	7C	
	spinosad (Conserve SC)	22 fl oz	5	Apply when stippling or mining first appears. Three sequential applications at 7-day intervals can maximize control of dipterous leafminers.

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES
INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Mites Check labels for type of mite that is controlled with a particular product, and the plants and situations that it can be used.	abamectin (Avid 0.15 EC)	4 fl oz	6	
	acequinocyl (Shuttle 15 SC)	6.4 to 12.8 fl oz	20B	
	bifenazate (Floramite SC)	4 to 8 fl oz	25	
	bifenthrin (Onyx) (Talstar®)	3.8 to 12.8 fl oz Apply per label	3	
	chlorpyrifos (Dursban 50W®)	1 lb	1B	
	clofentezine (Ovation)	2 fl oz	10A	
	dicofol (Kelthane 50 WSP)	0.5 to 1.0 lb	UN	
	disulfoton (Di-Syston 15 G®)	Apply per label	1B	For use on firs only.
	etoxazole (TetraSan 5 WDG)	4 to 8 packs	10B	Kills all life stages, including eggs.
	fenbutatin-oxide (Vendex 50 WP-T/N/O®)	8 to 16 oz	12B	
	fenpropathrin (Tame®)	Apply per label	3	May be tank mixed with Orthene T,T&O.
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	hexythiazox (Hexygon DF)	1 to 2 oz	10A	Kills all life stages, including eggs.
	lambda cyhalothrin (Scimitar GC®)	3 to 5 fl oz	3	
	malathion (Fyfanon)	1.5 pt	1B	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	Do not apply when buds are fully open and shoots are elongating. Observe phytotoxicity precautions.
	propargite (Ornamite)	Apply per label	12C	
	pyridaben (Sanmite)	4 packs	21	
	spinosad (Conserve SC)	22 fl oz	5	Apply when spider mites first appear prior to webbing.

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Nantucket pine tip moth See: EPP-7645 Nantucket Pine Tip Moth				Use pheromone traps to time insecticide applications. Multiple applications are usually needed.
	acephate (Orthene T, T&O WSP)	3 packs	1B	Observe phytotoxicity precautions.
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 WSP®)	1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	dimethoate (4E)	52.5 to 60 fl oz	1B	Observe phytotoxicity precautions.
	disulfoton (Di-Syston 15 G®)	Apply per label	1B	For use on firs only.
	imidacloprid (Marathon II)	Apply per label	4A	Soil injection only.
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	permethrin (Astro)	4 to 8 fl oz	3	
	spinosad (Conserve SC)	22 fl oz	5	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Plant galls Plant galls that attack branches can be removed by pruning and destroying the gall-infested material. See: EPP-7168 Plant Galls Caused by Insects and Mites	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Plant galls are usually a cosmetic problem. Difficult to control with insecticides. Timing is critical. Observe phytotoxicity precautions.
	dimethoate (4E)	Apply per label	1B	Observe phytotoxicity precautions.
	disulfoton (Di-Syston G®)	Apply per label	1B	
	spinosad (Conserve SC)	11 fl oz	5	
	thiamethoxam (Flagship 25 WG)	4 oz	4A	Apply during egg laying.
Scales and mealybugs Includes: Hard and soft scales Check label for specific scales, some products are only effective on soft scales.	acephate (Orthene T, T&O WSP)	2 packs	1B	Timing of scale insecticide applications is critical, and most target the mobile, crawler stage. Use double-sided sticky tape to monitor crawler activity. Observe phytotoxicity precautions.
	acetamiprid (Tri-Star 70 WSP)	2 to 4 packs	4A	Use higher rate when insect pressure is high.
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions. Treat trunk, stems, twigs, and foliage.
	chlothianidin (Celero 16 WSG)	3 to 4 oz	4A	Labeled for mealybug control.
	chlorpyrifos (Dursban 50 WSP®)	1 to 2 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	diazinon (AG 500®)	1 pt	1B	
	dimethoate (4E)	Apply per label	1B	Observe phytotoxicity precautions.
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	
	disulfoton (Di-Syston 15 G®)	Apply per label	1B	For use on firs only.
	fenpropathrin (Tame®)	Apply per label	3	May be tank mixed with Orthene T,T&O.
	imidacloprid (Marathon II)	Apply per label	4A	
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon)	Apply per label	1B	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	Do not apply when buds are fully open and shoots are elongating. Observe phytotoxicity precautions.
	pyriproxyfen (Distance)	8 to 12 fl oz	7C	
	thiamethoxam (Flagship 25 WG)	2 to 4 oz	4A	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Whiteflies	abamectin (Avid 0.15 EC)	8 fl oz	6	Used for suppression only.
	acetamiprid (Tri-Star 70 WSP)	2 to 4 packets	4A	Use higher rate when insect pressure is high.
	azadirachtin (Azatin)	10 to 16 fl oz	18B	Controls immature stages only.
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Labeled for ash whitefly control.
	chlothianidin (Celero 16 WSG)	3 to 4 oz	4A	
	chlorpyrifos (Dursban 50 WSP®)	0.5 to 1 lb	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	25 fl oz	3 + 4A	
	diazinon (AG 500®)	1 pt	1B	
	dimethoate (4E)	17.5 fl oz	1B	Observe phytotoxicity precautions.
	dinotefuran (Safari 20 SG)	4 to 8 oz	4A	
	fenpropathrin (Tame®)	Apply per label	3	
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	imidacloprid (Marathon II)	1.7 fl oz	4A	May also be applied as a soil injection.
	lambda cyhalothrin (Scimitar GC®)	3 to 5 fl oz	3	
	malathion (Fyfanon)	1.5 pt	1B	
	novaluron (Pedestal)	6 to 8 fl oz	15	
	paraffinic oil (Sunspray UltraFine)	1 to 2 gal	UN	
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	pymetrozine (Endeavor)	2.5 to 5.0 oz	9B	
	pyridaben (Sanmite)	4 to 6 packs	21	
	pyriproxyfen (Distance)	6 to 8 fl oz	7C	
	thiamethoxam (Flagship 25 WG)	2 to 4 oz	4A	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Common Name of Insecticide (Trade Name, Formulation)	Amount of Product/ 100 gal of water	MOA Group	Comments
Misc. pests of ornamentals or turf Includes many pests. Check product label for specific pests and rates.	abamectin (Avid 0.15 EC)	8 fl oz	6	Used for suppression of thrips populations.
	acephate (Orthene T, T&O WSP)	1 to 4 packs	1B	Observe phytotoxicity precautions.
	acetamiprid (Tri-Star 70 WSP)	1 to 6 packs	4A	
	abamectin (Avid)	8 fl oz	6	
	azadirachtin (Azatin)	Apply per label	18B	Controls immature stages only.
	Bacillus thuringiensis	Apply per label	11A,B, C	
	bifenthrin (Onyx) (Talstar®)	2.6 to 12.8 fl oz Apply per label	3	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	1.25 lb	1A	Observe phytotoxicity precautions.
	chlorpyrifos (Dursban 50 WSP®)	Apply per label	1B	
	cyfluthrin (Tempo 20 WP)	Apply per label	3	
	cyfluthrin + imidacloprid (Discus)	Apply per label	3 + 4A	
	deltamethrin (Deltagard GC®)	4 to 8 fl oz	3	
	diazinon (AG 500®)	1 to 3 pt	1B	
	dimethoate (4E)	Apply per label	1B	Observe phytotoxicity precautions.
	dinotefuran (Safari 20 SG)	Apply per label	4A	
	endosulfan (Thionex 50 W)	1 to 2 lb	2A	
	fenpropathrin (Tame®)	5.33 to 16 fl oz	3	
	fluvalinate (Mavrik)	4 to 10 fl oz	3	
	imidacloprid (Marathon II)	Apply per label	4A	
	lambda cyhalothrin (Scimitar GC®)	1.5 to 5.0 fl oz	3	
	malathion (Fyfanon, others)	Apply per label	1B	
	novaluron (Pedestal)	6 to 8 fl oz	15	
	paraffinic oil (Sunspray UltraFine)	1 to 3 gal	UN	May be applied during winter dormancy at higher rate. Observe phytotoxicity precautions.
	permethrin (Astro, Pounce®, Prelude)	Apply per label	3	
	pymetrozine (Endeavor)	2.5 to 5.0 oz	9B	
	spinosad (Conserve SC)	6 to 22 fl oz	5	
	thiamethoxam (Flagship 25 WG)	Apply per label	4A	

COMMERCIAL ORNAMENTALS AND CHRISTMAS TREES INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

1A=Carbamate
1B=Organophosphate
2A=Cyclodiene organochlorine
2B=Phenylpyrazole
3=Pyrethroid
4A=Neonicitinoid
4B=Nicotine
5=Spinosyns
6=Avermectins
7A=Juvenile hormone analogues
7B=Fenoxycarb
7C=Pyriproxyfen
8A=Methyl bromide (fumigant)
8B=Aluminum phosphide (fumigant)
8C=Sulfuryl fluoride (fumigant)
9A=Cryolite
9B=Pymetrozine
9C=Flonicamid
10A=Clofentezine
10B=Hexythiazox
11A1=Bt var. israelensis
11A2=Bt. var. sphaericus
11B1=Bt. var. aizawai
11B2=Bt. var. kurstaki
11C=Bt. var. tenebrionis
BLO=Biological Organism
M=Microbial
12A=Diafenthiuron
12A=Organotin miticide
12C=Propargite
13=Chlorfenapyr, DNOC
14=
15=Benzoylureas
16=Buprofezin
17=Cyromazine
18A=Diacylhydrazine
18B=Azadirachtin
19=Amitraz
20A=Hydramethylnon
20B=Acequinocyl
20C=Fluacrypyrim
21=METI acaricides, Rotenone
22=Indoxacarb
23=Tetronic acid derivitives
24A=Aluminum phosphide
24B=Cyanide
24C=Phosphine
25=Bifenazate
26=Fluroacetate
27A=P450 monooxygenase inhibitors
27B=Esterase inhibitors
28=Flubendiamide
NS=Non-specific, multi-site
UN=Unknown MOA

[r] Restricted Use Pesticide.

MOA Group Tables start on page 46 of the handbook. The numbers associated with the pesticide class column were developed by the Insecticide Resistance Action Committee, in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest or group of pests during a growing sequence, simply select a registered insecticide with a different number for each generation (14-21 days). You can rotate within the same number if there more than one subgroup is available (Example 2A and 2B). To further delay resistance from developing, integrate other control methods into your pest management programs.

CHRISTMAS TREE WEED CONTROL SUGGESTIONS

WEEDS	TIME OF APPLICATION	HERBICIDE (MOA GROUP) AND RATE PER ACRE	COMMENTS/REMARKS
Postemergent to weeds such as pigweed, henbit, nettle, filaree and cheese-weed, and preemergent to small seeded broad-leaves and grasses such as pigweed, lambsquarters, henbit, filaree and prickly lettuce.	Apply before weeds are 4" tall and before buds break. May be repeated. Post-emergent applications should be made prior to bud break or after foliage has had an opportunity to harden off.	Oxyfluoren (14) (Goal 2XL) See label	Directed Spray: Can be applied over top of conifer seedlings before bud break. Some injury has resulted when applied during flushes of new growth. Careful determination of soil conditions is necessary. (Dow AgroSciences).
Winter broadleaves, annual and perennial grasses, foxtail, ryegrass, wild oats, crabgrass, tall fescue, morningglory, panicum, orchard grass, purslane.	Fall or early Spring. Apply when trees are at least 1 year old in the fall to control winter weeds. Should be applied when temperatures do not exceed 55EF.	Pronamide [r] (15) (Kerb 50-W[r]) 1-2 lb (KerbWSP[r]) 2-4 lbs/acre (do not exceed 4lbs.acre - see label)	Topical Spray: Also some post-emergence activity. Acts mainly through root absorption. Not recommended on fine textured soils of high organic matter. Do not use over trees less than 1 year old; do not incorporate. (Dow AgroSciences).
Annual grasses and some small seeded broadleaves, annual bluegrass, chickweed, crabgrass, foxtails, goosegrass, lambsquarters, wild mustard, pigweed, prickly lettuce, ragweed.	Apply in Spring or Fall to prevent emergence.	Simazine (5) (Princep 4L) 2-4 lbs/acre (Princep) 2-4 lbs/acre Caliber 90) (Princep Liquid) 2-3 qts (Simazine 4L) 2-4 qts	Topical Spray: Do not apply to trees less than 3 years old. Do not apply more than once a year. Not listed for Virginia pine. Some postemergence activity. Can be mixed with Roundup. (Drexel, UAP, Syngenta, Agriliance).

[r] Restricted Use Pesticide

CHRISTMAS TREE WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE (MOA GROUP) AND RATE PER ACRE	COMMENTS/REMARKS
Annual grasses and some small seeded broadleaves, crabgrass, panicum, foxtails, goosegrass, seedling johnsongrass, pusley, pigweeds, purslane, spurge, lambsquarters.	Apply before weeds emerge.	Oryzalin (3) (Surflan A.S.) 2 qts	Topical Spray: Can only be legally applied in Oklahoma if used in a tank mix with Princep or Goal. May be applied over all conifers before bud break. Best to direct onto soil. Use lower rates on sandy soils and newly planted areas. Will not control emerged weeds. Soil should be in good tilth and free of clods before application. Needs 0.5" of water to activate. Good results if used in conjunction with Simazine (UPI).
A variety of grasses and broadleaf weeds.	Preemergence Fall or Spring	Prodiamine Barricade 4 FL 21-48 oz/acre (do not exceed 48 oz/A in a year – see label)	Topical or directed spray. Needs 0.5 inches of rain or equivalent irrigation for best results. Apply with minimum of 20 gallons per acre water using low pressure sprayer with 50 mesh or coarser screen. (Syngenta). Will not control emerged weeds.
Most annual and perennial broadleaves and grasses.	Apply to active, vigorous weed growth, wetting thoroughly without running off; July to October for best results. Avoid using Roundup-Pro or Ultra in summer if foliage contact of conifers is likely.	Glyphosate (9) (Roundup) 1-5 lb (Roundup-Ultra) See label (Roundup-Solugran) See label (Roundup-Drypak) See label (Roundup EZ DRY) See label (Roundup ProDry) See label (Roundup Custom) See label (Accord) See label (Credit) See label Many other generic formulations available.	Directed Spray: Has no soil activity. Do not allow spray to contact green stems or needles. Do not apply if rain is expected within 6 hours. A nonionic surfactant may be added to improve wetting. (Monsanto, Nufarm, Cheminova, Dow, DuPont, Lesco).

CHRISTMAS TREE WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE (MOA GROUP) AND RATE PER ACRE	COMMENTS/REMARKS
Annual and perennial grass weeds. Barnyardgrass, crabgrass, foxtail, goosegrass, johnsongrass, sandbur, cupgrass, panicum, quackgrass, switchgrass, bermudagrass.	Postemergence Apply when grasses are 2-8" tall but before tillering and/or heading .	Fluazifop-p-butyl (1) (Fusilade DX) 12-24 fl oz	Topical Spray: Always add crop oil concentrate or nonionic surfactant per label directions. Do not use flood type nozzles or spray tips which deliver course, large droplet sprays. Do not use through any type of irrigation system. For band applications, application with a single nozzle directly over the top of the row is not recommended. Best coverage is obtained with a minimum of two nozzles. Apply in 5-40 gal per acre of spray mixture with spray pressures of 40-60 psi at the nozzle tip. When grass foliage is dense use 60 psi and a minimum of 20 gal per acre to ensure coverage of weeds. (Syngenta).
Annual and perennial grasses including johnsongrass, bermudagrass, barnyardgrass, goosegrass, crabgrass, field sandburs, quackgrass, panicum.	Apply to actively growing grasses at recommended weed heights, usually 2-12 inches.	Clethodim (1) (Envoy) 13-17 oz	Topical Spray: Use high rates under heavy grass pressure. Always use a crop oil concentrate containing at least 15% emulsifier at 1% v/v (but not less than 1 pint per acre) in the finished spray volume. Use a minimum of 5 gals. And a maximum of 40 gals. Of spray solution per acre. For ground application, spray pressures should reflect a minimum of 30 psi and a maximum of 60 psi at the nozzle. Do not use flood nozzles. Unsatisfactory control may result if grasses are already stressed. (Valent)

CHRISTMAS TREE WEED CONTROL SUGGESTIONS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDE (MOA GROUP) AND RATE PER ACRE	COMMENTS/REMARKS
Broadleaf weeds.	Preemergence, any time prior to emergence of target weeds.	Isoxaben (21) (Gallery 75DF) 0.66-1.31 lb/A	Topical spray for listed species. Not listed for Virginia pine. Needs 0.5 inches rain or equivalent irrigation to activate. Maintain continuous agitation during spraying. (Dow AgroSciences)

MOA Group Tables start on page 46 of the handbook.

MANAGEMENT OF TURFGRASS INSECTS AND MITES

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Ants (including red imported fire ants) Social insects that live in colonies. Size and color variable, depending on species. All have characteristic narrow "waist" Damage: Build mounds, sometimes clear bare areas in turf. Red imported fire ants and red harvester ants can inflict a painful sting. Some people are hypersensitive to the sting. Management: No specific threshold has been established. Ants can be managed with baits or registered turf insecticide applications as mound drenches or perimeter sprays.	**Baits**		
	abamectin (Varsity)	0.36 oz	Baits may be applied as a broadcast, or mound treatment. Apply when ants are foraging. Follow specific label instructions. See end of publication for control notes on red imported fire ants.
	fenoxycarb (Award)	0.36 to 0.55 oz	
	fipronil (Chipco Choice)	4.6 oz	
	hydramethylnon (Amdro Pro)	0.36 to 0.55 oz	
	S-methoprene (Extinguish)	0.36 to 0.55 oz	
	spinosad (Justice)	0.33 to 0.66 cups	
	Sprays and Granulars		Sprays may be applied as a perimeter spray around the outside of a building or a mound drench. Follow specific label instructions. Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
	acephate (Orthene T, T&O, Spray 97)	Apply per label	
	bifenthrin (UP-Star) Gold SC®	 0.50 to 1.0 fl oz 0.25 to 1.0 fl oz	
	bifenthrin + imidacloprid (Allectus GC®)	Apply per label	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	2.5 to 5.0 lb/Acre	
	chlorpyrifos (Dursban) Pro® 50W-WSP®	 Apply per label 2 lb/Acre	
	cypermethrin (ProBuild)	Apply per label	
	cyfluthrin (Tempo) 20 WP SC Ultra	 0.18 to 0.35 oz 0.14 to 0.27 fl oz	
	cyfluthrin + imidacloprid (Discus)	3.4 to 5.6 fl oz	
	deltamethrin (Deltagard T&O, GC®) Granular	0.4 to 0.6 fl oz 2 to 3 lb	
	lambda cyhalothrin (Demand CS)	5 to 10 fl oz/Acre	
	permethrin (Perm-UP 3.2 EC®)	0.4 to 0.8 fl oz	
	spinosad (Conserve SC T&O)	Apply per label	

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Armyworm and cutworms Larval stage of several moths. Measure up to 1.5 inches. Some live above, and some below ground. Damage: These caterpillars chew grass blades and often live below ground during the day, especially in bentgrass greens. Damage is most evident with feeding activity of large larvae. Management: Treat when damage is noticeable and 2-3 small (1/2 inch or less) caterpillars per square foot are present.	acephate (Orthene T, T&O, Spray 97)	Apply per label	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
	azadirachtin (Ornazin 3% EC)	8 to 16 fl oz/Acre	
	bifenthrin (UP-Star) Gold SC^r	 0.18 to 1.0 fl oz 0.25 to 0.5 fl oz	
	bifenthrin + imidacloprid (Allectus GC^r)	1.1 to 2.9 lb	
	Bacillus thuringiensis var. *kurstaki* (Biobit, Dipel DF, Dipel Pro, Javelin WG)	Apply per label	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	2.5 to 5.0 lb/Acre	Do not irrigate treated areas within 24 hours post-application.
	chlorpyrifos (Dursban) Pro^r 50W-WSP^r	 1.5 fl oz 2 lb/Acre	
	clothianidin (Arena) 50 WDG 0.5 G	 6.4 to 12.8 oz/Acre 1.5 to 1.8 lb	
	cyfluthrin (Tempo) 20 WP SC Ultra	 0.18 to 0.35 oz 0.14 to 0.27 fl oz	
	cyfluthrin + imidacloprid (Discus)	3.4 to 5.6 fl oz	
	deltamethrin (Deltagard T&O, GC^r) Granular	0.2 to 0.4 fl oz 2 to 3 lb	
	halofenozide (Mach 2, Grubex) SC 1.5 G	 1.5 fl oz 1.55 lb	
	lambda cyhalothrin (Demand CS)	5 to 10 fl oz/Acre	
	permethrin (Perm-UP 3.2 EC^r)	0.4 to 0.8 fl oz	
	spinosad (Conserve SC T&O)	0.25 to 1.2 fl oz	Spinosad applied early morning or late afternoon can maximize control. Delay watering or mowing 12 to 24 hours post-application.
	trichlorfon (Dylox) 80 6.2 G	 2.50 to 3.75 oz 2 lb	

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Billbugs Adults are typical "weevils" with elongate snout measuring 0.25 inches, and having a shiny black body with raised "Y"-shaped area on thorax. Larvae: legless, having a white body with a brown head capsule. Damage: Adults chew holes in leaves and stems to lay eggs. Larvae burrow in stems, crown. Feeding leaves sawdust. Plants may die, and sod will not hold together when rolled up. Sometimes mistaken for winter-kill damage. Management: No threshold established. Treat if damage is noticeable in lawn in spring and billbug larvae are present.	bifenthrin (UP-Star) Gold SC^r bifenthrin + imidacloprid (Allectus GC^r) carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro^r 50W-WSP^r clothianidin (Arena) 50 WDG 0.5 G cyfluthrin (Tempo) 20 WP SC Ultra cyfluthrin + imidacloprid (Discus) deltamethrin (Deltagard T&O, GC^r) Granular halofenozide (Mach 2, Grubex) SC 1.5 G imidacloprid (Merit) lambda cyhalothrin (Demand CS)	 0.25 to 0.5 fl oz 0.25 to 0.5 fl oz 1.7 to 2.9 lb 10 lb/Acre 1.5 fl oz 2 to 4 lb/Acre 6.4 to 12.8 oz/Acre 1.0 to 1.8 lb 0.35 oz 0.27 fl oz 3.4 to 5.6 fl oz 0.6 to 0.9 fl oz 2 to 3 lb 2.9 fl oz 3 lb 3 to 4 tsp 10 fl oz/Acre	Active against adults. Active against larvae. Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
Chiggers Chigger: Small (0.5 mm) mite larvae Damage: Bites cause reddish welts, accompanied by intense itching that can persist for 7 to 10 days. Bites usually occur in areas where clothing fits tightly to the skin. Management: Regular mowing of grass and removal of weeds and brush can reduce chigger numbers. Repellents can be used for personal protection. If working in a chigger infested area, take a soapy bath immediately.	carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro^r 50W-WSP^r cyfluthrin (Tempo) 20 WP SC Ultra deltamethrin (Deltagard T&O, GC^r) Granular lambda cyhalothrin (Demand CS)	2.5 to 5.0 lb/Acre 0.33 fl oz 0.25 lb/Acre 0.35 oz 0.27 fl oz 0.4 to 0.6 fl oz 2 to 3 lb 10 fl oz/Acre	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Chinch bug Adults are 1/8 inch long, black with white wings that are folded over the back into an "hour glass" shape. Nymphs are reddish to brown, with a white stripe across their "shoulders". Damage: More of a problem in St. Augustinegrass. Aggregations of chinch bugs suck plant juices and clog phloem and xylem. As they feed, they also inject a toxin. Symptoms resemble drought injury; patchy with chlorotic and necrotic leaves. Management: No threshold established. Scout by flotation using a coffee can with both ends cut away; sink one end into the ground and fill can with 3/4 inch of water. Adults and nymphs will float to top. Keep thatch to a minimum and maintain proper levels of water and fertilizer.	acephate (Orthene T, T&O, Spray 97) bifenthrin (UP-Star) Gold SC®	Apply per label 0.25 to 1.0 fl oz 0.25 to 0.5 fl oz	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not. Higher application rates of UP-Star may be needed when adults and nymphs are present in mid-summer.
	bifenthrin + imidacloprid (Allectus GC®)	1.7 to 2.9 lb	
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	7.5 to 10.0 lb/Acre	Do not irrigate treated areas within 24 hours post-application.
	chlorpyrifos (Dursban) Pro® 50W-WSP®	 1.5 fl oz 2 lb/Acre	
	clothianidin (Arena) 50 WDG 0.5 G	 12.8 oz/Acre 1.5 to 1.8 lb	
	cyfluthrin (Tempo) 20 WP SC Ultra	 0.35 oz 0.27 fl oz	
	cypermethrin (ProBuild)	0.33 to 0.65 fl oz	
	deltamethrin (Deltagard T&O, GC®) Granular	0.6 to 0.9 fl oz 2 to 3 lb	
	lambda cyhalothrin (Demand CS)	20 fl oz/Acre	
	permethrin (Perm-UP 3.2 EC®)	0.4 to 0.8 fl oz	
	trichlorfon (Dylox) 80	 2.50 to 3.75 oz	
Digger wasp (Cicada killer, Scoliid and Typhiid wasps) Typical wasp appearance often colorful. Males often harass people who enter their breeding territory. Damage: Female wasps dig holes that they provision with cicadas. Not social, but sometimes nest in groups. Prefer bare ground. Management: No threshold established. Wasps prefer bare ground over mulched landscapes. Control with spray or dust of the nest entrances.	bifenthrin (UP-Star) Gold SC®	 0.25 to 0.5 fl oz 0.25 to 0.5 fl oz	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
	carbaryl (Sevin 80 WSP Carbaryl Insecticide)	Apply per label	
	chlorpyrifos (Dursban) 4E® 50W-WSP®	 Apply per label Apply per label	
	cyfluthrin (Tempo) 20 WP SC Ultra	 Apply per label Apply per label	
	deltamethrin (Deltagard T&O Granular)	2 to 3 lb	
	lambda cyhalothrin (Demand CS)	Apply per label	

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Fleas Small (0.03 to 0.4 inch) brown, wingless insects that are flattened from side to side. Damage: Fleas feed on blood, using sucking mouthparts. Bites cause small hardened bump that is itchy and or painful. Bites typically located on lower legs and ankles. Management: Treat areas where pets frequent (indoor and outdoor). Flea hotspots can be easily detected by wearing white athletic socks, or taking a white rag, attached to a stick, and dragging it over areas that might have infestations.	acephate (Orthene T, T&O, Spray 97) bifenthrin (UP-Star) Gold SC[r] bifenthrin + imidacloprid (Allectus GC[r]) carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro[r] 50W-WSP[r] cypermethrin (ProBuild) cyfluthrin (Tempo) 20 WP SC Ultra deltamethrin (Deltagard T&O, GC[r]) lambda cyhalothrin (Demand CS) permethrin (Perm-UP 3.2 EC[r]) spinosad (Conserve SC T&O)	Apply per label 0.5 to 1.0 fl oz 0.25 to 0.5 fl oz Apply per label 10 lb/Acre 1.5 fl oz 2 lb/Acre 0.33 to 0.65 fl oz 0.35 oz 0.27 fl oz 0.4 to 0.6 fl oz 10 fl oz/Acre Apply per label 1.2 fl oz.	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
Grasshopper 1-2 inches, outer wings leathery, inner wings clear or colored. Enlarged hind legs designed for jumping. Damage: Grasshoppers feed on foliage of numerous plants. Management: No threshold established. See F-7322: Grasshopper Control in Gardens and Landscapes for detailed information on control.	acephate (Orthene T, T&O, Spray 97) bifenthrin (UP-Star) Gold SC[r] carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro[r] 50W-WSP[r] cyfluthrin (Tempo) 20 WP SC Ultra cyfluthrin + imidacloprid (Discus) deltamethrin (Deltagard T&O, GC[r]) Granular lambda cyhalothrin (Demand CS)	Apply per label 0.25 to 0.5 fl oz 0.25 to 0.5 fl oz 2.5 to 5.0 lb/Acre 1.5 fl oz 2 lb/Acre 0.18 to 0.35 oz 0.14 to 0.27 fl oz 3.4 to 5.6 fl oz 0.4 to 0.6 fl oz 2 to 3 lb 5 to 10 fl oz/Acre	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Millipedes Long, with round body and many (80 to 400) legs. Damage: Millipedes rarely cause damage, but can invade households when populations build and conditions become dry. Management: Reduce or eliminate moist areas and harborage (grass clippings, leaves, wood debris). Water lawn during early morning to increase the time that turf is dry during a 24 hour period. Dethatch high-maintenance lawns.	bifenthrin (UP-Star) Gold SC® bifenthrin + imidacloprid (Allectus GC®) carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro® 50W-WSP® lambda cyhalothrin (Demand CS) permethrin (Perm-UP 3.2 EC®)	 0.25 to 0.5 fl oz 0.25 to 0.5 fl oz Apply per label 2.5 to 5.0 lb/Acre 1.5 fl oz 2 lb/Acre 5 to 10 fl oz/Acre 0.4 to 0.8 fl oz	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not
Mites: **(Bermudagrass, Zoysiagrass)** Small (less than 1/100 inches) white, cigar-shaped mites Damage: Alter the growth of grass, cause stunting, shortening of nodes in bermudagrass, "buggy whipping" in zoysiagrass). Plants may become yellow, weakened. Management: Cultural practices, including fertility and mowing, can reduce problem. Spray timing not currently known for most effective control. **(Clover)** Spider-like mites, dark green with orange-red markings, less than 1 mm long, unusually long front legs. Damage: Minor turf pest, can become nuisance when large numbers build and move to buildings for shelter in early spring and fall. Management: Cultural practices that enhance lawn health help limit damage and build up. Spot treat areas where mites accumulate.	 bifenthrin (UP-Star) Gold SC® chlorpyrifos (Dursban) Pro® 50W-WSP® dicofol (Kelthane 50 WSP)	 0.25 to 0.5 fl oz 0.25 to 0.5 fl oz 1.5 fl oz 2 lb/Acre 0.5 to 1.0 lb/Acre	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not. Optimal control may be achieved by mixing UP-Star with the labeled rate of an appropriate surfactant. Not for use on residential lawns.

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Mole crickets Adults cylindrical, 1.3 to 1.4 inches, body covered with dense coat of fine hair, and spade like front legs that resemble a mole's front legs. Damage: Northern mole cricket and prairie mole cricket are Oklahoma residents and are not considered major pests of turf. Can injure turf by feeding on turf and tunneling. Management: Define injured areas, and treat with insecticide. Normally control not required.	acephate (Orthene T, T&O, Spray 97)	Apply per label	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
	bifenthrin (UP-Star) Gold SC[r]	 0.50 to 1.0 fl oz 0.25 to 0.5 fl oz	 Apply late in the day followed by irrigation with up to 1/2 inch of water.
	bifenthrin + imidacloprid (Allectus GC[r])	Apply per label	
	clothianidin (Arena) 50 WDG 0.5 G	 12.8 oz/Acre 1.5 to 1.8 lb	
	cyfluthrin (Tempo) 20 WP SC Ultra	 0.35 oz 0.27 fl oz	
	cypermethrin (ProBuild)	0.33 to 0.65 fl oz	
	cyfluthrin + imidacloprid (Discus)	3.4 to 5.6 fl oz	Irrigate after application with 1/4 to 1/2 inch of water.
	deltamethrin (Deltagard T&O, GC[r]) Granular	0.6 to 0.9 fl oz 2 to 3 lb	 Irrigate after application.
	fipronyl (Chipco Choice)	Apply per label	
	imidacloprid (Merit)	4 tsp	
	lambda cyhalothrin (Demand CS)	10 to 20 fl oz/Acre	Use higher rate for populations comprised of mostly adults.
	permethrin (Perm-UP 3.2 EC[r])	0.4 to 0.8 fl oz	
	trichlorfon (Dylox) 80 6.2 G	 3.75 oz 3 lb	Thoroughly irrigate lawn following treatment.
Slugs and snails Soft bodied, with shell (snail) or bare (slug). Leave slime trail where they have been feeding. Damage: Chew leaves, scrape leaf tissue. Management: Treat with bait. Don't overwater lawn.	mesurol (Mesurol Pro[r])	0.5 to 1.0 lb	Not for use on residential lawns.
	metaldehyde	Apply per label	Rotate with mesurol to help avoid development of resistance in slugs and snails.

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Sod webworm Larvae vary from gray to light green to brown. Measure 0.6 to 1 inch. Adult moths with wingspans about 0.5 to 0.75 inch, many with a snout-like projection, and fly in a zigzag pattern when disturbed. Damage: Larvae chew on tender leaves, may cut off grass blades as they get older. Injury can be mistaken for disease or drought injury. Most likely to occur during late summer. Management: Bermudagrass usually can outgrow damage. Young larvae present about 2 weeks after peak moth flights. Monitor by using a soap flush (2 tbs soap per gal water).	acephate (Orthene T, T&O, Spray 97) azadirachtin (Ornazin 3% EC) *B. thuringiensis* var. *kurstaki* (Biobit, Dipel DF, Dipel Pro, Javelin WG) bifenthrin (UP-Star) Gold SC[r] bifenthrin + imidacloprid (Allectus GC[r]) carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro[r] 50W-WSP[r] clothianidin (Arena) 50 WDG 0.5 G cyfluthrin (Tempo) 20 WP SC Ultra cyfluthrin + imidacloprid (Discus) deltamethrin (Deltagard T&O, GC[r]) Granular halofenozide (Mach 2, Grubex) SC 1.5 G lambda cyhalothrin (Demand CS) methomyl (Lannate[r]) LV SP permethrin (Perm-UP 3.2 EC[r]) spinosad (Conserve SC T&O) trichlorfon (Dylox) 80 6.2 G	Apply per label 8 to 16 fl oz/Acre Apply per label 0.18 to 1.0 fl oz 0.25 to 0.5 fl oz 1.1 to 2.9 lb 7.5 to 10.0 lb/Acre 1.5 fl oz 2 lb/Acre 6.4 to 12.8 oz/Acre 1.0 to 1.8 lb 0.18 to 0.35 oz 0.14 to 0.27 fl oz 3.4 to 5.6 fl oz 0.2 to 0.4 fl oz 2 to 3 lb 1.5 fl oz 1.55 lb 5 to 10 fl oz/Acre 1.1 fl oz 0.4 oz 0.4 to 0.8 fl oz 0.25 fl oz 2.50 to 3.75 oz 2 lb	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
Sowbugs/Pillbugs Small, gray and "armored". Damage: Sowbugs rarely cause damage, but can invade households when populations build and conditions become dry. Management: Reduce or eliminate moist areas and harborage (grass clippings, leaves, wood debris). Water lawn during early morning to increase the time that turf is dry during a 24-hour period. Dethatch high-maintenance lawns.	bifenthrin (UP-Star) Gold SC[r] bifenthrin + imidacloprid (Allectus GC[r]) carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro[r] 50W-WSP[r] deltamethrin (Deltagard T&O, GC[r]) Granular lambda cyhalothrin (Demand CS) permethrin (Perm-UP 3.2 EC[r])	 0.25 to 0.5 fl oz 0.25 to 0.5 fl oz Apply per label 2.5 to 5.0 lb/Acre 1.5 fl oz 2 lb/Acre 0.4 to 0.6 fl oz 2 to 3 lb 5 to 10 fl oz/Acre 0.4 to 0.8 fl oz	Check registration for specific site uses. Some products are labeled for sod farms and golf courses, while others are not.
Ticks Small, with 8 legs, appearing flattened when unfed. Body color ranges from red to brown to nearly black. Four lifestages: egg, larva (six legs), nymph, and adult. Damage: Feeding results in inflammation, swelling, and potential secondary infection. Ticks can transmit disease, including Lyme, Rocky Mountain Spotted fever, tularemia, ehrlichiosis, and babisiosis to humans. Management: Manage ticks on household pets, and pet resting areas. Use physical inspection of anyone who is active in tick-infested areas during "tick season". Use repellents such as DEET, and treat premises as needed.	bifenthrin (UP-Star) Gold SC[r] bifenthrin + imidacloprid (Allectus GC[r]) carbaryl (Sevin 80 WSP Carbaryl Insecticide) chlorpyrifos (Dursban) Pro[r] 50W-WSP[r] cyfluthrin (Tempo) 20 WP SC Ultra cyfluthrin + imidacloprid (Discus) cypermethrin (ProBuild) deltamethrin (Deltagard T&O, GC[r]) Granular lambda cyhalothrin (Demand CS)	 0.5 to 1.0 fl oz 0.5 fl oz Apply per label 2.5 to 5.0 lb/Acre 0.33 fl oz 0.25 lb/Acre 0.18 to 0.35 oz 0.14 to 0.27 fl oz 3.4 to 5.6 fl oz 0.33 to 0.65 fl oz 0.4 to 0.6 fl oz 2 to 3 lb 5 to 10 fl oz/Acre	

MANAGEMENT OF TURFGRASS INSECTS AND MITES (CONT'D)

Pest, Damage and Management	Insecticide and Formulation	*Amount of Product/1000 ft^2	Comments
White grub Large, "C"-shaped grub with a white body and a brown head. Larval stage of several beetle species. Damage: White grubs feed on grass roots at or just below the thatch layer. Grass takes on droughty appearance. Damage more pronounced in fall. Predator activity from armadillos, skunks, moles, and birds indicates infestations and causes secondary damage. Management: Masked chafer: 10 to 20 per square foot May beetle: 3 to 8 per square foot	bifenthrin + imidacloprid (Allectus GC[r]) carbaryl (Sevin 80 WSP Carbaryl Insecticide) clothianidin (Arena) 50 WDG 0.5 G imidacloprid (Merit) halofenozide (Mach 2, Grubex) SC 1.5 G trichlorfon (Dylox) 80 6.2 G	2.3 to 2.9 lb 10 lb/Acre 6.4 to 12.8 oz /Acre 1.0 to 1.8 lb 3 to 4 tsp 2.9 fl oz 3.0 lb 3.75 fl oz 3 lb	Many of these products are most effective when grubs are small and feeding near the soil surface, usually July through August. Thoroughly irrigate lawn following treatment. Can be applied as a rescue treatment in late summer or early fall.

*Amount is for the listed product and formulation. Consult label that is provided with the purchased product for correct application methods and rates.
[r] Restricted Use Pesticide.

Control Notes for Imported Fire Ants:

Individual mound treatment.
Generally, non-chemical methods are not effective against fire ants. Digging or tilling up mounds simply moves them around. Boiling water (3 gallons per mound) may be effective for treating individual mounds, but it must be done carefully to avoid killing plants and not suffering from serious burns.

Best control has been achieved with chemical treatment of nests and surrounding areas. The best time to individually treat mounds with contact insecticides is on a sunny morning after a cool night, when ants are near the surface of the mound. Such treatments can be accomplished with drenches, surface sprays, granules, or baits.

Most mound drenches involve mixing the insecticide in 1-2 gallons of water. The treatment should be applied to the mound with a watering can that sprinkles the treatment on the mound much like a gentle rain. If the drench begins to cause the dirt on the mound to run off, stop and allow the liquid to soak into the mound, then resume drenching until all of the liquid is used.

Dust formulations like Pinpoint can be sprinkled on and around the mound, according to label instructions. If the label states that the treatment should be watered in, then do so with a watering can. Other products may state that the products should not be watered in.

Baits
Most ant baits contain a slow-acting insecticide, such as an insect growth regulator (IGR) that can be taken back to the mound and fed to other members of the colony, including the queen. They can be applied as a broadcast, or used as individual mound treatments. If they are used to treat individual mounds, the bait should be placed about 1-3 feet around, but not directly on, the mound.

Baits work best if applied when workers are actively foraging. This can be determined by leaving some greasy food, such as some chunks of tuna fish, or hot dog pieces, potato chips, or peanut butter near a mound and checking if for ant activity after 15-20 minutes. During the summer, worker ants forage at night and are actually inactive during the day. The best time to apply baits is in late afternoon or early evening. Moisture and rain will dissolve bait particles, so use baits only when grass and soil are dry, and no rain is expected within several hours after treatment.

A proven approach for managing red imported fire ants is to make a broadcast bait application in late spring when soil temperatures are above 70 degrees F and ants are actively foraging. This bait application should be followed up by treating individual problem mounds about 1-2 weeks later. For best results, always avoid disturbing the mound before or during treatment since it will cause the ants to move away and avoid the chemical.

For downloadable documents on red imported fire ant control options and more information on red imported fire ants in Oklahoma, check the Oklahoma State University Department of Entomology and Plant Pathology's Fire Ant Website at
http://entoplp.okstate.edu/fireants/fireants.html

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA

First and foremost, always read herbicide labels in their entirety before mixing or using the product. Do not rely solely on suggestions in this guide for pesticide use. The product label is the foremost and final set of directions! Herbicides are plant killers. They are toxic and can damage or endanger people, plants, animals and the environment if improperly selected or used. When used properly and as directed, the risk posed by herbicide use is generally considered acceptable. Herbicides are a vital and essential part of an Integrated Turf Pest Management Program. The need for herbicide use can be reduced but not likely completely eliminated if proper planning and action occur such as selecting and properly establishing well adapted species and varieties as well as practicing sound turfgrass management practices (including appropriate mowing, fertilization, irrigation, aeration, dethatching, disease, and insect management). Due to the necessity of repeat applications and the possibility of temporary turfgrass injury with some postemergent herbicides, most turfgrass managers prefer to use preemergent herbicides (Table 1). However, some weeds do escape a preemergent herbicide application and a postemergent product may be required (Table 2). It is impossible to name one herbicide that would be "best" for all turfgrass weed control situations. The following guidelines and tables can be used to aid in herbicide selection for turfgrass weed problems in Oklahoma. Remember to read and follow all directions on the herbicide label. Again, label requirements always take precedence over the information provided in this text.

Weed – A weed is simply a plant growing out of place or where it is not wanted by humankind. All plants have the capability of being a weed in one situation and a desirable species in another. While we may not want certain plant species in some designated areas we must remember that all species of plants are important to healthy and viable ecosystems somewhere on earth. Every species is deserving of our protection and preservation in some designated intended areas of plant habitation or storehouse areas such as their native areas of origin.

Turfgrass Tolerance - It is extremely important to select a herbicide that is labeled for your specific turfgrass species, its use area and height-of-cut. For example, Surflan (oryzalin) is labeled for use on warm-season turfgrasses and tall fescue, but it is not labeled for use on Kentucky bluegrass or perennial ryegrass (Table 3). Pendimethalin is labeled for bentgrass fairways but not for bentgrass putting greens due to low heights-of-cut. Postemergent herbicides such as 2,4-D or bentazon are safe on most turfgrasses. However, a turfgrass manager must be aware of the sensitivity of some turfgrasses to MSMA or Acclaim (fenoxaprop). Sometimes a herbicide is safe on one variety of a species but not on another variety of the same species. In these cases, one must rely on the label for information on individual varietal tolerance differences. Additionally, users are encouraged to conduct on-site testing of products on a small scale before treating the entire use area. Be familiar with the behavior of a product.

Weed Species - With the exception of Princep (simazine) and Aatrex (atrazine), most preemergent herbicides labeled for turfgrasses will provide good to excellent control of crabgrass if used in a split application program. Most preemergent herbicides including atrazine will control sandbur from seed (Table 4). Field sandbur is a short-lived perennial. Preemergent herbicides will not control sandbur plants arising from dormant perennial crown buds, rather only new plants arising from seed. In general, goosegrass is more difficult to control than crabgrass. A single application of Barricade at the appropriate rate is as effective as a split application, so it is an exception to the split application rule. When controlling broadleaf weeds postemergent, it is best to use labeled and safe pre-mix or tank-mix combinations of herbicides containing 2,4-D, dicamba, dichlorprop, mecoprop, and/or triclopyr rather than using a single herbicide active ingredient such as 2,4-D alone. Gallery or Portrait (isoxaben), is a broadleaf preemergent herbicide that has demonstrated good to excellent control of several broadleaf weeds. Herbicides for postemergent grassy weed control include: Acclaim (fenoxaprop), Image (imazaquin), Sencor (metribuzin), organic arsenicals (MSMA, DSMA, etc.) and Kerb (pronamide). Check for safety on the turf species/variety in question before using on a site. Products such as Roundup Pro (glyphosate) and Reward (diquat)should only be used on dormant bermudagrass for winter annual postemergent weed control because they are nonselective and will control actively growing vegetation.

Intended User - Herbicide labels specify the intended users and turfgrass areas of use for the product. Homeowners should never use herbicides that state that they are intended for commercial or professional use only.

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

Application Frequency – Although single applications of most preemergent herbicides can control crabgrass, better control can usually be achieved with most herbicides using a split application. A split application program means two applications. For summer annual weed control, apply one in the Jan-February time period and another in early to mid- May, approx 6-10 weeks after the first application. Remember, timing of the second application of a split application preemergent program should depend on anticipated herbicide breakdown in the soil, not just the simple passage of time on the calendar following the previous application. Warm, moist soils lead to rapid herbicide break down. Cool and/or dry soils delay herbicide breakdown. Heavy rains can cause herbicides such as atrazine and simazine to leach deeper into the profile, out of the range of preemergent activity effectiveness. Refer to the herbicide label to determine if more than one application is allowed or is usually necessary with any product.

Application Equipment - The type of application equipment may dictate the selection of a granular or sprayable formulation. Some preemergent herbicides such as bensulide, pendimethalin, prodiamine, oxadiazon and simazine are available as granular (G) or sprayable (E, WDG, L, or WP) formulations (Tables 1 and 2). Some granular formulations are only available as a pre-emergent plus fertilizer.

Fertilizer Based Products - Certain preemergent herbicides may be purchased on fertilizer carriers. Fertilizer-herbicide combination products provide a level of weed control similar to that obtained with the herbicide alone. However, the best time to fertilize does not always coincide with the best time to apply a herbicide. "Weed and Feed" products are an example of a herbicide + fertilizer combination. A "Weed and Feed" product can be a preemergent plus a fertilizer or a postemergent plus a fertilizer. Check the label to see which type of product is present. "Weed and Feed" products are not necessarily the best or easiest products to use in a good weed control or IPM program and many times they complicate rather than simplify the management program.

Ornamental Tolerance - Herbicides are commonly applied to sites that contain ornamental trees and shrubs. Careful attention should be given to the prevention of off-target drift. Several herbicides should never be applied under the drip line of established trees and shrubs.

Cost - The cost of a herbicide may vary according to the time of year the herbicide is purchased, the amount purchased, the type of formulation, and special dealer incentives. Since weed control and application frequency do vary among the different herbicides, carefully consider your turfgrass weed control situation in selecting the "best buy."

Herbicides form the base of the chemical weed control program in turfgrass. No one herbicide is always the "best" for all turfgrass weed control situations. By carefully analyzing your specific weed control situation, preemergent and postemergent herbicides can be selected to help meet the objectives of your chemical weed control program and minimize risk of injury to the environment.

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

Table 1. Suggested Preemergent Herbicides For Weed Control In Turfgrass

Common Name	Company	Trade Name(s) and Formulations(s)[1]	MOA Group
atrazine	Helena, Syngenta, United Horticultural Supply	Atrazine 4L, Aatrex 4L, Aatrex Nine-O Purge 4L	5
benefin	Dow AgroSciences, UAP, J.R. Simplot, LESCO, United Horticultural Supply	Balan 2.5G, Balan 60DF 2.5 Benefin Granular (2.5G)	3
benefin + oryzalin	Helena, Setre, Howard Johnson's	XL 2G, Excel - 5 Plus	3
benefin + oxadiazon	Regal	Regalstar	3 & 14
benefin + trifluralin	J.R. Simplot, United Horticultural Supply, Dow AgroSciences, The Andersons	Team 2G, Team Pro 0.86G	3
bensulide	PBI/Gordon, The Andersons, United Horticultural Supply, UAP	Betasan 2.9E, 4E, 7G, 12.5G Bensumec 4LF, Pre-San 7G, 12.5G Weedgrass Preventer 8.5G	8
bensulide + oxadiazon	The Andersons	Goose/Crab Control 6.5G	3 & 14
dithiopyr	Dow AgroSciences, LESCO, J.R. Simplot	Dimension G, Dimension 1EC, Dimension Ultra WSP	3
dithiopyr + oxadiazon	LESCO	SuperStar	3 & 14
ethofumesate	Bayer Env. Sci.	Prograss 1.5EC	16
fenarimol	Dow AgroSciences	Rubigan AS, EC	11
isoxaben	Dow AgroSciences, Green Light	Gallery 75DG, T&V, Portrait G	21
metolachlor	Syngenta	Pennant Magnum 7.62 EC	15
oryzalin	Dow AgroSciences	Surflan 4AS	3
oxadiazon	The Andersons, LESCO, Bayer ES (Chipco)	Ronstar 2G & 50WP	14
pendimethalin	The Andersons, LESCO, BASF	Pendulum 2G, 3.3EC, AquaCap & WDG Pre-M 60DG, 3.3EC, ProPendi (various)	3
prodiamine	The Andersons, Syngenta, various reformulators	Barricade G (various) Barricade 65WG	3
pronamide	Dow AgroSciences	Kerb 50WP Kerb 51WSP	15
siduron	PBI/Gordon The Andersons	Tupersan G, Tupersan 50W Fertilizer + Weed Preventer	7
simazine	Agriliance, Drexel Chemical, Syngenta, UAP-Platte	Princep 4L, Princep Liquid Simazine 4L, 90DF, 90 WDG	5

[1] Numeral refers to percent or pounds of active ingredient

MOA Group Tables start on page 46 of the handbook.

EC=emulsifiable concentrate, WP = wettable powder, L = liquid, G = granular, DG = dispersible granule, DF = dry flowable, AS = aqueous suspension, WG = water dispersible granule, WSP = water soluble packet.

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

Table 2. Suggested Turfgrass Weed Control Postemergent Herbicides

Common Name	Company	Trade Name(s) and Formulations(s)[1]	MOA Group
atrazine	Helena, Syngenta, United Horticultural Supply	Atrazine 4L, Aatrex 4L, Aatrex Nine-O Purge 4L	5
bentazon	BASF, Top Pro, LESCO	Basagran T/O, 4L, Lescogran 4L, Prompt	6
carfentrazone +2,4 Dester +MCPP + dicamba	PBI Gordon	Speed Zone	4 & 14
chlorsulfuron	LESCO, Riverdale	LESCO TFC, DG, Corsair 75DG	2
clopyralid	Dow AgroSciences	Lontrel	4
dicamba	The Andersons, PBI/Gordon, Syngenta	Banvel, Dicamba 4L, K-O-G Weed Control	4
diclofop-methyl	Bayer Environmental Sciences	Illoxan 3EC	1
diquat	Zeneca, Syngenta	Reward	22
DSMA	Setre Chemical, Drexel Chemical, Helena, UAP Platte	Numerous trade names and formulations are available.	17
ethofumesate	Bayer Environmental Sciences	Prograss 1.5EC	16
fenoxaprop-ethyl	Bayer Environmental Sciences	Acclaim Extra 0.57EC	1
fluazifop-butyl	Syngenta, Zeneca	Fusilade II, Fusilade T&O	1
fluroxypyr	DowAgroscineces	Spotlight 1.5EC	4
foramsulfuron	Bayer Environmental Sciences	Revolver 0.19 EC	2
glufosinate-ammonium	Bayer Environmental Sciences	Finale 1EC	10
glyphosate	Monsanto, Cheminova, AgriStar, LESCO, Dow AgroSciences, Riverdale, Syngenta	Avail, Roundup Pro, Roundup Pro Concentrate, Touchdown Pro, Glypro Plus, Gly Star Pro, Razor, Prosecutor, Glyfos 4L	9
glyphosate + 2,4-D	Monsanto	Campaign	9 & 4
halosulfuron	Monsanto	Manage 75DG	2
imazaquin	BASF	Image 70DG	2
MCPA	PBI/Gordon, Riverdale	MCPA 4L	4
MCPA + MCPP + dicamba	Riverdale, PBI/Gordon	Tri-Power Selective, Trimec, ENCORE	4
MCPA + clopyralid + dicamba	Riverdale	Trupower Selective	4
mecoprop (MCPP)	Riverdale, PBI/Gordon, LESCO	MCPP-4 amine, Mecomec 2.5EC, 4EC	4
MCPP + 2,4-D + dicamba	PBI/Gordon LESCO Riverdale	Trimec Classic, LAF-637, 899 Trimec Southern, Turf Ester, LESCO Three-Way Selective Bentgrass Selective, Triplet SF, Triplet Sensitive	4
MCPA + triclopyr + dicamba	LESCO, Riverdale	Cool Power, Three-Way Ester II	4
MCPA + triclopyr + dicamba	Riverdale	Horsepower	4
Metribuzin	Bayer	Sencor Turf 75W	5
metsulfuron methyl	Riverdale	Manor	2
MSMA, DSMA	LESCO, United Horticultural Supply, Platte, Riverside	Numerous trade names and formulations are available.	17
Quinclorac	BASF	Drive 75D	4
Rimsulfuron	Griffin	TranXit GTA	2
Simazine	Syngenta	Princep 80W, 4L, 90DG, 4G	5
Sethoxydin	BASF, Top Pro	Poast 1.5L, Vantage	1
Triclopyr	Dow AgroSciences	Turflon Ester	4
triclopyr + clopyralid	Dow AgroSciences	Confront	4
2,4-D	LESCO, ISK Biosciences PBI/Gordon, Interag, Riverside, Nu Farm, Riverdale	DYMEC, AM-40 Amine Numerous trade names and formulations are available.	4
2,4-D + clopyralid + dicamba	Riverdale	Millennium Ultra	4

MOA Group Tables start on page 46 of the handbook.

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

Table 2. Suggested Turfgrass Weed Control Postemergent Herbicides

Common Name	Company	Trade Name(s) and Formulations(s)[1]	MOA Group
2,4-D + dicamba	Aventis, LESCO	Many	4
2,4-D + MCPP	LESCO, Ortho	Lescopar, Weed-B-Gone	4
2,4-D + MCPP + dicamba + MSMA	PBI/Gordon	Trimec Plus Quadmec	4 & 17
2,4-D + MCPP + 2,4-DP	Riverdale	Dissolve, Triamine	4
2,4-D + triclopyr + clopyralid	LESCO	Momentum	4
Quinclorac	BASF	Drive 75DF	4

[1] Numeral refers to percent or pounds of active ingredient
MOA Group Tables start on page 46 of the handbook.
WP = wettable powder, L = liquid, G = granular, DG = dispersible granule, DF = dry flowable, AS = aqueous suspension.

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

TABLE 3. TURFGRASS TOLERANCE OF HERBICIDES

Herbicides	Bermuda	Zoysia	Centipede	St. Augustine	Tall Fescue	Perennial Ryegrass	Kentucky Bluegrass	Bentgrass Putting Green
Preemergence								
Atrazine	T(D),I	T(D),I	T	T	NR	NR	NR	NR
Benefin	T	T	T	T	T	T	T	NR
benefit + oryzalin	T	T	T	T	T	NR	NR	NR
benefin +trifluralin	T	T	T	T	T	T	T	NR
Bensulide	T	T	T	T	T	T	T	T
bensulide + oxadiazon	T	T	NR	NR	T	I	I	I
DCPA	T	T	T	T	T	T	T	NR
Dithiopyr	T	T	T	T	T	T	T	T
Ethofumesate	T(D),I	NR	NR	NR	NR	T	T	NR
Fenamirol	T	-	-	-	-	-	-	I
Metolachlor	T	NR	T	T	NR	NR	NR	NR
Oryzalin	T	T	T	T	T	NR	NR	NR
Oxadiazon	T	T	NR	T	T	T	T	NR
Pendimethalin	T	T	T	T	T	T	T	NR
Prodiamine	T	T	T	T	T	T	T	NR
Pronamide	T	NR	NR	NR	NR	NR	NR	NR
Siduron	NR	NR	NR	NR	T	T	T	NR
Simazine	T	T	T	T	NR	NR	NR	NR
Postemergence								
Asulam	T	NR	NR	T	NR	NR	NR	NR
Atrazine	T(D)	I	T(D)	T	NR	NR	NR	NR
Bentazon	T	T	T	T	T	T	T	NR
Chlorsulfuron	T	NR	NR	NR	NR	NR	T	NR
Dicamba	T	T	S-I	S-I	T	T	T	NR
Diquat	T(D)	NR	NR	NR	NR	NR	NR	NR
Ethofumesate	I	NR	NR	NR	NR	T	T	NR
fenoxaprop-ethyl	NR	T	NR	NR	T	T	T	NR
Glyphosate	T(D)	NR	NR	NR	NR	NR	NR	NR
glyphosate +2, 4-D	T(D)	NR	NR	NR	T-I	NR	NR	NR
Imazaquin	T	T	T	T	NR	NR	NR	NR
Mecoprop	T	T	S-I	S-I	T	T	T	T
Mefluidide	T	NR	NR	T	T	T	T	NR
2,4-D	T	T	S-I	S-I	T	T	T	NR
Metribuzin	T	NR	NR	NR	NR	NR	NR	NR
MSMA/DSMA	T	I	S	S	I	I	I	NR
Paclobutrazol	NR	NR	NR	NR	NR	NR	NR	T
Pronamide	T	NR	NR	NR	NR	NR	NR	NR
Sethoxydim	NR	NR	T	NR	NR	NR	NR	NR
Simazine	T(D)	T	T	T	NR	NR	NR	NR
triclopyr + 2,4-D	NR	NR	NR	NR	T	T	T	NR
Triclopyr	NR	NR	NR	NR	T	T	T	NR

D = Dormant turf only
NR = Not registered
S = Sensitive, DO NOT use this herbicide
I = Intermediately tolerant, use herbicide with care, since grass may be injured.
T = Tolerant

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

TABLE 4. RESPONSE OF WEEDS TO HERBICIDES.

	PREEMERGENCE														
	atrazine	benefin	benefin + oryzalin	benefin + trifluralin	bensulide	bensulide + oxadiazon	DCPA	ethofumesate	fenamirol	oryzalin	oxadiazon	pronamide	pendimethalin	siduron	simazine
Annuals															
Grasses															
annual bluegrass	E	E	E	E	E	F	F	G	G	G	G	E	G		E
crabgrass	F	E	E	E	E	E	G			E	E		E	G	F
goosegrass		F	F	F	F	E	F			G	E		G	P	
sandbur		F	G	F	G	G	F			G	F		G		
Broadleaves															
bittercress	E						F								E
common chickweed	E	G	G				G	L		G	P	E	L		E
corn speedwell	E	E					G				G	E			G
henbit	E	G	G				F			G	P	P	L		E
hop clover	E										G				E
knotweed	E		L		G		G			L	G			P	G
lespedeza	E				G		G				G				E
mustards	E				G						E				E
parsley piert	E	E	E	E	E					G	E	P			G
spurges	E		L							L	F		L	P	G
spurweed	E										P	P			E
vetches	E														
Perennials															
Grasses															
bahiagrass	F														
bermudagrass															
dallisgrass															
tall fescue	F														F
Broadleaves															
clovers	E														G
dandelion	F														
dichondra	G														
docks	G														
ground ivy															
mallow															
mock strawberry															
mousear chickweed		E													E
pennywort	E														
plantains	G														
woodsorrel	E														
violets															
Virginia buttonweed	F														
Other Weeds															
nutsedge															
wild garlic/onion															

E = Excellent. >90% control. G = Good, 80% to 89%. F = Fair, 70% to 79% control. P = Poor, <70% control.

L = Weed species is listed on the herbicide label, but has not been evaluated by the University of Arkansas.

- = Weed response is not known.

SELECTION OF HERBICIDES FOR TURFGRASS WEED PROBLEMS IN OKLAHOMA (CONT'D)

TABLE 4. RESPONSE OF WEEDS TO HERBICIDES.

	POSTEMERGENCE																			
	asulam	atrazine	bentazon	bromoxynil	chlorsulfuron	2,4-D	2,4-D + dichlorprop	2,4-D + mecoprop + dicamba	dicamba	diquat	ethofumesate	fenoxaprop	glyphosate	imazaquin	mecoprop	metribuzin	MSMA/DSMA	pronamide	sethoxydim	simazine
Annuals																				
Grasses																				
annual bluegrass		E								E	E		E			E	F	E		
crabgrass	G									E		G	E			G	E		E	
goosegrass	G									E		L	E			G			G	
sandbur	G										E			E	L		G			
Broadleaves																				
bittercress		E				G	E	E	E	E			E			G				E
common chickweed		E				F	E	E	E	E			E	L	L	G		E		E
corn speedwell		E				F	E	E	E	E			E			E		E		E
henbit		E				F	E	E	E	G			E	L		G		P		E
hop clover		E				F	E	E	E	E			E			G				G
knotweed		E					G	G	E				E			G				
lespedeza		E				F	E	E	E	G			E			E	G			
mustards		E		L		E	E	E	E	E			E							G
parsley piert		E				F	E	E	E	E			E	L		E		P		E
spurges		E		L		F	G	G	G	E			E			E	F			
spurweed		E	G	G		G	E	E	E	E			E			G		P		G
vetches		E				E	E	E	E	E			E							
Perennials																				
Grasses																				
bahiagrass			F										G				F			
bermudagrass													E							
dallisgrass													E				E			
tall fescue			F		L					G			E			G				
Broadleaves																				
clovers	E					F	E	E	E				F		L	G				
dandelion	F					E	E	E	E				E							
dichondra	E								G				E							
docks	G					G	E	E	E				E							
ground ivy						F	G	G	G				G		L					
mallow							E	E	E				G							
mock strawberry						F	G	G	G				G							
mousear chickweed	G					F	E	E	E				E	L	L	E				E
pennywort	E					F	E	E	E				E							
plantains	F					P	F	F	F				E		L					
woodsorrel	E					P	G	G	G				E							
violets						F	G	G	G											
Virginia buttonweed						P	G	G	F				F							
Other Weeds																				
nutsedge			G			F	F	F					G	G			F			
wild garlic/onion						G	G	G					E	E						

E = Excellent. >90% control. G = Good, 80% to 89%. F = Fair, 70% to 79% control. P = Poor, <70% control.
L = Weed species is listed on the herbicide label, but has not been evaluated by the University of Arkansas.
- = Weed response is not known.

SUGGESTIONS FOR WEED CONTROL IN TURFGRASS

WEEDS	TIME OF APPLICATION	AMOUNT OF ACTIVE HERBICIDE PER ACRE	COMMENTS
Crabgrass, foxtails and selected small seeded broadleaf weeds. Goosegrass and sandbur from seed. Annual bluegrass, Brome spp. and other winter annual grassy weeds.	Preemergence Jan-March and Preemergence Aug-Sept	benefin + oryzalin (XL) 2 to 3 lbs ai./A (2% G at 2.25 to 3 lb prod./1000 sq ft)	For summer weed control apply 1st in Jan-Mar. A 2nd application in mid to late May is required for crab & goosegrass control. For fall weed control apply in late Aug.-1st week of Sept. Lawn grasses should be well established. Water in the soil soon after application. A split application of 1.5 lb ai. /A followed by 1.5 lb ai. /A has been very effective. Use low rate on cool season grasses. Kentucky bluegrass and perennial ryegrass are sensitive to oryzalin applications.
		benefin + trifluralin (Team) 1.33-2 lb + 0.67-1 lb ai/A (2% G at 2.3 to 3.4 lb/1000 sq ft)	Same as benefin + oryzalin above. Cool season grasses are more tolerant to this product.
		bensulide (Bensumec, Betasan, Weed Grass Preventer) 7.5-12.5 lb ai./A (5-10 oz of 4E/1000 sq ft)	Same as for benefin above. Bensulide alone provides little to no control of goosegrass. Many formulations of bensulide are labeled for use on bentgrass putting greens.
		bensulide + oxadiazon (Goose/Crab Control) 6 + 1.5 lb ai./A (2.6 lb prod/1000 sq ft)	In early spring before crabgrass or goosegrass germinates. In late summer for annual bluegrass. For professional use only. May be applied to bentgrass putting greens.
		dithiopyr (Dimension) split application of 1.5 + 1.5 qt/A (1.1 + 1.1 fl oz/1000 sq ft)	See "South" portion of use table on product label. For preemergent control use split application program. Reseeding, overseeding or sprigging within three months may inhibit establishment of desirable grass. Also labeled for use on buffalograss and creeping bentgrass putting greens. Reduce rates on bentgrass putting greens. Provides early postemergent control of crabgrass when surfactant is used.
		oxadiazon (Ronstar 2G) 100-150 lbs prod./A (2% G at 2.3-3.4 lbs/1000 sq ft) (Ronstar 50WP) (4-6 lbs prod./A 1.5-2.2 dry oz/1000 sq ft)	Do not apply to wet turf. Several broadleaf weeds are controlled pre at the higher rate. Check label for tolerant ornamental shrubs, vines, and trees. Oxadiazon is an effective preemergent herbicide for goosegrass control. When applying wettable powder use 30 to 150 gal per acre (0.75 to 3.5 gal/1000 sq ft.). Only use Ronstar 50WP on dormant turf due to phytotoxicity.
	Preemergence March-April and Preemergence Aug-Sept	oryzalin (Surflan) 1.0-1.5 lb AI/A (0.7-1.1 fl oz 4AS/1000 sq ft)	For summer weed control apply 1st in Jan-Mar. A 2nd application in mid to late May is required for crab & goosegrass control. For fall weed control apply in late Aug.-1st week of Sept. For warm-season grasses and tall fescue. Not for use on bentgrass putting greens. Kentucky bluegrass and perennial ryegrass are sensitive to oryzalin.
		pendimethalin (Pendulum, Pre-M, Weed Grass Control) 1.5-3.0 lb AI/A (0.9-1.8 oz 60 WDG/1000 sq ft)	For summer weed control apply 1st in Jan-Mar. A 2nd application in mid to late May is required for crab & goosegrass control. For fall weed control apply in late Aug.-1st week of Sept. Use lower rates on cool-season grasses.
		prodiamine (Barricade 65WG) (0.5-2.3 lb/A)	Apply prior to germination of specific target weeds. Single application at 0.88 lbs ai/A is one of the best preemergent crabgrass control treatments. Split applications usually not necessary for crabgrass control if good management is undertaken. For best control of goosegrass make a sequential application as per label. For fall weed control apply in late Aug.-1st week of Sept. Rates depend upon target weed species.
		siduron (Tupersan) 6 lb AI/A (8.25 tbs 50WP/1000 sq ft)	This product is unique in that it is safe to use at the time of seeding cool-season or on newly seeded perennial cool-season turfgrasses. Do not use on warm-season grasses, especially bermuda. This product does not control annual bluegrass. Used primarily in the spring to prevent crabgrass from invading newly seeded cool-season grasses. As better preemergent herbicides are available if mature cool-season turf is present, consider using siduron only for new seeding operations with cool-season turf.

SUGGESTIONS FOR WEED CONTROL IN TURFGRASS (CONT'D)

WEEDS	TIME OF APPLICATION	AMOUNT OF ACTIVE HERBICIDE PER ACRE	COMMENTS
Annual bluegrass, burclover, henbit, spurweed, and other annual grass and broadleaf weeds.	Postemergence and Preemergence Oct-April	simazine 1-2 lbs AI/A (Princep DF) 0.4-0.8 oz/1000 sq ft (Princep 4L) 0.75-1.5 fl oz/1000 sq ft, depending on species)	For use on warm-season grasses only. Do not use on cool-season grasses. Apply after October 1 for winter weeds and before April 15 for control of summer annual weeds. Use low rates for annual bluegrass control. Do not make more than 2 applications per year. Read label before using around trees and ornamentals. Do not treat areas that drain onto sensitive sites such as greens or cool-season grasses.
		metribuzin (Sencor) 0.25-0.5 lb AI/A (0.12-0.28 oz 75DF/1000 sq ft)	For use in established bermuda by turf professionals. Use only on golf courses & sod farms. See label for details & precautions. Tank mix with MSMA for goosegrass control. Can be applied to dormant turf for control of winter annuals. Do not use on cool-season grasses.
		pronamide (Kerb) 0.75-1 lb AI/A (1-1.5 tbs 50WP/1000 sq ft)	Use only on bermudagrass. Pronamide has shown excellent control of annual bluegrass. It will control many young grasses that have already germinated and prevent later germinating seedlings. Read label for notes on preemergence activity.
Crabgrass, foxtails, goosegrass, sandbur, dallisgrass and nutsedge in bermudagrass.	Post-emergence May - Aug	Organic Arsenicals: DSMA (Chipco Turf Kleen) MSMA (Daconate, etc.) CAMA (Ortho Crabgrass Killer) Use label rates.	Easiest to control when plants are young and actively growing (May). Repeated applications 10 to 14 days apart may be needed for effective control. Try to apply when temperature is between 80° and 90°F. Do not water for 24 hours after application. For goosegrass, sandbur, dallisgrass, and yellow nutsedge, treatments may need to be repeated (4 times) every 7 to 10 days until control is achieved.
		asulum (Asulox) 2 lb AI/A (1.8 oz prod/1000 sq ft)	Use only on Tifway 419 bermudagrass and St. Augustine. Do not apply on golf course greens or tees.
Goosegrass	Post-emergence July-Aug	metribuzin + MSMA (Sencor + Daconate) See label for rates.	For application on established bermudagrass turf mowed at 0.5 inches or greater. Do not apply on bermudagrass which is under temperature or moisture stress.
Yellow nutsedge	Post-emergence May-Sept	bentazon (Basagran) 1 lb AI/A (0.75 oz of 4L/1000 sq ft)	Make applications when plants are actively growing. Additional applications at 10 to 14 day intervals are needed until nutsedge is eliminated. Do not make more than three applications per year. Avoid spraying shrubs and ornamentals. Apply at least 1 gal of water per 1000 sq ft and do not mow for 3 to 5 days before or after treatment. Make sure soil moisture is adequate for active nutsedge growth. Will not control purple nutsedge.
		imazaquin (Image) 0.25-0.5 lb AI/A (1-2 tbs of 1.5L/1000 sq ft)	Add nonionic surfactant at 0.25%. Repeat applications are needed for best results. Imazaquin will injure tall fescue and other cool-season grasses.
Yellow or Purple nutsedge control	Post-emergence May-Sept (cont'd)	imazaquin (Image) 0.25-0.5 lb AI/A (1-2 tbs of 1.5L/1000 sq ft)	See previous remarks for Image herbicide.
	Post-emergence May- Sept	halosulfuron (Manage) 0.67 to 1.33 oz/A 0.9 grams/1000 sq ft	May be applied to bermudagrass, bahiagrass, zoysiagrass, centipedegrass, St. Augustinegrass, Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue. Apply broadcast when sedges have reached the three- to eight-leaf stage. Use lower rate for light infestations and higher rate for heavy infestations. A second treatment will usually be required 6 to 10 weeks after the initial treatment. Use an 80% active nonionic surfactant at 2 qt per 100 gal of spray solution (0.5% v/v). Do not exceed 1 to 2 pt of surfactant per acre. Do not apply to putting greens. Manage only suppresses green kyllinga.

SUGGESTIONS FOR WEED CONTROL IN TURFGRASS (CONT'D)

WEEDS	TIME OF APPLICATION	AMOUNT OF ACTIVE HERBICIDE PER ACRE	COMMENTS
Crabgrass and foxtails.	Early Postemergence March-April	dithiopyr (Dimension) 2 qt/A fenoxaprop (Acclaim) 0.12-0.25 lb ai/A (0.35-0.75 oz 1L/1000 sq ft	Provides early postemergent control of crabgrass. Best if applied pre-tillering to crabgrass. Addition of nonionic surfactant may improve control. May be used in combination with MSMA or Acclaim for postemergent control of crabgrass (see label). Apply to actively growing grasses between the 3 leaf and 4 tiller stage. Use only on established Kentucky bluegrass, tall fescue, and perennial ryegrass. Do not apply on bermudagrass. Lower rates can be used for early emerging crabgrass. Mature crabgrass (greater than 4 tillers) will not be completely controlled.
Winter broadleaf weeds: henbit chickweed shepherds purse wild geranium	Postemergence October-November or February-March	Several Products: dicamba mecoprop or MCPP spotlight (fluroxypyr) Speed Zone (carfentrazone +2,4D ester +MCPP + dicamba)	Lower rates can achieve adequate control when applied to plants that are small and actively growing. Winter annual broadleaf weeds (henbit, chickweed, etc.) are best controlled with fall applications (October-November). A second application to control winter annual broadleaf weeds can be made during late winter (February-March) before bermudagrass begins to green up. Summer annual broadleaf weeds (knotweed, spurge, etc.) are controlled best in the late spring (May-June) after bermudagrass has greened up. 2,4-D will control several broadleaf weeds alone (see label).
Summer broadleaf weeds: spurge knotweed puncture vine carpetweed	Postemergence May-June	2,4-D (several) 2,4-D + dicamba	However, there are several excellent mixtures of 2,4-D, MCPP, dicamba, dichlorprop and triclopyr that will control a large number of broadleaf weeds. Read the label and use as directed. Avoid application on or near desirable trees and shrubs. Shallow roots may take up the chemical and cause injury. Do not spray when the wind is blowing. Ester formulations are more effective controlling broadleaf weeds, but should not be applied when daytime temperatures will exceed 65°F. Amine formulations are safer around ornamental trees and shrubs. Winter annual perennial broadleaf (dandelion, white clover, etc.)
Winter broadleaf weeds: dandelion oxalis black medic bur clover hop clover spring beauty white clover Summer broadleaf weeds: plantain puncture vine purslane dwarf fleabane woodsorrel	Postemergence October-November or February-March Postemergence May-June	2,4-D + dichlorprop + dicamba (Super Trimec) 2,4-D + MCPP (Chipco Turf Kleen, Ortho Weed-B-Gon) 2,4-D + MCPP + dicamba (Trimec Classic, Three-Way, Weed-B-Gone) 2,4-D + MCPP + dichlorprop (Weedestroy) 2,4-D + triclopyr (Turlon II)	May need more than one application to achieve complete control. Late fall applications are more effective (October-November) than late winter applications (February-March). Safety around ornamentals is greater in late fall when trees and shrubs are going dormant. Summer perennial broadleaf weeds (plantain, fleabane, etc.) are best controlled in late spring and early summer (May-June) when these weeds are small and actively growing. Repeat applications may be needed for broadleaf herbicide mixtures that contain only 2,4-D or only 2,4-D + MCPP. Avoid using dicamba when tree roots are above the surface.
Select summer & winter annual broad leaves	See label	metsulfuron (Manor), chlorsulfuron (Corsair)	Post-emergent control of several broadleaf weeds. See labels for details.

SUGGESTIONS FOR WEED CONTROL IN TURFGRASS (CONT'D)

WEEDS	TIME OF APPLICATION	AMOUNT OF ACTIVE HERBICIDE PER ACRE	COMMENTS
Several winter and summer annual broadleaf weeds.	Preemergence Aug-Sept & Jan - April	isoxaben (Gallery, Portrait) See label for rates and weeds controlled.	Preemergence herbicide which shows excellent activity on several winter (henbit, chickweed, shepherdspurse, etc.) and summer annual (spurge, knotweed, etc.) broadleaf weeds. Application rates are specific for desired weeds to be controlled. Late summer (August-September) applications should provide adequate control for winter annual broadleaf weeds. Early spring (March-April) applications will be needed for summer annual broadleaf weed control. Isoxaben has little or no preemergent control for annual grassy weeds.
Most winter annual and broadleaf and grassy weeds.	Nonselective Postemergence January-February (See crabgrass section for additional products, e.g., simazine)	glyphosate (Roundup Pro, Honcho many) Use label rates. Several products and formulations are available. glyphosate + 2,4-D (Campaign) 2-4 pt/A	Bermudagrass must be dormant! Excellent, nonselective weed control of grassy and broadleaf weeds can be achieved with late winter (January-February) applications of glyphosate. Annual bluegrass and chickweed are particularly susceptible. For henbit and dandelion, the addition of hormone type herbicides may be necessary to achieve complete control. Applications should be made on sunny days with temperatures at 50°F or above. Do not water for 12 hours after application. For postemergent control of selected grasses and broadleaf weeds in tall fescue and bermudagrass areas such as airports, dry canals, industrial plant sites, parking areas, parks, schools, storage areas, and other public areas. Apply 2-4 pt/A to dormant bermudagrass for weed control. Use carrier rate of 15-30 GPA.
Most winter annual and broadleaf and grassy weeds.		diquat (Reward) 0.25-0.5 lb/A (0.4-0.8 oz prod/A)	Bermudagrass must be completely dormant. Add a * nonionic surfactant for better control. Not as effective on cool-season perennial broadleaf and grassy weeds. Burndown treatment only, will not kill plants with large or perennial crowns.
Over seeded perennial ryegrass transition aid where bermuda is the desired turf.	See label	Pronamide (Kerb) metsulfuron-methyl (Manor) chlorsulfuron (Corsair) rimsulfuron (TranXit) foramsulfuron (Revolver)	See label for specific details. Manor, Corsair, TranXit and Revolver have provided more reliable control of overseeded ryegrass than Kerb in recent trials.

DISEASE CONTROL FOR TURFGRASSES

TURFGRASS DISEASES AND CONTROL

Diseases of turfgrass common to Oklahoma are only a few among many known to occur in other areas of the United States. In spite of the best efforts of the homeowner or commercial turf manager disease problems develop after following a good maintenance program. The first defense against turfgrass disease is to follow fundamental rules in turf management such as choice of adapted grass varieties, good drainage, proper watering, fertilization, thatch removal and mowing. When disease problems occur, early detection and proper identification of the disease are essential in order to select the proper control practice and reduce extensive damage. Consult product labels carefully. All label recommendations and restrictions must be followed for proper control and pest resistance management.

TABLE 1: DISEASE CONTROL FOR TURFGRASSES

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Algae (various species; primarily blue-green species; NOT a true disease). All grasses most prevalent on putting greens and other turf mowed excessively short.	Turf areas in partially shaded, damp locations become weak and begin to thin. Traffic and close-mowing enhance potential for algae development. Long-term overcast, rainy weather periods encourage algae on putting greens. These algae are commonly green or brown in color and can be sheet-like, leaf-like, or cushion-like in appearance. Due to their high water content, algae are often quite slippery. Algae growth may become so prolific that they cover turf plants and inhibit water penetration.	Chlorothalonil (M)	Daconil Ultrex: 1.8 – 3.2 oz Manicure Ultrex: 1.8 – 3.2 oz Echo ultimate: 1.8 – 3.2 oz	7-14	Fungicides are most effective when used as a preventative. Consult formulation label for annual maximum use guidelines.
		Copper hydroxide (M) + Mancozeb (M)	Junction: 2.0 – 4.0 oz	7-14	Phytotoxicity can result. Test in a small area before widespread use is adopted. If phytotoxicity occurs discontinue use. Do not apply in spray solutions with a pH of less than 6.5. DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.
		Mancozeb (M)	Fore: 6.0 oz Protect DF: 6.0 oz Pentathlon: 6.0 oz	7-14	DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.
	Notes and cultural controls: Improve air circulation and light exposure. Improve drainage and reduce irrigation frequency and amount. Reduce freely available nitrogen at site. On putting greens, verticut lightly, aerify, and/or topdress to disrupt and dry algal mats.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Anthracnose leaf blight and Anthracnose basal rot *(Colletotrichum cereale)* All grasses.	The causal fungus can infect leaves, sheaths, and tillers. In creeping bentgrass and *Poa annua*, stolons and crowns also may be rotted (anthracnose basal rot). Leaf infection appears as reddish-brown to brown lesions that are often surrounded by a yellow halo. Lesion size may span the blade width and often one lesion will cause complete yellowing of a blade. Tiller infection results in stem girdling and the subsequent appearance of small, yellow patches of turf. The causal fungus can sometimes be observed with a hand lens. It will appear as a dark, cushion-like reproductive structure (acervulus) with black spines (setae) extending from the cushion. Anthracnose basal rot may have deep-seated infections that are not readily diagnosed with only a hand lens.	Azoxystrobin (11)	Heritage: 0.2 – 0.4 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Chlorothalonil (M)	Daconil Ultrex: 1.8 – 3.2 oz Manicure Ultrex: 1.8 – 3.2 oz Echo ultimate: 1.8 – 3.2 oz	7-14	Fungicides are most effective when used as a preventative. Consult formulation label for annual maximum use guidelines.
		Fenarimol (3)	Rubigan A.S.: 1.7 – 3.5 oz	30	Apply preventatively when conditions are favorable for disease development.
		Fludioxonil (12)	Medallion: 0.2 – 0.5 oz	14	Apply preventatively when conditions are favorable for disease development. DO NOT use on grasses intended for animal feed or live stock grazing. DO NOT apply more than 1.5 oz per 1000 SQ FT in one calendar year
		Myclobutanil (3)	Eagle 40WP: 0.6 oz	14-21	On Bentgrass greens, high rates may result in unacceptable growth regulation. DO NOT apply more than 7.2 oz per 1000 SQ FT per calendar year.
		Propiconazole (3)	Banner Maxx: 1.0 – 2.0 oz Spectator: 0.37 – 0.72 oz	14-28	Apply preventatively when conditions are favorable for disease development. On Bentgrass greens, high rates may result in unacceptable growth regulation. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Pyraclostrobin (11)	Insignia: 0.5 – 0.9 oz	14-28	DO NOT apply more than two (2) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Thiophanate-methyl (1)	Cleary 3336F: Basal rot (4.0 – 6.0 oz); Foliar (2.0 – 4.0 oz)	14	Apply preventatively when conditions are favorable for disease development.
		Triadimefon (3)	Bayleton 50 WP: 1.0 oz	30	
		Trifloxystrobin (11)	Compass: 0.15 – 0.2 oz Compass: 0.25 oz	14 21	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides. Application intervals should be extended to 21 days if the highest rate is used.
	Notes and cultural controls: Avoid stressed turf caused by consistent low mowing and rolling of greens, other pests, fertility imbalances, or moisture extremes. Thatch removal will be helpful. In bentgrass greens, manage localized dry spots to prevent anthracnose basal rot from developing.				
Brown Patch, Rhizoctonia Blight *(Rhizoctonia solani)* Cool Season Grasses: Bluegrass creeping bentgrass fescues ryegrass	Grass is killed in circular to irregular areas that may expand to several feet in diameter. In close-cut cool season grasses, a darkened "smoke ring" border may be apparent. Brown patch in cool season grasses occurs during humid weather at 75-85°F. High N, thatch buildup, and excessive moisture favor disease.	Azoxystrobin (11)	Heritage: 0.2 – 0.4 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Chlorothalonil (M)	Daconil Ultrex: 1.8 – 3.2 oz Manicure Ultrex: 1.8 – 3.2 oz Echo ultimate: 1.8 – 3.2 oz	7-14	Fungicides are most effective when used as a preventative. Consult formulation label for annual maximum use guidelines.
		Fenarimol (3)	Rubigan A.S.: 1.5 oz	7-14	Apply preventatively using the lowest rates and longest labeled intervals when conditions are favorable for disease development. Use higher rates and shorter intervals when the disease is present.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Fludioxonil (12)	Medallion: 0.2 – 0.5 oz	7 - 14	Apply preventatively when conditions are favorable for disease development. For longest labeled application interval use the highest rate. DO NOT use on grasses intended for animal feed or live stock grazing. DO NOT apply more than 1.5 oz per 1000 SQ FT in one calendar year
		Fluoxastrobin (11)	Disarm: 0.09 - 0.36 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Iprodione (2)	Chipco 26019: 1.5 – 2.0 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than six (6) applications in one year. DO NOT use on grasses intended for animal feed or live stock grazing.
		Mancozeb (M)	Fore: 4.0 oz Protect DF: 4.0 oz Pentathlon: 4.0 oz	7	DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.
		Myclobutanil (3)	Eagle 40WP: 0.6 oz	14-21	On Bentgrass greens, high rates may result in unacceptable growth regulation. DO NOT apply more than 7.2 oz per 1000 SQ FT per calendar year.
		PCNB (14)	Terraclor 75 WP: 3.0 – 4.0 oz Turfcide 400: 4.5 – 6.0 oz	7-10	Apply preventatively when conditions are favorable for disease development. May cause short-term discoloration of turfgrass

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Propiconazole (3)	Banner Maxx: 1.0 – 2.0 oz Spectator: 0.37 – 0.72 oz	14-21	Apply preventatively when conditions are favorable for disease development. Under conditions of high temperature and humidity, use higher rates and shorter application intervals within the ranges given. On Bentgrass greens, high rates may result in unacceptable growth regulation. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
		Pyraclostrobin (11)	Insignia: 0.5 – 0.9 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Thiophanate-methyl (1)	Cleary 3336F: 2.0 – 4.0 oz	14	Apply preventatively when conditions are favorable for disease development.
		Triadimefon (3)	Bayleton 50 WP: 0.5 – 1.0 oz	15 - 30	Apply preventatively when conditions are favorable for disease development. If applied as a curative treatment use higher rates and shorter application intervals within the ranges given.
		Trifloxystrobin (11)	Compass: 0.15 – 0.2 oz Compass: 0.25 oz	14 21	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides. Application intervals should be extended to 21 days if the highest rate is used.
	Notes and cultural controls: Maintain adequate fertility. Avoid excess fast-release nitrogen. Irrigate deeply. Reduce thatch.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Dollar Spot *(Sclerotinia homoeocarpa)* bahiagrass bermudagrass centipedegrass creeping bentgrass ryegrass St. Augustinegrass tall fescue zoysiagrasses	On fine textured grasses, spots appear 1-2" in diameter. On tall or coarse grasses, patches may reach 5" or more in diameter. Often, straw-colored lesions move in from leaf margins or occur as distinct bands across the leaf. Most active during 60-80°F in spring and fall. Moisture from fog, dew, or irrigation initiate disease. Low soil moisture, thatch, low N and K favor disease.	Boscalid (7)	Emerald: 0.13 – 0.18 oz	14-28	Apply preventatively when conditions are favorable for disease development.
		Chlorothalonil (M)	Daconil Ultrex: 1.0 – 5.0 oz Manicure Ultrex: 1.0 – 5.0 oz Echo ultimate: 1.8 – 3.2 oz	7-14	Fungicides are most effective when used as a preventative. Use higher labeled rates and shorter intervals for curative treatments and intensively mowed turf grasses. Consult formulation label for annual maximum use guidelines.
		Fenarimol (3)	Rubigan A.S.: 0.75 – 1.5 oz	10 - 28	Apply preventatively when conditions are favorable for disease development. If applied as a curative treatment use higher rates and shorter application intervals within the ranges given.
		Iprodione (2)	Chipco 26019: 1.5 – 2.0 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than six (6) applications in one year. DO NOT use on grasses intended for animal feed or live stock grazing.
		Mancozeb (M)	Fore: 6.0 – 8.0 oz Protect DF: 6.0 – 8.0 oz Pentathlon: 6.0 – 8.0 oz	7	DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.
		Myclobutanil (3)	Eagle 40WP: 0.5 - 1.2 oz	14 - 28	DO NOT apply more than 7.2 oz per 1000 SQ FT per calendar year.
		Propiconazole (3)	Banner Maxx: 0.5 oz Spectator: 0.18 oz	7	Apply preventatively in the fall. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
		Pyraclostrobin (11)	Insignia: 0.9 oz	14	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Thiophanate-methyl (1)	Cleary 3336F: 2.0 – 4.0 oz	14	Apply preventatively when conditions are favorable for disease development.
		Triadimefon (3)	Bayleton 50 WP: Preventative (0.5 oz); Curative (1.0 oz)	15 - 30	Apply preventatively when conditions are favorable for disease development. If applied as a curative treatment use highest labeled rate initially, then use the preventative schedule for subsequent applications.
		vinclozolin (2)	Curalan EG: 1.0 oz	21 - 28	Apply preventatively when conditions are favorable for disease development. DO NOT use on grasses intended for animal feed or live stock grazing.
	Notes and cultural controls: Avoid N deficiency. Irrigate in morning. Avoid thatch buildup. Wipe heavy dew off in mornings.				
Fairy Ring (*Chlorophyllum* sp., *Lycoperdon* sp. *Marasmius* sp., and other mushroom fungi) All grasses *Also see localized dry spots/rings*.	Irregular sized circular to semi-circular bands of lush green turf become apparent. Turf within circular area may decline, turn brown and thin. Toxins may be involved, but hydrophobic soil is a major problem. Mushrooms may be associated with the rings. Rings may persist for years.	Azoxystrobin (11)	Heritage: 0.4 oz	28	Apply as soon as fairy ring symptoms develop. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Flutolanil (7)	Prostar: Preventative (2.2 oz); Curative (4.5 oz)	21 - 28	Apply preventatively when conditions are favorable for disease development. If symptoms develop use the higher recommended rate.
	Notes and cultural controls: Difficult to control. Plugging or aerating to allow more water and fertilizer to reach the roots may help. Some surfactants have helped water penetration. Avoid excess nitrogen fertilization, irrigate infrequently but thoroughly, avoiding light frequent irrigations. Protect newly seeded areas that are highly susceptible. Reduce shade and increase air movement around greens.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Large Patch (formally known as **Zoysia patch)** *(Rhizoctonia solani)* Warm Season Grasses: bermudagrass centipedegrass St. Augustinegrass zoysiagrass	Grass is killed in circular to irregular areas that may expand to several feet in diameter. Leaf fascicles pull easily from plant due to rot at leaf base. Large patch occurs in fall, spring and sometimes in mid-winter on warm season grasses. High N, thatch buildup, and excessive moisture favor disease.	Azoxystrobin (11)	Heritage: 0.2 – 0.4 oz	14-28	Apply one (1) or two (2) applications approximately one month prior to dormancy. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Flutolanil (7)	Prostar: 2.2 oz	30	Apply preventatively when conditions are favorable for disease development.
		Fluoxastrobin (11)	Disarm: 0.36 oz	14-28	Apply one (1) or two (2) applications approximately one month prior to dormancy. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Iprodione (2)	Chipco 26019: 2.0 oz	14-21	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than six (6) applications in one year. DO NOT use on grasses intended for animal feed or live stock grazing.
		Myclobutanil (3)	Eagle 40WP: 1.2 oz	28	DO NOT apply more than 7.2 oz per 1000 SQ FT per calendar year.
		PCNB (14)	Terraclor 75 WP: 16.0 oz Turfcide 400: 16.0 – 24.0 oz	21-28	Apply preventatively when conditions are favorable for disease development. May cause short-term discoloration of turfgrass
		Propiconazole (3)	Banner Maxx: 3.0 – 4.0 oz Spectator: 1.1 – 1.4 oz	1 application in early fall	Apply preventatively in the fall. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
		Triadimefon (3)	Bayleton 50 WP: 1.0 - 2.0 oz	1 application in early fall; repeat in spring if necessary	Apply preventatively when conditions are favorable for disease development.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Trifloxystrobin (11)	Compass: 0.15 – 0.2 oz Compass: 0.25 oz	14 21	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides. Application intervals should be extended to 21 days if the highest rate is used.
	Notes and cultural controls: Maintain adequate fertility. Avoid excess fast-release nitrogen. Irrigate deeply. Reduce thatch.				
Leaf Spot (Melting out) "Helminthosporium" (*Bipolaris, Drechslera, Exerohilum* spp.) bahiagrass bermudagrass bluegrass creeping bentgrass ryegrass St. Augustinegrass zoysiagrasses	Symptoms include leaf spotting and "melting-out" phases. Leaves have circular to elongated, purplish or brown spots with straw-colored centers on older lesions. Numerous lesions cause leaves to turn reddish-brown, then yellow, and die. Sheath and crown rot may be present. Ryegrass, bluegrass (Poa trivialis) and bermudagrass are most susceptible. Most prevalent when temperatures range from 69-98°F during mild periods of spring and fall.	Azoxystrobin (11)	Heritage: 0.2 - 0.4 oz	14 - 21	Apply when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Chlorothalonil (M)	Daconil Ultrex: 1.8 – 3.2 oz Manicure Ultrex: 1.8 – 3.25 oz Echo ultimate: 1.8 – 3.2 oz	7 - 14	Fungicides are most effective when used as a preventative. Consult formulation label for annual maximum use guidelines.
		Fludioxonil (12)	Medallion: 0.2 – 0.5 oz	14 - 21	Apply preventatively when conditions are favorable for disease development. DO NOT use on grasses intended for animal feed or live stock grazing. DO NOT apply more than 1.5 oz per 1000 SQ FT in one calendar year
		Iprodione (2)	Chipco 26019: 1.5 – 2.0 oz	14-28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than six (6) applications in one year. DO NOT use on grasses intended for animal feed or live stock grazing.
		Mancozeb (M)	Fore: 4.0 oz Protect DF: 4.0 oz Pentathlon: 4.0 oz	7	DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Myclobutanil (3)	Eagle 40WP: 0.6 oz	14	DO NOT apply more than 7.2 oz per 1000 SQ FT per calendar year.
		PCNB (14)	Terraclor 75 WP: 7.0 – 10.0 oz Turfcide 400: 3.0 oz	21-28	Apply preventatively when conditions are favorable for disease development. May cause short-term discoloration of turfgrass
		Propiconazole (3)	Banner Maxx: 1.0 – 2.0 oz Spectator: 0.37 – 0.72 oz	14	Apply preventatively in the fall. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
		Trifloxystrobin (11)	Compass: 0.1 – 0.15 oz Compass: 0.15 - 0.25 oz	14 21	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides. Application intervals should be extended to 21 - 28 days if the higher rates are used.
		vinclozolin (2)	Curalan EG: 1.0 oz	14 - 28	Apply preventatively when conditions are favorable for disease development. DO NOT use on grasses intended for animal feed or live stock grazing.
	Notes and cultural controls: Maintain a balanced fertility. Irrigate deeply in the mornings. raise mower height during disease outbreaks. Reduce thatch.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Pythium Blight (*Pythium* spp., especially *P. aphanidermatum*) Mostly cool season turfgrasses; creeping bentgrass, ryegrasses, and bluegrasses are susceptible	Grass dies in spots or streaks. Initially, the affected grass has a dark color and a greasy appearance, particularly in spots. Spots may develop a copper color and eventually a bleached, straw color as affected tissues die and dry. After prolonged moist or foggy periods, the cottony mycelium may be seen on the turf (note: this symptom is NOT always evident). Pythium can be spread by foot traffic or mowers passing over infected grasses. Occurs during warm, humid, foggy weather in poorly drained soils. Ryegrass, rough bluegrass, and bentgrass used for overseeding are most susceptible.	Azoxystrobin (11)	Heritage: 0.4 oz	10 - 14	Apply when conditions are favorable for disease development. During periods favorable for disease, treat on the 10 day application interval. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Fosetyl-Al (33)	Chipco signature: 4.0 oz Chipco signature: 8.0 oz	14 21	Fungicides are most effective when used as a preventative. Use the longer application interval for higher rates.
		Mancozeb (M)	Fore: 8.0 oz Protect DF: 8.0 oz Pentathlon: 8.0 oz	5	DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.
		Mefonoxam (4)	Quali Pro: 0.2 – 1.0 oz Subdue Maxx: 0.5 – 1.0 oz	10 - 21 7 - 14	During prolonged periods favorable for disease development use higher rates with shorter intervals within the range indicated.
		Phosphite (salts of phosphorus acid) (33)	Primera Magellan: 4.1 – 8.2 oz Vital: 4.0 – 6.0 oz	12 – 21 14	Apply preventatively when conditions are favorable for disease development.
		Propamocarb (28)	Banol: Preventative (1.5 – 2.0 oz); Curative (3.0 – 4.0 oz) Proplant: Preventative (1.3 – 2.0 oz); Curative (3.0 – 4.0 oz)	7 - 21	DO NOT apply more 12 fl oz per 1000 sq ft per calendar year.
		Pyraclostrobin (11)	Insignia: 0.9 oz	10 - 14	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
	Notes and cultural controls: To minimize the potential for resistance, alternate between classes of fungicides. Improve aeration and drainage. Avoid frequent, shallow irrigation. Reduce mowing and minimize equipment or foot traffic across infested turf. Wash equipment that passes from infected to non-infected grass areas.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Pythium Root Rot (*Pythium* spp.) All grasses	Roots are dark, soft with few or no feeder roots present. Sometimes, new roots may be initiated from crown regions as older roots become diseased. Root rot is favored in poorly drained or continuously wet soils. Areas will appear chlorotic and be less vigorous in growth, but usually do not die. Can occur year around, especially on over-irrigated sites.	Azoxystrobin (11)	Heritage: 0.4 oz	10 - 14	Apply when conditions are favorable for disease development. During periods favorable for disease, treat on the 10 day application interval. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Fosetyl-Al (33)	Chipco signature: 4.0 oz Chipco signature: 8.0 oz	14 21	Fungicides are most effective when used as a preventative. Use the longer application interval for higher rates.
		Mefonoxam (4) *	Quali Pro: 0.2 – 1.0 oz Subdue Maxx: 0.5 – 1.0 oz	10 - 21 7 - 14	During prolonged periods favorable for disease development use higher rates with shorter intervals within the range indicated.
		Propamocarb (28) *	Banol: Preventative (1.5 – 2.0 oz); Curative (3.0 – 4.0 oz) Proplant: Preventative (1.3 – 2.0 oz); Curative (3.0 – 4.0 oz)	7 - 21	DO NOT apply more 12 fl oz per 1000 sq ft per calendar year.
	Notes and cultural controls: To minimize the potential for resistance, alternate between classes of fungicides. Avoid overwatering. Water into the root-zone. Aerate compacted and poorly drained soils. Foliar fertilizer treatments may be useful. * only azoxystrobin and fosetyl-Al have Pythium root rot on the label.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Rust (*Puccinia* spp.) bermudagrass ryegrass St. Augustinegrass tall fescue zoysiagrasses	Small yellow to orange or reddish-brown pustules on the leaves. Heavily infected areas appear thin and chlorotic. Ryegrass and zoysiagrasses are most susceptible. Humid weather following a drought period favors epidemics.	Azoxystrobin (11)	Heritage: 0.2 - 0.4 oz	14 - 28	Apply when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Chlorothalonil (M)	Daconil Ultrex: 3.7 – 5.0 oz Manicure Ultrex: 3.7 – 5.0 oz Echo ultimate: 3.2 – 5.0 oz	14	Fungicides are most effective when used as a preventative. Consult formulation label for annual maximum use guidelines.
		Mancozeb (M)	Fore: 4.0 oz Protect DF: 4.0 oz Pentathlon: 4.0 oz	7 - 14	DO NOT use on grasses grown for seed. DO NOT use on grasses intended for animal feed or live stock grazing.
		Propiconazole (3)	Banner Maxx: 1.0 – 2.0 oz Spectator: 0.37 – 0.72 oz	14 - 28	When conditions are favorable for disease development. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
		Pyraclostrobin (11)	Insignia: 0.5 - 0.9 oz	14 - 28	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than two (2) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Thiophanate-methyl (1)	Cleary 3336F: 4.0 – 6.0 oz	14	Rotations and/or tank mix combinations with chlorothalonil or mancozeb are recommended by the label.
		Triadimefon (3)	Bayleton 50 WP: 0.5 - 1.0 oz	15 - 30	Apply preventatively when conditions are favorable for disease development. Use lower rates and longer intervals if conditions are not favorable for disease development.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
		Trifloxystrobin (11)	Compass: 0.10 – 0.15 oz Compass: 0.20 - 0.25 oz	14 21	Apply preventatively when conditions are favorable for disease development. DO NOT apply more than three (3) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides. Application intervals should be extended to 21 days if the highest rate is used.
	Cultural controls: Plant resistant or tolerant varieties. Maintain growth by fertilizing and irrigating adequately. Mow frequently and remove clippings.				
Slime Mold (*Physarum* sp., and *Fuligo* sp.) All grasses	Bluish-gray encrustations on leaf blades. In spring and summer during heavy rain, prominent white or yellow slimy masses may develop. Slime molds are not parasites of turf.	None are needed.			
	Cultural controls: Avoid drought conditions preceding hot, humid or wet weather; improve poorly drained soils and improve aeration to roots and crowns.				
Spring Dead Spot (*Ophiosphaerella herpotricha Ophiosphaerella korrae, Ophiosphaerella narmari*) bermudagrass, especially sterile hybrids.	First appears as circular dead areas 6" up to 2' in diameter in the spring when the rest of the turf area turns green with new growth. Normally bermudagrass does not invade the dead areas as the growing season progresses nor do the dead areas increase in size until the next spring.	Azoxystrobin (11)	Heritage: 0.4 oz	14 - 28	Apply one (1) or two (2) applications prior to bermudagrass dormancy DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Fenarimol (3)	Rubigan A.S.: 4.0 – 6.0 oz	1 fall application	Use the low rate if application occurs in September; otherwise use the high rate in October or November.
		Myclobutanil (3)	Eagle 40WP: 1.2 oz	28	Make one (1) or two (2) applications in the fall before grass becomes dormant.
		Propiconazole (3)	Banner Maxx: 4.0 oz Spectator: 1.44 oz	30	If a single application is used, apply in September or October. For multiple applications begin sprays in August. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
	Cultural controls: In established bermudagrass, thorough cultivation of dead areas may provide temporary recovery. Manage thatch by cultural methods, and avoid excess, unbalance N fertilization in late summer or early fall.				

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND AFFECTED GRASSES	SYMPTOMS	COMMON NAME (FUNGICIDE MOA GROUP**)	FORMULATION: RATE/1000 SQ FT	APPLICATION INTERVAL (DAYS)	REMARKS
Take-all Patch (*Gaeumannomyces graminis* var. *graminis)* Creeping bentgrass St. Augustinegrass	Initially, symptoms appear in late spring or early summer and manifest as grass that is growing poorly, off colored, or wilted. As temperatures increase and plants become stressed, patches will become thin and turn yellow, orange, or bronze in color. Bluegrasses and fescues have some resistance to the pathogen and can sometimes be found growing in the center of dead patches. Roots, stolons, and crowns will appear dark brown or black in color.	Azoxystrobin (11)	Heritage: 0.4 oz	28	Begin applications when conditions are favorable for disease. Make two (2) applications 28 days apart in the spring and two (2) applications 28 days apart in the fall. DO NOT apply more than two (2) sequential applications if *Pythium spp.* Are known to be present; otherwise DO NOT apply more than four (4) sequential applications of QoI (strobilurin) fungicides.
		Fenarimol (3)	Rubigan A.S.: 4.0 oz	30	Begin applications when conditions are favorable for disease.
		Propiconazole (3)	Banner Maxx: 2.0 - 4.0 oz Spectator: 0.72 - 1.44 oz	30	Make one (1) to two (2) fall applications beginning in September and October or when night temperatures drop to 55°F and one (1) to two (2) applications in April and May. DO NOT apply more than 16 fl oz per 1000 SQ FT of Banner Maxx, or 5.8 fl oz of Spectator per calendar year.
		Pyraclostrobin (11)	Insignia: 0.9 oz	28	Apply preventatively when conditions are favorable for disease development. Make two (2) applications in the fall and two (2) applications in the spring. DO NOT apply more than two (2) sequential applications of QoI (strobilurin) fungicides. For best results use in rotation with non-QoI fungicides.
		Triadimefon (3)	Bayleton 50 WP: 1.0 – 2.0 oz	21 - 28	Apply preventatively in the spring or fall. To control existing infections, apply 2 oz for the initial treatment followed by 1 – 2 oz at 21 – 28 day intervals.
	Cultural controls: Utilize acidifying fertilizers, such as ammonium sulfate or ammonium chloride. Improve root health by aeration and other accepted cultural practices.				

** Fungicide MOA groups begin on page 56.

DISEASE CONTROL FOR TURFGRASSES (CONT'D)

DISEASE AND PATHOGEN	SYMPTOMS	CONTROLS
Nematodes commonly found in Oklahoma: Ring - *Criconemella* spp. Spiral - *Helicotylenchus* spp. Stunt - *Tylenchorhynchus* spp. Root Lesion - *Pratylenchus* spp. Lance - *Hoplolaims* spp.	Typical above ground symptoms are lack of plant vigor, off-color, general decline, wilting of plants, thin areas of turf with dead plants. Nematodes injure roots, reduce water and nutrient uptake. Roots may be stubby, with brown lesions, black or brown burnt effect. Laboratory analysis is required for positive identification.	Nematicide application should not be made unless nematodes are known to be a problem.

TABLE 2: PREPACKAGED FUNGICIDE MIXTURES

ACTIVE INGREDIENTS (Fungicide MOA Group**)	SOME PRODUCT NAMES
azoxystrobin (11) + propiconazole (3)	Headway
copper hydroxide (M) + mancozeb (M)	Junction
fenarimol (3) + chlorothalonil (M)	LESCO Twosome
myclobutanil (3) + mancozeb (M)	MANhandle
thiophanate-methyl (1) + chlorothalonil (M)	Consyst, Spectro
thiophanate-methyl (1) + flutolanil (7)	SysStar
Trifloxystrobin (11) + triadimefon (3)	Armada, Tartan

** Fungicide MOA groups begin on page 56.

Several fungicides listed in table 1 are also available in prepackaged mixtures of two or more active ingredients (Table 2). Prepackaged mixtures can be useful in providing a broad spectrum fungicide strategy to target multiple organisms at a single time and also provide some protection against fungicide resistance. In addition, prepackaged mixtures can be used with the confidence that the active ingredients that are combined in the tank are truly compatible. However, be sure to consult the label for all rates, recommendations, and restrictions; all fungicide rates and remarks included in table 1 are for solo active ingredients, NOT prepackaged mixtures.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Aphids	Acephate	Orthene	1B	24	Has translaminar-systemic activity as a spray. Check label for phytotoxicity information.
	Abamectin	Avid	6	12	Has translaminar-systemic activity as a spray.
	Acetamiprid	Tristar	4A	12	Has translaminar-systemic activity as a spray.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Slow-acting. Works best when tank mixed with other insecticides.
	Beauveria bassiana	Botanigard/Naturalis	M	4	3 to 5 applications may be needed.
	Bifenthrin	Talstar[r]	3	12	
	Chlorpyrifos + Cyfluthrin	Duraplex	1B + 3	24	Aerosol formulation.
	Clothianidin	Celero	4A	12	Has translaminar-systemic activity. Apply as a foliar or drench.
	Cyfluthrin	Decathlon	3	12	Systemic insecticides with long residual activity. Highly water soluble.
	Dinotefuran	Safari	4A	12	
	Endosulfan	Thiodan	2A	24	
	Fenpropathrin	Tame[r]	3	24	May be combined with Orthene.
	Flonicamid	Aria	9B	12	Has translaminar-systemic activity. Apply as a foliar or drench.
	Fluvalinate	Mavrik	3	12	
	Imidacloprid	Marathon	4A	12	Systemic insecticide with long residual activity.
	Insecticidal soap	M-Pede/Olympic Insecticidal soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Kinoprene	Enstar II	7A	4	Slow acting. Only works on young aphids.
	Neem oil	Triact Oil	UN	4	Short residual activity. See note 2.
	Paraffinic oil	Sunspray Ultra-Fine Oil	UN	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Permethrin	Astro	3	12	
	Pymetrozine	Endeavor	9B	12	Has systemic activity. Prevents insects from feeding by blocking mouthparts.
	Thiamethoxam	Flagship	4A	12	Systemic insecticide. Applied as a foliar or drench.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Caterpillars	Acephate	Orthene	1B	24	Check label for phytotoxicity information.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Azatin may be used on greenhouse-grown vegetables.
	Bacillus thuringiensis var. *kurstaki*	Dipel	11B2	4	May be used on greenhouse-grown vegetables. Insects must consume material.
	Beauveria bassiana	Naturalis	M	4	Works best when tank mixed with other insecticides. 3 to 5 applications may be needed.
	Bifenthrin	Talstar[r]	3	12	
	Chlorfenapyr	Pylon	13	12	Has translaminar-systemic activity. Do not make more than 2 applications in a sequence, or more than 3 times total per growing cycle. Check label for phytotoxicity information.
	Chlorpyrifos + Cyfluthrin	Duraplex	1B + 3	24	Aerosol formulation.
	Cyfluthrin	Decathlon	3	12	
	Diflubenzuron	Adept	15	12	Prevents insects from molting. Cannot be used on poinsettias, hibiscus, or Reiger begonia. Long residual activity.
	Fenpropathrin	Tame[r]	3	12	Has beet armyworm activity only.
	Fluvalinate	Mavrik	3	12	
	Permethrin	Astro	3	12	
	Spinosad	Conserve	5	4	
	Tebufenozide	Confirm	18A	4	Disrupts molting of caterpillars.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Fungus Gnats (Adults)	Bifenthrin	Talstar[r]	3	12	
	Chlorpyrifos + Cyfluthrin	Duraplex	1B + 3	24	Aerosol formulation.
	Cyfluthrin	Decathlon	3	12	
	Paraffinic Oil	Sunspray Ultra-Fine Oil	UN	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Permethrin	Astro	3	12	
Fungus Gnats (Larvae)	Azadirachtin	Azatin/Ornazin	18B	4/12	Azatin may be used on greenhouse-grown vegetables.
	Bacillus thuringiensis var. *israelensis*	Gnatrol	11A1	4	Slow-acting. May be used on greenhouse-grown vegetables.
	Chlorpyrifos	Duraguard	1B	24	Microencapsulated formulation.
	Chlorfenapyr	Pylon	13	12	Do not make more than 2 applications in a sequence, or more than 3 times total per growing cycle. Check label for phytotoxicity information.
	Cyromazine	Citation	17	12	Slow-acting.
	Diflubenzuron	Adept	15	12	Prevents insects from molting. Cannot be used on poinsettias, hibiscus, or Reiger begoinia. Long residual activity.
	Kinoprene	Enstar II	7A	4	Slow-acting.
	Phytoseiid mites		BLO	0	Certain species of these predatory mites are active in the soil. Check label for specific site requirements
	Pyriproxyfen	Distance	7C	12	Read label for precautions when using on poinsettias.
	Steinernema feltiae	Nemasys/Scanmask/ Entoneem	BLO	0	Beneficial nematode that attacks fungus gnat larvae. Apply before fungus gnat populations are high. Compatible with many pesticides, but some products may reduce efficacy of nematodes.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Leafminers	Abamectin	Avid	6	12	Active on larvae. Has translaminar-systemic activity.
	Acephate	Orthene	1B	24	Active on larvae. Has translaminar-systemic activity as a spray. Check label for phytotoxicity information.
	Azadirachtin	Azatin/Orazin	18B	4/12	Active on larvae. May be used on greenhouse-grown vegetables.
	Cyromazine	Citation	17	12	Active on larvae.
	Permethrin	Astro	3	12	Active on adults.
	Spinosad	Conserve	5	4	Active on larvae. Has translaminar-systemic activity.
Mealybugs	Acephate	Orthene	1B	24	Has translaminar-systemic activity as a spray. Check label for phytotoxicity information.
	Acetamiprid	Tristar	4A	12	Has translaminar-systemic activity as a spray.
	Beauveria bassiana	Botanigard/Naturalis	M	4	Works best when tank mixed with other insecticides. 3 to 5 applications may be needed.
	Bifenthrin	Talstar[r]	3	12	Works best on the crawler stages.
	Buprofezin	Talus	16	12	Works best on the crawler stages.
	Clothianidin	Celero	4A	12	Has translaminar-systemic activity. Apply as a foliar or drench.
	Cyfluthrin	Decathlon	3	12	Works best on the crawler stages.
	Fenpropathrin	Tame[r]	3	24	Works best on the crawler stages.
	Flonicamid	Aria	9B	12	Has translaminar-systemic activity. Apply as a foliar or drench.
	Fluvalinate	Mavrik	3	12	Works best on the crawler stages.
	Imidacloprid	Marathon	4A	12	Slow-acting, long residual systemic insecticide.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Kinoprene	Enstar II	7A	4	May be used as a drench for control of root mealybug.
	Neem oil	Triact Oil	HO	4	Short residual activity.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Thiamethoxam	Flagship	4A	12	Systemic insecticide. Applied as a foliar or drench.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Mites (Twospotted Spider)	Abamectin	Avid	6	12	Has translaminar-systemic activity.
	Beauveria bassiana	Naturalis	M	4	3 to 5 applications may be needed.
	Bifenazate	Floramite	25	4	Do not make more than two applications per crop per year. Is compatible with use of biological control organisms.
	Bifenthrin	Talstar®	3	12	
	Chlorfenapyr	Pylon	13	12	Has translaminar-systemic activity. Do not make more than 2 applications in a sequence, or more than 3 times total per growing cycle. Check label for phytotoxicity information.
	Clofentezine	Ovation	10A	12	Works on mite eggs. Is compatible with use of biological control organisms.
	Etoxazole	TetraSan	10B	12	Works on mite eggs, larvae and nymphs. Do not apply more than 2 times per growing cycle.
	Fenbutatin-oxide	Vendex®	12B	48	Works best at temperatures above 70°F.
	Fenpropathrin	Tame®	3	24	
	Fenpyroximate	Akari	21	12	Do not rotate with Sanmite.
	Fluvalinate	Mavrik	3	12	
	Hexythiazox	Hexygon	10B	12	Works on mite eggs, larvae and nymphs.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	4	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Neem oil	Triact Oil	HO	4	Short residual activity.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Phytoseiid mites	(various products)	BLO	0	Widely used predatory mites of spider mites, including two-spotted spider mite. Check label for specific site requirements for each species.
	Pyridaben	Sanmite	21	12	Do not rotate with Akari.
	Spiromesifen	Judo	23	12	Has translaminar properties. Long residual activity.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Mites (Cyclamen)	Abamectin	Avid	6	12	Has translaminar-systemic activity.
	Chlorfenapyr	Pylon	13	12	Has translaminar-systemic activity. Do not make more than 2 applications in a sequence, or more than 3 times total per growing cycle. Check label for phytotoxicity information.
	Endosulfan	Thiodan	2A	24	
	Phytoseiid mites	(various products)	BLO	0	Widely used predatory mites of mite pests. Check label for specific site requirements for each species.
Mites (Broad)	Abamectin	Avid	6	12	Has translaminar-systemic activity.
	Bifenthrin	Talstar®	3	12	
	Chlorfenapyr	Pylon	13	12	Has translaminar-systemic activity. Do not make more than 2 applications in a sequence, or more than 3 times total per growing cycle. Check label for phytotoxicity information.
	Phytoseiid mites	(various products)	BLO	0	Widely used predatory mites of mite pests. Check label for specific site requirements for each species.
	Pyridaben	Sanmite	21	12	

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Scales (Soft and Armored)	Acephate	Orthene	1B	24	Works best on the crawler stages. Check label for phytotoxicity information.
	Bifenthrin	Talstar[r]	3	12	Works best on the crawler stages.
	Buprofezin	Talus	16	12	Works best on the crawler stages.
	Cyfluthrin	Decathlon	3	12	Works best on the crawler stages.
	Imidacloprid	Marathon	4A	12	Only active on soft scales.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soal	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Kinoprene	Enstar II	7A	4	Slow-acting. Only active on the crawler stages.
	Neem oil	Triact Oil	HO	4	Short residual activity.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Pyriproxyfen	Distance	7C	12	Slow-acting. Only active on the crawler stages.
Slugs	Iron phosphate	Sluggo	UN	0	Bait formulation.
	Metaldehyde	Deadline	UN	12	Bait formulation.
	Methiocarb	Mesurol	1A	24	Bait formulation.
Thrips	Abamectin	Avid	6	12	Rotate with Conserve and Mesurol.
	Acephate	Orthene	1B	24	Works best when tank mixed with Tame. Check label for phytotoxicity information.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Works best when tank mixed with other insecticides.
	Beauveria bassiana	Botanigard/Naturalis	M	4	Works best when tank mixed with other insecticides. 3 to 5 applications may be needed.
	Bifenthrin	Talstar[r]	3	12	
	Cyfluthrin	Decathlon	3	12	
	Fenpropathrin	Tame[r]	3	24	Works best when tank mixed with Orthene.
	Fluvalinate	Mavrik	3	12	
	Kinoprene	Enstar II	7A	4	Slow-acting. Only active on the nymphal stages.
	Novaluron	Pedestal	15	12	Only active on the nymphal stages.
	Methiocarb	Mesurol	1A	24	Rotate with Conserve and Avid.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Phytoseiid mites	(various products)	BLO	0	Widely used predatory mites of thrips, including western flower thrips. Check label for specific site requirements for each species.
	Spinosad	Conserve	5	4	Avoid using at frequent intervals. Rotate with Mesurol and Avid.

GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Whiteflies	Abamectin	Avid	6	12	Has translaminar-systemic activity.
	Acephate	Orthene	1B	24	Has translaminar-systemic as a spray. Works on nymphs and adults. Check label for phytotoxicity information.
	Acetamiprid	Tristar	4A	12	Has translaminar-systemic activity as a spray.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Works best when tank mixed with other insecticides. Active on nymphs.
	Beauveria bassiana	Botanigard/Naturalis	M	4	Works best when tank mixed with other insecticides. Active on nymphs and adults. 3 to 5 applications may be needed.
	Bifenthrin	Talstar[r]	3	12	Active on nymphs and adults.
	Buprofezin	Talus	16	12	Active on nymphs.
	Clothianidin	Celero	4A	12	Has translaminar-systemic activity. Apply as a foliar or drench.
	Cyfluthrin	Decathlon	3	12	Active on nymphs and adults.
	Dinotefuran	Safari	4A	12	Systemic insecticide with long residual activity. Highly water soluble.
	Encarsia formosa		BLO	0	Parasitic wasp of greenhouse whitefly.
	Endosulfan	Thiodan	2A	24	May be used on greenhouse-grown tomatoes. Active on nymphs and adults.
	Fenpropathrin	Tame[r]	3	24	Active on nymphs and adults.
	Flonicamid	Aria	9B	12	Has translaminar-systemic activity. Apply as a foliar or drench.
	Fluvalinate	Mavrik	3	12	Active on nymphs and adults.
	Imidacloprid	Marathon	4A	12	Slow-acting, long residual systemic insecticide.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals. Active on nymphs and adults.
	Kinoprene	Enstar II	7	4	Slow-acting. Only active on the nymphs.
	Neem oil	Tract Oil	HO	4	Active on nymphs and adults.
	Novaluron	Pedestal	15	12	Active on nymphs.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Active on eggs, pupae, nymphs, and adults. Avoid applying at frequent intervals. See note 2.
	Permethrin	Astro	3	12	Active on nymphs and adults.
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GREENHOUSE FLORAL CROPS INSECT AND MITE CONTROL SUGGESTIONS (CONT'D)

Pest	Pesticide Common Name	Pesticide Trade Name	Pesticide Class	REI**	Comments
Whiteflies (cont'd)	Pymetrozine	Endeavor	9B	12	Has systemic activity. Works on nymphs and adults. Prevents insects from feeding by blocking mouthparts.
	Pyridaben	Sanmite	21	12	Works on nymphs and adults.
	Pyriproxyfen	Distance	7C	12	Only works on the nymphs.
	Thiamethoxam	Flagship	4A	12	Systemic insecticide. Applied as a foliar or drench

[r] Restricted Use Pesticide.

*** The numbers associated with the pesticide class column were developed by the Insecticide Resistance Action Committee, (IRAC) in 2005. It is intended to help in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest or group of pests during a growing sequence, simply select a registered insecticide with a different number for each generation (14-21 days). You can rotate within the same number if more than one subgroup is available (Example: 2A and 2B). To further delay resistance from developing, integrate other control methods into your pest management programs.**

1A=Carbamate
1B=Organophosphate
2A=Cyclodiene organochlorine
2B=Phenylpyrazole
3=Pyrethroid
4A=Neonicitinoid
4B=Nicotine
5=Spinosyns
6=Avermectins
7A=Juvenile hormone analogues
7B=Fenoxycarb
7C=Pyriproxyfen
8A=Methyl bromide (fumigant)
8B=Aluminum phosphide (fumigant)
8C=Sulfuryl fluoride (fumigant)
9A=Cryolite
9B=Pymetrozine
9C=Flonicamid
10A=Clofentezine
10B=Hexythiazox
11A1=Bt var. israelensis
11A2=Bt. var. sphaericus
11B1=Bt. var. aizawai
11B2=Bt. var. kurstaki
11C=Bt. var. tenebrionensis
BLO=Biological Organism
M=Microbial
HO=Horticultural Oil
12A=Diafenthiuron
12B=Organotin miticide
12C=Propargite
13=Chlorfenapyr, DNOC
14=
15=Benzoylureas
16=Buprofezin
17=Cyromazine
18A=Diacylhydrazine
18B=Azadirachtin
19=Amitraz
20A=Hydramethylnon
20B=Acequinocyl
20C=Fluacrypyrim
21=METI acaricides, Rotenone
22=Indoxacarb
23=Tetronic acid derivitives
24A=Aluminum phosphide
24B=Cyanide
24C=Phosphine
25=Bifenazate
26=Fluroacetate
27A=P450 monooxygenase inhibitors
27B=Esterase inhibitors
28=Flubendiamide
NS=Non-specific, multi-site
UN=Unknown MOA

**** REI=Restricted Entry Interval**

NOTES:

1. Before purchasing and using any pesticide, read the label carefully for registered use(s), rates, and application frequency. Also note toxicity category on the label of each pesticide since toxicity ratings may affect reentry intervals and note any ventilation requirements. Wear protective clothing as recommended on each pesticide label.
2. When using horticultural oils it is important to not use oils with insecticidal soap or any sulfur containing compounds. Also, do not use horticultural oils in sprayers in which fungicides have been used. Frequent agitation is required when using horticultural oil sprays.
3. Insecticides having a broad spectrum of activity (e.g., pyrethroids, organophosphates, carbamates, neonicotinoids), may not be compatible with biological control because they can harm some natural enemies. Some broad-spectrum insecticides are more selective than others, and selectivity further depends on how, when, and where the insecticide is applied. Be sure to check the label for the kinds of insects controlled by the product, or contact your county extension educator for information on compatibility with biological control.

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Bacterial blights, leafspots, & wilts	Copper sulphate Pentahydrate (M)	Phyton-27	5.5SEC	Calla lily, chrysanthemum, cyclamen, holiday cactus, iris, primula, palms, tropical foliage, orchid, poinsettia - *Erwinia* soft rot; begonia, holiday cactus, geranium, hibiscus, ivy, impatiens, orchid, palms, poinsettia, tropical foliage, zinnia - *Pseudomonas* and *Xanthomonas*.	24	
	Copper (fixed) (M)	Camelot		See label.	12	
	Copper Hydroxide (M)	Kocide	77WP	Aralia, begonia, carnation, ivy, philodendron - bacterial leaf spots.	24	
	Fosetyl-Al (33)	Aliette	WDG	*Xanthomonas* blight only.	12	Do not mix with coppers.
Botrytis blights, spots, and stem rots	Azoxystrobin (11)	Heritage	50WP	See label.	4	Best used as a preventative.
	Chlorothalonil (M)	Exotherm Termil		**Foliage** and **blooms** of African violet, ageratum, alyssum, aphelandra, azalea, calceolaria, celosia, chrysanthemum, cineraria, cyclamen, dianthus, Easter lily, fuchsia, geranium, gloxinia, hydrangea, lantana, marigold, nasturtium, primrose, rose, salvia, scarlet sage, schizanthus, snapdragon, verbena, zinnia. **Foliage only** of aster, balsam, begonia, caladium, carnation, coleus, delphinium, impatiens, lobelia, palm, petunia, poinsettia, porch ivy, variegated hoya, *Vinca rosea*.	48	Smoke fumigation. Do not treat poinsetties in color.

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Botrytis blights, spots, and stem rots (cont'd)		Daconil Ultrex Concorde	82.5WDG 6F	See Label.	12	
	Chlorothalonil + thiophanate-Methyl (M, 1)	Spectro Consyst	90WDG 67WDG	See label.	12	
	Copper sulphate pentahydrate (M)	Phyton-27	5.5EC	African violet, begonia, calla lily, chrysanthemum, cyclamen, ferns, freesias, fuchsia, geraniums, gerbera, hibiscus, holiday cactus, impatiens, iris, ivy, kalanchoe, New Guinea impatiens, orchids, palms, pansy, primula, poinsettia, rose, spathiphyllum, tropicals, zinnia.	24	
	Copper (fixed) (M)	Camelot		See Label	12	
	Copper Hydroxide (M)	Kocide	77WP	Azalea, bulbs, carnation, chrysanthemum.	24	
	Dimethomorph (40)	Stature	50DM	See Label.	24	
	Fenhexamide (17)	Decree	50WDG	See label.	4	
	Fludioxonil (12)	Medallion	50WP	See label.	12	
	Fungus - *Streptomyces*	Mycostop	30WP	Label lists 46 ornamentals.	4	For disease suppression.
	Fungus- *Trichoderma*	PlantShield	HC	See label.	0	For diseas4e suppression.
	Iprodione (2)	Chipco 26019	50WP	Ageratum, alyssum, aphelandra, artemisia, aster, azalea, cactus, calendula, carnation, chrysanthemum, cineraria, coleus, coral bells, crassula, croton, columbine, cyclamen, daffodil, dahlia, delphinium, deutzia, dianthus, dieffenbachia, dizygotheca, dracaena, English ivy, episcia, ficus, gazania, geranium, gladiolus, gloxinia, gypsophila, hoya, hydrangea, impatiens, iris, kalanchoe, lily, lipstick vine, marigold, monarda, palm, pansy, peperomia, periwinkle, philodendron, phlox, pilea, pittosporum, poinsettia, poppy, pothos, primrose, protea, rose, salvia, schefflera, snapdragon, spathiphyllum, statice, tree ivy, tulip, violet, zinnia.	12	

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Botrytis blights, spots, and stem rots (cont'd)	Mancozeb (M)	Protect Dithane Fore Fore Pentathlon	80WP 75DF 80WP Flo 4F	See labels.	24	
	Neem Oil (NL)	Concern	70	See label.	4	
	Potassium Bicarbonate (NL)	Milstop		2.5-5.0 lb	4	
	Thiophanate-Methyl (1)	Cleary's 3336 Fungo FLO Fungo 50 Systec 1998	50WP LF 50WSB 4.5F	Rose, flowers, ornamentals.	12	
	Trifloxystrobin (11)	Compass	50WDG	See label.	12	
	Triflumizole (3)	Terraguard	50WP	See label.	12	
Downy mildews	Azoxystrobin (11)	Heritage	50WP	See label.	4	
	Chlorothalonil + Thiophanate methyl (M, 1)	Spectro	90WDG	See label.	12	
	Dimethomorph (40)	Stature	50DM	See label.	24	
	Fosetyl-A1 (21)	Aliette	WDG	Roses only.	12	
	Kresoxim-methyl (11)	Cygnus	50WDG	See Label		
	Mancozeb (M)	Protect	75DF	See label.	24	
	Neem Oil	Concern	70	See label.	4	
	Trifloxystrobin (11)	Compass	50WDG	See label.	12	Can damage petunias and New Guinea impatiens.
	Potassium phosphite (NC)	Vital		1-2 qt	4	

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Leaf and flower spots and blights caused by other fungi (cont'd)	Azoxystrobin (11)	Heritage	50WP	See label.	4	
	Chlorothalonil (M)	Exothem 20		Azalea, carnation, chrysanthemum, daisy, dracaena, gladiolus, iris, leatherleaf fern, philodendron, parlor palm, prayer plant, oyster plant, rose, statice, syngonium - various leaf spots and blights (consult label).	48	
		Daconil Ultrex Concorde	82.5WDG 6F	See Label	 12	
	Chlorothalonil + thiophanate-Methyl (M, 1)	Spectro Consyst	90WDG 67WDG	See labels.	12	
	Copper sulphate Pentahydrate (M)	Phyton-27	5.5EC	See label.	24	
	Copper (fixed) (M)	Camelot		See label.	12	
	Copper Hydroxide (M)	Kocide	77WP	Aralia - *Cercospora, Alternaria*; azalea - *Cercospora, Phytophthora* dieback; begonia - anthracnose; carnation - *Alternaria*; chrysanthemum - *Septoria*; rose - black spot; Yucca - *Cercospora, Septoria*.	24	
	Dimethomorph (40)	Stature	50DM	See label.	24	
	Fludioxinil (12)	Medallion	50WP	See label.	12	
	Flutolanil (7)	Contrast	70WSP	See label.	12	
	Fungus-*Trichoderma*	PlantShield	HC		0	Cutting dip.
	Iprodione (2)	Chipco 26019	50WP	Ageratum, alyssum, aphelandra, artemisia, aster, azalea, cactus, calendula, carnation, chrysanthemum, cineraria, coleus, coral bells, crassula, croton, columbine, cyclamen, daffodil, dahlia, delphinium, deutzia, dianthus, dieffenbachia, dizygotheca, dracaena, English ivy, episcia, ficus, gazania, geranium, gladiolus, gloxinia, gypsophila, hoya, hydrangea, iris, kalanchoe, lily, lipstick vine, marigold, monarda, palm, pansy, peperomia, periwinkle, philodendron, phlox, pilea, pittosporum, poinsettia, poppy, primrose, protea, rose, salvia, schefflera, snapdragon, spathiphyllum, statice, tree ivy, tulip, violet, zinnia - miscellaneous leaf spots.	12	

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Leaf and flower spots and blights caused by other fungi (cont'd)				Chrysanthemum - ray blight; iris - ink spot; tulip - fire; zinnia - alternate leaf spot.		
	Kresoxin- methyl (11)	Cygnus	50WDG	See label.	12	
	Mancozeb (M)	Protect DF Dithane Fore Fore Pentathlon	70DF 75DF 80WP WSP	See labels.	24	
	Myclobutanil (3)	Eagle	40WP	Ornamentals.	24	
	Neem Oil (NL)	Concern	70	See label.	4	
	Potassium Bicarbonate (NL)	Milstop		2.5-5.0 lb	4	
	Thiophanate-Methyl (1)	Cleary's 3336 Fungo FLO Fungo 50 Systec 1998	50WP LF 50WSB 4.5F	Azaleas, rhododendron - *Ovulinia* and *Sclerotinia* blight; Flowers, ornamentals - Anthracnose, *Cercospora*, *Entomosporium*, *Ramularia* and *Septoria* leaf spots, *Ascochyta* and *Phomopsis* blights; Iris - Didymellina leaf spot; rose - black spot.	12	
	Thiophanate-methyl + Mancozeb (M, 1)	Zyban	WSB	See label.	24	
	Triadimefon (3)	Strike	50WDB	Ageratum, azalea, iris, marigold, nephthytis, phlox, zinnia - various leaf spots.	12	
	Trifloxystrobin (11)	Compass	50WDG	See label.	12	Can damage petunias and New Guinea impatiens.

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Powdery mildews	Azoxystrobin (11)	Heritage	50WP	See label.	4	
	Chlorothalonil + thiophanate-Methyl (M, 1)	Spectro Conyst	90WDG 67WDG	See label.	12	
	Copper sulphate Pentahydrate (M)	Phyton-27	5.5EC	Begonia, rose, and others.	24	Foliar spray. Mix carefully, begin with lower dosage ;increase as required.
	Fenarimol	Rubigan		See label.	12	
	Fungus-*Trichoderna*	PlantShield	HC	See label.	0	
	Kresoxim-methyl (11)	Cygnus	50WDG	See label.	12	
	Myclobutanil (3)	Eagle	50WP	All ornamentals.	24	
	Neem Oil (NL)	Concern	70	See label.	4	
	Piperalin (NL)	Pipron	82.4EC	Chrysanthemum, dahlia, lilac, phlox, rose, zinnia.	12	
	Potassium Bicarbonate (NL)	Milstop		See labels.	4	
	Soaps (NC)	M-Pede		Roses.	4	
	Sulfur (M)	Sulfur	GL, 90 dust	See label.	12	
	Thiophanate-Methyl (1)	Cleary's 3336 Fungo FlO Fungo 50 Systec 1998	50WP LF 50WSB 4.5F	Ornamentals, roses.	12	
	Thiophanate-methyl + Mancozeb (M, 1)	Zyban	WSB	Kalanchoe, phlox, rose, stock, zinnia.	24	
	Triadimefon (3)	Strike	50WDG	African violet, calendula, carnation, chrysanthemum, cineraria, crassula, daisy, geranium, gerbera, grape leaf ivy, kalanchoe, rose, snapdragon.	12	
	Trifloxystrobin (11)	Compass	50WDG	See label.	12	

[r] Restricted Use Pesticide

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Rhizoctonia stem, crown and root rots	Azoxystrobin (11)	Heritage	50WP	See label.	4	
	Bacteria-*Bacillus*	Rhapsody	1.34%	See label.	0	
	Chlorothalnil + thiophanate-methyl (M, 1)	Spectro	90WDG	See label.	12	
	Copper sulfate Pentahydrate (M)	Phyton-27	5.5EC	See label.	24	
	Ethazol + Thiophanate-Methyl (14, 1)	Banrot[r] Banrot[r]	40WP 8G	African violet, ageratum, aglaonema, aralia, ajuga, alyssum, aster, azalea, balsam, begonia, cactus, caladium, calendula, camellia, carnation, celosia, chamaedorea palm, chrysanthemum, coleus, croton, dahlia, delphinium, dieffenbachia, dracaena, dusty miller, Easter lily, epipremnum, euonymus, fatsia, fern, ficus, fittonia, gardenia, geranium, gynura, gypsophila, hoya, hydrangea, impatiens, ivy, kalanchoe, larkspur, lobelia, maranta, marigold, nasturtium, nautilocalyx, pansy, pereromia, petunia, philodendron, phlox, pilea, poinsettia, salvia, schefflera, snapdragon, statice, syngonium, trade-scantia, verbena, zinnia, zygocactus.	12	Professional use only.
	Fludioxonil (12)	Medallion	50 WP	See label.	12	
	Flutolanil (7)	Contrast	70WSP	See label.	12	
	Fungus-*Gliocladium*	SoilGuard	12G	All ornamentals.	4	
	Fungus-*Trichoderma*	RootShield PlantShield	G HC	All ornamentals.	0	Cutting dip.
	Iprodione (2)	Chipco 26019	50WP	Ageratum, alyssum, aphelandra, artemisia, aster, azalea, cactus, calendula, carnation, chrysanthemum, cineraria, coleus, coral bells, crassula, croton, columbine, cyclamen, daffodil, dahlia, delphinium, deutzia, dianthus, dieffenbachia, dizygotheca, dracaena, English ivy, episcia, ficus, gazania, geranium, gladiolus, gloxinia, gypsophila, hoya, hydrangea, iris, kalanchoe, lipstick vine, marigold, monarda, lily, palm, pansy, peperomia, periwinkle, philodendron, phlox, pilea, pittosporum, poinsettia, poppy, primrose, protea, rose, salvia, schefflera, snap dragon, spathiphyllum, statice, tree ivy, tulip, violet, zinnia.	12	

[r] Restricted Use Pesticide

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Rhizoctona stem, crown and root rots (cont'd)	Quintozene (14)	Terraclor	75WP	Tropical foliage plants, bedding and flowering plants, herbaceous and woody ornamentals - growing medium drench at time of seeding and transplanting. Easter lilies - bulb dip.	12	
	Thiophanate-Methyl (1)	Cleary's 3336 Fungo FLO Fungo 50 Systec 1998	50WP LF 50WSB 4.5F	Herbaceous annuals, perennials and bedding plants - growing media drench. Flowable also preplant dip.	12	
	Trifloxystrobin (11)	Compass	50WDG	See label.	12	Can damage petunias and New Guinea impatiens.
	Triflumizole (3)	Terraguard	50WP	See label.	12	
Root diseases caused by soil nematodes	Azadirachtin (18B)	Ornazin	3% EC	Annual garden plants, temperate perennial non-food garden herbs, commercial greenhouse crops (including nursery/seed crops/medical crops/tobacco), houseplants, home and retail greenhouse and conservatory plants, public display plantings, bulb, corm, and tuber ornamentals, subtropical/tropical garden evergreen plants, ground covers, and aquatic plants; ornamental trees, shrubs, and vines; forest tree nurseries, and ornamental brunch grasses.	12	Have nematode counts made before and several weeks after treatment.
Root rots caused by other fungi (not *Pythium* or *Phytoph-thera*)	Azoxystrobin (11)	Heritage	50WP	*Fusarium* and *Sclerotium rolfsii*.	4	Best used as a preventa-tive.
	Bacteria-*Bacillus*	Rhapsody	1.34%	See label..	0	
	Copper sulfate Pentahydrate (M)	Phyton-27	5.5EC	See label. (*Cylindrocladium*)	24	

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Root rots caused by other fungi (cont'd)	Ethazol + Thiophanate-methyl (14, 1)	Banrot[r] Banrot[r]	40WP 8G	African violet, ageratum, aglaonema, aralia, ajuga, alyssum, aster, azalea, balsam, begonia, cactus, caladium, camellia, carnation, celosia, chamaedorea palm, chrysanthemum, coleus, croton, dahlia, delphinium, dieffenbachia, dracaena, dusty miller, Easter lily, epipremnum, euonymus, fatsia, fern, ficus, fittonia, gardenia, geranium, gynura, gypsophila, hoya, hydrangea, impatiens, ivy, kalanchoe, larkspur, lobelia, maranta, marigold, nasturtium, nautilocalyx, pansy, peperomia, petunia, philodendron, phlox, pilea, poinsettia, salvia, schefflera, snapdragon, statice, syngonium, tradescantia, verbena, zinnia, zygocactus - Thielaviopsis root rot and Fusarium root rot.	12	Professional use only.
	Fludioxonil (12)	Medallion	50WP	See label.	12	
	Flutolanil (7)	Contrast	70WSP	*Sclerotium rolfsii* crown and root rot.	12	
	Fungus - *Streptomyces*	Mycostop	30WP	*Fusarium*, *Alternaria*, and *Phomopsis* on 46 ornamentals.	4	
	Fungus- *Trichoderma*	RootShield PlantShield	G HC	All ornamentals.	0	
	Iprodione (2)	Chipco 26019	50WP	Spathiphyllum - *Cylindrocladium* root rot; Gladiolus - *Fusarium* corm rot.	12	
	Quintozene (14)	Terraclor	75WP	Tropical foliage plants, bedding and flowering plants, herbaceous and woody ornamentals - growing medium drench at time of seeding and transplanting. Easter lilies - bulb dip.	12	
	Thiophanate-Methyl (1)	Cleary's 3336 Fungo FLO Fungo 50 Systec 1998	50WP LF 50WSB 4.5F	Herbaceous annuals, perennials and bedding plants. Black root rot (*Thielaviopsis*).	12	
	Triflumizole (3)	Terraguard	50WP	*Cylindrocladium* and *Thielaviopsis* rots, see label.	12	

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Rusts	Azoxystrobin (11)	Heritage	50WP	See label.	4	
	Chlorothalonil (M)	Daconil Ultrex Exotherm Termil	825WDG	Geranium, hollyhock, hydrangea.	12 48	
	Chlorothalonil + thiophanate-Methyl (M, 1)	Spectro Consyst	90WDG 67WDG	See labels.	12	
	Flutalonil (7)	Contrast	70WSP	See label.	12	
	Kresoxin- methyl (11)	Cygnus	50WDG			
	Mancozeb (M)	Dithane FORE Protect Pentathlon	75DF 75DF	See labels.	24	
	Myclobutanil (3)	Eagle	40WP	All ornamentals.	24	
	Neem Oil (NL)	Concern	70	See label.	4	
	Triadimefon (3)	Strike	50WDG	Calendula, carnation, chrysanthemum, fern (Boston), geranium, snapdragon.	12	
	Trifloxystrobin (11)	Compass	50WDG	See label.	12	
	Triflumizole (3)	Terraguard	50WP	See label.	12	
Water mold, damping off, root and crown rot (*Pythium* and *Phyto-phthora*)	Etridiazole (14)	Terrazole	35WP	African violet, ageratum, aglaonema, alyssum, anthurium, arctostaphylus, aster, balsam, begonia, calendula, caladium, calceolaria, carnation, celosia, ceanothus, chrysanthemum, Chinese evergreen, coleus, dahlia, daphne, dianthus, dieffenbachia, Easter lily, echeveria, foxglove, geranium, gerbera, gypsophila, heather, impatiens, larkspur, marigold, nephthytis, orchid, pansy, peperonia, petunia, philodendron, pilea, poinsettia, portulaca, pothos, salvia, sinningia, snapdragon, statice, stokesia, verbena, vinca, zinnia, zygocactus.	12	Growing medium drench.
				African violet, ageratum, aglaonema, alyssum, anthurium, aster, azalea, balsam, begonia, brassaia, caladium, calceolaria, calendula, camellia, carissa, carnation, celosia, coleus, Chinese evergreen, chrysanthemum, dahlia, dianthus, dieffenbachia, dracaena, Easter lily, echeveria, epipremnum, ficus, foxglove, geranium, gerbera, gloxinia, gypsophila, impatiens, larkspur, marigold, nephthytis, orchid, pansy, peperomia, petunia, philodendron, pilea, poinsettia, portulaca, salvia, sinningia, snapdragon, stokesia, verbena, vinca, zinnia, zygocactus.	12	Preplant incorpora-tion into growing medium.

[r] Restricted Use Pesticide

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Water mold, damping off, root and crown rot (*Pythium* and *Phytophthora*) (cont'd)	Etridiazole (14) (cont'd)	Truban	30WP	African violet, ageratum, aglaonema, alyssum, anthurium, aster, balsam, begonia, brassaia, caladium, calceolaria, calendula, camellia, carnation, celosia, Chinese evergreen, coleus, chrysanthemum, dahlia, dianthus, dieffenbachia, Easter lily, echeveria, foxglove, geranium, gerbera, gypsophila, impatiens, larkspur, marigold, nephthytis, orchid, pansy, peperomia, petunia, pilea, portulaca, pothos, philodendron, poinsettia, salvia, sinningia, snapdragon, stokesia, verbena, vinca, zinnia, zygocactus.	12	Growing medium drench.
		Truban	25EC	African violet, aglaonema, alyssum, anthurium, azalea, brassaia, cactus, caladium, calathea, calendula, celosia, crassula, dahlia, dianthus, dieffenbachia, Easter lily, ficus, geranium, gerbera, gynura, hedera, hoya, kalanchoe, larkspur, maranta, marigold, nephrolepis, nephthytis, pansy, peperomia, petunia, philodendron, phlox, pilea, poinsettia, pothos, salvia, sinningia, snapdragon, stromanthe, verbena, vinca, zinnia, zygocactus.	12	Growing medium drench.
	Etridiazole + Thiophanate-Methyl (14, 1)	Banrot[r] Banrot[r]	40WP 8G	African violet, ageratum, aglaonema, aralia, ajuga, alyssum, aster, azalea, balsam, begonia, cactus, caladium, calendula, camellia, carnation, celosia, chamaedorea palm, chrysanthemum, coleus, croton, dahlia, delphinium, dieffenbachia, dracaena, dusty miller, Easter lily, epipremnum, euonymus, fatsia, fern, ficus, fittonia, gardenia, geranium, gynura, gypsophila, hoya, hydrangea, impatiens, ivy, kalanchoe, larkspur, lobelia, maranta, marigold, nasturtium, nautilocalyx, pansy, peperomia, petunia, philodendron, phlox, pilea, poinsettia, salvia, schefflera, snapdragon, statice, syngonium, tradescantia, verbena, zinnia, zygocactus.	12	WP for drench and G for incorpor-ation into growing medium. Professional use only.
	Fosetyl-A1 (33)	Aliette	WDG	**Foliar application** - Plants such as aglaonema, aphelandra, azalea, begonia, bougainvillea, boxwood, *Cattleya skinneri*, cissus, dieffenbachia, geranium, hibiscus, impatiens, leatherleaf fern, marigold, pansy, petunia, pittosporum, philodendron, pothos, rhododendron, spathiphyllum, vinca, zinnia. **Drench application** - Plants such as aphelandra, azalea, boxwood, cissus, dieffenbachia, philodendron, pittosporum, rhododendron, schefflera and spathiphyllum.	12	See label. Do not exceed one application every 30 days. Do not tank mix with flowable Daconil or mancozebs or coppers.
	Fungus- *Gliocladium*	Soil Guard	12G	All ornamentals.	4	
	Fungus- *Streptomyces*	Mycostop	30WP	Label lists 46 ornamentals.	4	

GREENHOUSE FLORAL CROPS DISEASE CONTROL SUGGESTIONS (CONT'D)

DISEASE	COMMON NAME (MOA Group)	BRAND NAME		REGISTERED CROPS	REI (Hours)	COMMENTS
Water mold, damping off, root and crown rot (*Pythium* and *Phytophthora*) (cont'd)	Fungus-*Trichoderma*	RootShield PlantShield	G HC	All ornamentals.	4 0	
	Mefenoxam (4)	Subdue Maxx Subdue WSP	22ME	See label.	0	
	Potassium phosphite	Vital		1-2 qt	4	
	Bacteria-*Bacillus*	Rhapsody	1.34%	See Label	0	
	Dimethomorph (40)	Stature DM	50WP	See Label	24	

MOA Group Tables start on page 46 of the handbook.

This list is presented for information only. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. Before purchasing and using any pesticide, you must check all labels for registered use, rates and application frequency.

This section was not revised in 2007.

HOME GARDEN VEGETABLE INSECT CONTROL
(For Commercial Vegetables See Next Section.)

NOTE: The following recommendations are for application of insecticides to control insect and mite pests. To assist in identifying pests, and making decision to control pests, please consult OSU Fact Sheet F-7313, "Home Vegetable Garden Insect Pest Control." Before applying any insecticide you should always read the label to determine safety measures, to determine whether the insecticide is labeled for use on the crop and to determine how long to wait prior to re-entering the treated area or consuming treated produce.

The insect pests listed in the following Table are commonly occurring pests in most vegetable gardens. The insecticides listed as effective in controlling the pests are non-restricted use insecticides commonly available through garden supply centers and retail stores. We have listed the insecticides based on the ACTIVE ingredient which will be noted on the front of the label along with the percentage composition of the active ingredient in the product. We do NOT list specific names of insecticides because there are hundreds of brands, most of which contain similar active ingredients. We also do not list specific mixing directions because most products differ slightly in composition and thus specific mixing directions vary. PRODUCT LABELS WILL PROVIDE SPECIFIC DIRECTIONS AS TO USE, PROPER MIXING AND A LIST OF CROPS THAT CAN BE TREATED, ALWAYS CONSULT THE LABEL FOR THESE DIRECTIONS.

Crop	Insect/Pest	Synthetic[1]	Organic[2]
ASPARAGUS	Aphids	Dimethoate Malathion	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Beetles	Carbaryl Lambda-cyhalothrin Permethrin	Pyrethrins Entrust
BEANS	Aphids	Dimethoate Malathion Endosulfan	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Beetles, crickets, leafhoppers	Carbaryl Dimethoate Malathion Endosulfan Lambda-cyhalothrin Permethrin	pyrethrins
	Mites	Dicofol	Neem extracts Pyrethrins Insecticidal soap
COLE CROPS (cabbage, cauliflower, broccoli)	Aphids	Dimethoate Malathion Endosulfan	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Caterpillars (worms, loopers, cutworms)	Endosulfan Lambda-cyhalothrin esvenfalerate Permethrin	*Bacillus thuringiensis*-based products Entrust
	Harlequin bug	Dimethoate Cyfluthrin Malathion Endosulfan Lambda-cyhalothrin Permethrin	Pyrethrins Entrust

This section was not revised in 2007.

HOME GARDEN VEGETABLE INSECT CONTROL (CONT'D)

(For Commercial Vegetables See Next Section.)

Crop	Insect/Pest	Synthetic[1]	Organic[2]
CORN (Sweet)	Aphids	Dimethoate Malathion	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Caterpillars (corn earworm, armyworm) For corn earworm control apply insecticides in mixture with vegetable oil directed to corn silk at 2-3 day intervals	Cyfluthrin Lambda-cyhalothrin Permethrin esfenvalerate	*Bacillus thuringiensis*-based products pyrethrins + emulsifiable vegetable oil. Entrust
	Beetles	Carbaryl Lambda-cyhalothrin Permethrin	Pyrethrins
CUCURBIT CROPS (cantaloupes, melons, pumpkin, squash)	Aphids	Dimethoate Malathion Endosulfan	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Beetles	Carbaryl Endosulfan	Pyrethrins Entrust
	Caterpillars (pickleworm, vine borers, loopers)	Endosulfan Malathion Lambda-cyhalothrin esfenvalerate Permethrin	*Bacillus thuringiensis*-based products
	Mites	Dicofol	Neem extracts Pyrethrins Insecticidal soap
	Squash bug	Endosulfan Lambda-cyhalothrin Permethrin	Neem extracts Pyrethrins Entrust
EGGPLANT	Aphids	Malathion Endosulfan	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Beetles (Flea)	Carbaryl	Pyrethrins
	Colorado Potato Beetle	Carbaryl Endosulfan Lambda-cyhalothrin esfenvalerate Permethrin	*Bacillus thuringiensis*–based products Entrust
LEAFY GREENS (kale, collards, mustard, turnips, spinach)	Aphids	Dimethoate Malathion Endosulfan	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Caterpillars	Endosulfan Malathion Lambda-cyhalothrin esfenvalerate Permethrin	*Bacillus thuringiensis*-based products Entrust

This section was not revised in 2007.

HOME GARDEN VEGETABLE INSECT CONTROL (CONT'D)
(For Commercial Vegetables See Next Section.)

Crop	Insect/Pest	Synthetic[1]	Organic[2]
ONIONS	Thrips	Malathion Lambda-cyhalothrin Permethrin	Neem extracts Pyrethrins
PEAS (SOUTHERN AND ENGLISH)	Aphids	Dimethoate Malathion	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana* –based products
	Beetles and Weevils	Carbaryl Malathion Lambda-cyhalothrin Permethrin	Pyrethrins
PEPPERS	Aphids	Dimethoate Malathion	Neem extracts Pyrethrins Insecticidal soap
	Flea beetle Caterpillars (fruitworm, hornworms)	Endosulfan Carbaryl Cyfluthrin Endosulfan Malathion Lambda-cyhalothrin esfenvalerate Permethrin	*Beauvaria bassiana*–based products Pyrethrins *Bacillus thuringiensis*-based products Entrust
POTATOES (Irish)	Colorado Potato Beetle	Cyfluthrin Carbaryl Endosulfan Lambda-cyhalothrin esfenvalerate Permethrin	*Bacillus thuringiensis*–based products
	Flea Beetles	Carbaryl	Pyrethrins
POTATOES (Sweet)	Sweet potato weevil	Malathion Endosulfan Lambda-cyhalothrin Permethrin	Pyrethrins
TOMATOES	Aphids	Dimethoate Endosulfan	Neem extracts Pyrethrins Insecticidal soap *Beauvaria bassiana*–based products
	Caterpillars (fruitworm, pinworm, hornworms)	Cyfluthrin Endosulfan Lambda-cyhalothrin esfenvalerate Permethrin	*Bacillus thuringiensis*-based products Entrust
	Mites	Dicofol	Neem extracts Pyrethrins Insecticidal soap
SOIL PESTS - for preplant incorporation	Wireworms, grubs, cutworms	Lambda-cyhalothrin Permethrin	None available

[1]Synthetic insecticides are processed from natural sources or manufactured.
[2]Organic insecticides are derived from natural sources including extractions from plants or animals or from naturally occurring inorganic sources including minerals. The use of these insecticides fits within constraints dictated in guidelines for production under "organic" standards.

This section was not revised in 2007.

HOME GARDEN VEGETABLE INSECT CONTROL (CONT'D)

(For Commercial Vegetables See Next Section.)

Recommended dilution rates for home garden insect pest control.

INSECTICIDE	FORMULATION	AMOUNT TO MIX WITH 1 GALLON OF WATER
Bacillus thuringiensis	Dipel 2X Thuricide and other formulations	1 T refer to label
carbaryl	Sevin 50WP Sevin 27 EC	3 T 3 t
cyfluthrin	Bayer Advanced Garden Products Multi Insect Killer	see label
dicofol	Kelthane 42 EC Kelthane 18.5 EC Kelthane 35% WP	1 t 1 T 1.5 T
dimethoate	Cygon 2EC	1 t
endosulfan	Thiodan 3 EC	2 2/3 T
insecticidal soap	Safer Insecticidal Soap M-Pede	6 T 2.5 T
malathion	Malathion 50EC Malathion 57EC Malathion 25WP	1.5 T 2-3 t 3 T
neem extract	Azatin EC Align EC Neemix	1 t 1 T 10 T
pyrethrin	Pyrenone Crop Spray Pyrellin EC	2/3 - 1 T 1.5 T
permethrin	Spectracide/Triazide	See Label
lambda-cyhalothrin	Spectracide/Triazide	See Label
Esfeuvalerate	Ortho Bug-F-Gone	See Label
Spinosad	Entrust	See Label

T = tablespoon; t = teaspoon; WP = wettable powder; EC = emulsifiable concentrate; Dust = applied directly to plants.

COMMERCIAL VEGETABLE INSECT CONTROL PRODUCTS

This section lists products that are currently registered for use in controlling insect and mite pests listed for each vegetable group. Inclusion of a product does NOT imply effectiveness, only that it is labeled for use on that vegetable group at the time of publication. Because changes in product registration occur frequently, CONSULT THE LABEL ATTACHED TO THE CONTAINER BEFORE USING THE PRODUCT. Resistance Management Grouping - do not make repeated sequential applications from the same grouping.

VEGETABLE AND COMMON PESTS	Currently registered insecticides Common name for active ingredient followed by a typical Trade name and maximum rate per acre.		MOA Group and application restrictions
ASPARAGUS			
Aphids	dimethoate, Dimate	1 pint	1B
Asparagus beetles	methomyl, Lannate SP[r]	1 pound	1A
Caterpillars	chlorpyrifos, Lorsban 75WG	1.3 lbs	1B
grasshoppers	carbaryl, Sevin 80S	2 ½ pounds	1A
	permethrin, Pounce 3.2EC[r]	4 oz	3
	Bacillus thuringiensis, Dipel DF	2 lbs	11B2
	neem extracts, Azadirect	2 pints	
	pyrethrum, Pyganic EC 5.0	18 oz	3
	spinosad,, Spintor 2 SC	6 oz	5 Ferns only
	malathion, Malathion 57ec	2 pints	1B
BEANS (snap)			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Bean leaf beetle	carbaryl, Sevin 80S	1 7/8 pounds	1A
Caterpillars	acephate, Orthene 75S	1 1/3 lbs	1B
Leafhoppers	naled, Dibrom 8E	1 ½ pints	1B
Mites	malathion, Malathion 5	2 pints	1B
Stink bugs	oxydemeton-methyl, MSR[r]	2 pints	1B
	phorate, Thimet 20G[r]	9 oz/1000 ft	1B
	dimethoate, Dimate	1 pint	1B
	endosulfan, Endosulfan	2 2/3 pints	2A
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	bifenthrin, Capture[r]	6.4 oz	3
	lambda-cyhalothrin, Warrior Z[r]	3.8 oz	3
	gamma-cyhalothrin, Proaxis[r]	3.84 oz	3
	cyfluthrin, Baythroid	3.2 oz	3
	imidacloprid, Admire 2F	24 oz	4
	spinosad, Spintor 2SC	10 oz	5
	pyrethrins, Pyganic EC 5.0	18 oz	3
	cyromazine, Trigard	2.4 oz	17
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, Dipel DF	1 lb	11B2
	fatty acid soap, Safer Soap		
	buprofezine, Courier	9 oz	
	methoxyfenozide, Intrepid	8 oz	
	pyriproxyfen, Esteem 35WP	4 oz	7C
BEANS (dry)			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Bean leaf beetle	carbaryl, Sevin 80S	1 7/8 pounds	1A
Caterpillars	acephate, Orthene 75S	1 1/3 lbs	1B
Leafhoppers	naled, Dibrom 8E	1 ½ pints	1B
Mites	dimethoate, Dimate	1 pint	1B
Stink bugs	oxydemeton-methyl, MSR[r]	2 pints	1B
	disulfoton, Di-Syston 8[r]	2 pints	1B
	endosulfan, Endosulfan	2 2/3 pints	2A
	dicofol, Kelthane MF	3 pints	20
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	lambda-cyhalothrin, Warrior Z[r]	3.8 oz	3
	gamma-cyhalothrin, Proaxis[r]	3.84 oz	3
	cyfluthrin, Baythroid	3.2 oz	3
	imidacloprid, Admire 2F	24 oz	5
	spinosad, Spintor 2SC	10 oz	4
	pyrethrins, Pyganic EC 5.0	18 oz	3

COMMERCIAL VEGETABLE INSECT CONTROL PRODUCTS (CONT'D)

This section lists products that are currently registered for use in controlling insect and mite pests listed for each vegetable group. Inclusion of a product does NOT imply effectiveness, only that it is labeled for use on that vegetable group at the time of publication. Because changes in product registration occur frequently, CONSULT THE LABEL ATTACHED TO THE CONTAINER BEFORE USING THE PRODUCT. Resistance Management Grouping - do not make repeated sequential applications from the same grouping.

VEGETABLE AND COMMON PESTS	Currently registered insecticides Common name for active ingredient followed by a typical Trade name and maximum rate per acre		MOA Group and application restrictions
BEANS (dry) cont'd			
	cyromazine, Trigard	2.4 oz	17
	neem extracts, Azadirect	2 pints	
	pryiproxyfen, Esteem 35WP	4 oz	7C
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
HEADING BRASSICA CROPS (Broccoli, cabbage, cauliflower)			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Diamond back moth	carbaryl, Sevin 80S	2 ½ pounds	1A
Cabbage looper	thiodicarb, Larvin 3.2	40 oz	1A
Harlequin bugs	naled, Dibrom 8E	2 pints	1B
Thrips	malathion, Malathion 5	2 pints	1B
Flea beetles	diazinon, All Pro Diazinon AG500	1 gal	1B
	chlorpyrifos, Lorsban 75WG	1.3 lb	1B
	dimethoate, Dimate	1 pint	1B
	oxydemeton-methyl, MSR[r]	2 pints	1B
	chlorpyrifos, Lorsban 50W	2 lbs	1B
	endosulfan, Endosulfan	1 quart	2A
	permethrin, Pounce 3.2EC[r]	4 oz	3
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	bifenthrin, Capture[r]	6.4 oz	3
	fenpropathrin, Danitol[r]	16 oz	3
	lambda-cyhalothrin, Warrior Z[r]	3.8 oz	3
	gamma-cyhalothrin, Proaxis[r]	3.84 oz	3
	cypermethrin, Ammo 2.5EC[r]	5 oz	3
	cyfluthrin, Baythroid	2.4 fl oz	3
	imidacloprid, Admire 2F	24 oz	4A
	acetamiprid, Assail	3 oz	4A
	spinosad, Spintor SC	10 oz	5
	pymetrozine, Fulfill	2.75 oz	9B
	methoxyfenozide, Intrepid	8 oz	18
	tebufenozide, Confirm	8 oz	18
	indoxycarb, Avaunt	3.5 oz	7
	emamectin benzoate, Proclaim	4.8 oz	6
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	guanidine, Venom	4 oz	
	thiamethoxam Actara	3 oz	4A
	emmamectin benzoate, Denim	6 fl oz	6

COMMERCIAL VEGETABLE INSECT CONTROL PRODUCTS (CONT'D)

This section lists products that are currently registered for use in controlling insect and mite pests listed for each vegetable group. Inclusion of a product does NOT imply effectiveness, only that it is labeled for use on that vegetable group at the time of publication. Because changes in product registration occur frequently, CONSULT THE LABEL ATTACHED TO THE CONTAINER BEFORE USING THE PRODUCT. Resistance Management Grouping - do not make repeated sequential applications from the same grouping.

VEGETABLE AND COMMON PESTS	Currently registered insecticides Common name for active ingredient followed by a typical Trade name and maximum rate per acre		MOA Group and application restrictions
CUCURBIT CROPS (melons, squash, pumpkins, gourds)			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Cucumber beetles	carbaryl, Sevin 80S	1 ¼ pounds	1A
Squash bugs	malathion, Malathion 5	2 pints	1B
Thrips	dimethoate, Dimate	1 pint	1B melons only
Caterpillers	naled, Dibrom 8E	2 pints	1B not watermelon
Mites	oxydemeton-methyl, MSR[r]	2 pints	1B
Melonworm	dicofol, Kelthane 35	1 2/3 lbs	20
Pickleworm	endosulfan, Endosulfan	2 2/3 pints	2A
	permethrin, Pounce 3.2EC[r]	4 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	bifenthrin, Capture[r]	6.4 oz	3
	fenpropathrin, Danitol[r]	16 oz	3
	cyfluthrin, Baythroid	2.8 fl oz	3
	imidacloprid, Admire 2F	24 oz	4A
	spinosad, Spintor 2 SC	8 oz	5
	avermectin, Agri-mek	16 oz	6
	pymetrozine, Fulfill	2.75 oz	9B
	buprofezin, Courier	9 oz	16
	cyromazine, Trigard	2.4 oz	17
	methoxyfenozide, Intrepid	8 oz	18
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	spiromesifen, Oberon	8.5 oz	
	bifenazate, Acramite	1.0 lb	
	Beauveria bassiana, Botanigard	4 lb	
	Buprofezine, Courier	9 oz	
LEAFY BRASSICA CROPS (Collards, kale, mustard, turnip)			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Caterpillars	malathion, Malathion 5	2 pints	1B
Harlequin bugs	dimethoate, Dimate	½ pint	1B
Thrips	endosulfan, Endosulfan	1 quart	2A
Flea beetles	permethrin, Pounce 3.2EC[r]	4 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	cypermethrin, Ammo 2.5EC[r]	5 oz	3
	zetacypermethrin, Fury[r]	4.3 oz	3
	imidacloprid, Admire 2F	24 oz	4A
	spinosad, Success	10 oz	5
	pymetrozine, Fulfill	2.75 oz	9B
	methoxyfenozide, Intrepid	8 oz	18 turnips only
	tebufenozide, Confirm	8 oz	18
	emamectin benzoate, Proclaim	4.8 oz	6
	indoxycarb, Avaunt	3.5 oz	7
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	chlorpyrifos, Lorsban 75WG	1.33 lb	1B
	spiromesifen, Oberon 2 SC	8.5 fl oz	
	carbaryl, Sevin SL	1 qt	1A
	diazinon, All Pro Diazinon AG500	4 qt	1B
	cyfluthrin, Baythroid	2.8 fl oz	3
	thimethoxam, Actara	3 oz	4A
	emamectin benzoate, Denim	6 fl oz	6

COMMERCIAL VEGETABLE INSECT CONTROL PRODUCTS (CONT'D)

This section lists products that are currently registered for use in controlling insect and mite pests listed for each vegetable group. Inclusion of a product does NOT imply effectiveness, only that it is labeled for use on that vegetable group at the time of publication. Because changes in product registration occur frequently, CONSULT THE LABEL ATTACHED TO THE CONTAINER BEFORE USING THE PRODUCT. Resistance Management Grouping - do not make repeated sequential applications from the same grouping.

VEGETABLE AND COMMON PESTS	Currently registered insecticides Common name for active ingredient followed by a typical Trade name and maximum rate per acre		MOA Group and application restrictions
OKRA			
Aphids	carbaryl, Sevin 80S	1 7/8 pounds	1A
Caterpillars	malathion, Malathion 5	2 pints	1B NOT when pods present
Mites	spinosad, Spintor 2SC	10 oz	5
	methoxyfenozide, Intrepid	8 oz	18
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	bifenazate, Acramite	1 lb	
	imidacloprid, Nuprid 2F	32 oz	4A
	esfenvalerate, Asana	9.6 fl oz	3
	pyriproxyfen, Esteem	4 oz	7C
ONIONS			
Thrips	methomyl, Lannate SP[r]	1 pound	1A
Caterpillars	malathion, Malathion 5	2 pints	1B
Mites	endosulfan, Endosulfan	1 quart	2
	permethrin, Pounce 3.2EC[r]	12 oz	3
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	lambda-cyhalothrin, Warrior Z[r]	3.8 oz	3
	gamma-cyhalothrin, Proaxis[r]	3.84 oz	3
	cypermethrin, Ammo 2.5EC[r]	5 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	cyromazine, Trigard	2.4 oz	17
	fatty acid soap, Safer Soap		
	spinosad, Spintor 2SC	10 oz	5
	diazinon, All Pro Diazinon AG500	4 qt	1B
	pyrethrins, Prentox Pyronyl	12 oz	3
	acetamiprid, Assail	4 oz	4A
FRUITING CROPS (peppers, tomatoes, eggplant)			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Fruitworm	carbaryl, Sevin 80S	2 ½ pounds	1A
Hornworm	naled, Dibrom 8E	2 pints	1B NOT tomatoes
Pinworm	malathion, Malathion 5	2 pints	1B
Stink bugs	oxydemeton-methyl, MSR[r]	2 pints	1B NOT tomatoes
Colorado potato beetle	dimethoate, Dimate	2/3 pint/peppers	1B NOT eggplant
Thrips		1 pint tomatoes	
Flea beetles	acephate, Orthene 75S	2/3 lbs	1B
Leafhoppers	dicofol, Kelthane MF	1 ½ pints	20
	endosulfan, Endosulfan	1 quart	2A
	permethrin, Pounce 3.2EC[r]	8 oz	3
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	bifenthrin, Capture[r]	5.2 oz	3
	fenpropathrin, Danitol[r]	10 2/3 oz	3 tomatoes only
	lambda-cyhalothrin, Warrior Z[r]	3.8 oz	3
	gamma-cyhalothrin, Proaxis[r]	3.84 oz	3
	cyfluthrin, Baythroid 2[r]	2.8 oz	3
	pyriproxifen, Knack	10 oz	7D
	imidacloprid, Admire 2F	24 oz	4A
	thiamethoxam, Actara	4 oz	4
	acetameprid, Assail	4 oz	4
	buprofezine, Courier	9 oz	16 tomatoes only
	cyromazine, Trigard	2.6 oz	17
	methoxyfenozide, Intrepid	8 oz	18

COMMERCIAL VEGETABLE INSECT CONTROL PRODUCTS (CONT'D)

This section lists products that are currently registered for use in controlling insect and mite pests listed for each vegetable group. Inclusion of a product does NOT imply effectiveness, only that it is labeled for use on that vegetable group at the time of publication. Because changes in product registration occur frequently, CONSULT THE LABEL ATTACHED TO THE CONTAINER BEFORE USING THE PRODUCT. Resistance Management Grouping - do not make repeated sequential applications from the same grouping.

VEGETABLE AND COMMON PESTS	Currently registered insecticides Common name for active ingredient followed by a typical Trade name and maximum rate per acre		MOA Group and application restrictions
FRUITING CROPS (peppers, tomatoes, eggplant) cont'd			
	avermectin, Agri-mek	16 oz	6 NOT eggplant
	spinosad, Spintor 2SC	10 oz	5
	indoxycarb, Avaunt	3.5 oz	7
	emamectin benzoate, Proclaim	4.8 oz	6
	pymetrozine, Fulfill	2.75 oz	9B
	tebufenozide, Confirm	8 oz	18
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	spiromesifen, Oberon	8.5 oz	
	bifenazate, Acramite	1.0 lb	
	thiamethoxam, Actara	3 oz	4A
POTATO			
Aphids	methomyl, Lannate SP[r]	1 pound	1A
Hornworm	phorate, Thimet 20G[r]	11 oz/1000 ft	1B
Colorado potato beetle	malathion, Malathion 5	2 pints	1B
Thrips	dimethoate, Dimate	1 pint	1B
Leafhoppers	endosulfan, Endosulfan	1 quart	2
Flea beetles	permethrin, Pounce 3.2EC[r]	8 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	cyfluthrin, Baythroid 2[r]	2.8 oz	3
	imidacloprid, Admire 2F	1.3 oz/1000 ft	4A
	thiamethoxam, Actara	1.5 oz	4
	avermectin, Agri-mek	16 oz	6
	spinosad, Spintor 2SC	6 oz	5
	pymetrozine, Fulfill	2.75 oz	9B
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	acetamiprid, Assail 30sg	4 oz	4A
	clothionidin, Clutch 50 wdg	1.5 oz	4A
SPINACH			
Aphids	carbaryl, Sevin 80S	2 ½ pounds	1A
Caterpillars	methomyl, Lannate SP[r]	1 pound	1B
Thrips	dimethoate, Dimate	½ pint	1B
Leafhoppers	malathion, Malathion 5	2 pints	1B
	diazinon, All Pro Diazinon AG500	4 qt	1B
	permethrin, Pounce 3.2EC[r]	4 oz	3
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	bifenthrin, Capture[r]	6.4 oz	3
	cyfluthrin, Baythroid	3.2 oz	3
	imidacloprid, Admire 2F	24 oz	4A
	spinosad, Spintor 2 SC	10 oz	5
	abamectin, Agri-mek	16 oz	
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		

COMMERCIAL VEGETABLE INSECT CONTROL PRODUCTS (CONT'D)

This section lists products that are currently registered for use in controlling insect and mite pests listed for each vegetable group. Inclusion of a product does NOT imply effectiveness, only that it is labeled for use on that vegetable group at the time of publication. Because changes in product registration occur frequently, CONSULT THE LABEL ATTACHED TO THE CONTAINER BEFORE USING THE PRODUCT. Resistance Management Grouping - do not make repeated sequential applications from the same grouping.

VEGETABLE AND COMMON PESTS	Currently registered insecticides Common name for active ingredient followed by a typical Trade name and maximum rate per acre		MOA Group and application restrictions
SWEET CORN			
Earworm	methomyl, Lannate SP[r]	1 pound	1A
Armyworm	carbaryl, Sevin 80S	2 ½ pounds	1A
European corn borer	malathion, Malathion 5	2 pints	1B
Flea beetles	chlorpyrifos, Lorsban 75WG	4 lbs	1B
Mites	oxydemeton-methyl, MSR	2 pt	1B
	diazinon, All Pro Diazinon AG500	4 qt	1B
	permethrin, Pounce 3.2EC[r]	8 oz	3
	zeta-cypermethrin, Fury[r]	4.3 oz	3
	esfenvalerate, Asana XL[r]	9.6 oz	3
	lambda-cyhalothrin, Warrior[r]		3
	gamma-cyhalothrin, Proaxis[r]	3.84 oz	3
	cyfluthrin, Baythroid 2[r]	3.2 oz	3
	methoxyfenozide, Intrepid	8 oz	18
	spinosad, Spintor 2SC	10 oz	5
	indoxycarb, Avaunt	3.5 oz	7A
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
SWEET POTATO			
Aphids	carbaryl, Sevin 80S	2 ½ pounds	1A
Caterpillars	chlorpyrifos, Lorsban 75WG	2.7 lbs	1A
Flea and tortoise beetles	endosulfan, Endosulfan	1 quart	2
	cyfluthrin, Baythroid	2.8 oz	3
	thiamethoxam, Actara	1.5 oz	4
	spinosad, Spintor 2SC	6 oz	5
	pymetrozine, Fulfill	2.75 oz	9B
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	thiamethoxam, Actara	3 oz	4A
ROOT CROPS (radish and turnips)			
Aphids	carbaryl, Sevin 80S	2 ½ pounds	1A
Caterpillars	dimethoate, Dimate	1 pint	1B NOT radish
Harlequin bugs	malathion, Malathion 5	2 pints	1B
Thrips	permethrin, Pounce 3.2EC[r]	4 oz	3
Flea beetles	esfenvalerate, Asana XL[r]	9.6 oz	3
	cyfluthrin, Baythroid	2.8 oz	3
	pyrethrins, Pyganic EC 5.0	18 oz	3
	neem extracts, Azadirect	2 pints	
	Bacillus thuringiensis, DipelDF	1 lb	11B2
	fatty acid soap, Safer Soap		
	tebufenozide, Confirm	8 oz	
	spinosad, Spintor 2SC	6 oz	5
	thiamethoxam, Actara	3 oz	4A

[r] Restricted Use Pesticide.

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
Mode of action is important to consider when selecting herbicides in order to reduce the potential for weed populations to develop resistance to particular families of herbicides. If you have questions regarding herbicide resistance contact your local county extension office.			
NON-SELECTIVE USES FOR VARIOUS VEGETABLES			
Annual and perennial grasses, broadleaf and sedges.	Postemergence to weeds. Preplant or preemergence to crop or as a spray or wiper application between rows in established crops.	Roundup 4S (glyphosate) (9) 0.25 to 1.5 lb a.i./A	Check label for approved vegetable crops. Will control perennials such as johnsongrass and bermudagrass. For some vegetables it is recommended that application not be made within three days prior to planting. Applications such as shielded and hooded sprayers and wipers must be of a design that will not permit spray to contact the crop.
Grasses and broadleaf	Postemergence to weeds and Preplant or Preemergence to crops. Use as a directed or shielded spray as approved for specific crops.	Gramoxone Inteon[r] (paraquat) (22) 0.26 to 1.0 lb a.i./A + nonionic surfactant or crop oil concentrate.	Apply before crop emerges. Provides top kill and suppression of perennials. Effective in "stale seedbed" plantings using seedbeds formed well in advance of planting. Use the higher rate for heavier infestations. Rates dependent upon use, check label.
Annual broadleaf weeds	Preplant burndown and post applications using hooded sprayer	Aim EC, EW (carfentrazone) up to 0.03 lb a.i./A	Check labels for specific crops and applications. Coverage is essential for good control, can be tankmixed with other postemergence herbicides for control of a wider spectrum of weed species.
Grasses and broadleaf	Postemergence to weeds. Preemergence to crop or as a directed spray in emerged crops.	Scythe (pelargonic acid) (No #) Rate depends on spray mixture concentration.	Control or burndown of annual and perennial weeds. Approved for numerous vegetables – see label for specific uses. Apply in 75 to 200 gallons per acre of spray mixture.
ASPARAGUS*			
Emerged annual broadleaf and grass	Preplant or Preemergence	Gramoxone Inteon[r] (paraquat) (22) 0.625 to 1 lb a.i./A + nonionic surfactant or crop oil concentrate	Apply prior to or after seeding, but before emergence of the crop. Crop plants emerged at time of application will be injured. For established plantings at least 2 years old, apply prior to emergence of crop or after last harvest. Note harvest restictions on label
Grasses and broadleaf	Preemergence to weed germination following spring cultivation of established asparagus beds.	Devrinol (napropamide) 4 lb a.i./A	Apply only to plantings that have been established for a minimum of 1 year. Apply and incorporate using shallow tillage or irrigation.
Annual broadleaf and grass	Early spring preemergence or post-harvest application	Metribuzin 75 DF (metribuzin) (5) 1 to 2 lb a.i./A	For established crowns. Apply after tillage or chopping fern in the spring prior to asparagus emergence and post-harvest. Do not use during the first growing season after seeding or setting crowns. Rate depends on soil type and application times.
Annual broadleaf and a few grass weeds	Preemergence and Postemergence	Lorox[r] DF (linuron) (7) 0.5 to 1.0 lb a.i./A	Apply postemergence to new plantings when ferns are in the 6-18 inch stage. Apply preemergence or postemergence to established plantings. See label for further instructions.
Annual grass, Johnsongrass, Bermudagrass, broadleaf weeds	Preemergence and Postemergence	Diuron 4L, 80DF, 80WDG (diuron) (7) 0.8 to 3.2 lb a.i./A	For established crowns. Apply after tillage or chopping fern in the spring and again after harvest season. Apply to clean soil before weeds emerge. Do not exceed 2.25 lbs per application.
Emerged grasses	Postemergence	Fusilade DX (fluazifop-butyl) (1) 0.09 to 0.37 lb a.i./A +0.5 to 1% oil	Target grasses must be actively growing. Do not harvest for 1 day after application. Check label for weed size and species.
Emerged grasses	Postemergence	Poast 1.5 L (sethoxydim) (1) 0.1875 to 0.47 lb a.i./A. See label for surfactants.	May harvest 1 day after application. See label for recommended rates for specific weed species and for appropriate surfactant.
Annual broadleaf	Harvest or Post harvest	2,4-D amine (4) 1.4 to 1.9 lb a.i./A	May harvest 1 day after application. Treat after cutting. Do not use over 2 applications spaced one month apart. Use drop nozzles to keep the spray off the plants.
Broadleaf weeds amd Nutsedge	Postemergence and Post-Transplant	Sandea (Halosulfuron) 0.047 to 0.07 lb a.i./A	See label for instructions on Postemergence and Post-Transplant applications. Split applications can be made for control of nutsedge, controls purple & yellow nutsedge.
Grass weeds, carpetweed, chickweed, henbit, pigweed, etc.	Post harvest, early spring, preemergence to crop and weeds.	Trifluralin HF and others (trifluralin) (3) 0.5 to 2.0 lb a.i./A	5 day pre-harvest (PHI). Apply after harvest period immediately following last harvest prior to fern development. Can be applied to dormant fields in winter.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
BEANS* (Snap, Lima, Field) (Check each label to determine if the herbicide has label approval for the type beans grown)			
Annual grass and some broadleaf weeds	Preplant	Eptam 7E, 20G (EPTC) (8) 3 lb a.i./A	Apply and incorporate just prior to planting. Do not use on lima and other flat pod beans. Requires thorough incorporation to a depth of 3 inches.
Annual grass and broadleaf weeds	Preplant incorporated	Trifluralin HF and others (trifluralin) (3) 0.50 to 0.75 lb a.i./A	Incorporate soon after application. The herbicide can be applied 0 to 10 weeks before planting, use 0.5 lb/A except on heavy soils. Dry beans only
Annual grass and broadleaf weeds	Preplant incorporated	Prowl 3.3 EC and Prowl H_2O (pendimethalin) (3) 0.7 to 1.4 lb a.i./A	Incorporate within 7 days after application and prior to planting.
Controls annual grasses and certain broadleaf weeds	Preemergence or preplant incorporated	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply uniformly to soil at time of planting.
Annual grass and some broadleaf	Preplant or Preemergence	Dual Magnum, (s-metolachlor) (15) 0.95 to 1.90 lb a.i./A	See label.
Annual broadleaf and some grass weeds	Preplant, Preplant incorporated, Preemergence, early postemergence,	Outlook (dimethenamide-P) (15) 0.56 to 0.98 lb a.i./A	Drybeans only. Can also be applied early postemergence (first to third trifoliate stage). There needs to be a minimum of 70 days between application and harvest.
Broadleaf weeds amd Nutsedge	Preemergence	Sandea (halosulfuron) (2) 0.023-0.031 lbs a.i./A	Apply uniformly after planting, but prior to cracking. Lower rates for lighter textured soils.
Annual broadleaf and yellow nutsedge	Postemergence	Basagran (bentazon) (6) 0.5 to 1.0 lb/A	Apply early postemergence after five trifoliate leaf stage of beans, but according to weed stages listed on the label.
Grass and broadleaf species	Postmergence	Pursuit DG (imazethapyr) (2) see label for rates	Check federal and supplemental labels. In snapbeans use only as a tank mix with Basagran. Uses vary with formulation.
Annual grasses and broadleaf	Postemergence	Raptor (imazamox) (2) 0.031 lb a.i./A	Only for certain types of dry beans. Some varieties are susceptible to injury. Apply before flowering.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.47 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 15 days of harvest of succulent beans and 30 days of harvest of dry beans. See label for recommended rates for specific weed species and for appropriate surfactant.
Emerged annual and perennial grasses	Postemergence	Assure II (quizalofop) (1) 0.034 to 0.082lb a.i./A plus oil or surfactant	Apply to young actively growing grasses. Do not apply within 15 days of harvest of succulent beans and 30 days of harvest of dry beans. Use crop oil concentrate at 1% V/V.
Annual weeds	Layby	Eptam 7E (EPTC) (8) 3 lb a.i./A	Apply at the time of last cultivation and incorporate into the soil before beans start to pod.
Harvest Aid	Prior to harvest	Aim EC (carfentazone) (14) 0.015-0.030 lb a.i./A. Use crop oil at 1% V/V.	Aim may be used alone or in tank mix with other harvest aids. Do not apply within 3 days of harvest. Dry bean or southern peas only.
Defoliant/ desiccant	Prior to harvest	Defol (several formulations) (sodium chlorate) (No #) 6 lb (1 gal) a.i./A	Apply 7-10 days before harvest of dry beans or southern peas.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
Harvest Aid	Prior to harvest	Gramoxone Inteon[r] (paraquat) (22) 0.3 to 0.5 lb a.i./A	Dry beans only. Apply at maturity. See label.
Suppression of Annual grasses and velvetleaf and spurred anoda	Preemergence applied to soil surface from 30 days before planting to just prior to crop emergence	Command 3ME (clomazone) (13) 0.15 to 0.25 lb a.i./A	Use lower recommended rate for coarse soils and higher recommended rate for fine textured soils. See "Vegetable Disclaimer" section of label.
Control annual grasses and certain broadleaved weeds, see label for specifics	Preemergence or preplant incorporated	Dacthal Flowable only (DCPA) (3) 4.5 - 10.5 lb a.i./A	Apply uniformly to soil at time of planting.
Broadleaf and Nutsedges	Preemergence and postemergence on snapbean, but not drybean	Sandea (Halosulfuron) 0.023 to 0.031 lb a.i./A	Snapbean and drybeans only. Check label for crop rotational schedule prior to use. Label gives further detail regarding rates and when to apply.
Controls annual and some perennial grass weeds	Postemergence	Select 2EC or Prism (clethodim) (1) 0.09 to 0.25 lb a.i./A always use 1% crop oil concentrate	Dry beans only: Always use 1% crop oil concentrate v/v.
BEETS*			
Grassy weeds	Postemergence	Select 2EC or Prism (clethodium) (1) 0.09 to 0.125 lb a.i./A Always use 1% cropoil concentrate	Do not apply more than 8 fll oz. per acre in a single application.
Annual broadleaf	Postemergence	Spin-Aid 1.3 EC (phenmedipham) (5) 0.49 to 0.98 lb a.i./A	Apply when beets are past the 4 to 6 true leaf stage and weeds are at the 2 true leaf stage.
Emerged annual and perennial grass	Postemergence	Poast 1.5 (sethoxydim) (1) 0.1875 to 0.47 lb a.i./A. See label for surfactants.	Apply to actively growing grasses. Do not apply within 60 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Annual broadleaf	Preemergence and early Postemergence	Pyramin DF (Pyrazon) (5) 3.0 to 3.5 lb a.i./A	If rain does not fall within 10 days after treatment, irrigate field to activate the herbicide.
Broadleaf weeds	Postemergence	Stinger (clopyralid) (4) 0.094 to 0.187 lb a.i./A	Use of application rates at the lower end of the rate range will control young weeds and will reduce the risk of damaging the crop.
CARROTS*			
Annual broadleaf and grass	Preplant incorpated	Trifluralin HF and others (trifluralin) (3) 0.5 to 1 lb a.i./A	Incorporate thoroughly into the soil soon after application and before planting.
Annual broadleaf and a few grass weeds	Postemergence	Lorox[r] DF (linuron) (7) 0.75 to 1.5 lb a.i./A	Apply according to the label only after carrots are 3 inches high and do not use wetting agent. Do not exceed 2 lb ai per season.
Annual broadleaf weeds	Postemergence	Metribuzin 75 DF (metribuzin) (5) 0.25 lb/A	Apply after carrots have 5 to 6 true leaves but before weeds are larger than 1 inch. Do not apply within 60 days of harvest.
Grasses	Postemergence	Fusilade DX (fluazifop-butyl) (1) 0.09 to 0.188 lb a.i./A + 0.5 to 1% oil	Do not harvest within 45 days of application. Target grasses must be actively growing. Do not exceed 48 fl oz Fusilade DX per acre/crop.
Grass weeds	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.47 lb a.i./A. See label for surfactants.	Apply to young actively growing grasses. Do not apply within 30 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Controls annual and some perennial grass weeds	Postemergence	Select 2EC or Prism (clethodim) (1) 0.09 to 0.125 lbs a.i./A Always use 1% crop oil concentrate v/v	Do not apply more than 8 fl oz. per acre in a single application.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
COLE CROPS* (Broccoli, Cabbage, Cauliflower) (Check each label to determine if the herbicide has label approval for the cole crop grown)			
Emerged annual and perennial grass	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 30 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Annual grass and broadleaf	Preplant incorporated or Preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Apply and incorporate shallowly before planting or apply after planting just prior to sprinkler irrigation. See details on label for instructions on incorporation with irrigation.
Annual grass and broadleaf	Preplant incorporated	Trifluralin HF and others (trifluralin) (3) 0.5 to 0.75 lb a.i./A	Thoroughly incorporate soon after application and before seeding or transplanting. Direct seeded cole crops have exhibited marginal tolerance to higher than recommended rates, use only up to 0.75 lb a.i./A rate for them. Transplanted cole crops can use up to 1.0 lb a.i./A rate.
Annual broadleaf	Prior to transplanting	Goal 2XL (oxyfluorfen) (14) 0.25 to 0.5 lb a.i./A	Apply as surface spray after soil preparation and before transplanting. Not for seeded crop.
Controls annual grasses and certain broadleaf weeds, see label for specifics	Preemergence or preplant incorporated	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply uniformly to soil at time of planting. Can be sprayed directly over transplant.
Annual graases and broadleaf	Preemergence and preplant incorporated	Devrinol 50DF (napropramide) (15) 1-2 lbs. a.i./A	Direct seeded or transplanted. Broccoli, Brussels Sprouts, Cabbage and Cauliflower. Rate depends on soil type. Sprinkler irrigate surface applications.
Suppression of annual grasses and velvetleaf and spurred anoda	Preemergence	Command 3ME (clomazone) (13) 0.25 to 0.49 lb a.i./A	Cabbage transplants only: Use lower recommended rate for coarse soils and higher recommended rate for fine textured soils. See "Vegetable Disclaimer" section of label.
Grass weeds	Postemergence	Select 2EC (clethodium) (1) 0.09 to 0.125 lb a.i./A Always use 1% crop oil concentrate	Do not apply more than 8 fll oz. per acre in a single application.
CUCURBITS* (Cantaloupe, Cucumber, Watermelon, Squash, Pumpkin) Check the label to determine if the herbicide has label approval for the vine crop grown.			
Annual broadleaf weeds	Preemergence or Postemergence	Alanap L (naplalam) (19) 2 to 4 lb a.i./A	Apply to a clean soil after seeding or transplanting crops and before weeds emerge. Use postemergence when crops are ready to vine, but before weeds emerge. Do not use adjuvants with postemergence application. Do not use on pumpkin or squash. Soil type determines rate.
Annual broadleaf and grass weeds	Preplant incorporate and Preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Incorporate thoroughly into the soil with shallow cultivation for preplant incorporated or irrigate for preemergence applications following planting, must wet soil 2 to 4 inches deep. Where broadleaf weeds are a problem, a follow-up with Alanap has been successful in Kansas.
Annual grass and broadleaf weeds	Preplant incorporate or preemergence	Alanap L (naptalam) (19) 2 to 4 lb/A + Prefar 4E (bensulide) (8) 4 to 6 lb a.i./A	Incorporate the mixture into soil at a depth of ½ inch to 1 inch or use overhead irrigation immediately after planting. Injury may occur if excessive rainfall follows application. Do not use on pumpkin or squash.
	Preplant	Command 3ME (clomazone) (13) 0.15 to 0.75 lb a.i./A	Refer to label for crop specific instructions. Rates vary with crops. See "Vegetable Disclaimer" section of label.
Annual grass and broadleaf weeds	Post-plant prior to weed emergence	Trifluralin HF and others (trifluralin) (3) 0.5 to 1.0 lb a.i./A	Apply as directed spray under leaves when crop is in the 3 to 4 leaf stage and immediately incorporate into the soil.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
CUCURBITS* (cont'd)			
Annual grasses and broadleafs	Preemergence following planting	Curbit 3EC (ethalfluralin) (3) 1.12 to 1.69 lb a.i./A	Use only as post-plant surface application immediately after seeding. Cucumbers, melons, watermelons, summer and winter squash, and pumpkins.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 14 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Broadleaf weeds, and nutsedge	Preemergence or postemergence to row middles and furrows. Check label for more complete instructions.	Sandea (halosulfuron) (2) 0.023-0.047 lbs a.i./A Use 0.25-.050% Non ionic surfactant V/V for postemergence applications	Check label for when Sandea can be applied to cucurbit crops. Application area and timing will vary between different types of cucurbits and therefore the label must be checked for instructions on how to apply.
Harvest aid	Prior to harvest	Defol, several formulations (Sodium chlorate) (No #) 6.0 lb a.i./A	Defoliation of cucurbits grown for seed only.
Controls annual grasses and certain broadleaved weeds, see label for specifics	Only after plants have 4-5 true leaves	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply uniformly to soil only after plants have 4-5 true leaves and are well established and in a good state of growth.
Controls annual and some perennial grass weeds	Postemergence	Select 2EC and Prism (clethodim) (1) 0.09 to 0.125 lb a.i./A Always use 1% crop oil Concentrate	Do npt apply more than 8 fl oz. per acre in a single application.
EGGPLANT*			
Annual grasses and broadleaf	Preplant or Preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Incorporate before planting or apply to surface and follow with irrigation. See label for instructions for incorporation with irrigation.
All emerged weeds	Post emergence directed spray	Gramoxone Inteon[r] (paraquat) (22) 0.5 lb a.i./A	1 day PHI
Broadleaf and nutsedge	Postemergence	Sandea (halosulfuron) (2) 0.023-0.047 lbs a.i./A use 0.25-0.50% non-ionic surfactant for postemergence applications	Apply to row middles and furrows. Avoid contact of herbicide with planted crop.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 20 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Controls annual and some perennial grassy weeds	Postemergence	Select 2EC and Prism (clethodim) (1) 0.09 to 0.125 lb a.i./A Always use 1% crop oil Concentrate	Do npt apply more than 8 fl oz. per acre in a single application.
Controls annual grasses and certain broadleaved weeds, see label for specifics	4-6 weeks after transplanting or seeding when plants are 4-6 inches high	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply 4-6 weeks after transplanting or seeding once plants are 4-6 inches high. Check label for rates based on soil types and weeds to control.
Broadleaf	Preplant Incorporated or Preemergence Incorporated with irrigation.	Devrinol 50DF (napropramide) (5) 1-2 lbs. a.i./A	Transplanted only. Rate depends on soil type.
Broadleaf and nutsedge weeds	Postemergence to crop	Sandea (Halosulfuron) (2) 0.023 to 0.047 lbs a.i./A Use Non-ionic-surfactant (NIS) 0.25 to 0.5% V/V	Row middle and furrow application. Avoid contact with crop.

[r]Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
GREENS* (Mustard, Turnips, Collards, Kale) Check each herbicide label to determine if the herbicide has label approval for the greens grown.			
Annual grass and broadleaf weeds	Preplant incorporated	Trifluralin HF and others (trifluralin) (3) 0.5 to 0.75 lb/A	Apply before planting, thoroughly incorporate into soil soon after application. Not for turnip roots.
Annual grass and broadleaf	Preplant or preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Prefar is not labled for turnip greens. See full label for details on mechanical incorporation and incorporation with irrigation.
Emerged annual and perennial grass	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 pt a.i./A. See label for surfactants.	Poast is not labled for use on turnip. Apply to actively growing grasses. Do not apply within 30 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Grass weeds	Postemergence	Select 2EC (clethodim) (1) 0.09 to 0.125 lb a.i./A always use 1% crop oil concentrate	Do not apply more than 8 fl.oz. per acre in a single application. 14 day preharvest interval.
Broadleaf weeds	Postemergence	Stinger (clopyralid) (4) 0.12 to 0.187 lb a.i./A	For turnips grown for roots and tops.
Controls annual grasses and certain broadleaved weeds, see label for specifics	Preemergence or preplant incorporated	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply uniformly to soil at time of seeding, can be preplant incorporated.
LETTUCE*			
Annual broadleaf and grass	Preplant	Balan DF (benefin) (3) 1.2 to 1.5 lb a.i./A	Apply prior to planting and incorporate into the soil soon after application. See label for details.
Annual grass	Preplant or Preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Incorporate into the soil prior to planting. Follow label directions and do not incorporate too deep. If incorporated with irrigation see label for instructions.
Emerged annual and perennial grass	Postemergence	Poast 1.5 L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 30 days of head lettuce harvest or 15 days of leaf lettuce harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Annual grass and broadleaf weeds	Preplant incorporated or Preemergence with irrigation for incorporation or Postemergence	Kerb[r] 50W (pronamide) (15) 1 to 2 lb a.i./A	Can be used in direct seeded or transplanted lettuce. Do not apply post to leaf lettuce. Read label for complete directions. Do not apply within 55 days of harvest.
OKRA*			
Annual grass and broadleaf weeds	Preplant incorporated	Trifluralin HF and others (trifluralin) (3) 0.5 to 1 lb a.i./A	Incorporate into the soil soon after application.
ONION*			
Annual grass and broadleaf	Preplant or Preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Follow label directions for mechanical incorporation or incorporation with irrigation.
Grasses	Postemergence	Fusilade DX (fluazifop-butyl) (1) 0.09 to 0.188 lb a.i./A + 0.5 to 1% oil	Do not harvest within 45 days of application. Target grasses must be actively growing. Do not exceed 48 fl oz Fusilade DX per acre/crop.
Emerged broadleaf weeds	Postemergence	Goal 2XL (oxyfluorfen) (14) 0.12 to 0.5 lb a.i./A	Apply after seeded onions have at least 2 expanded true leaves. Use a low rate on small onions. Do not apply during cloudy, wet conditions. Apply immediately after transplanting onions. Apply to dry bulb type onions only. Do not apply within 45 days of harvest. Check label for rates according to type of crop (seeded vs. transplant).

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
ONION* (cont'd)			
Annual broadleaf and some grass weeds	Preemergence to weeds following crop emergence	Outlook (dimethenamide-P) (15) 0.33 to 0.98 lb a.i./A	Apply after onions have a least 2 expanded true leaves for direct seeded and for transplanted onions wait several days for soil to settle around plants prior to application. There needs to be a minimum of 30 days between application and harvest.
Annual grasses and small-seeded broadleaf weeds	Preemergence	Prowl 3.3 EC and Prowl H_2O (pendimethalin) (3) 0.7 to 1.4 lb a.i./A	Apply when onions have 2 to 9 true leaves.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grasses. Do not apply within 30 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Controls annual and some perennial grass weeds	Postemergence	Select 2EC and Prism (clethodim) (1) 0.09 to 0.25 lb a.i./A Always use 1% crop oil concentrate	Do not apply Clethodim within 45 days of onion harvest.
Controls annual grasses and certain broadleaf weeds, see label for specifics.	Preemergence, preplant incorporated, and layby	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 7.5 lb a.i./A. Check label for rates based on soil types for preemergence applications.	Onions: Apply uniformly to soil at time of planting. A layby application can be made as single application or in addition to a Dacthal preemergence application. Has given extended grass control in trials.
Annul grass and broadleaf weeds	Preplant or Postplant as direct spray.	Trifluralin HF and others (trifluralin) (3) 0.375 to 0.625 lb a.i./A	Direct spray between established onion rows and apply as a soil incorporated treatment. Use spray shields to avoid injury to crop.
PEAS* (Southern, edible Cowpeas, Garden pea)			
Annual grass and broadleaf weeds	Preplant incorporated	Trifluralin HF and others (trifluralin) (3) 0.5 to 0.75 lb a.i./A	Incorporate soon after application. Application rates for cowpea vary from those of garden pea refer to label for further information.
	Preemergence or preplant incorporated	Dual Magnum; (s-metolachlor) (15) 0.95 to 1.9 lb a.i./A	On English peas, use only preemergence applications.
Annual broadleaf and grass	Pre-Plant Incorporated	Eptam 7E (EPTC) (8) 3 – 6.12 lb a.i./A	Can be applied at layby as a directed spray at base of plants. Check label for rates and other application procedures.
Annual grasses and small-seeded broadleaf weeds	Preplant incorporated	Prowl 3.3 EC and Prowl H_2O (pendimethalin) (3) 0.7 to 1.4 lb a.i./A	Do not apply Prowl more than once per season.
Broadleaf weeds and grasses	Preplant incorporated or Preemergence	Pursuit DG (imazethapyr) (2) 0.063 lb a.i./A	Replant restrictions can be up to 18 months. Do not apply within 30 days of harvest. Check label.
Annual grasses and broadleaf	Postemergence	Raptor Imazamox (2) 0.031 lb a.e./A	Only for certain types of dry peas. Some varieties are susceptible to injury. Apply before flowering. Always add Basagran as a tank mix partner, see Raptor label for rates.
Annual grass and broadleaf weeds	Preplant or Preemergence	Command 3ME (clomazone) (13) 0.49 lb a.i./A	Apply as a broadcast application. Refer to label for crop rotational instructions.
Grasses	Postemergence	Assure II (quizalofop P-ethyl) (1) 0.0.034 – 0.082 lbs a.i./A plus crop oil conc.	Do not harvest within 60 days of application to dry peas or 30 days to succulent peas. Use crop oil concentrate (COC) at a rate of 1% V/V in spray tank. See label for tank-mix combinations that are possible.
Annual broadleaf weeds and yellow nutsedge	Postemergence	Basagran (bentazon) (6) 0.50 to 1 lb a.i./A	Apply early postemergence when weeds are small and actively growing and before weeds reach the maximum size listed on the label. Apply after the 4 node stage of crop plants.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
		PEAS* (continued)	
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.47 lb a.i./A. See label for surfactant.	Apply to young actively growing grass. Do not apply within 15 days of harvest of succulent peas and 30 days of harvest of dry peas. See label for recommended rates for specific weed species and for appropriate surfactant.
Harvest Aid	Prior to harvest	Aim EC (carfentazone) (14) 0.015-0.03 lb a.i./A. Use crop oil at 2% V/V or NIS at 0.25% V.V.	Aim may be used alone or in tank mix with other harvest aids. Do not apply within 3 days of harvest. Dry pea or southern peas only.
Harvest Aid	Preharvest	Defol (several formulations) (sodium chlorate) (No #) 6 lb a.i./A (1 gal)	Southern Pea only. Apply 7 to 10 days before harvest for defoliation. Do not graze treated fields or feed treated forage to livestock.
		PEPPER*	
Annual grasses	Preplant or Preemergence	Prefar 4E (bensulide) (8) 5 to 6 lb a.i./A	Incorporate before planting or apply to the surface and follow with sprinkler irrigation. Use only on types of peppers indicated on the label.
Broadleaf weeds and nutsledge	Postemergence	Sandea (halosulfuron) (2) 0.023-0.047 lbs a.i./A Use 0.25-0.50% non-ionic surfactant V/V	Apply to row middles and furrows. Avoid contact of herbicide with planted crop. See label for further information regarding how Sandea can be applied to pepper.
All emerged weeds	Postemergence directed spray	Gramoxone Inteon[r] (paraquat) (22) 0.5 lb a.i./A	
Annual grass	Pre-transplant	Trifluralin HF and others (trifluralin) (3) 0.5 to 1.0 lb a.i./A	Thoroughly incorporate into the soil soon after application prior to transplanting. For use only on transplanted crop.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 20 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Annual grasses and broadleaf	Preplant Incorporated or preemergence incorporated with irrigation.	Devrinol 50DF, 2[E] (napropramide) (15) 1-2 lbs. A.i./A	Direct seeded or transplanted. Rate depends on soil type. See supplemental label for use under plastic mulch.
Annual grasses and certain broadleaved weeds	4-6 weeks after transplanting or seeding when plants are 4-6 inches high	Dacthal Flowable only (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply 4-6 weeks after transplanting or seeding once plants are 4-6 inches high. Check label for rates based on soil types and weeds to control.
Harvest Aid	Preharvest	Defol (several formulations) (sodium chlorate) (No #) 3.0 to 7.5 lb a.i./A	Chili pepper for processing only: Apply 7 to 10 days before harvest for defoliation. Do not graze treated fields or feed treated forage to livestock.
Suppression of annual grasses and velvetleaf and spurred anoda	Preemergence	Command 3ME (clomazone) (13) 0.25 to 1.0 lb a.i./A	Use lower recommended rate for coarse soils and higher recommended rate for fine textured soils.
Controls annual and some perennial grassy weeds	Postemergence	Select 2EC and Prism (clethodim) (1) 0.09 to 0.125 lb a.i./A Always use 1% crop oil concentrate	Do not apply more than 8 fl oz. per acre in a single application. Do not use on banana peppers.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
POTATOES* (Irish)			
Emerged annual grass and broadleaf	Preplant or Preemergence	Gramoxone Inteon[r] (paraquat) (22) 0.26-0.5 lb a.i./A plus nonionic surfactant or crop oil concentrate	Apply up to ground cracking, before potatoes have emerged. Follow directions and precautions on the label.
Annual broadleaf and grass	Preplant or drag-off Preemergence or Preemergence Incorporated	Eptam 7E (EPTC) (8) 3 – 6.12 lb a.i./A	Thoroughly incorporate immediately after application just prior to planting. Also may be used at drag-off or layby treatment. If drag-off is practiced, apply after drag-off. If incorporation is used, do so soon after planting before plants emerge. Do not apply within 45 days of harvest.
	Preplant or Post-plant or Preemergence or Time of drag-off	Dual Magnum; (s-metolachlor) (15) 0.95 to 2.5 lb a.i./A	Apply and incorporate in the top 3 inches of soil before planting or in the top 2 inches of soil after planting or preemergence after planting or after drag-off, prior to potato emergence. Check label for timing of different rates.
Annual grass and broadleaf weeds	At planting, drag-off or layby	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Initial irrigation after applying Dacthal should not exceed 1 inch.
Annual broadleaf and some grass weeds	Preemergence to weeds following planting or drag-off.	Outlook (dimethenamide-P) (15) 0.56 to 0.98 lb a.i./A	Do not apply within 40 days prior to harvest. Rates of Outlook to use are based upon soil texture, see label for additional information.
Annual grass and broadleaf weeds	Preemergence incorporated	Prowl 3.3 EC and Prowl H_2O (pendimethalin) (3) 0.7 to 1.4 lb a.i./A	Apply and incorporate after planting prior to crop emergence. Apply tank mixes as specified on Prowl label. Tank mixes may include Eptam, Metribuzin, and Matrix.
Annual broadleaf and grass weeds	Preemergence Time of drag-off	Dual Magnum (s-metolachlor) (15) 0.95 to 1.27 lb a.i./A + Lexone DF (metribuzin) (5) 0.5 to 1.0 lb a.i./A	Apply after planting as a preemergence, delayed preemergence or after drag-off. Do not apply after crop emerges.
Annual grass and broadleaf weeds	Preemergence or Postemergence	Trifluralin HF and others (trifluralin) (3) 0.5 to 1 lb a.i./A	Apply and incorporate Trifluralin after planting but before emergence, following drag-off, or after potato plants have fully emerged.
Broadleaf and some grass weeds	Preemergence	Lorox DF (linuron) (7) 0.75 to 1.5 lb a.i./A	Plant the crop 2 inches deep and follow label directions. Rainfall needed for activation. Do not spray over top of emerged potatoes. Note soil type affects use rates.
Annual broadleaf	Preemergence or postemergence	Metribuzin 75 DF (metribuzin) (5) 0.25 to 1.0 lb a.i./A	Rate is determined by soil type. Atlantic, Bellchip, Centennial, Chipbelle, and Shepody are sensitive to Metribuzin see label for instructions. Do not apply within 60 days of harvest. See label for precautions.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.47 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 30 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Controls annual and some perennial grass weeds	Postemergence	Select 2EC or Prism (clethodim) (1) 0.09 to 0.25 lb a.i./A Always use 1% crop oil concentrate	Do not apply Clethodim within 30 days of onion harvest. Note that Select has 2 lbs of Clethodim per gallon and Prism has 0.94 lbs of Clethodim per gallon, be certain to calibrate by lbs active ingredient per acre.
Harvest Aid	Prior to harvest	Aim EC (carfentazone) (14) 0.05-0.09 lb a.i./A. Use crop oil at 1% V/V.	Aim may be used alone or in tank mix with other harvest aids. Do not apply within 7 days of harvest.
Harvest Aid	Preharvest	Defol 750 (sodium chlorate) (No #) 6 lb a.i./A (1 gal)	Apply 10 days before harvest. See label for details of instruction.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
		SPINACH*	
Annual broadleaf weeds	Postemergence	Spin-Aid 1.3 EC (phenmedipham) (5) 0.49 to 0.98 lb a.i./A	For processing spinach past the 4 to 6 true leaf stage and weeds at the 2 true leaf stage. Do not spray within 40 days of harvest.
Annual and perennial broadleaf weeds	Postemergence	Stinger (clopyralid) (4) 0.062 to 0.12 lb a.i./A	Extreme growing conditions prior to, during, or after application can increase the chance of crop damage.
Grass Weeds	Postemergence	Select 2EC (clethodim) (1) 0.09 to 0.125 lb a.i./A Always use 1% crop oil concentrate	Do not apply more than 8 fl oz. per acre in a single application. 14 day prehavest interval.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grass. Do not apply within 15 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
		SWEET CORN*	
Annual broadleaf and grass	Preemergence or early Postemergence	Atrazine[r] 4L (atrazine) (5) 1.2 to 2 lb a.i./A	Postemergence up to 3 weeks after planting. Do not replant to any crop except corn or sorghum until the following year. Do not use on sandy soils for preemergence treatment.
Annual broadleaf and grass weeds and yellow nutsedge	Preplant or Preemergence Postmergence	Dual Magnum (s-metolachlor) (15) 0.95 to 1.90 lb a.i./A	Apply and incorporate in the top 2 inches of soil up to 14 days prior to planting or apply after planting prior to weed and crop emergence. Postmergence until corn is 40 inches tall.
Annual broadleaf and grass weeds and yellow nutsedge	Preplant or Preplant incorporated or Postemergence or Preemergence	Bicep II Magnum (atrazine + s-metolachlor) (5, 15) 2.89 to 3.61 lb a.i./A	For preplant, apply within 14 days before planting. For postemergence directed, apply to corn not exceeding 5 to 12 inches in height.
Broadleaf and nutsedge weeds	Post to crop	Sandea (halosulfuron) (2) 0.031 to 0.047 lb a.i./A Use 0.25-0.50% non-ionic surfactant	See label for crop growth stage and application methods.
Annual broadleaf and grass weeds and yellow nutsedge	Preplant Surface or Incorporated, Preemergence or Early Postemergence	Outlook (dimethenamid) (15) 0.56-0.98 lb a.i./A	Determine rate by cation exchange capacity of soil or soil type. Will not control emerged weeds. Use in reduced tillage systems. Apply post to corn up to 12 inches tall. 50 day pre-harvest interval.
Annual grasses and small-seeded broadleaf weeds	Premergence Postmergence	Prowl 3.3 EC and Prowl H_2O (pendimethalin) (3) 0.95 to 1.9 lb a.i./A	For □reemergence, make certain seed is covered by at least 1 ½ inch of soil prior to application. Apply postmergence until corn is 20-24 inches tall or has 8 leaf collars.
Annual broadleaf weeds	Postemergence	2,4-D amine (2,4-D) (4) 0.25 to 0.5 lb a.i./A	Apply postemergence from emergence to tasseling for control of small broadleaf weeds. Use directed spray after corn is more than 8 inches tall.
Annual and perennial broadleaf	Postemergence	Stinger (clopyralid) (4) 0.094 to 0.187 lb a.i./A	Do not apply sweetcorn greater than 18 inches tall.
Annual broadleaf and yellow nutsedge	Postemergence	Basagran (bentazon) (6) 0.50-1.0 lb a.i./A	Weed size critical for good results.
Broadleaf	Postemergence	Aim EC (carfentazone) (14) 0.008-0.016 lb a.i./A. Use non-ionic surfactant or crop oil.	Needs to be applied with drop nozzles or other sprayers that direct the spray away from the "whorl" of the corn plant.
Annual broadleaf weeds	Preplant burndown through 14-leaf collar growth stage.	Aim EC, EW (carfentrazone) up to 0.03 lb a.i./A. Use nonionic surfactant at 0.25% V/V or crop oil concentrate at 1% V/V.	Coverage is essential for good control, can be tankmixed with other postemergence herbicides for control of a wider spectrum of weed species. Make application to actively growing weeds up to 4 inches high or rosettes up to 3 inches in diameter.
Emerged annual broadleaf and grass	Post directed and shielded application.	Gramoxone Inteon[r] (paraquat) (22) 0.49 to 2.0 lb a.i./A. Use nonionic surfactant or crop oil concentrate	Apply before crop emerges. Will top kill and suppress perennials. Direct spray contact can cause severe crop damage.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
SWEETPOTATOES* (Transplants)			
Annual broadleaf and grass	Pre-Plant Incorporated Pre-Plant Bed-Over Pre-Plant Bed-Up Post-Plant	Eptam 7E (EPTC) (8) 1.53 – 7.43 lb a.i./A	Thoroughly incorporate immediately after application just prior to planting for PPI application. Check label for specific rates to be used for each type of application.
Emerged annual and perennial grasses	Postemergence	Fusilade DX (fluazifop) (1) 0.09 to 0.188 lb a.i./A Use 0.5 to 1.0% crop oil V/V	Apply with ground equipment to young actively growing grass. Do not apply within 55 days of harvest.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to actively growing grasses. Do not apply within 60 days of harvest. Rates and pre-harvest intervals will vary according to location within the state, read label for more details. See label for recommended rates for specific weed species and for appropriate surfactant.
Controls annual and some perennial grassy weeds Johnsongrass Bermudagrass	Postemergence	Select 2EC or Prism (clethodim) (1) 0.09 to 0.25 lb a.i./A Always use 1% crop oil concentrate	Do not apply within 30 days of harvest.
Suppression of annual grasses and velvetleaf and spurred anoda	Preemergence	Command 3ME (clomazone) (13) 0.75 to 1.24 lb a.i./A	Apply as a broadcast application. See label for harvest waiting period information. For EC formulation see label.
Controls annual grasses and certain broadleaved weeds, see label for specifics	Preemergence or preplant incorporated	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A	Apply uniformly to soil at time of transplanting. Check label or rates based on soil types and weeds to control. Layby applications can be made up to 6 weeks after transplanting.
Annual grasses and broadleaf	Apply after transplanting and incorporate with light irrigation	Devrinol 50DF, 2^{E} (napropramide) (15) 1-2 lbs. A.i./A	Apply to weed free soil following transplanting, be certain to incorporate with light irrigation to wet soil to a depth of 2-4 inches.

[r] Restricted Use Pesticide

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

WEEDS	TIME OF APPLICATION	HERBICIDES, (MOA GROUP) AND AMOUNT OF ACTIVE INGREDIENT PER ACRE	COMMENTS
		TOMATOES*	
Broadleaf weeds and nutsledge	Pre-Transplant and Postemergence	Sandea (halosulfuron) (2) 0.023-0.047 lbs a.i./A Postemergence use 0.25-0.50% Nonionic surfactant V/V	See label for instructions of how to apply at both Pre-transplant and Post. Avoid contact with planted crop. Check label for further instructions regarding when and how Sandea can be applied to tomatoes.
Grass and broadleaf Weeds	Preplant incorporated and preplant before transplanting	Dual Magnum (s-metolachlor) (15) 0.95-1.90 lbs a.i./A	Do not apply to varietes with unknown tolerance to Dual Magnam. See label for other restriction.
Annual grasses and broadleaf	Preplant Incorporated or preemergence incorporated with irrigation.	Devrinol 50DF, 2[E] (napropramide) (15) 1-2 lbs. A.i./A	Direct seeded or transplanted. Rate depends on soil type. See supplemental label for use under plastic mulch.
Emerged weeds	Post emergence directed spray	Gramoxone Inteon[r] (paraquat) (22) 0.5 lb a.i./A. Use non-ionic surfactant or crop oil.	Control weeds between rows. Do not allow spray drift to contact crop. Do not harvest within 30 days of application.
Annul grass and broadleaf weeds	Preplant or Postplant as direct spray.	Trifluralin HF and others (trifluralin) (3) 0.5 to 1 lb a.i./A	Thoroughly incorporate immediately after application. Apply prior to transplanting. See label for information about direct seeded tomatoes.
Annual grass and broadleaf weeds	Preplant or Postemergence	Metribuzin 75 DF (metribuzin) (5) 0.25 to 0.5 lb a.i./A	For transplanted crop apply preplant incorporated alone or in combination with Trifluralin as indicated on the label. Apply postemergence to established tomatoes. Weed infestation determines rate. See label for precautions and rates up to 1.0 lbs ai/A for post-directed applications.
Emerged annual and perennial grasses	Postemergence	Poast 1.5L (sethoxydim) (1) 0.1875 to 0.28 lb a.i./A. See label for surfactants.	Apply to young actively growing grasses. Do not apply within 20 days of harvest. See label for recommended rates for specific weed species and for appropriate surfactant.
Controls annual grasses and certain broadleaved weeds, see label for specifics	4-6 weeks after transplanting or seeding when plants are 4-6 inches high	Dacthal W-75; Flowable (DCPA) (3) 4.5 to 10.5 lb a.i./A Check label for rates based on soil types and weeds to control	Apply 4-6 weeks after transplanting or seeding once plants are 4-6 inches high. Check label for rates based on soil types and weeds to control.
Controls annual and some perennial grass weeds	Postemergence	Select 2EC or Prism (clethodim) (1) 0.09 to 0.25 lb a.i./A Always use 1% crop oil concentrate	Do not apply Clethodim within 20 days of tomato harvest.

[r] Restricted Use Pesticide

* See herbicide label for directions, precautions and limitations

MOA Group Tables start on page 46 of the handbook.

SUGGESTIONS FOR WEED CONTROL IN VEGETABLE CROPS (CONT'D)

Additional information may be found in the following OSU Cooperative Extension Publications:

Weed Control in Vegetables Guide to effective weed control http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1086/PSS-2750web.pdf	CR 6008 PSS 2750
Calibrating a Low Pressure Ground Sprayer http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2209/BAE-1216web.pdf	BAE 1216
Use of Plastic Mulch and Row Covers in Vegetable Production http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1099/HLA-6034web.pdf	HLA 6034

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DISEASE CONTROL GUIDE FOR VEGETABLE CROPS

Chemical control is an important tool in the prevention of vegetable crop diseases. However, cultural controls are effective against many diseases and should be integrated into vegetable production systems. For some diseases, cultural controls are the only effective management strategy.

CULTURAL PRACTICES for vegetable disease control include the following:
Resistant varieties: Varieties of some vegetable crops are resistant to one or more diseases and should be planted in place of susceptible varieties (i.e., those with no resistance claimed).
Exclusion: Avoid introducing plant pathogens into fields or gardens. Use certified or otherwise healthy seed and transplants obtained from reputable sources. Do not transport soil on equipment or boots from diseased areas to disease-free areas.
Crop rotation: Practice crop rotation to avoid the build-up of disease problems. Apply long rotations (2 to 4 years) where diseases have become established. Use non-related crops for rotations. Avoid rotating within legume, crucifer, cucurbit, and solanaceous (tomato, pepper, potato) crop groups. Diseases often attack several crops within each group.
Sanitation: Remove and destroy diseased plants from plantings to help prevent spread to healthy plants. Residue management consisting of removal, soil incorporation, or burning of old plant parts, weeds, and trash is important for reducing survival of pathogens and resulting inoculum available for infection of the next crop.

FUNGICIDES: Fungicides and other disease control chemicals are most effective when they are applied before infection. Because new plant growth is vulnerable to infection and fungicides are subject to weathering, fungicides must be reapplied at regular intervals during the period of pathogen activity in order to keep plants adequately protected. Carefully read the manufacturer's label and use according to the instructions. Pay particular attention to recommended protective clothing, the number of days allowed between the last application and harvest (i.e., the pre-harvest interval), and the total allowable amount per season.
Inorganic fungicides are sold under various brands and formulations. Copper fungicides include basic copper sulfate, Kocide, Copper Count N, Tenn-Cop, and many other brands. Sulfurs include sulfur dusts, dry flowables (e.g. Mircothiol Special), liquid flowables (e.g. Red Ball F), and wetable powders (Sulfur 90W). Bordeaux mixture is a mixture of copper sulfate and lime. TopCop is a mixture of copper and sulfur. Coppers are generally suggested for control of bacterial diseases, but they also may provide adequate control of fungus diseases. Coppers may burn foliage of some crops when applied under cool and wet conditions. Lime is added to the bordeaux mixture to soften the copper sulfate component. Bordeaux mixture can be made by adding 2-10 lbs (2-10 tbs) of copper sulfate and 2-24 lbs (2-24 tbs) of lime to 100 gal (1 gal) of water. The higher rates of lime should be used for copper-sensitive crops. Sulfurs are effective for powdery mildews, but may burn foliage when temperatures are hot (>90°F). A few common brands are specified in the crops listing. Check the labels for recommended rates and use patterns for other coppers and sulfurs.
Fungicide resistance management - The potential for development of resistance in leaf spot fungi is a concern for several fungicide classes that have a site-specific mode of action. Resistance development can result in loss of effectiveness and control failures. Most of the at-risk fungicides are systemic to some degree. At-risk fungicides can be grouped according to mode of action. Group 1 fungicides (benzimidazoles) such as Topsin, and Group 11 (strobilurin) fungicides such as Quadris and Cabrio are very prone to resistance development and sudden losses in effectiveness have been reported for some diseases. Other fungicide groups are less prone to resistance development, but may be still at risk. The following resistance management guidelines should be followed when using at-risk fungicides:

1) Reduce initial pathogen levels through the use of good cultural practices such as crop rotation.
2) Follow label directions - do not exceed the maximum number of consecutive applications, and do not use less than the minimum labeled rate.
3) Do not exceed the maximum allowed amount or number of applications per season. Extending the allowed amount of one Group 11 fungicide with another will increase the risk of resistance development.
4) Keep the disease pressure low by using an effective application schedule.
5) Calibrate the sprayer. Configure spray tips to apply a sufficient volume of water to achieve good coverage.
6) Avoid using Group 11 fungicides all season long. Use alternating sprays or blocks of sprays of these fungicides with unrelated fungicides or tank-mix with unrelated fungicides. For example, Group 3 and Group 11 fungicides can by applied in alternating blocks with protectant (multi-site, Group M) fungicides such as chlorothalonil (eg. Bravo) or mancozeb (eg. Dithane), or with each other. Tank mixes of at risk fungicides with a protectant or with fungicides in another group are appropriate.
7) Alternating or tank-mixing one Group 3 fungicide with another or one Group 11 fungicide with another will not help prevent resistance development.

Commercial crops: The rates of fungicide are listed in Table 4 on a per acre or 100 gal basis unless otherwise specified. When making applications on a per acre basis, be sure to calibrate the sprayer and apply in a sufficient volume of water to achieve thorough plant coverage. Fungicides act like paint to protect plants from infection, so use adequate pressure and spray volumes. When making applications on a per 100 gal basis, mix the specified amount in 100 gal and spray to runoff. Be sure to use agitation to keep any of the various formulations in suspension.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

Home gardens: Most of the fungicides listed for commercial vegetable crops (see Table 4) can be used in home gardens, but they are not usually available in small quantities. Table 1 lists home and garden products recommended for disease control in vegetable crops. Table 1 does not include ready to use products or fungicides formulated in combination with insecticides. When using commercial products that list rates on a per acre or 100 gallon basis in gardens or small plantings, consult Table 2 to convert the suggested per acre or 100 gal rate to the per gallon rate. When using fungicide in gardens and small plantings on a per gallon rate, frequently agitate the spray tank and spray plants to runoff. Registered fungicides are listed under the common name of the active ingredient. Always check the label for crop-specific rates and days to harvest restrictions.

TABLE 1. HOME GARDEN FUNGICIDES AVAILABLE IN SMALL QUANTITIES FOR VEGETABLE CROPS.

COMMON NAME: (MOA GROUP) FORMULATION AND RATE	BRAND	CROP USES AND REMARKS
captan (M): Captan Fungicide 50W 0.5 to 2.5 tsp/lb seed	Hi-Yield	Seed treatment to control damping-off on beans, cabbage, corn, melons, peas, squash, beets, and spinach. Purchase treated seed or apply at the crop-specific rate on the label.
chlorothalonil (M): Fung-onil Multipurpose Fungicide 2.7F 1.5 tsp to 1 tbs/gal Daconil Fungicide Concentrate 2.7F 1.5 tsp to 1 tbs/gal Ortho Garden Disease Control 2.7F 1.5 tsp to 1 tbs/gal Ortho Daconil 2787 2.7F 1.5 tsp to 1 tbs/gal Veg., Flower, Fruit and Orn. Fungicide 1.14F 1 to 2 tbs/gal Gordon's Multi Purpose Fungicide 1.14F 1 to 2 tbs/gal Broad Spectrum Lawn and Garden Fungicide 1.14F 1 to 2 tbs/gal	Bonide Garden Tech Ortho Ortho Hi-Yield PBI/Gordon Ferti-lome	Foliar spray for fungal diseases on beans, carrots, cole crops, cucurbits, garlic, onions, potatoes, sweet corn, and tomatoes. Spray to runoff (drip) on a 7 to 14 day schedule. See label for diseases controlled, crop-specific rates, and days to harvest restrictions.
copper hydroxide (M): Copper Fungicide 2.4F 1.3 to 5.5 tsp/gal	Hi-Yield	Foliar spray for bacterial and fungal diseases on beans, carrots, cole crops, cucurbits, eggplant, lettuce, onions, peas, peppers, spinach, and tomatoes. Spray to runoff (drip) on a 5 to 10 day schedule. See label for diseases controlled and crop-specific rates.
copper octanoate (M): Copper Soap Liquid Fungicide (10%) 1 to 4 tbs/gal Liquid Copper Fungicide (10%) 1 to 4 tbs/gal	Natural Guard Bonide	Foliar spray for bacterial and fungal diseases on beans, beets, carrots, cole crops, cucurbits, eggplant, garlic, greens, lettuce, onions, peas, peppers, potatoes, spinach, and tomatoes. Spray to runoff (drip) on 5 to 10 day schedule. See label for diseases controlled and crop-specific rates.
copper sulfate (M): Bordeaux Mix Fungicide 12.5% 4 to 4.5 tbs/gal Gordon's Bordeaux Mixture 13.3% 6 tbs/gal	Hi-Yield PBI/Gordon	Foliar spray for bacterial and fungal diseases on tomatoes. Spray to runoff (drip) on a 7 to 10 day schedule.
mancozeb (M): Mancozeb Flowable 4F 2 to 5 tsp/gal	Bonide	Foliar spray for fungal diseases on asparagus, cucurbits, onions, potatoes, sweet corn, and tomatoes. Spray to runoff (drip) on a 7 to 10 day schedule. See label for diseases controlled, crop-specific rates, and days to harvest restrictions.
maneb (M): Maneb Garden Fungicide 80W 1.5 tbs/gal Gordon's Maneb Tomato and Vegetable Fungicide 80W 1.3 tbs/gal	Hi-Yield PBI/Gordon	Foliar spray for fungal diseases on cole crops, cucurbits, eggplant, onions, potatoes, peppers, and tomatoes. Spray to runoff (drip) on a 7 to 10 day schedule. See label for diseases controlled, crop-specific rates, and days to harvest restrictions.
sulfur (M): Dusting Wettable Sulfur 90W 4 tbs/gal Dusting Sulfur 90W 4 tbs/gal Wettable Dusting Sulfur 90W 2 tbs/gal Sulfur Plant Fungicide 90W 3 tbs/gal	Hi-Yield Ferti-lome Green Light Bonide	For rust and powdery mildew on peas and beans. Apply on 7 to 10 day intervals.

TABLE 2. CONVERSION TABLE FOR MIXING SMALL QUANTITIES OF LIQUID AND DRY FUNGICIDES

DRY FORMULATIONS

RATE/ACRE OR 100 GAL	1/4 lb	½ lb	1 lb	2 lb	3 lb	4 lb	5 lb
RATE/GAL	½ tsp	1 tsp	2 tsp	1 tbsp	1.5 tbsp	2 tbsp	3 tbsp

LIQUID FORMULATIONS

RATE/ACRE OR 100 GAL	1/4 pt	½ pt	1 pt	2 pt	3 pt	4 pt	5 pt
RATE/GAL	1/4 tsp	½ tsp	1 tsp	2 tsp	3 tsp	4 tsp	5 tsp

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

Seed treatment: Use of seed treatment fungicides is suggested for all vegetable crops including indoor transplant production. Vegetable crop seed is expensive and many of the crops are prone to damping off, particularly small seeded crops and super sweet corn varieties which lack seedling vigor. Table 3 lists seed treatment fungicides registered for use on vegetable crops. Purchased vegetable seed often is pretreated and ready to plant. Use products in Table 3 for untreated seed or for special orders from seed dealers.

TABLE 3. SEED TREATMENT FUNGICIDES FOR VEGETABLE CROPS

DISEASE	COMMON NAME: (MOA GROUP) FORMULATION AND RATE/100 lb SEED	REMARKS
Damping off (*Fusarium, Pythium, Rhizoctonia*)	captan (M): Captan 400 4F 1 to 12 fl oz Dyna-Shield Captan 4F 1 to 12 fl oz Nu-Gro Captan 4000 4F 1 to 12 fl oz	Labeled for most vegetable crops. Purchase treated seed or apply at the crop-specific rate on the label.
	thiram (M): Thiram 42S 2 to 8 fl oz Thiram 50W 2 to 8 oz Protector-D 35D 4.5 oz	Labeled for most vegetable crops. Purchase treated seed or apply at the crop-specific rate on the label. Planter box treatment for peas and beans.
	metalaxyl (4): Apron TL 1F 2 to 4 fl oz Allegiance FL 2.65F 0.75 to 1.5 fl oz Allegiance LS 1.63F 1.2 fl oz Allegiance Dry 1.5 to 2 oz	Systemic fungicide for enhanced *Pythium* control. Mix with captan or thiram for *Fusarium* and *Rhizoctonia*. Beans, beets, carrots, peas, southern peas, spinach, and sweet corn. Most vegetable crops. Beans, beets, cucumber, okra, peas, southern peas, and sweet corn. Planter box treatment for beets, beans, okra, southern peas, peas, and sweet corn.
	mefenoxam (4): Apron XL LS 0.085 to 0.64 fl oz	Systemic fungicide for *Pythium* control on most vegetable crops. Mix with captan, thiram, or fludioxanil for *Fusarium* and *Rhizoctonia*.
	metalaxyl (4) + trifloxystrobin (11): Trilex AL 5.7 fl oz	Beans, peas, southern peas.
	Bacillus subtilis (Biological): Kodiak Concentrate 0.1 to 0.5 oz Kodiak Flowable 0.2 to 1 fl oz Kodiak HB 3 to 8 oz	Biological seed protectant for all vegetable crops. Colonizes root system for extended disease control. Apply in combination with a chemical seed treatment. Planter box treatment.
	Bacillus plumilus (Biological): Yield Shield 0.1 oz	Biological seed protectant for beans, peas, and southern peas.
	fludioxonil (12): Maxim 4FS 0.08 to 0.16 fl oz	For control of *Fusarium* and *Rhizoctonia* on most vegetable crops. Mix with Apron or Allegiance for *Pythium* control.
	maneb (M): Manex 4F 12.8 fl oz	Tomatoes.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 8.5 oz Dithane F-45, Manzate, or Penncozeb 4F 12.8 fl oz	Tomatoes.
	carboxin (7): Vitavax-34 2.0 to 4.0 fl oz Vitavax 3F 2 to 4 fl oz	Beans, sweet corn. Sweet corn.
	carboxin (7) + thiram (M): RTU-Vitavax-Thiram 6.8 fl oz Vitavax M 12 fl oz Vitavax CT 12 fl oz Pro-Gro 80D 2.5 lb/100 lb seed	Liquid planter box treatments for dry beans. Liquid planter box treatments for dry beans. Liquid planter box treatments for dry beans. Control of smut on onion seed.
	carboxin (7) + PCNB (14) +metalaxyl (4): Prevail 3 to 5 oz	Planter box treatment for beans and sweet corn.
	azoxystrobin (11): Dynasty 0.15 to 0.76 fl oz	Beans and sweet corn.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

TABLE 4. CROP LISTING FOR DISEASE CONTROL IN COMMERCIAL VEGETABLE CROPS.

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
ASPARAGUS		
Fusarium stem, crown, and root rot (decline)	See next column	Plant hybrid varieties tolerant to *Fusarium*. Select a well-drained site and correct acid soils with lime. Avoid planting diseased crowns or replanting into problem fields.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 1 lb Dithane, Manzate, or Penncozeb 4F 1.6 pt	Dip crowns in specified dosage in 100 gal water for 5 minutes prior to planting.
Cercospora blight Rust Purple spot	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Purple spot only. Apply on 7 to 14-day schedule in alternation with a fungicide in a different group (mode of action).
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 2 to 4 pt Bravo, Echo, or Equus 82.5DF 1.8 to 3.6 lb	Apply after harvest when ferns fully develop and repeat on 2 to 4-week intervals.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 2 lb Dithane, Manzate, or Penncozeb 4F 1.6 qt	Cercospora: Apply on 2 to 4-wk intervals beginning after harvest when ferns lap between rows. Rust: Apply on 10–day intervals when rust first appears.
	myclobutanil (3): Nova 40W 5 oz	Rust only: Apply on 14-day intervals when rust first appears.
Phytophthora crown and spear rot	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 pt Ultra Flourish 2E 2 pt Metastar 2E AG 2 qt	Broadcast over cutting beds 30 to 60 days before cutting and again just before cutting. Treat new plantings after covering crowns or transplanting seedlings.
	fosetyl-AL (33): Aliette or Linebacker 80WDG 5 lb	Apply once to fully expanded ferns.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Apply once to fully expanded ferns.
BEANS (snap, dry [navy, pinto, kidney, lima])		
Bacterial blights (common, halo, and brown spot)	See next column	Plant disease-free seed and practice crop rotation.
Bacterial blights (common, halo, and brown spot) (cont'd)	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1 to 3 lb Kocide or Nu Cop DF 1.5 to 3 lb Kocide 2000 or Champ DF 0.75 to 2.25 lb Kocide, Champ, or Nu Cop 3F 0.7 to 2 pt	Begin when plants are 6-inches tall and repeat on 7 to 14-day intervals.
	copper sulfate (M): Cuprofix Ultra 40DF 0.75 to 2 lb	Begin when plants are 6-inches tall and repeat on 7 to 14-day intervals.
	other copper fungicides (M)	See labels
Anthracnose Cercospora leaf spot Downy mildew Rust Powdery mildew	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.3 to 3 pt Bravo, Echo, or Equus 82.5DF 1.25 to 2.7 lb Echo 90DF 1.1 to 2.5 lb	Rust on snap beans; and anthracnose, downy mildew, Cercospora, and rust on dry beans. Apply at early bloom and repeat on 7 to 10-day intervals. Rates vary by bean type and disease (see labels).
	maneb (M): Maneb 75DF or 80W 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Anthracnose, downy mildew, and rust on dry beans only. Apply when plants are small and repeat on 5 to 7-day intervals. Do not apply within 30 days of harvest.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME: (MOA GROUP) FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
BEANS (CONT'D)		
Anthracnose Cercospora leaf spot Downy mildew Rust Powdery mildew (cont'd)	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	azoxystrobin (11) + chlorothalonil (M): Quadris Opti 5.5F 1.6 to 2.4 pt	Dry beans only. Apply on 7 to 14-day intervals.
	pyraclostrobin (11): Headline 2.08E 5.5 to 8 fl oz	Rust, anthracnose, and powdery mildew on dry beans only. Apply at early bloom, and repeat 10 to 14-days later if necessary.
	thiophanate methyl (1): Topsin M or T-Methyl 70W 1 to 2 lb Topsin or T-Methyl 4.5F 1.25 to 2.5 pt Thiophanate Methyl 85WDG 0.8 to 1.6 lb	Anthracnose only. Apply the low rate at early bloom and repeat 7 to 10 days later or apply the high rate once at full bloom. Also controls white and gray molds (see below).
	sulfur (M): Microthiol or Kumulus 80DF 3 to 10 lb other sulfur formulations*	Rust and powdery mildew only. Apply on 7 to 14-day intervals at the first appearance of disease. See labels.
	myclobutanil (3): Nova 40W 4 to 5 oz	Rust on snap beans only. Apply on 7 to 10-day intervals when rust first appears. Also controls Rhizoctonia web blight (see below).
	pyraclostrobin (11): Headline 2.08E 6 to 9 fl oz	Apply on 7-14 day intervals in alternation with a fungicide in a different group (mode of action).
Rhizoctonia stem and root rot	PCNB (14): Terraclor 75W 1.4 to 2.2 oz /1000 ft row	Apply in furrow at planting. Other formulations (15G, 2E, and 4F) available.
	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz/ 1000 ft row Amistar 80DF 0.12 to 0.25 fl oz/1000 ft row	Apply in furrow at planting.
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 0.5 to 1 pt Metastar 2E AG 2 to 4 pt	Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia stem and root rot Pythium damping off	mefenoxam (4) + PCNB (14): Ridomil Gold PC 0.75 lb/1000 ft row	Apply in furrow at planting.
Rhizoctonia web blight and pod rot	myclobutanil (3): Nova 40W 4 to 5 oz	Apply on 7 to 10-day intervals when pods begin to develop.
	azoxystrobin: (11) Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Same as for anthracnose (see above)
White mold (*Sclerotinia*) Gray mold (*Botrytis*)	chlorothalonil (M): Bravo, Echo, Equus, Chlorothalonil	Gray mold only on snap and dry beans. Apply at early bloom and repeat on 7-day intervals using the high rates listed for anthracnose, etc (See above).
	dicloran (14): Botran 75W 2.25 to 4 lb	White mold on snap beans only. Apply low rate to bush types and high rate to pole types on 7-day intervals beginning at early bloom.
	boscalid (7): Endura 70WG 8 to 11 oz	Apply at early bloom and again at full bloom.
	cyprodinil (9) + fludioxanil (12): Switch 62.5WG 11 to 14 oz	Apply at early bloom and again at full bloom.
	iprodione (2): Rovral 4F 1.5 to 2 pt Iprodione 4L AG 1.5 to 2 pt	Apply at early bloom and again at full bloom.
	thiophanate-methyl (1): Topsin M or T-Methyl 70W 1 to 2 lb Topsin or T-Methyl 4.5F 1.25 to 2.5 pt Thiophanate Methyl 85WG 0.8 to 1.6 lb	Apply the low rate at early bloom and repeat 7-10 days later or make a single application of the high rate at full bloom. Also controls anthracnose (see above).

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP) FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
BEETS		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia damping off and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz/ 1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting.
Cercospora leaf spot Powdery mildew Downy mildew	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply in alternation with a fungicide in a different group (mode of action) on 7 to 14-day intervals for Cercospora and 5 to 7-day intervals for mildews.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 to 5 lb Kocide or Nu Cop DF 2 to 5 lb Kocide 2000 or Champ DF 1.3 to 3.75 lb Kocide, Champ, or Nu Cop 3F 1.3 to 3.3 pt	Apply on 10 to 14-day intervals.
	copper sulfate (M): Cuprofix Ultra 40DF 1.25 to 3 lb	Apply on 10 to 14-day intervals.
	other copper fungicides (M):	See labels.
	pyraclostrobin (11): Cabrio 20EG 8 to 12 oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	trifloxystrobin (11): Flint 50WG 2 to 3 oz Gem 25WG 4 to 6 oz Gem 500SC 1.9 to 2.9 fl oz	Apply on 7 to 14-day intervals in alternation with a fungicide from a different group (mode of action).
	sulfur (M): Microthiol or Kumulus 80DF 3 to 5 lb other sulfur formulations:	Powdery mildew only. Apply on 10 to 14-day intervals. See labels.
CARROTS		
Pythium damping off and root dieback	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt/A Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia damping off and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow or as a band over the row after emergence.
Early blight (*Cercospora*) Late blight (*Alternaria*) Bacterial blight	azoxystrobin (11): Quadris 2.08F 9.2 to 20.3 fl oz Amistar 80DF 3 to 5 oz	Early and late blights only. Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	azoxystrobin (11) +chlorothalonil (M): Quadris Opti 5.5F 2.4 pt	Early and late blights only. Apply on 7 to 14-day intervals.
	boscalid (7): Endura 70WG 4.5 oz	Late blight only. Apply on 7 to 14-day intervals. See label for resistance management.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 lb Kocide or Nu Cop DF 2 lb Kocide 2000 or Champ DF 1.3 to 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Apply when plants are small and repeat on 5 to 7-day intervals.
	copper sulfate (M): Cuprofix Ultra 40DF 1.25 lb	Apply on 7 to 14-day intervals.
	other copper fungicides (M)	See labels.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
CARROTS (CONT'D)		
Early blight (Cercospora) Late blight (Alternaria) Bacterial blight (cont'd)	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.5 to 2 pt Bravo, Echo, or Equus 82.5DF 1.4 to 1.8 lb Echo 90DF 1.25 to 1.6 lb	Early and late blights only. Apply when plants are small and repeat on 7 to 10-day intervals.
	cyprodinil (9) + fludioxanil (12): Switch 62.5WG 11 to 14 oz	Late blight only. Apply on 7 to 10-day intervals.
	iprodione (2): Rovral 4F 1 to 2 pt Iprodione 4L AG 1.0 to 2 pt	Late blight only. Apply up to 4 times on 14-day intervals when conditions favor disease development.
	pyraclostrobin (11): Cabrio 20EG 8 to 12 oz	Early and late blights only. Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	pyraclostrobin (11) + boscalid (7): Pristine 38WG 8 to 10.5 oz	Early and late blights only. Apply on 7 to 14-day intervals. See label for resistance management.
	trifloxystrobin (11): Flint 50WG 2 to 3 oz Gem 25DF 4 to 6 oz Gem 500SC 1.9 to 2.9 fl oz	Early and late blights only. Apply on 7 to 14-day intervals in alternation with a fungicide from a different group (mode of action).
White mold (*Sclerotinia*) Gray mold (*Botrytis*)	thiabendazole (1): Mertect 340F 2.5 pt/100 gal	Dip carrots in suspension for 5 to 10 seconds before storage.
Cavity spot	mefenoxam (4) + copper hydroxide (M): Ridomil Gold/Copper 65W 2 lb	Apply 40 days after using Ridomil at planting (see Pythium). Make 2 to 4 applications on a 14-day schedule.
	mefenoxam (4) + chlorothalonil (M): Ridomil Gold/Bravo 76W 1.5 to 2 lb Ridomil Gold/Bravo SC 6.67F 1.5 to 2.5 pt	Also controls early and late blights. Apply 40 days after using Ridomil Gold at planting (see Pythium). Make 2 to 4 applications on a 14-day schedule.
COLE CROPS (broccoli, Brussels sprouts, cabbage, cauliflower)		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 0.25 to 0.5 pt Ultra Flourish 2E 0.5 to 1 pt Metastar 2E AG	Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting.
Basal stem rot (*Phytophthora*)	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting.
Club root	See next column	Maintain soil pH above 7.2.
	PCNB (14): Terraclor 75W 2 lb / 100 gal Terraclor 75W 2.3 lb / 1000 ft row	Other formulations (4F, 2E, and 15G) available. Apply ½ pt transplant solution per plant. Apply in a 12 to 15 inch band and incorporate 4 to 6 inches deep before planting.
Rhizoctonia damping off, wire stem, and bottom rot	PCNB (14): Terraclor 75W 12.2 to 18.4 oz / 1000 ft row Terraclor 15G 0.7 to 1 lb / cubic yard media	Other formulations (4F, 2E, and 15G) available. Row-drench treatment. Apply as an 8-inch band in 35 gal/acre planting. Transplant production. Mix thoroughly with growing media before planting.
Black leg	See next column	Use western-grown, disease-free seed.
	iprodione (2): Rovral 4F 2 pt Iprodione 4L AG 2 pt	Broccoli only. Apply as a basal spray at 2 to 4-leaf stage and repeat 2 to 3 weeks later if needed.
Black rot (bacterial)	See next column	Plant disease-free seed or soak seeds in hot water at 122oF for 25 min (cabbage and Brussels sprouts) or 20 min (cauliflower and broccoli). Plant resistant varieties and rotate fields with non-hosts for 2 years.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
COLE CROPS (CONT'D)		
Black rot (bacterial) (cont'd)	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1 to 2 lb Kocide or Nu Cop DF 1 to 2 lb Kocide 2000 or Champ DF 0.7 to 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Apply on 7 to 10-day intervals after transplanting or emergence.
	copper sulfate (M): Cuprofix Ultra 40DF 0.75 to 1.25 lb	Apply on 7 to 10-day intervals after transplanting or emergence.
	other copper fungicides	See labels.
Alternaria leaf spot Downy mildew	acibenzolar-S-methyl (P): Actigard 50WG 1.0 oz	Activates plant resistance to downy mildew. Make up to four applications on 7 to 10 day intervals. See label for plant safety precautions.
	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply in alternation with a fungicide in a different group (mode of action) on 7 to 14-day intervals.
	boscalid (7): Endura 70WG 6 to 9 oz	Alternaria only. Apply on 7 to 14-day intervals.
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.5 pt Bravo Echo, or Equus 82.5DF 1.4 lb Echo 90DF 1.25 lb	Apply on 7 to 10-day intervals after transplanting or emergence.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1 to 2 lb Kocide or Nu Cop DF 1 to 2 lb Kocide 2000 or Champ DF 0.7 to 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Apply on 7 to 10-day intervals after transplanting or emergence.
	copper sulfate (M): Cuprofix Disperss 1.5 to 2.5 lb	Apply on 7 to 10-day intervals after transplanting or emergence.
	other copper fungicides (M):	See labels.
	cyprodinil (9) + fludioxanil (12): Switch 62.5WG 11 to 14 oz	Alternaria only. Apply on 7 to 10-day intervals.
	fosetyl-AL (33): Aliette or Linebacker 80WDG 2 to 5 lb	Downy mildew only. Apply on 7 to 21-day intervals. Use 2 to 3 lb in tank mixes or 3 to 5 lb alone. Do not tank-mix with copper fungicides.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Downy mildew only. Apply on 7 to 21 day intervals.
	maneb (M): Maneb 75DF or 80W 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Apply on 7 to 10-day intervals after transplanting or emergence. Do not apply within 7 days of harvest.
	mefenoxam (4) + chlorothalonil (M): Ridomil Gold/Bravo 76W 1.5 lb Ridomil Gold SC 6.67F 1.5 pt	Make up to four applications on 14-day intervals when conditions favor mildew development. Do not apply within 7 days of harvest.
	pyraclostrobin (11): Cabrio 20EG 0.75 to 1 lb	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a non Group 11 fungicide.
White mold (*Sclerotinia*)	boscalid (7): Endura 70WG 6 to 9 oz	Apply on 7 to 14-day intervals.
Pythium damping off Phytophthora blight	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast suggested rates or band over seed row and incorporate before or water in after planting.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME: (MOA GROUP) FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
CUCURBITS (cantaloupe, cucumber, pumpkin, squash, watermelon)		
Pythium damping off Phytophthora blight (cont'd)	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Apply on 5 to 7-day intervals in a tank mix with another fungicide beginning when plants are small; also controls downy mildew (see below).
	cyazofamid (21): Ranman 3.3F 2.75 fl oz	Apply on 7-day intervals in alternation with another fungicide. Also controls downy mildew (see below).
Pythium and Phytophthora root rots	propamocarb hydrochloride (28): Previcur Flex 6SC 1:1000 stock solution (eg. 12.8 fl oz /100 gal)	Greenhouse use. Drench saturated rock wool or growing media before transplanting and/or apply through drip system after transplanting.
Rhizoctonia damping off and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz/ 1000 ft row Amistar 80DF 0.12 to 0.25 fl oz/ 1000 ft row	Apply in furrow at planting or as a band over the row after emergence or transplanting.
Angular leaf spot Bacterial leaf spot Bacterial fruit blotch	See next column	Plant disease-free seed, cucumber varieties resistant to angular leaf spot, and practice crop rotation with non-cucurbits. Copper sprays may reduce spread.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1.5 to 3 lb Kocide or Nu Cop DF 1.5 to 3 lb Kocide 2000 or Champ DF 1 to 2.25 lb Kocide, Champ, or Nu Cop 3F 1 to 3 pt	Apply at first sign of foliar disease and repeat on 7-day intervals.
	copper sulfate (M): Cuprofix Ultra 40DF 1.25 to 2 lb	Apply on 5 to 7-day intervals.
	other copper fungicides (M):	See labels.
Anthracnose Alternaria leaf spot Cercospora leaf spot Downy mildew Gummy stem blight Powdery mildew	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.5 to 3 pt Bravo, Echo, or Equus 82.5DF 1.4 to 2.7 lb Echo 90DF 1.25 to 2.5 lb	Apply on 7 to 14-day intervals.
	azoxystrobin (11): Quadris 2.08F 11 to 15.4 fl oz Amistar 80DF 3 to 5 oz	Apply on 7 to 14 day intervals in alternation with a non Group 11 fungicide.
	azoxystrobin (11) + chlorothalonil (M): Quadris Opti 5.5F 3.2 pt	Apply on 7 to 14-day intervals in alternation with a non-group 11 fungicide.
	cymoxanil (27): Curzate 60DF 3.2 oz	Downy mildew fungicide. Apply in a tank mix with a protectant fungicide (group M) on 5 to 7 day intervals.
	copper fungicides (M):	Same as for bacterial leaf spots (see above).
	cyazofamid (21): Ranman 3.3F 2.1 to 2.75 fl oz	Downy mildew fungicide. Apply on 7 to 10-day intervals in alternation with another fungicide.
	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Downy mildew fungicide. Apply on 7 to 10-day intervals in a tank mix with a protectant fungicide (group M).
	famoxadone (11) + cymoxanil (27) : Tanos 50DF 8 oz	Downy mildew fungicide. Apply on 7-day intervals in a tank mix with a protectant (group M) fungicide.
	fenamidone (11): Reason 500SC 5.5 to 8.2 fl oz	Downy mildew fungicide. Apply on 7 to 10-day intervals in alternation with a non Group 11 fungicide.
	fosetyl-Al (33): Aliette or Linebacker 80WDG 2 to 5 lb	Downy mildew fungicide. Apply on 7 to 14-day intervals. Use 2 to 3 lb in tank mixes or 3 to 5 lb alone.
	kresoxim-methyl (11): Sovran 50WG 3.2 to 4.8 oz	Powdery mildew only. Apply on 7 to 14 day intervals in alternation with a non Group 11 fungicide.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME: (MOA GROUP) FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
CUCURBITS (CONT'D)		
Anthracnose Alternaria leaf spot Cercospora leaf spot Downy mildew Gummy stem blight Powdery mildew (cont'd)	mefenoxam (4) + chlorothalonil (M): Ridomil Gold Bravo 76W 2 to 3 lb Ridomil Gold Bravo SE 3.67F 2.5 to 3.25 pt	Downy mildew fungicide. Alternate with a protectant (group M) fungicide on 7 to 14-day intervals.
	mefenoxam (4) + copper hydroxide (M): Ridomil Gold Copper 65W 2 lb	Downy mildew fungicide. Alternate with a protectant (group M) fungicide on 7 to 14-day intervals.
	mefenoxam (4) + mancozeb (M): Ridomil Gold MZ 68W 2.5 lb	Downy mildew fungicide. Alternate with a protectant (group M) fungicide on 7 to 14-day intervals.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 2 to 3 lb Dithane, Manzate, or Penncozeb 4F 1.6 to 2.4 qt	Apply on 7 to 14-day intervals, but not within 5 days of harvest.
	maneb (M): Maneb 75DF or 80W 1 to 2 lb Manex 4F 1.2 to 1.6 qt	Apply on 7 to 14-day intervals, but not within 5 days of harvest.
	mancozeb (M) + copper hydroxide (M): ManKocide DF 2 to 4 lb	Apply on 7 to 14-day intervals, but not within 5 days of harvest.
	mancozeb (M) + copper sulfate (M): Cuprofix MZ Dispererss 4 to 7.25 lb	Apply on 7 to 10-day intervals, but not within 5 days of harvest.
	myclobutanil (3): Nova 40W 2.5 to 5 oz	Powdery mildew only. Apply on 7 to 10-day intervals when disease first appears.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Downy mildew only. Apply on 7 to 21 day intervals.
	propamocarb hydrochloride (28): Previcur Flex 6SC 1.2 pt	Downy mildew fungicide. Apply in a tank mix with a protectant fungicide (group M) on 7 to 14-day intervals.
	pyraclostrobin (11): Cabrio 20EG 8 to 16 oz	Apply on 7 to 14-day intervals in alternation with a non Group 11 fungicide.
	pyraclostrobin (11) + boscalid (7): Pristine 38WG 12.5 to 18.5 oz	Apply on 7 to 14-day intervals in alternation with a non Group 11 fungicide. Use the high rate for anthracnose.
	quinoxyfen (13): Quintec 2.08F 4 to 6 fl oz	Powdery mildew on cantaloupe and watermelon only. Apply on 10 to 14-day intervals in alternation with another fungicide.
	sulfur (M): Microthiol or Kumulus 80DF 2 to 10 lb other sulfur formulations:	Powdery mildew only. Apply on 10 to 14-day intervals. See labels.
	thiophanate-methyl (1): Topsin or T-Methyl 70W 0.5 lb Topsin or T-Methyl 4.5F 10 fl oz Thiophanate Methyl 85WDG 0.4 lb	Apply on 7 to 14-day intervals in a tank mix with mancozeb or another fungicide.
	trifloxystrobin (11): Flint 50WG 1.5 to 4 oz	Apply on 7-day intervals in alternation with a non Group 11 fungicide.
	triflumizole (3): Procure 50W 4 to 8 oz Procure 480SC 4 to 8 fl oz	Powdery mildew only. Apply on 7 to 14-day intervals.
	zoxamide (22) + mancozeb (M): Gavel 75DF 1.5 to 2 lb	Downy mildew fungicide. Apply on 7 to 10 day intervals.
Bacterial wilt	See next column	Does not affect watermelon. Use insecticide to control cucumber beetles which spread the bacterium.
Fusarium wilt	See next column	Different strains cause wilt in cantaloupe and watermelon. Plant resistant varieties, practice crop rotation, fumigate soil with Vapam or methyl bromide (see Nematode Control).

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP) FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
CUCURBITS (CONT'D)		
Belly rot (*Rhizoctonia*)	azoxystrobin (11): Quadris 2.08F 11 to 15.4 fl oz Amistar 80DF 3 to 5 oz	Make first application at the 1 to 3-leaf stage followed by a second application 10 to 14-days later.
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 8.25 pt Bravo, Echo, or Equus 82.5 DF 7.6 lb	Make single application when vines begin to run in a sufficient volume to obtain runoff to soil surface or apply by chemigation.
	thiophanate-methyl (1):	Same as for anthracnose (see above).
White mold (*Sclerotinia*)	dichloran (14): Botran 75W 1.3 lb	Greenhouse cucumbers only. Apply on 14-day intervals when disease first appears.
EGGPLANT		
Pythium damping off Phytophthora blight	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 pt Ultra Flourish 2E 2 pt Metastar 2E AG 4 to 8 pt	Broadcast at suggested rate or band over row and incorporate before or water in after planting. For Phytophthora, make up to two more directed applications on 30-day intervals.
Phytophthora blight	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Apply in a tank mix with a protectant (group M) fungicide begining when plants ar small and repeat on 7 to 10-day intervals.
Rhizoctonia damping off and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting or as a band over the row after emergence or transplanting.
Anthracnose Early and late blights	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	boscalid (7): Endura 70WG 2.5 to 3.5 fl oz	Early blight only. Apply on 7 to 14-day intervals. See label for resistance management.
	fluoxastrobin (11): Evito 480SC 4F 3.8 to 5.7 fl oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	maneb (M): Maneb 75DF or 80W 1.5 to 2.0 lb Manex 4F 1.2 to 1.6 qt	Apply at first fruit cluster and repeat on 7 to 10-day intervals. Do not apply within 5 days of harvest.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 lb Kocide or Nu Cop DF 2 lb Kocide 2000 or Champ DF 1.3 to 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Apply at first fruit cluster and repeat on 7 to 10-day intervals.
	copper sulfate (M): Cuprofix Ultra 40 DF 1.25 lb	Apply on 7 to 10-day intervals.
	other copper fungicides (M):	See labels.
	pyraclostrobin (11): Cabrio 20EG 8 to 16 oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	trifloxystrobin (11): Flint 50WG 2 to 4 oz	Apply on 7 to 14-day intervals. For late blight, use the high rate in a tank mix with a protectant (group M) fungicide.
GREENS (collards, kale, mustard, spinach mustard, turnip)		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Turnip only. Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia damping off and wirestem	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft of row	Apply in-furrow at planting or over the row after emergence.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
GREENS (CONT'D)		
Black rot (bacterial) Bacterial leaf spots	See next column	Plant disease-free seed and practice crop rotation with non-hosts for at least 2 years. Copper sprays may reduce disease.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1 to 2 lb Kocide or Nu Cop DF 1 to 2 lb Kocide 2000 or Champ DF 0.75 to 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Begin applications when plants are small and repeat on 7 to 10-day intervals.
	copper sulfate (M): Cuprofix Ultra 40DF 0.75 to 1.25	Begin applications when plants are small and repeat on 7 to 10-day intervals.
	other copper fungicides (M)	See labels.
Anthracnose Downy mildew Cercospora leaf spot Black spot (*Alternaria*) White rust Powdery mildew	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply in alternation with a fungicide in a different group (mode of action) on 7 to 14-day intervals.
	boscalid (7): Endura 70WG 6 to 9 oz	Black spot and powdery mildew only. Do not use on turnip. Apply on 7 to 14-day intervals.
	copper fungicides (M)	Same as for black rot (see above).
	cyprodinil (9) + fludioxanil (12): Switch 62.5WG 11 to 14 oz	Black spot and powdery mildew only. Apply on 7 to 10 day intervals.
	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Downy mildew only. Apply on 7-day intervals in a tank mix with another fungicide active against downy mildew.
	fosetyl-AL (33): Aliette or Linebacker 80WDG 2 to 5 lb	Downy mildew only. Do not use on turnip. Apply on 7 to 21 day intervals. Do not tank mix with copper fungicides.
	maneb (M): Maneb 75DF or 80W 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Kale only. Apply on 7 to 10-day intervals. Do not apply within 10 days of harvest.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Downy mildew only. Apply on 7 to 21 day intervals.
	sulfur (M): Microthiol or Kumulus 80DF 3 to 10 lb other sulfur formulations	Powdery mildew only. Apply on 10 to 14-day intervals. See labels.
	pyraclostrobin (11): Cabrio 20EG 12 to 16 oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	trifloxystrobin (11): Flint 50WG 2 to 3 oz Gem 25DF 4 to 6 oz Gem 500SC 1.9 to 2.9 fl oz	Turnip only. Apply on 7 to 14-day intervals in alternation with a fungicide from a different group (mode of action).
LETTUCE		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Field use only. Broadcast suggested rates or band over the seed row and incorporate before or water in after seeding.
Pythium and Phytophthora root rots	propamocarb hydrochloride (28): Previcur Flex 6SC 1:1000 stock solution (eg. 12.8 fl oz /100 gal)	Greenhouse use. Drench saturated rock wool or growing media before transplanting and/or apply through drip system or to foliage after transplanting.
Botrytis rot Bottom rot (*Rhizoctonia*) Drop (*Sclerotinia*)	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz	Bottom rot only. Apply in furrow at planting or as a band over the row after emergence or transplanting.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
LETTUCE (CONT'D)		
Botrytis rot Bottom rot (*Rhizoctonia*) Drop (*Sclerotinia*) (cont'd)	boscalid (7): Endura 70WG 8 to 11 oz	Drop and Botrytis only. Apply after emergence or transplanting and repeat 14 days later if needed.
	cyprodinil (9) + fludioxanil (12): Switch 62.5WG 11 to 14 oz	Apply after thinning and again 2 weeks later.
	dicloran (14): Botran 75W 2 to 5.3 lb Botran 75W 2.6 lb	Field-Apply 2 lb before thinning and 3.3 lb after thinning or 5.3 lb after thinning. Direct spray to lower plant and adjacent soil. Greenhouse- Botrytis rot on leaf lettuce only. Apply 7 days after transplanting and repeat when plants are half mature.
	iprodione (2): Rovral 4F 1.5 to 2 pt Iprodione 4L AG 1.5 to 2 pt	Apply at the 3-leaf stage and repeat up to two more times on 10-day intervals. Direct spray to lower plant and adjacent soil.
Downy mildew Powdery mildew Septoria leaf spot Cercospora leaf spot	azoxystrobin (11): Quadris 2.08F 12.3 to 15.4 fl oz Amistar 80DF 3 to 5 oz	Apply on 7-day intervals in alternation with a fungicide in a different group (mode of action).
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1 to 2 lb Kocide or Nu Cop DF 1 to 2 lb Kocide 2000 or Champ DF 0.75 to 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Begin applications when plants are small and repeat on 7 to 10-day intervals.
	famoxadone (11) + cymoxanil (U) : Tanos 50DF 8 oz	Downy mildew fungicide. Apply on 7-day intervals in a tank mix with maneb.
	dimethomorph (40): Acrobat 50WG 6.4 oz Forum 4.18F 6 fl oz	Downy mildew fungicide. Apply on 5 to 10 day intervals in a tank mix with another fungicide active against downy mildew.
	fenamidone (11): Reason 500SC 5.5 to 8.2 fl oz	Downy mildew fungicide. Apply on 7 to 10-day intervals in alternation with a fungicide with a different mode of action.
	fosetyl-AL (33): Aliette or Linebacker 80WDG 2 to 5 lb	Downy mildew fungicide. Apply on 7 to 21-day intervals when disease threatens. Use 2 to 3 lb in tank mixes with maneb and 3 to 5 lb alone.
	maneb (M): Maneb 75DF 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Apply when disease appears and repeat on 7 to 10- day intervals. Do not apply within 10 days of harvest.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Downy mildew only. Apply on 7 to 21 day intervals.
	propamocarb hydrochloride (28): Previcur Flex 6SC 2 pt	Downy mildew fungicide. Apply on 7 to 10-day intervals.
	pyraclostrobin (11): Cabrio 20EG 12 to 16 oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	quinoxyfen (13): Quintec 2.08F 4 to 6 fl oz	Powdery mildew only. Apply on 10 to 14-day intervals in alternation with another fungicide.
	sulfur (M): Microthiol or Kumulus 80DF 5 to 10 lb other sulfur formulations	Powdery mildew only. Apply on 10 to 14-day intervals. See labels.
ONIONS (dry bulb, green, garlic)		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 0.5 to 1 pt Ultra Flourish 2E 1 to 2 pt Metastar 2E AG 2 to 4 pt	Broadcast suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia damping off	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz/1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting or in a band over the row after emergence or transplanting.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
ONIONS (CONT'D)		
Damping off Seedling blight Smut	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 1.6 oz / 1000 ft row Dithane, Manzate, or Penncozeb 4F 2.6 fl oz /1000 ft row	Spray in furrow at seeding.
	maneb (M): Maneb 75DF or 80DF 1.6 oz /1000 ft row Manex 4F 2.6 fl oz /1000 ft row	Spray in furrow at seeding.
Bacterial rots: Slippery skin Sour skin Soft rot	See next column	Allow tops to mature before harvest, but harvest quickly after tops lodge and avoid bruising. Dry well before topping. Carefully examine and cull immature or soft bulbs.
Botrytis blight Downy mildew Purple blotch	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Purple blotch and downy mildew only. Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	azoxystrobin (11) + chlorothalonil (M): Quadris Opti 5.5F 1.6 to 3.7 pt	Apply on 7 to 14-day intervals in alternation with a non-group 11 fungicide.
	boscalid (7): Endura 70WG 6.8 fl oz	Botrytis and purple blotch only. Apply on 7 to 14-day intervals. See label for resistance management.
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1 to 3 pt Bravo, Echo, or Equus 82.5DF 1 to 2.7 lb Echo 90DF 0.9 to 2.5 lb	Rates and pre-harvest intervals vary with the type of onion and target disease (see labels). Apply on 7 to 10-day intervals.
	cyprodinil (9) + fludioxonil (12): Switch 62.5WG 11-14 oz	Botrytis and purple blotch only. Apply on 7 to 10-day intervals.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 lb Kocide or Nu Cop DF 2 lb Kocide 2000 or Champ DF 1.5 lb Kocide, Champ, or Nu Cop 3F 1.3 pt	Purple blotch and downy mildew only. Apply on 7 to 10-day intervals.
	copper sulfate (M): Cuprofix Ultra 40DF 1.25 to 3 lb	Purple blotch and downy mildew only. Apply on 7 to 10-day intervals.
	dicloran (14): Botran 75W 1.5 to 2.6 lb	Botrytis blight only. Apply when disease threatens and repeat on 14-day intervals.
	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Downy mildew only. Apply on 5 to 7-day intervals in a tank mix with a protectant (group M) fungicide.
	fenamidone (11): Reason 500SC 5.5 fl oz	Downy mildew and purple blotch only. Apply on 7 to 10-day intervals in alternation with a fungicide with a different mode of action.
	fosetyl Al (33): Aliette or Linebacker 80WDG 2 to 3 lb	Downy mildew and purple blotch on dry bulb only. Apply on 7 to 14- day intervals.
	iprodione (2): Rovral 4F 1.5 pt Iprodione 4L AG 1.5 pt	Botrytis and purple blotch on dry bulb only. Apply on 14-day intervals when disease threatens.
	maneb (M): Maneb 75DF or 80W 2 to 3 lb Manex 4F 1.2 to 1.6 qt	Apply on 7-day intervals when disease threatens.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 3 lb Dithane, Manzate, or Penncozeb 4F 2.4 qt	Dry bulb only. Apply on 7-day intervals when disease threatens.
	mancozeb (M) + copper hydroxide (M): ManKocide DF 2.5 lb	Dry bulb only. Apply on 7-day intervals when disease threatens.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP) FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
ONIONS (CONT'D)		
Botrytis blight Downy mildew Purple blotch (cont'd)	mancozeb (M) + copper sulfate (M): Cuprofix MZ Dispererss 5 to 7.25 lb	Dry bulb only. Apply on 7-day intervals when disease threatens.
	mefenoxam (4) + chlorothalonil (M): Ridomil Gold/Bravo 76W 2 lb Ridomil Gold SC 6.67F 2.5 pt	Apply on 7 to 14-day intervals.
	mefenoxam (4) + mancozeb (M): Ridomil Gold MZ 68W 2.5 lb	Dry bulb only. Apply on 7 to 14-day intervals.
	mefenoxam (4) + copper hydroxide (M): Ridomil/Gold Copper 65W 2 lb	Apply on 7 to 14-day intervals.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Downy mildew only. Apply on 7 to 21 day intervals.
	pyraclostrobin (11): Cabrio 20EG 8 to 12 oz	Purple blotch and downy mildew only. Apply on 7 to 14-day intervals. Use the high rate for downy mildew. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	pyraclostrobin (11) + boscalid (7): Pristine 38WG 8 to 10.5 oz	Apply on 14-day intervals. See label for resistance management.
	pyrimethanil (9): Scala 5F 9 to 18 fl oz	Botrytis and purple blotch only. Apply on 7 to 14-day intervals. Use the low rate in tank mixes with a protectant (group M) fungicide.
Smudge	See next column	Plant colored varieties where the disease is persistent.
White rot	See next column	Avoid infested areas for 8-10 years.
	azoxystrobin (1): Quadris 2.08F 6.2 to 12.3 fl oz Amistar 80DF 2 to 5 oz	Same as for Botrytis blight (See above).
	cyprodinil (9) + fludioxanil (12): Switch 62.5WG 0.5 to 1 oz/1000 ft row	Spray in furrow at planting.
	dicloran (14): Botran 75W 5.3 lb	For sets only. Spray in furrow and covering soil in a 5-inch band on 40-inch beds at planting.
	iprodione (2): Rovral 4F 4 pt (broadcast) Iprodione 4L AG 4 pt (broadcast)	Garlic only. Apply as a band in furrow at planting.
	thiophanate-methyl (1): Topsin or T-Methyl 70W 0.75 oz /1000 ft row Topsin or T-Methyl 4.5F 1 fl oz /1000 ft row Thiophanate Methyl 85WDG 0.6 oz /1000 ft row	Onions only. Spray in furrow at planting.
	PCNB (14): Terraclor 75W 20 oz /1000 ft row or Terraclor 4F.7 fl oz/1000 ft row Terraclor 75W 13.5 lb/1000 lb cloves Terraclor 4F 2.5 gal /1000 lb cloves	Garlic only. Spray in furrow and covering soil at planting. Clove treatment. Apply in sufficient water to achieve good coverage.
Clove rot (*Penicillium*)	thiophanate-methyl (1): Topsin or T-Methyl 70W 1 lb Topsin or T-methyl 4F 1.25 pt Thiophanate Methyl 85WDG 12.8 oz	Garlic only. Immerse and agitate cloves for 5 minutes in specified rate suspended in 100 gal water. Drain and dry prior to planting
PEAS		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 0.5 to 1 pt Metastar 2E AG 2 to 4 pt	Broadcast suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia damping off and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply at planting in furrow or over the row after emergence. See label for resistance management

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
PEAS (CONT'D)		
Anthracnose Ascochyta leaf spot and blight Alternaria leaf spot Powdery mildew	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply on 7-14 day intervals in alternation with a fungicide in a different group (mode of action).
	sulfur (M): Microthiol or Kumulus 80DF 3 to 10 lb other sulfur formulations*	Powdery mildew only. Apply on 10 to 14-day intervals. See labels.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1.5 to 3 lb Kocide or Nu Cop DF 1.5 to 3 lb Kocide 2000 or Champ DF 1 to 2.25 lb Kocide, Champ, or Nu Cop 3F 1 to 2 pt	Apply at first sign of disease and repeat on 7-day intervals.
	copper sulfate (M) Cuprofix Ultra 40DF 1 to 2 lb	Apply at first sign of disease and repeat on 7-day intervals.
	other copper fungicides (M):	See labels.
	pyraclostrobin (11): Headline 2.08E 6 to 9 fl oz	Apply on 7-14 day intervals in alternation with a fungicide in a different group (mode of action).
PEPPERS		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 pt Ultra Flourish 2E 2 pt Metastar 2E AG 4 to 8 pt	Broadcast at suggested rate or band over the seed row and incorporate before or water in after planting (see Phytophthora blight and crown rot).
Rhizoctonia damping off, stem and root rot	PCNB (14): Terraclor 15G 0.7 to 1 lb / cubic yard media Terraclor 4F 6 to 12 fl oz /100 gal Terraclor 15G 0.5 to 0.7 lb/1000 ft row or Terraclor 4F 2.2 to 3.3 fl oz/1000 ft row	Transplant production. Thoroughly mix with growing media prior to planting. Transplant production. Apply as a drench treatment. Direct seeded hot peppers. Apply in furrow at planting.
	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting or as a band over the row after emergence or transplanting.
Anthracnose Cercospora leaf spot Gray leaf spot Powdery mildew Early blight	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply in alternation with a fungicide in a different group (mode of action) on 7 to 14-day intervals.
	boscalid (7): Endura 70WG 2.5 to 3.5 fl oz	Early blight only. Apply on 7 to 14-day intervals. See label for resistance management.
	fluoxastrobin (11): Evito 480SC 4F 3.8 to 5.7 fl oz	Apply on 7 to 14-day intervals in alternation with a non Group 11 fungicide.
	maneb (M): Maneb 75DF or 80W 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Apply on 7-14 day intervals when disease threatens. Do not apply within 7 days of harvest.
	pyraclostrobin (11): Cabrio 20EG 8 to 12 oz	Not for use in greenhouses. Apply in alternation with a fungicide from a different group (mode of action) on 7 to 14-day intervals.
	sulfur (M): Microthiol or Kumulus 80DF 3 to 10 lb other sulfur formulations*	Powdery mildew only. Apply on 7 to 14-day intervals. See labels.
	trifloxystrobin (11): Flint 50WG 1.5 to 4 oz	Not for use in greenhouses. Apply on 7 to 14-day intervals. See label for resistance management.
Bacterial spot	See next column	Plant disease-free seed or transplants, use resistant varieties, and rotate with crops other than tomato and pepper for 3 years.
	Sodium hypochlorite: Chlorox 1 part + 3 parts water	Surface disinfection for suspect seed. Soak in bleach solution for 1 minute, drain, rinse, and dry.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
PEPPERS (CONT'D)		
Bacterial spot (cont'd)	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 to 3 lb Kocide or Nu Cop DF 2 to 3 lb Kocide 2000 or Champ DF 1.5 to 2.25 lb Kocide, Champ, or Nu Cop 3F 1.3 to 2 pt	Apply before the disease appears and repeat on 5 to 10 day intervals. Tank mix with maneb (see above) for increased control.
	copper sulfate (M): Cuprofix ultra 40DF 1.25 to 3 lb	Apply on 5 to 10-day intervals. Tank mix with maneb for increased control.
	other copper fungicides (M):	See labels.
	streptomycin sulfate (25): Agri-mycin, AG-Streptomycin, Agricultural Streptomycin, or Firewall 17W 1 lb	Transplant production only. Mix in 100 gal water and apply on 4 to 5-day intervals beginning at the first true leaf stage in tank mix with a copper fungicide.
Phytophthora blight	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 pt Ultra Flourish 2E 2 pt Metastar 2E AG 4 to 8 pt	Follow the application at planting (see Pythium damping off) with up to two more basal sprays on 30-day intervals.
	mefenoxam (4) + copper (M): Ridomil Gold/Copper 65W 2.5 lb	Make up to 4 applications on 10 to 14-day intervals following at least one basal spray of mefenoxam. Do not apply within 7 days of harvest.
	famoxadone (11) + cymoxanil (U): Tanos 50DF 8 to 10 oz	Apply on 5 to 7-day intervals in a tank mix with a protectant fungicide (group M) fungicide.
	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Apply on a 5 to 10 day intervals in a tank mix with another fungicide active against Phytophthora blight beginning when plants are small.
Pythium and Phytophthora root rots	propamocarb hydrochloride (U): Previcur Flex 6SC 12.8 fl oz /100 gal	Greenhouse use. Drench saturated rock wool or growing media before transplanting and/or apply through drip system after transplanting.
Southern blight	PCNB (14): Terraclor 75W 3 lb / 100 gal or 11 oz / 1000 ft row Terraclor 4F 4.5 pt / 100 gal or 10.6 to 15.8 fl oz / 1000 ft row	Apply ½ pt of 100 gal solution per transplant or spray 11 oz rate in furrow. Apply ½ pt of 100 gal solution per transplant or spray 10.6 to 15.8 fl oz rate in furrow.
	fluoxastrobin (11): Evito 480SC 4F 3.8 to 5.7 fl oz	Apply on 7 to 14-day intervals in alternation with a non Group 11 fungicide.
POTATOES		
Black leg & soft rot (bacterial)	streptomycin sulfate (25): Agri-mycin, AG-Streptomycin, Agricultural Streptomycin, or Firewall 17W 0.5 lb/100 gal	Purchase certified, disease-free seed or soak cut seed pieces in solution immediately prior to planting.
Fusarium seed piece decay Rhizoctonia stem canker/black scurf Silver scurf	maneb (M): Maneb 75DF or 80W 1 lb/10 gal Manex 4F 0.8 qt/10 gal	Fusarium only. Dip whole or cut seed tubers prior to planting.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 1.25 lb/50 gal Dithane, Manzate, or Penncozeb 4F 1 qt / 50 gal Potato Seed Treater 6D 1 to 1.3 lb/100 lb seed Potato Seed Treater PS 8D 1 lb/100 lb seed	Fusarium only. Dip whole or cut seed tubers prior to planting. Dip whole or cut seed tubers prior to planting. Dust treatment for whole or cut seed tubers. Dust treatment for whole or cut seed tubers.
	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Rhizoctonia only. Apply in furrow at planting or as a band over the row after emergence.
	fludioxonil (12): Maxim Potato Seed Protectant 0.5D 0.5 lb / 100 lb seed	Apply dust so that cut seed pieces are thoroughly covered.
	fludioxonil (12) + mancozeb (M): Maxim MZ 10.1D 0.5 lb/100 lb seed	Apply dust so that cut seed pieces are thoroughly covered.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
POTATOES (CONT'D)		
Fusarium seed piece decay Rhizoctonia stem canker/black scurf Silver scurf (cont'd)	flutolanil (7): Moncut 70DF 0.7 to 1.1 lb	Spray in furrow at planting.
	flutolanil (7) + mancozeb (M) MonCoat MZ 7.5D 0.75 to 1.0 lb/100 lb seed	Apply dust so that cut seed pieces are thoroughly covered.
	thiophanate-methyl (1): Tops 2.5D 1 lb/100 lb seed	Apply dust so that cut seed pieces are thoroughly covered.
	thiophanate-methyl (1) + mancozeb (M) + cymoxanil (27): Evolve 9.5D 0.75lb / 100 lb seed	Additional suppression of seedborne late blight. Apply dust so that cut seed pieces are thoroughly covered.
	thiophanate-methyl (1) + mancozeb (M): Tops MZ 8.5D 0.75 to 1 lb/100 lb seed	Apply dust so that cut seed pieces are thoroughly covered.
Early blight Late blight	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply in alternation with a fungicide in another group (mode of action) on 5 to 7-day intervals. Use low rates for early blight and high rates for late blight.
	azoxystrobin (11) + chlorothalonil (M): Quadris Opti 5.5F 1.6 pt	Apply on 7 to 14-day intervals in alternation with a non-group 11 fungicide.
	boscalid (7): Endura 70WG 2.5 to 4.5 oz	Early blight only. Apply on 7 to 14-day intervals. Also controls white mold (See below).
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1 to 4 lb Kocide or Nu Cop DF 1 to 4 lb Kocide 2000 or Champ DF 1 to 3 lb Kocide, Champ, or Nu Cop 3F 1 to 2.7 pt	Begin applications when plants are 6 inches high and repeat on 7 to 10-day intervals. Increase rates and shorten spray interval as disease pressure increases.
	cyazofamid (21): Ranman 3.3F 2.1 to 2.75 fl oz	Late blight only. Apply on 7 to 10-day intervals in alternation with another fungicide.
	cymoxanil (27): Curzate 60DF 3.2 oz	Late blight fungicide. Apply in a tank mixture with a protectant fungicide (group M) on 5 to 7-day intervals.
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1 to 1.5 pt Bravo, Echo, or Equus 82.5DF 0.9 to 1.4 lb Echo 90DF 0.9 to 1.25 lb	Apply on 7 to 14-day intervals beginning when plants are 6 inches high or when disease is anticipated. Use the high rates and short interval where late blight is present.
	dimethomorph (40): Acrobat 50W 4 to 6.4 fl oz Forum 4.18F 4 to 6 fl oz	Late blight fungicide. Apply on 5 to 10-day intervals in a tank mix with a protectant fungicide (group M).
	dimethomorph (15) + mancozeb (M): Acrobat MZ 69W 1.25 to 2.25 lb	Late blight fungicide. Apply on 5 to 10-day intervals beginning when plants are 6 inches high or when disease is anticipated.
	famoxadone (11) + cymoxanil: (27) Tanos 50DF 6 to 8 oz	Apply on 7 to 10-day intervals in a tank mix with a protectant (group M) fungicide.
	fenamidone (11): Reason 500SC 5.5 to 8.2 fl oz	Apply on 5 to 10-day intervals in alternation with a fungicide from a different mode of action group.
	fluazinam (29): Omega 4F 5.5 fl oz	Late blight only. Apply on 7 to 10-day intervals. Also controls white mold (see below).
	fluoxastrobin (11): Evito 480SC 4F 3.8 fl oz	Apply on 7 to 10-day intervals in alternation with a non Group 11 fungicide.
	iprodione (2): Rovral 4F 1 to 2 pt Iprodione 4L AG 1 to 2 pt	Early blight only. Make up to 4 applications on 10 to 14-day intervals.
	maneb (M): Maneb 75DF or 80W 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Apply on a 5 to 10-day interval beginning when plants are 6 inches high or when disease is anticipated. Use the high rates and short interval for late blight.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
POTATOES (CONT'D)		
Early blight Late blight (cont'd)	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 1.5 to 2 lb Dithane. Manzate, or Penncozeb 4F 1.2 to 1.6 qt	Apply on a 5 to 10-day interval beginning when plants are 6 inches high or when disease is anticipated. Use the high rates and short interval for late blight.
	mancozeb (M) + copper hydroxide (M): Mankocide DF 1.5 to 5 lb	Apply on 7 to 10-day intervals at 1.5 to 2 lb when plants are 6 inches high and increase rate to 4 to 5 lb when rows close and disease pressure increases.
	mancozeb (M) + copper sulfate (M): Cuprofix MZ Dispererss 1.5 to 4.75 lb	Apply on 7 to 10-day intervals. Do not apply within 14 days of harvest.
	mefenoxam (4) + chlorothalonil (M): Ridomil Gold/Bravo 76W 2 lb Ridomil Gold SC 6.67F 2.5 pt	Make up to 3 applications on 14-day intervals when disease threatens. Alternate with a protectant (group M) fungicide every 7 days when disease pressure is heavy.
	mefenoxam (4) + mancozeb (M): Ridomil Gold MZ 68W 2.5 lb	Make up to 3 applications on 14-day intervals when disease threatens. Alternate with a protectant (group M) fungicide every 7 days when disease pressure is heavy.
	mefenoxam (4) + copper hydroxide (M): Ridomil Gold/Copper 65W 2 lb	Add 0.8 lb mancozeb and make up to 3 applications on 14-day intervals when disease threatens. Alternate with a protectant (group M) fungicide every 7 days when disease pressure is heavy.
	metiram (M): Polyram 80DF 1.5 to 2 lb	Apply on 5 to 10-day intervals beginning when plants are 6 inches high or when disease is anticipated.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 10 pt Agri-Fos 3.3L 2.5 to 10 pt	Late blight only. Apply on 5 to 10-day intervals in alternation with another fungicide.
	propamocarb hydrochloride (28): Previcur Flex 6SC 0.7 to 1.2 pt	Late blight fungicide. Apply on 7 to 10-day intervals in a tank mix with a protectant (group M) fungicide.
	pyraclostrobin (11): Headline 2.08E 6 to 12 fl oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	pyrimethanil (9): Scala 5F 9 to 18 fl oz	Early blight only. Apply on 7 to 14-day intervals in a tank mix with another fungicide.
	trifloxystrobin (11): Gem 25WG 6 to 8 oz Gem 500SC 2.9 to 3.8 fl oz	Apply on 7 to 10-day intervals. For late blight, use the high rate in a tank mix with 75% of the labeled rate of a protectant fungicide (Group M).
	triphenyltin hydroxide (30): Super Tin or Agri Tin 80W[r] 2.5 to 3.7 oz Super Tin 4L[r] 4 to 6 fl oz	Apply on 7-day intervals beginning when plants are 6 inches high or when disease is anticipated. Do not apply within 7 days of harvest.
	zoxamide (22) + mancozeb (M): Gavel 75DF 1.5 to 2 lb	Apply on 5 to 10 day intervals depending on disease pressure. Do not apply within 14 days of harvest.
Scab	See next column	Plant in soil below pH 5.5 and/or apply ammonium sulfate post-emergence.
White mold (*Sclerotinia*)	boscalid (7): Endura 70WG 5.5 to 10 oz	Apply just prior to row closure or when conditions become favorable and repeat 14 days later if necessary. Also controls early blight (See above).
	dicloran (14): Botran 75W 2 lb	Apply at the first sign of disease or just prior to row closure and repeat on 10 to 14-day intervals.
	fluazinam (M): Omega 4F 5.5 to 8 fl oz	Apply on 7 to 10-day intervals. Also controls late blight (see above).
	iprodione (2): Rovral 4F 1 qt Iprodione 4L AG 2 pt	Apply at first sign of disease or just prior to row closure and repeat on 2 to 4 week intervals if needed.

[r] Restricted use pesticide.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
POTATOES (CONT'D)		
Pythium leak Pink root (*Phytophthora*)	mefenoxam or metalaxyl (4): Ridomil Gold 4E 0.42 oz / 1000 ft row Ultra Flourish 0.84 oz / 1000 ft row Metastar 2E AG 1.68 fl oz / 1000 ft row	Apply in a 6 to 8-inch band directly over the seed pieces at planting. Foliar application(s) of a mefenoxam combination product (see below) may also be needed.
	mefenoxam (4) + chlorothalonil (M): Ridomil Gold/Bravo 76W 2 lb Ridomil Gold SC 6.67F 2.5 pt	Make one application at tuber initiation (flowering) and repeat 14-days later. Also controls early and late blight (See above).
	mefenoxam (4) + mancozeb (M): Ridomil Gold MZ 68W 2.5 lb	Make one application at tuber initiation (flowering) and repeat 14-days later. Also controls early and late blight (See above).
	mefenoxam (4) + copper hydroxide (M): Ridomil Gold/Copper 65W 2 lb	Make one application at tuber initiation (flowering) and repeat 14-days later. Also controls early and late blight (See above).
Storage rots: Fusrarium dry rot	thiabendazole (1): Mertect 340F 0.42 fl oz / ton tubers or gal water	Mist unwashed tubers on conveyor line with tumbling action in sufficient water to achieve good coverage. A second misting or 20-second dip prior to shipping is permitted.
RADISHES		
Pythium damping off	mefenoxam or metalaxyl (M): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast suggested rates or band over seed row and incorporate before or water in after planting.
Rhizoctonia damping off, wirestem, and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting or as a band over the row after emergence.
Downy mildew White rust Cercospora leaf spot Powdery mildew	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply in alternation with a fungicide in a different group (mode of action) on 7 to 14-day intervals.
	mefenoxam (4) + copper hydroxide (M): Ridomil Gold/Copper 65W 2 lb	Apply on a 14-day schedule following an application of Ridomil Gold 4E or 44W at planting (see Pythium damping off).
	pyraclostrobin: (11) Cabrio 20EG 8 to 16 oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
SPINACH		
Pythium damping off	mefenoxam or metalaxyl (4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia root rot and damping off	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting or as a band over the row after emergence.
White rust Blue mold (downy mildew) Anthracnose	See next column.	Plant resistant varieties for blue mold and white rust; practice crop rotation for white rust and anthracnose.
	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Begin applications when plants are and alternate with a fungicide in a different group (mode of action) on 7-day intervals.
	acibenzolar-S-methyl (P): Actigard 50WG 0.75 oz	Activates plant resistance to white rust and blue mold. Make up to three applications on 7 to 10 day intervals in alternation with another fungicide. See label for plant safety precautions.
	fosetyl-AL (33): Aliette or Linebacker 80WDG 2 to 5 lb	White rust and blue mold only. Apply on 7-day intervals beginning when plants are small. Do not mix with copper fungicides. May cause leaf injury.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
SPINACH (CONT'D)		
White rust Blue mold (downy mildew) Anthracnose (cont'd)	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 to 3 lb Kocide or Nu Cop DF 2 to 3 lb Kocide 2000 or Champ DF1.5 to 2.25 lb Kocide, Champ, or Nu Cop 3F 1.3 to 2.7 pt	Begin applications when plants are small and repeat on 7-day intervals. May cause leaf injury.
	copper sulfate (M): Cuprofix Ultra 40DF 1.25 to 2 lb	Apply on 7 to 10-day intervals. May cause leaf injury.
	other copper fungicides (M):	See labels. May cause leaf injury.
	mefenoxam (4) + copper hydroxide (M): Ridomil Gold Copper 65W 2.5 lb	Apply following use of Ridomil Gold at planting (see Pythium damping off) on 14-day intervals. Do not apply within 21 days of harvest.
	mefenoxam or metalaxyl (4): Ridomil Gold 4E 0.25 pt Ultra Flourish 2E 0.5 pt Ridomil Gold 2.5G 5 lb Metastar 2E AG 1 pt	White rust and blue mold only. Following use of mefenoxam at planting (see Pythium damping off) shank in (E) or side-dress (G) suggested rates after each of up to two cuttings.
	phosphorous acid (33): Phostrol 4.3L 2.5 to 5 pt Agri-Fos 3.3L 2.5 to 5 pt	Apply on 7-21 day intervals in alternation with another fungicide.
	pyraclostrobin (11): Cabrio 20EG 8 to 12 oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
SOUTHERN PEAS		
Pythium damping off	mefenoxam or metalaxyl(4): Ridomil Gold 4E 0.5 to 1 pt Metastar 2E AG 2 to 4 pt	Broadcast suggested rate or band over the seed row and incorporate before or water in after planting.
Rhizoctonia damping off and root rot	azoxystrobin (11): Quadris 2.08F 0.4 to 0.8 fl oz /1000 ft row Amistar 80DF 0.12 to 0.25 oz /1000 ft row	Apply in furrow at planting or as a band over the row after emergence. See label for resistance management.
Bacterial blights (halo, common, and brown spot)	See next column	Plant disease-free seed.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 1.5 to 3 lb Kocide or Nu Cop DF 1.5 to 3 lb Kocide 2000 or Champ DF 1 to 2 lb Kocide, Champ, or Nu Cop 3F 1 to 2 pt	Apply on 7 to 14-day intervals beginning when plants are small or disease threatens.
	copper sulfate (M): Cuprofix Disperss 1.5 to 3.5 lb	Apply on 7 to 14-day intervals beginning when plants are small or disease threatens.
	other copper fungicides (M):	See labels.
Anthracnose Cercospora leaf spot Rust Powdery mildew	azoxystrobin (11): Quadris 2.08F 6.2 to 15.4 fl oz Amistar 80DF 2 to 5 oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	azoxystrobin (11) + chlorothalonil (M) Quadris Opti 5.5F 1.6 to 2.4 pt	Apply on 7 to 14-day intervals.
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.3 to 3 pt Bravo, Echo, or Equus 82.5DF 1.25 to 2.7 lb Echo 90DF 1.1 to 1.6 lb	Apply at early bloom and repeat on 7 to 10-day intervals.
	maneb (M): Maneb 75DF or 80W 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Anthracnose and rust only. Apply when plants are small and repeat on 5 to 7-day intervals. Do not apply within 30 days of harvest.
	pyraclostrobin (11): Headline 2.08E 6 to 9 fl oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action)..

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
SOUTHERN PEAS (CONT'D)		
Anthracnose Cercospora leaf spot Rust Powdery mildew (cont'd)	sulfur (M): Microthiol or Kumulus 80DF 3 to 10 lb other sulfur formulations (see labels)	Rust and powdery mildew only. Apply on 7 to 14-day intervals at the first appearance of disease.
SWEET CORN		
Stewart's wilt (bacterial)	See next column	Plant resistant varieties and control flea beetles which spread the bacterium where warranted.
Leaf blights Leaf spots Rust	azoxystrobin (11): Quadris 2.08F 6.2 to 15.5 fl oz Amistar 80DF 2 to 5 oz	Apply on 7 to 14-day intervals. Use low rates for rust and high rates for leaf spots and blights. See label for resistance management.
	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.5 to 2 pt Bravo, Echo, or Equus 82.5DF 1.4 to 1.8 lb Echo 90DF 1.25 to 1.6 lb	Fresh market only. Apply on 4 to 7 day intervals when disease first appears.
	maneb (M): Maneb 75DF or 80W 1.5 lb Manex 4F 1.2 qt	Apply on 3 to 10-day intervals when disease first appears.
	mancozeb (M): Dithane, Manzate, or Penncozeb 75DF 1.5 lb Dithane, Manzate, or Penncozeb 4F 1.2 qt	Apply on 4 to 7-day intervals when disease first appears.
	propiconazole (4): Tilt, Propimax, or Bumper 3.6E 2 to 4 fl oz	Apply when disease first appears and repeat on 14-day intervals. Use the high rate for rust.
	propiconazole (4) + azoxystrobin (11): Quilt 1.66F 7 to 14 fl oz	Apply on 7 to 14-day intervals in alternation with a non-group 11 fungicide.
	propiconazole (4) + trifloxystrobin (11): Stratego 2.08F 7 to 12 fl oz	Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	pyraclostrobin (11): Headline 2.08E 6 to 12 fl oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
Maize dwarf mosaic virus	See next column	Plant resistant hybrids and control Johnsongrass in and around fields.
SWEET POTATOES		
Pythium damping off	mefenoxam or metalaxyl(4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Metastar 2E AG 4 to 8 pt	Broadcast suggested rate or band over the seed row and incorporate before or water in after planting.
Black rot Scurf Fusarium stem rot	dicloran (14): Botran 75W 1 lb/7.5 gal Botran 75W 3 to 3.75 lb/1000 sq ft	Scurf only. Dip seed roots 10-15 seconds in suspension, drain and bed promptly. Mix suggested rate in 14 gal water and spray or sprinkle over bedded seed before covering.
	thiabendazole (1): Mertect 340F 8 oz/7.5 gal	Dip seed roots for 1 to 2 minutes and bed immediately. Change solution when dirty.
Southern blight	dicloran (14): Botran 75W	Same as for scurf (see above).
Storage rot: Rhizopus rot	dicloran (14): Botran 75W 1 lb/100 gal	Spray or dip immediately after washing.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
TOMATOES		
Pythium damping off Phytophthora root rot	fosetyl-AL (33): Aliette or Linebacker 80WDG 2.5 to 5 lb	Apply as a foliar spray at the 2-4 leaf stage or immediately after transplanting.
	mefenoxam or metalaxyl(4): Ridomil Gold 4E 1 to 2 pt Ultra Flourish 2E 2 to 4 pt Ridomil Gold 2.5G 20 lb Metastar 2E AG 2 to 4 qt	Broadcast suggested rate or band over row and incorporate before or water in after planting or transplanting.
Pythium and Phytophthora root rots	propamocarb hydrochloride (28): Previcur Flex 6SC 12.8 fl oz / 100 gal	Greenhouse use. Drench saturated rock wool or growing media before transplanting and/or apply through drip system after transplanting.
Southern blight	fluoxastrobin (11): Evito 480SC 4F 3.8 to 5.7 fl oz	Apply on 7 to 10-day intervals in alternation with a non Group 11 fungicide. Also controls early blight and late blight (see below).
	PCNB (14): Terraclor 75W 3 lb / 100 gal or 14.6 oz / 1000 ft row Terraclor 4F 4.5 pt / 100 gal or 10.6 to 15.8 fl oz / 1000 ft row	Other formulations (2E, 4F, 15G) available. Apply ½ pint of 100 gal solution per transplant or spray 14.6 oz in furrow. Apply ½ pint of 100 gal solution per transplanting or spray 10.6 to 15.8 fl oz/1000 ft of row in furrow.
Bacterial spot Bacterial speck Bacterial canker	See next column	Plant disease free seed or transplants or soak suspect seed at 132°F for 30 min. Rotate with crops other than tomato and pepper for 3 years.
	sodium hypochlotite (M): Chlorox 1 part + 3 parts water	Surface disinfection for suspect seed. Soak in bleach solution for 1 minute, drain, rinse, and dry.
	streptomycin sulfate (25): Agri-mycin, AG-Streptomycin, Agricultural Streptomycin, or Firewall 17W 1 lb / 100 gal	Transplant production. Apply on 7-day intervals beginning at the first true leaf stage in tank mix with a copper fungicide.
	acibenzolar-S-methyl (21): Actigard 50WG 0.33 to 0.75 oz	Activates plant resistance to bacterial spot and speck. Make up to six weekly applications beginning within one week of transplanting. Do not apply within 14 days of harvest.
	copper hydroxide (M): Kocide 101, Champion, or Nu Cop 50W 2 to 4 lb Kocide or Nu Cop DF 2 to 4 lb Kocide 2000 or Champ DF 1.5 to 3 lb Kocide, Champ, or Nu Cop 3F 1.3 to 2.7 pt	Apply before the disease appears and repeat on 7-day intervals or more frequently if needed. Tank mix with maneb (see below) for increased control.
	copper sulfate (M): Cuprofix Ultra 40DF 1.25 to 3 lb	Apply before the disease appears and repeat on 7 to 10-day intervals. Tank mix with maneb (see below) for increased control.
	other copper fungicides (M):	See labels.
Fusarium wilt	See next column	Plant resistant varieties designated "F" on labels or in seed catalogs. Practice crop rotation to avoid the development of new races.
Anthracnose Early and late blights Gray leaf spot and mold Septoria leaf spot Fruit rots	chlorothalonil (M): Bravo, Applause, Echo, Equus, Chloronil, or Chlorothalonil 6F 1.4 to 2.7 pt Bravo, Echo, or Equus 82.5DF 1.3 to 2.6 lb Echo 90DF 1.1 to 2.5 lb	Field use only. Apply on 7 to 14-day intervals beginning at fruit set. Use the high rates for control of fruit rots.
	azoxystrobin (11): Quadris 2.08F 5.0 to 6.2 fl oz Amistar 80DF 1.6 to 2 oz	Apply on 7 to 14-day intervals in alternation with a fungicide in a different group (mode of action).
	azoxystrobin (11) + chlorothalonil (M): Quadris Opti 5.5F 1.6 pt	Apply on 7 to 14-day intervals in alternation with a non-group 11 fungicide.
	boscalid (7): Endura 70WG 9 to 12.5 fl oz	Early blight only. Apply on 7-14-day intervals. See lablel for resistance management. Also controls Botrytis stem canker (see below).
	copper hydroxide (M):	Same as for bacterial spot (see above).
	copper sulfate (M):	Same as for bacterial spot (see above).

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
TOMATOES (CONT'D)		
Anthracnose Early and late blights Gray leaf spot and mold Septoria leaf spot Fruit rots (cont'd)	copper fungicides (M):	Same as for bacterial spot (see above).
	cyazofamid (21): Ranman 3.3F 2.1 to 2.75 fl oz	Late blight only. Apply on 7 to 10-day intervals in alternation with another fungicide.
	cymoxanil (27): Curzate 60DF 3.2 to 5 oz	Late blight fungicide. Apply in a tank mixture with a protectant fungicide (group M) on 5 to 7-day intervals.
	famoxadone (11) + cymoxanil (27): Tanos 50DF 6 to 8 oz	Apply on 5 to 7-day intervals in a tank mix with a protectant (group M) fungicide.
	mancozeb: (M) Dithane, Manzate, or Penncozeb 75DF 1.5 to 2 lb Dithane, Manzate, or Penncozeb 4F 1.12 to 1.6 qt	Apply on 7 to 10-day intervals beginning at fruit set. Do not exceed 8 lb or 6.4 qt per season or apply within 5 days of harvest.
	copper hydroxide (M) + mancozeb (M): ManKocide 2.7 to 5.3 lb	Apply on 7 to 10-day intervals. Do not apply within 7 days of harvest. Also controls bacterial spots (See above).
	mancozeb (M) + copper sulfate (M): Cuprofix MZ Disperss 1.75 to 4.75 lb	Apply on 7-day intervals. Do not apply within 7 days of harvest. Also controls bacterial spots (See above).
	dimethomorph (40): Acrobat 50W 6.4 oz Forum 4.18F 6 fl oz	Field use only. Late blight fungicide. Apply on 5 to 10-day intervals in a tank mix with a protectant (group M) fungicide.
	dimethomorph (40) + mancozeb (M): Acrobat MZ 2.25 lb	Field use only. Late blight fungicide. Apply on 5 to 10-day intervals. Do not apply within 5 days of harvest.
	fluoxastrobin (11): Evito 480SC 4F 3.8 fl oz	Apply on 7 to 10-day intervals in alternation with a non Group 11 fungicide. Also controls southern blight (see above).
	maneb (M): Maneb 75DF 1.5 to 2 lb Manex 4F 1.2 to 1.6 qt	Field and greenhouse. Apply on 7 to 10 day intervals beginning at fruit set. Do not apply within 5 days of harvest.
	mefenoxam (4) + chlorothalonil (M): Ridomil Gold/Bravo 76W 2 lb Ridomil Gold SC 6.67F 2.5 pt	Field use only. Apply up to 3 times on 14-day intervals. Alternate with a protectant (group M) fungicide every 7 days when disease pressure is heavy. Do not apply within 14 days of harvest.
	mefenoxam (4) + mancozeb (M): Ridomil Gold MZ 68W 2.5 lb	Field use only. Apply up to 3 times on 14-day intervals. Alternate with a protectant (group M) fungicide every 7 days when disease pressure is heavy. Do not apply within 5 days of harvest.
	mefenoxam (4) + copper hydroxide (M): Ridomil Gold/Copper 65W 2 lb	Field use only. Tank mix with mancozeb or maneb and apply up to 3 times on 14-day intervals. Alternate with a protectant (group M) fungicide every 7 days when disease pressure is heavy. Do not apply within 14 days of harvest.
	propamocarb hydrochloride (28): Previcur Flex 6SC 0.7 to 1.5 pt	Late blight fungicide. Apply in a tank mix with a protectant fungicide (group M) on 7 to 10-day intervals.
	pyraclostrobin (11): Cabrio 20EG 8 to 16 oz	Field use only. Apply on 7 to 14-day intervals. Make up to 2 sequential applications before alternating with a fungicide from a different mode of action group.
	pyrimethanil (9): Scala 5F 9 to 18 fl oz	Early blight only. Apply on 7 to 14-day intervals in a tank mix with another fungicide. Also controls Botrytis stem canker (see below).
	triflozystrobin (11): Flint 50WG 2 to 4 fl oz	Apply on 7 to 10-day intervals. For late blight, tank mix the high rate and 75% of the labeled rate of of a protectant (group M) fungicide.
	ziram (M): Ziram 76DF 3 to 4 lb	Anthracnose, early blight, and Septoria only. Apply on 7 to 14-day intervals beginning at fruit set. Do not apply within 7 days of harvest.
	zoxamide (22) + mancozeb (M): Gavel 75DF 1.5 to 2 lb	Apply on 7 to 10 day intervals. Do not exceed 4 applications or apply within 5 days of harvest.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

DISEASE	COMMON NAME (MOA GROUP): FORMULATION AND RATE/ACRE OR 100 GAL	REMARKS
TOMATOES (CONT'D)		
Botrytis stem canker Sclerotinia stem canker	See next column.	Maintain greenhouse temperature above 70°F and relative humidity below 90%, avoid wetting plants, and prune petioles flush to stem.
	boscalid: (7) Endura 70WG 9 to 12.5 oz	Make up to 2 applications on 14-day intervals.
	dicloran: (14) Botran 75W 1 lb	Greenhouse only. Spray stems to a height of 18-24 inches and repeat weekly or as needed. Do not exceed 4 applications per crop.
	pyrimethanil (9): Scala 5F 9 to 18 fl oz	Botrytis stem canker only (field or greenhouse). Apply on 7 to 14-day intervals in a tank mix with another fungicide. Ventilate greenhouse for 2 hours after use. Also controls early blight (see above).
Powdery mildew	myclobutanil: (3) Nova 40W 2.5 to 4 oz	Apply on 7 to 14-day intervals when mildew first appears.
	pyraclostrobin: (11) Cabrio 20EG 8 to 12 oz	Not for use in greenhouses. Apply on 7 to 14-day intervals. See label for resistance management.
	sulfur: (M) Microthiol or Kumulus 80DF 5 to 10 lb other sulfur formulations*	Apply at first symptoms and repeat as needed on 7-14 day intervals. See labels.

MOA Group Tables start on page 46 of the handbook.

NEMATODE CONTROL FOR VEGETABLE CROPS

Nematodes are microscopic worms that live in soil. Several species feed on plant roots and are damaging to vegetable crops where high populations develop. Growers are usually not aware of the presence of nematode problems until plants appear stunted, yellowed, wilted, or are eventually killed. Growers should examine roots of plants in areas of poor growth. Galls or swellings on the root system are symptoms of root-knot nematodes. If a nematode problem is suspected, a lab analysis of soil should be done to determine the type and number of nematodes present so that an effective control program can be developed. Control programs are aimed at reducing nematode levels below damaging levels before planting susceptible crops. Nematode problems generally cannot be corrected after planting. Therefore, a nematode analysis, in which the types of nematodes present and their population levels in the soil are determined, is critical to an effective management program. Where nematode problems are suspected, soil and root samples should be collected and submitted to the OSU Plant Disease Diagnostic Laboratory prior to planting any nematode susceptible crop. Samples should be submitted through local county extension offices. It is best to sample late in the growing season before turning under the crop. Consult OSU Extension Facts #7610 for information on taking an adequate sample and proper care and handling of samples.

CULTURAL PRACTICES for nematode control include:

Resistant varieties: Plant varieties known to be resistant to nematodes. Several tomato varieties are resistant to root-knot nematode. These have an "N" designation on labels or in seed catalogs.

Crop rotation: Rotation to non-host crops such as grasses (corn, etc.) for root-knot nematode is an excellent means of reducing nematode populations below damaging levels. Other non-host crops are available depending on the type of nematode infestation. Rotation in home gardens can be applied by moving the location of the different crop types yearly.

Sanitation: Soon after harvest, pull plants and roots and remove to destroy nematodes and eggs in the roots or apply shallow tillage to shred the debris. Work the soil and fallow for several days so the sun will dry out the top layer of soil and kill some of the nematodes. Avoid moving contaminated soil on equipment to clean areas.

Nematode-free transplants: Nematodes can be introduced into fields and gardens in or on roots of tomatoes, peppers, etc. Buy or produce nematode-free plants. Do not transplant material with galled root systems.

CHEMICAL SOIL TREATMENT (COMMERCIAL GROWERS): Several types of chemicals are available which range from those specific for nematode control (nematicides, See Table 5) to multipurpose soil fumigants (See Table 6) which effectively control weed seeds, nematodes, fungi, and soil insects. All of these are restricted use pesticides for commercial use by certified applicators and must be applied before or at planting. There are no chemical treatments available to correct nematode problems during the season. Those registered for vegetable crops are listed below. A good time to apply fumigants is in the fall (September or October) because they all require a waiting period to allow the fumigant to dissipate before it is safe to plant. Spring fumigation may interfere with planting schedules if cold or wet weather prevents fumigation or delays fumigant penetration and dissipation. Specific soil temperature, moisture, and tillage conditions are required for optimum performance of soil fumigants. Check the label to ensure that the product-specific soil requirements are met.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

HOME GARDEN TREATMENTS: Home gardeners have fewer options for nematode treatments because all nematicides and fumigants are either restricted use pesticides or they are not available in quantities suitable for home use. However, several safer methods of nematode control have been developed which are best suited to small-scale, garden settings. These include the use of green manures, soil solarization, and chitin application.

Green manures: Incorporation of crucifer green manure (cabbage, mustard, rape, canola) into moist soil results in the release of compounds which act as "biological soil fumigants" and kill nematodes. The practice is most effective where combined with soil solarization.

Soil solarization: Soil solarization is a method of pasteurizing soil using solar radiation. The area to be solarized should be tilled as deep as possible and moistened by irrigation or rainfall. Cover the area with clear plastic (polyethylene) film and seal the edges with soil. Leave the film in place for three to five weeks (the longer the better) during the summer or early fall. The goal is to heat the soil to high temperatures for as long as possible to achieve a good kill. Consult OSU Extension Facts #7640 for more information on solarization.

Chitin application: Hi-Yield Nem-A-Cide Nematode Control (Voluntary Purchasing Groups) is a formulation of chitin (crab shells) and urea which stimulate the growth and activity of soil microbes that destroy nematodes. At 2-4 weeks before planting, broadcast at 5 lb/100 sq ft or band at or band over the row at 2.25 to 7 lb/100 ft of row and incorporate 6 to 8 inches deep.

TABLE 5. NEMATICIDES FOR NEMATODE CONTROL IN COMMERCIAL VEGETABLE CROPS

COMMON NAME: (GROUP) FORMULATION	CROPS	APPLICATION METHOD	RATE/1,000 FT ROW OR ACRE	REMARKS
ethoprop (1B): Mocap 15G[r]	Beans (snap,lima)	Row	0.9 to 1.4 lb/1,000 ft	Preplant incorporate, 12 to 15-inch band.
	Cabbage	Row	0.9 lb/1,000 ft	Preplant incorporate, 15-inch band.
	Cucumbers	Row	2.1 lb/1,000 ft	Preplant incorporate, 12 to 15-inch band.
	Potatoes	Row	1.4 lb/1,000 ft	Preplant incorporate, 12-inch band.
	Sweet corn	Row	0.75 to 1 lb/1,000 ft	Preplant incorporate, 12 to 15-inch band.
	Sweet potatoes	Row	1.6 to 2 lb/1,000 ft	Preplant incorporate, 12 to 15-inch band.
ethoprop (1B): Mocap 6E[r]	Cabbage	Row	2.4 fl oz/1,000 ft	Preplant incorporate, 12 to 15-inch band.
	Potatoes	Row	4.4 fl oz/1,000 ft	Preplant incorporate, 12-inch band.
	Sweet potatoes	Row	5.1 to 6.9 fl oz/1,000 ft	Preplant incorporate, 12 to 15-inch band.
aldicarb (1A): Temik 15G[r]	Dry beans	Row	7.5 to 15 oz/1,000 ft	Preplant incorporate in a 6-inch band.
	Sweet potatoes	Row	15 to 30 oz/1,000 ft	12-inch band at planting in open row, hill up immediately and plant in treated zone.
fenamiphos (1B): Nemacur 3E[r]	Eggplant	Row	5.9 fl oz/1,000 ft	Preplant incorporate, 12-inch band before transplanting.
oxamyl (1A): Vydate L[r]	Carrots	Broadcast	2 to 4 gal/acre	Broadcast and incorporate within 1 week of planting.
		In-furrow	1 to 2 gal/acre	Apply to seed furrow at planting in 20 gal water/acre.
	Cucurbits (cantaloupe, squash, cucumber, pumpkin, watermelon)	Broadcast	1 to 2 gal/acre	Broadcast or band over row (base rate on band width) and incorporate before planting.
		Foliar spray	2 to 4 pt/acre	2 to 4 weeks after the at-plant treatment, make 2 applications 2 to 3 weeks apart.
	Eggplant	Band	1 gal/acre	Band over row 2 to 3 weeks after transplanting and repeat 4 weeks later.
		Foliar spray	2 qt/acre	2 to 4 weeks after the last band application, make two applications 7 to 14 days apart. Do not apply within 7 days of harvest.
	Peppers (bell and non-bell)	Transplant water	2 pt	Apply with transplant water in a minimum of 200 gal/acre
		Foliar spray	2 to 4 pt	Apply 14 days after transplant treatment and repeat at 7 to 14-day intervals as needed. Do not apply within 7 days of harvest.

[r] Restricted use pesticide

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

COMMON NAME: (GROUP) FORMULATION	CROPS	APPLICATION METHOD	RATE/ACRE	REMARKS
oxamyl: (1A) Vydate L[r] (cont'd)	Potatoes	In-furrow	1 to 2 gal	Apply to seed furrow in at least 20 gal water/acre at planting.
		Foliar spray	2 to 4 pt	Follow the in-furrow treatment as needed on 5 to 7-day intervals, but not within 7 days of harvest.
	Sweet potatoes	Broadcast	2 to 3 gal	Band over row (base rate on band width) and incorporate before planting slips.
		In-furrow	1 to 2 gal	Apply in a minimum of 200 gal transplant water during planting of slips
	Tomatoes	Foliar spray	2 to 4 pt	Apply when plants become established and repeat on 1 to 2-week intervals. Do not apply within 1 day of harvest.

TABLE 6. MULTIPURPOSE FUMIGANTS FOR COMMERCIAL VEGETABLE CROPS

COMMON NAME: FORMULATION	CROP	APPLICATION METHOD	RATE	REMARKS
chloropicrin (99%) Chlor-O-Pic [r] Metapicrin [r] NutraPic [r] Chloropicrin [r]	Most vegetable crops	Broadcast or row	150 to 500 lb / treated acre	Inject 6 to 8 inches deep at least 14 to 21 days before planting and seal by packing, irrigation, or plastic film. Reduce rate by 33% if sealed by plastic. Controls nematodes, some weeds, and some soilborne diseases.
dichloropropene (98%): Telone II [r]	Most vegetable crops	Broadcast or row	9 to 12 gal / treated acre	Inject at least 12 inches deep into well-worked, moist soil at least 14 days before planting. Seal by light tillage and packing. Controls nematodes.
dichloropropene (98%): Telone EC [r]	Most vegetable crops	Drip irrigation	9 to 18 gal / treated acre	Apply at least 14 days before planting through drip system under sealed plastic in sufficient water to thoroughly wet soil profile. Controls nematodes.
dichloropropene (78%)+ chloropicrin (17%): Telone C-17 [r]	Most vegetable crops	Broadcast or row	10 to 17 gal / treated acre	Inject 12 inches deep into well-worked, moist soil at least 14 days before planting. Seal by light tillage and packing. Controls nematodes and some soilborne diseases.
dichloropropene (61%)+ chloropicrin (33%): InLine [r]	Most vegetable crops	Drip irrigation	13 to 20.5 gal / treated acre	Apply at least 14 days before planting through drip system under sealed plastic in sufficient water to thoroughly wet soil profile. Controls nematodes and some soilborne diseases.
dichloropropene (61%)+ chloropicrin (35%): Telone C-35 [r]	Most vegetable crops	Broadcast or row	13 to 20.5 gal / treated acre	Inject 12 inches deep into well-worked, moist soil at least 14 days before planting. Seal by light tillage and packing. Controls nematodes and some soilborne diseases.
dichloropropene (39%)+ chloropicrin (59%): Pic-Clor 60	Most vegetable crops	Broadcast or row	13 to 20.5 gal / treated acre	Inject 12 inches deep into well-worked, moist soil at least 14 days before planting. Seal by light tillage and packing. Controls nematodes and some soilborne diseases.
metam-potassium: Sectagon K54 (54%) K-Pam HL (54%)	Most vegetable crops	Broadcast , row, chemigation, or drip irrigation	30 to 60 gal /treated acre	Inject 8 to 10 inches deep into deeply tilled, moist soil; or apply by irrigation at least 14 to 21 days before planting. Seal by packing, tarp, or light irrigation. Controls nematodes, some soilborne diseases, and weeds.
metam-sodium: Vapam HL (42%) Metam CLR (42%) Metam Sodium (32.7%) Metam KLR (54%) Sectagon 42 (42%)	Most vegetable crops	Broadcast, row, chemigation, or drip irrigation	30 to 75 gal/treated acre 30 to 75 gal/treated acre 40 to 100gal/treated acre 30 to 75 gal /treated acre 30 to 75 gal/treated acre	Inject 8 to 10 inches deep into deeply tilled, moist soil; or apply by irrigation at least 14 to 21 days before planting. Seal by packing, tarp, or light irrigation. Controls nematodes, some soilborne diseases, and weeds.

[r] Restricted use pesticide.

DISEASE CONTROL GUIDE FOR VEGETABLE CROPS (CONT'D)

COMMON NAME: FORMULATION	CROP	APPLICATION METHOD	RATE	REMARKS
methyl bromide (98%) + chloropicrin (2%): (8A) Brom-O-Gas 2% [r 1] MBC [r 1] Terr-O-Gas 98 [r 1]	Most vegetable crops	Broadcast	180-240 lb/treated acre	Inject into soil and tarp immediately with plastic film. Application to rows or beds under plastic mulch is more economical. Controls nematodes, soilborne diseases, and weeds.
methyl bromide (67%) + chloropicrin (33%): (8A) Bro-Mean C-33 [r 1] MBC-33 [r 1] Terr-O-Gas 67 [r 1]	Most vegetable crops	Broadcast	270 to 350 lb/treated acre	Same as 98% methyl bromide.

[r] Restricted use pesticide.
[1] Methyl bromide fumigation is dangerous and potentially deadly for inexperienced users. Commercial fumigators are available for training and/or custom fumigation.