USDA United States Department of Agriculture

Warm-Season Grasses

Establishment, Maintenance and Management for Erosion Control, Water Quality, and Wildlife Habitat

Conservation Fact Sheet ***February 2016***

INTRODUCTION

Warm-season grasses produce most of their growth during the warmest months of the year, typically from June through early September. Many warm-season grasses are deep rooted, long-lived perennials with considerable tolerance to relatively low pH, low fertility, and drought. Warm-season grasses grow best on deep, well drained soils, although a few species will tolerate poorly drained soils.

Warm-season grasses can be planted to reduce soil erosion and sedimentation, improve water quality, and provide wildlife habitat or forage for grazing animals. Stiff-stemmed warm-season grasses can serve as a barrier to erosion and can trap sediments. Warm-season grasses with a bunch-type growth form provide nesting habitat and cover for birds and mammals. Forbs and legumes are usually planted in combination with warm-season grasses to provide sources of food, including seeds, insects, and wildflower pollen and nectar.

If the primary purpose of the planting is to provide habitat for wildlife and pollinators, refer to the Maryland NRCS fact sheet *Native Herbaceous Plantings.*

This fact sheet provides instructions for planting, maintaining, and managing warm-season grasses so that they can serve their intended purpose. Using proper planting and establishment techniques will significantly improve plant health, reduce weed problems, and increase the likelihood of success.

SELECTION OF SPECIES, CULTIVARS, AND ECOTYPES

The species and cultivars of warm-season grasses can play an important role in the function of the planting. More species and cultivars of warm-season grasses have become commercially available in the last decade, and it's important to select a warm-season grass that will provide the desired functions.

Once established, tall-statured warm-season grasses such as switchgrass *(Panicum virgatum)*, big bluestem *(Andropogon gerardii)*, indiangrass *(Sorghastrum nutans)*, and coastal panicgrass *(Panicum amarum)*

Photo by Anne Lynn

tend to produce large amounts of biomass, both above and below the ground. High levels of below ground biomass production increase soil organic matter, hold soil particles together, and can enhance nutrient uptake and processing. Above ground biomass production can reduce soil erosion, increase soil organic matter, and provide large quantities of forage.

Excessive amounts of above ground biomass can also have negative effects on wildlife and plant diversity. The build-up of duff (or dead plant material) under warm-season grasses can function like a mulch that smothers other plants. A thick duff layer can also make it more difficult for birds to move around and forage.

Short to medium statured warm-season grasses, such as little bluestem *(Schizachyrium scoparium)*, broom-sedge *(Andropogon virginicus)*, purple lovegrass *(Eragrostis spectabilis)*, purpletop *(Tridens flavus)*, and deertongue *(Dicanthelium clandestinum)*, produce less biomass than the taller warm-season grasses. Although they can adequately control soil erosion and increase soil organic matter, they provide less soil cover, and are less beneficial for forage production.

The smaller quantities of biomass production offer advantages, however, for plant diversity and wildlife habitat. While providing less soil cover, they allow

Program Participation *– If you are enrolled in a program that provides financial assistance for establishment and/or management of warm-season grasses/forbs, specific restrictions and requirements may apply. Refer to the program guidance provided in addition to this fact sheet.*

more sunlight penetration and seed germination, which tends to promote plant diversity. The lack of excessive ground cover enables birds and small mammals to forage more efficiently.

Cultivars are varieties of a plant that were selected and bred for specific traits or characteristics. Grass cultivars are commonly selected for growth habit, forage quality, and site suitability. Of all the commercially available native warm-season grasses, switchgrass probably has the greatest number of commercially available cultivars.

Another plant selection type that is becoming more common is an *ecotype*. A plant ecotype is a selection of a plant from a subregion or local area within the species' range. Ecotypes are adapted to local soils and climate, and may be hardier than cultivars in a natural environment.

Local ecotypes may exhibit greater survivability and reproduction than cultivars in natural systems. A cultivar that is not locally adapted may require a higher level of management for it to be productive. On the other hand, some cultivars may be extremely hardy and out-compete native vegetation.

Ecotypes are often desirable for ecological restoration because they can increase plant diversity without compromising the survival of other native plants. Ecotypes may also provide other values that enhance ecosystem function, such as plant-animal interactions.

When selecting grasses, consider the use of local ecotypes when available. Refer to Tables 1 - 3 for a selected list of varieties and their genetic origins. Regional and local seed suppliers may carry ecotypes that are adapted locally.

Table 1. Selected list of switchgrass *(Panicum virgatum)* varieties and their characteristics.

Variety	Characteristics
'Blackwell' (OK)	Medium height, with rather large stems. Ranked high in leafiness, total forage produced, and resistance to rust and other diseases. 'Blackwell' switchgrass is noted for its vigorous growth during late spring and early summer. Lowland variety; performs well on wet sites in the Northeast.
'BoMaster' (NC)	Best used as a biomass crop, but can be managed as pasture or harvested and stored as hay or silage. Field trials indicate a higher biomass yield than 'Cave-In-Rock.' 'BoMaster' is a lowland variety that is well-adapted to the Southeastern states and the Mid-Atlantic Region.
'Carthage' (NC)	Leafy growth habit; best used for forage and hay production, but also provides erosion control and wildlife habitat. 'Carthage' exhibits strong seedling vigor, better than average rhizome spread, higher forage nutrient value, and earlier spring recovery than Midwestern varieties. Upland variety; grows best in well-drained sandy to loamy soils, but does not perform as well in heavier or wet soils.
'Cave-In-Rock' (IL)	Good biomass producer in the Northeast on fertile soils. 'Cave-in-Rock' has good seedling vigor and is resistant to lodging. Upland variety; grows best on well-drained soils, but tolerates a wide range of conditions from droughty to poorly drained.
High Tide Germplasm (Mid-Atlantic)	Specialized for use in stabilizing tidal shorelines and streambanks. Prefers loamy or sandy well-drained soil, but will grow on poorly-drained soil at the toe of slopes. Behaves more as a sod-forming grass on poorly-drained sites.
'Kanlow (OK)	Tall, coarse, productive variety, especially adapted to lowlands where a high water table or flooding occurs. 'Kanlow' can be inundated for several weeks without damage.
'Shelter' (WV)	Thicker stems and fewer leaves than other varieties. 'Shelter' was selected for its upright form and stiff stems that remain erect during winter to shelter wildlife. Biomass and forage production is less than other varieties. 'Shelter' is an upland variety that is adapted to a wide range of soil conditions, but is best suited for well-drained or moderately well-drained soils.

Table 2. Selected list of indiangrass *(Sorghastrum nutans)* varieties and their characteristics.

Variety	Characteristics
'Americus' (GA)	Primarily used for wildlife habitat and soil conservation; less suitable for forage ('Rumsey' is better for that purpose). Tolerant of most upland conditions, but is most productive on moderately well to well-drained soils.
'Rumsey' (IL)	Good for pasture and hay. 'Rumsey' provides increased forage production, better seedling vigor, and resistance to lodging as compared to other indiangrass varieties. Grows best on moderately well to well-drained soils.
Suther Germplasm (NC)	Suther Germplasm was collected from a wet, native prairie in the Piedmont Region. It is best suited for wildlife habitat and soil conservation, preferably on moist sites in Plant Hardiness Zone 7b.
Additional Ecotypes	Unnamed PA and VA ecotypes of indiangrass may be commercially available for wildlife habitat and soil conservation purposes.

Table 3. Selected list of eastern gamagrass *(Tripsacum dactyloides)* varieties and their characteristics.

Variety	Characteristics
'Highlander' (TN)	Superior vigor, growth form and development, and disease resistance. 'Highlander' is recommended for forage production, preferably as a hay crop, but can be grazed if managed properly. Grows best on well-drained, fertile soils, but tolerates heavier, more poorly-drained soils. It has fairly good flood and drought tolerance.
'Meadowcrest' (MD)	Robust vegetative growth, later flowering date, and disease resistance. 'Meadowcrest' is primarily suited for wildlife habitat and soil conservation, but can be used for forage. Does best in well-drained to moderately wet soils. Some drought tolerance, and can withstand some flooding.
'Pete' (KS/OK)	Robust growth habit and high forage production potential. 'Pete' is excellent for pasture and hay; good for wildlife habitat and biomass production. Very tolerant of poorly drained soils; less tolerant of droughty soils.

SITE PREPARATION

Before planting, it is essential to reduce competition from other vegetation that may be present on the planting site, such as other grasses or weeds. The type and density of the existing vegetation will determine how much pre-planting control is needed.

It's important to allow adequate time to complete this process. If significant quantities of noxious or aggressive weeds or invasive plants are present, be aware that you may need a year or two to control them before you can plant, especially if you will be planting a large area. Noxious weeds — johnsongrass, shattercane, bull thistle, Canada thistle, musk thistle, and plumeless thistle — must be controlled as required by Maryland state law.

For more information about controlling specific weeds in warm-season grass plantings, contact your local Maryland Cooperative Extension office or county weed control specialist.

Sites without Existing Vegetation

If the warm-season grasses will be planted into a clean, relatively weed-free area (such as cropland that was planted during the previous growing season), then competition from existing vegetation should not be a concern. However, a cover crop or nurse crop may be needed for erosion control and/or to reduce future weed competition (see page 4).

Take into account any noxious or aggressive weeds on the site that might have been suppressed (but not killed) with previous herbicide applications. If live rootstocks are present, these weeds may be very difficult to kill in a new planting without destroying the desirable plants. If you think you may have a weed problem, or if you don't know the site's weed history, it may be prudent to wait one full growing season to see what comes up. Use an appropriate herbicide to treat weeds if they occur, and plant a full-season cover crop. Then plant the warm-season grasses in the fall (as a dormant planting) or in the following spring. Spring plantings of warm-season grasses may be conducted until early summer if sufficient moisture is available

Sites with Existing Vegetation

If warm-season grasses are going to be planted into existing vegetation (for example, into other grasses or weeds), you will need to reduce competition before planting. For sites that need extensive preparation, much of the work can be done during the fall prior to spring planting, or in late summer before a fall planting.

Mow or bush hog the field or planting site, and treat using one of the following methods:

Herbicide treatment. Choose a non-selective herbicide with low persistence (e.g., glyphosate) to kill existing vegetation. Follow all label directions when using herbicides and consider herbicide persistence (carryover) as it may affect new plantings.

For extremely vigorous turf or weeds, you should plan to make one application of herbicide in early fall, followed by another the next spring before planting. Or if you make the first herbicide application in the spring, you should plan to make a second application a few weeks before planting, depending on label directions.

Do not plant the warm-season grasses until the competing vegetation is sufficiently controlled. It is much easier to control the competition before planting than afterward. Cultivation of the planting area may be needed following herbicide treatment if the dead plant matter is very thick and will be difficult to plant through. You may also need to re-spray after cultivation if weed seeds brought to the surface germinate.

Cultivation only. If you do not want to use herbicides, then you will need to cultivate the field or planting site to remove all existing vegetation. Cultivation is usually less effective than herbicides for killing heavy sod or persistent weeds. Also, bare ground produced by cultivation may be subject to erosion and can provide a good seedbed for more weed growth. If necessary, use a cover crop or nurse crop of oats, barley, or wheat to control erosion and help suppress weeds.

Herbicide Carryover

Carryover from herbicide treatments (recently applied or from prior years) can pose a threat to new plantings. Seedlings are particularly sensitive to herbicide carryover. The persistence of herbicides is directly affected by factors such as soil pH and moisture. To assess risks before planting, read the herbicide label or contact the manufacturer for specific information on persistence.

PLANTING

Planting Dates

Recommended planting dates typically range from late winter to late spring, and may include fall dormant plantings. Most warm-season grasses are usually planted in the spring. Warm-season grass seeds need a soil temperature of at least 50 degrees F in order to germinate. If soil temperatures are colder than 50 degrees, or moisture is not adequate, the seeds will remain dormant until conditions are favorable.

Before deciding on the best planting date, consider the need for weed control vs. the likelihood of having sufficient moisture for germination and growth of grass seedlings. Where cool-season weeds are likely to be a problem, planting in mid to late spring will allow more time for weed control before planting. On droughty sites, plantings made during late winter to early spring are more likely to have the soil moisture necessary for seedling establishment.

To obtain recommended planting dates for your site, contact your local NRCS Service Center.

Types of Seed

Many warm-season grasses (e.g., big bluestem, little bluestem, and indiangrass) have fluffy or chaffy seeds that are best planted by using a specially designed native grass drill. Native grass drills have picker wheels in the seed box that stir the seed and push it down into the large drop tubes.

Other warm-season grasses (for example, switchgrass, coastal panicgrass, and deertongue) have small, relatively "clean" seeds that can be planted by using a conventional grass drill or cultipacker-type seeder. A grain drill may also be used if it can be properly calibrated to plant small seeds at the recommended rate. Eastern gamagrass has a large, clean seed that can be drilled with a corn planter.

Warm-season grasses are sold in pounds of Pure Live Seed (PLS). PLS = (purity x germination)/100. PLS is important because native grass seed tends to be significantly lower in purity and germination than the seed of cool-season grasses.

Some native grasses (such as eastern gamagrass) are especially slow to germinate and should be “stratified” before planting. Stratification involves placing the seed in a moist material at a specified temperature and period of time to simulate natural conditions. Stratification can be a do-it-yourself project, but most people find it is easier and more reliable to purchase "treated" (pre-stratified) seed. Stratified seed must be planted soon after treatment because the seed is moist and tends to get moldy.

Seed Availability

Seeds of many species may be available throughout the year, but supplies are usually best from late winter to early spring. Don't wait to buy seed until the day you are ready to plant. Local seed suppliers may not always have the species or varieties that you want in stock, but may be able to order them for you. Or you may need to order your seeds from a catalog or online. Contact your local NRCS Service Center if you need the names of suppliers. Store all seeds in a cool dry place before planting.

Using a Cover Crop or Nurse Crop

If erosion is a concern, use a cover crop or nurse crop of 20 to 40 pounds/acre of oats, barley, or wheat. Oats are the preferred nurse crop because they are less competitive than the other small grains. To use as a cover crop, plant the small grain at the higher rate in the fall prior to a spring planting of warm-season grasses. Use the lower rate when a small grain is planted as a nurse crop at the same time as planting the warm-season grasses.

If erosion is not a concern, a cover crop or nurse crop can be planted at the lower seeding rate to help suppress weeds.

Planting Methods

Generally, the best method for establishing warm-season grasses is to use a no-till planter to drill seed into existing cover (for example, into a cover crop, crop residue, chemically killed weeds or grasses, etc.). No-tilling into undisturbed soil greatly reduces the germination of annual weeds and minimizes erosion, especially where slopes are 6 percent or greater. The use of a native grass drill is highly recommended for many species.

No-till planting into plant residue. On sites where existing vegetation was killed with herbicide or there is crop residue from previous years, no-till the warm-season grasses directly through the dead residue. Add a nurse crop as needed to control erosion and/or suppress weeds. If you must work up the soil because the residue is too thick to plant through, it is strongly recommended that you use a cover crop or nurse crop.

No-till spring planting into a fall cover crop. In the fall, prepare a seedbed by working the soil with a plow, disk, or similar equipment. Continue tillage until a reasonably uniform seedbed is prepared, then plant a cover crop. In the spring, no-till the warm-season grass seed into the cover crop. If the cover crop is tall, mow it first and no-till into the stubble. If aggressive or noxious weeds have developed since the previous fall, use an appropriate herbicide before planting.

Broadcast planting. If necessary, warm-season grasses can be planted by broadcasting onto a conventionally prepared seedbed. Broadcast seed onto a well-prepared, firm seedbed. Grasses with small or fluffy seeds may need to be mixed with a filler (for example, sawdust, finely ground corn, or slightly moistened peat moss) to achieve an even distribution of seed. Incorporate the seed into the soil 1/8 to1/4 inch deep by cultipacking, raking, or dragging. Broadcasting is usually less successful than no-tilling because it is more difficult to get good seed placement in the soil. Do not broadcast eastern gamagrass. It needs to be drilled 1/2 to 1-inch deep.

Lime and Fertilizer

Warm-season grasses are much more tolerant of poor site conditions than most cool-season grasses. It is usually not necessary to add lime to native grass plantings, provided the soil pH is 5.0 or above. If the pH is below 5.0, lime can be applied to achieve a pH of 5.5 to 6.5.

Similarly, phosphorus (P2O5) and potassium (K2O) should only be applied if a soil test indicates that these nutrients are in the low range. The use of commercial fertilizer and other forms of plant nutrients must be in compliance with Maryland nutrient management regulations, as applicable. Fertilizer applied without a soil test may result in an inefficient quantity of nutrients for plant establishment, or could result in over application of nutrients leading to potential water quality problems and excessive weed growth. For additional information, consult with your local Maryland Cooperative Extension specialist or certified nutrient management consultant.

Warm-season grasses need very little nitrogen. Do not apply any nitrogen at the time of planting because it will encourage weed growth.

PROTECTING PLANTS

Use fences and other exclusion devices to control livestock and human access to the planting, at least until it is well established. Many types of fences and exclusion devices are available. Contact your local NRCS Service Center for recommendations for your site.

ESTABLISHING THE PLANTING

Warm-season grasses usually take two to three years to become fully established. During that time, weeds can be a major problem.

The goal of weed control is to reduce (but not eliminate) competition from broadleaf and grass weeds such as mare's tail, ragweed, dandelion, foxtail, crabgrass, etc. Many of these plants provide food and wildlife cover, but if they get too tall and dense, they will shade out the warm-season grass seedlings. Don't wait until weeds are four feet tall before trying to control them. Mowing them at that stage will produce so much plant litter that you may smother the seedlings.

If you must use herbicides, minimize the risk to pollinators and other beneficial insects by choosing active ingredients and formulations (such as granules or solutions) that have the least impact on bees. Spray on warm, dry evenings and at least an hour after sunset when bees are not active. Do not spray when flowers in or immediately adjacent to the planting are in bloom.

Planting Year

In the first growing season after seed germination, it is very important to ensure that the seedlings do not get shaded out by weeds. Weeds can be controlled by mowing or herbicide treatment, as follows:

Mow the planting as needed during the summer months to control weeds and keep them below 18 inches. Mow to a height of 6 to 8 inches or just above seedling height (do not mow seedlings). Discontinue mowing after early August unless you can set the mower high enough to stay above the seedlings. Nesting season restrictions on mowing do not apply during the establishment period.

Selective herbicides can be used for controlling specific weeds, and are most effective when weeds are young and actively growing. If you have native wildflowers in your planting, mowing or using specialized herbicides such as Plateau may be the best options, because most wildflowers are susceptible to herbicides that control broadleaf weeds. Be sure to read and follow herbicide label instructions.

Second and Third Year After Planting

In early spring, if unwanted cool-season grasses or weeds comprise more than 25 percent of the stand, either treat with an appropriate herbicide or keep the area mowed very short until the warm-season grasses start to green up. Non-selective herbicides (e.g., Roundup) can be used to control cool-season grasses when warm-season grasses are dormant, but will also kill most actively-growing legumes or wildflowers.

Throughout the growing season, mow above seedling height (about 8 inches) as needed to keep weeds under control.

MAINTENANCE

By the 3rd year, warm-season grasses should be well established. Once established, warm-season grasses need periodic maintenance to control noxious and invasive weeds, and to prevent succession of woody vegetation. Most stands require occasional mowing every 2 to 3 years to keep trees and shrubs from invading. Additional measures, such as targeted herbicide application, may also be needed.

Mature stands that are not regularly hayed or grazed may pose a fire hazard. Firebreaks of cool-season grasses may be appropriate around buildings, woodlands, or other locations.

Weed Control

Control noxious weeds and other invasive plants by spot treatment, using mechanical methods or approved herbicides. Control of noxious weeds (specifically, johnsongrass, shattercane, bull thistle, Canada thistle, musk thistle, and plumeless thistle) is required by state law. Contact your local University of Maryland Extension office or county weed control specialist concerning recommendations for spot-treating the weed problem.

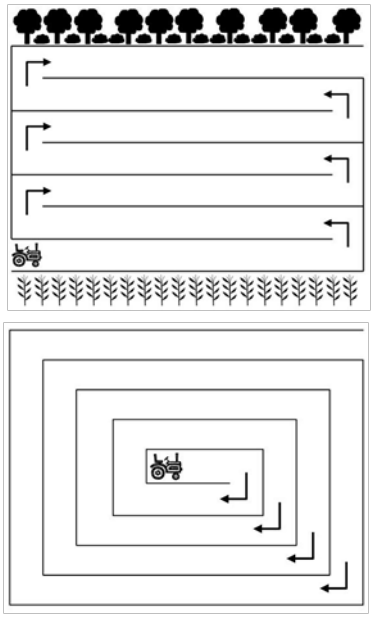
Control of Woody Growth

Methods to control woody growth include mowing, targeted herbicide treatment, and strip disking. Mowing is the most common method because of access to equipment, but not necessarily the most effective method. Herbicide treatment is a common and effective method of controlling brush. Strip disking may also be used, and is discussed in the Management section (see page 7) of this fact sheet.

Mowing. For woody vegetation control, mowing during the growing season, generally in late summer, will be more effective than mowing during the dormant season, because it will limit the amount of carbohydrate reserves that can be translocated to the roots. If mowing in the fall, mow early enough to allow grasses to reach a height of 6 inches or more before the first killing frost.

For optimum wildlife benefits, mow on a 2 to 3 year rotation to control woody growth. Mow only 1/3 to 1/2 of the planting each year. The remaining unmowed areas will provide year-round wildlife food and cover. Do not mow during the primary nesting season (April 15 - August 15), and do not mow only for cosmetic purposes.

To the extent possible, mow in a manner that will provide escape routes for wildlife at the time of mowing, such as mowing from the inside out, or mowing from the field side toward the woods edge.



Edge-to-edge (top) or inside-to-outside (bottom) mowing patterns provide escape routes for wildlife.

Where water quality has been identified as the primary purpose, more frequent mowing may be needed to maintain grass in a dense turf-type condition that will control erosion and reduce sedimentation. If stands are dense and have large quantities of top growth, cuttings should be removed if at all possible. If the cuttings are not removed, they can smother new growth.

Targeted herbicide application. Herbicide treatment is a common and effective method for controlling woody vegetation. Methods vary depending on the type, size, and age of the target species, and the size of the treatment area. This fact sheet provides some general recommendations on the use of herbicides for woody vegetation control. For more specific information, contact your local University of Maryland Extension office or county weed control specialist.

Small areas of woody vegetation can be treated using basal bark, foliar spray, or cut-surface treatment methods in which the herbicide is applied with portable sprayers and hand tools.

Large areas of woody vegetation will likely require foliar application of a systemic herbicide using a wick bar applicator. Systemic herbicides (e.g., 2,4-D) are absorbed by the plant and translocated to the roots. Woody vegetation may need to be mowed and allowed to re-grow to enable effective application of herbicide to foliar surfaces.

Application of systemic herbicides in late summer or early fall, prior to leaf-drop, is typically more effective because the herbicide will be translocated to the roots.

Check the pesticide label to determine the types of plants that are controlled or damaged by the herbicide. If you have native wildflowers in your planting, mowing or using specialized herbicides such as Plateau may be the best options, because most wildflowers are susceptible to herbicides that control broadleaf weeds.

Always read and follow the pesticide label when applying herbicides.

MANAGEMENT

Once established, warm-season grass stands may need periodic management to maintain stand vigor, reduce litter accumulation, enhance wildlife benefits, and enhance or maintain plant diversity. The type and frequency of management will depend on the purpose of the planting. Management practices may be used alone or in combination to achieve desired objectives.

When warm-season grasses are established for wildlife habitat purposes, periodic disking and/or prescribed burning are usually necessary to prevent the grasses from becoming too dense. Under dense conditions, the movement of ground birds and germination of annual forbs and legumes are inhibited. Management activities are typically conducted on a 2 to 4 year rotation to maintain a diversity of wildlife cover throughout and across years. For optimum wildlife habitat, all of these activities should be conducted outside of the primary nesting season for birds and ground-nesting wildlife (April 15 - August 15).

For optimum water quality benefits, maintaining a dense stand of grasses is recommended, and where feasible, using management practices such as haying and grazing to remove nutrient-rich top growth from the site.

Strip Disking

Strip disking is used to reduce the density of the warm-season grass stands, provide openings in the stand for wildlife movement and foraging, and to increase plant diversity and food sources by encouraging the germination of forbs and legumes. The appropriate intensity and timing for disking will depend on the purpose of the warm-season grass planting and the stand characteristics. Strip disking should only be used if it will not result in excessive erosion or adversely impact water quality, and will not destroy the planting.

Minimum set-backs. The following set-backs are required in order to maintain the functions of the planting and protect water quality.

Do not disk in these areas:

- Within 20 feet from a watercourse, water body, or wetland.
- Within 15 feet from adjacent cropland or intensively used areas, if present. Infrequently used field roads or firebreaks planted with cool-season grasses can be included in this set-back.

Disking intensity. Before disking, mow the area that will be disked. Fall mowing can facilitate spring disking by providing time for breakdown of leaf matter.

The required disking intensity will vary depending on the density of grasses in the stand. For stands where grasses are not dense, a single pass with a light finish disk may be sufficient.

Thick stands of perennial warm-season grasses will require heavier, more intensive disking to open up the stand. In thick stands, multiple passes with a tandem disk, or a single pass with a heavy offset disk may be required to thin the grasses. A heavy offset disk will slice and turn the soil and bury residue, which may be necessary to reduce the overall cover of grasses. After use of a heavy offset disk or when the soil has been turned over, the soil surface should be smoothed with a cultipacker, harrow, or other finishing implement.

Spacing and timing. Disk in strips on 1/3 to 1/2 of each field on a 2 or 3-year rotation. Disk on the contour in an alternating pattern of disked and undisked strips.

Strip disk either in late summer to early fall (September 1 – October 15), or in late winter to early spring (preferably in March). Fall disking tends to promote the growth of forbs and legumes (e.g., ragweed, partridge pea), whereas spring disking tends to promote the growth of annual grasses (e.g., foxtail). Warm-season grasses are generally more susceptible to disking in late summer or early fall, when they are sending reserves into their roots, so disking at this time is more useful for reducing the thickness of the grasses. Spring disturbance, especially disking, tends to enhance the growth of warm-season grasses.

Do not disk during the primary nesting season (April 15 – August 15).

Use the following additional guidance for disking on highly erodible land with an Erodibility Index (EI) ≥ 16:

- Disk in strips no wider than 30 feet. Undisked strips should be twice the width of disked strips. Disking intensity should be light enough to maintain at least 30% residue cover in the disked strips. Do not disk parts of the field where excessive erosion is likely to occur.

- On highly erodible land with an EI > 30, only disk in the upper half of the slope, and adjust the disking intensity to attain at least 60% residue cover.

Prescribed Burning

Prescribed burning is the most effective management technique for removing accumulated plant litter and controlling woody plants. Prescribed burning will also enhance warm-season grass re-growth, but when used alone, may not be effective for maintaining the forb and legume component of the stand.

Conduct prescribed burns on a 2 to 3 year rotation, usually starting in the 4th or 5th year after planting.

Prescribed burning can be used in combination with strip disking to create greater habitat diversity and/or to facilitate disking. Within a given year, half of the undisked strips between disked strips can be burned to create a mosaic of undisturbed, disked, and burned strips.

Prescribed burning requires the use of firebreaks that are usually 12 to 15 feet wide. Existing strips of cool-season grasses or disked strips of bare ground can be used as firebreaks.

Prescribed burning requires a permit and may not be allowed in some areas. Contact your local office of the Maryland Department of Natural Resources, Forest Service, or NRCS Service Center for current information concerning permits and assistance for this practice. Do not burn during the primary nesting season (April 15 - August 15).

Interseeding Forbs and Legumes

As a grass stand matures, the forb and legume components tend to naturally decline. Forbs and legumes may be interseeded into existing grass stands to maintain plant diversity and provide food for wildlife. Refer to the Maryland NRCS fact sheet *Native Herbaceous Plantings* for additional information about managing these stands for optimum wildlife and pollinator habitat.

Interseed forbs and legumes on an as-needed basis. This management practice is not a food plot activity, and should only be used as necessary to maintain plant diversity. The use of strip disking will also encourage germination of wildflowers that are currently in the seedbank.

Use the same forbs and legumes as originally specified in the planting mix, or select a different mix based on recommendations from your local NRCS Service Center. Native forb and legume mixes can be inter-seeded at a rate of 2 to 5 lbs. pure live seed (PLS) per acre, while introduced legumes such as clovers and annual lespedezas are typically interseeded at rates from 5 to 10 lbs. per acre, depending on the species.

If the grass stand is thick or contains more than ¼ inch of litter (thatch), lightly disk or harrow the stand prior to seeding. It is especially important for native forbs and legumes to ensure that the stand contains space for the plants to establish. When disking or harrowing is needed, use a minimum set-back of at least 20 feet from a watercourse, water body, or wetland.

The best time to interseed native forbs and legumes is in the spring. Contact your local NRCS Service Center for additional information and planting recommendations. For optimum wildlife habitat, do not interseed during the primary nesting season (April 15 - August 15). Use one of the following planting methods for inter-seeding:

***Broadcast seeding*.** Cut the grass short before seeding. Broadcast the seed. Then go over it with a cultipacker, drag or harrow to enhance seed-to-soil contact.

***No-till planting*.** Cut the grass short before seeding and no-till drill the seed ¼-inch into the soil.

Managed Haying and Grazing

Managed haying or grazing can be used to reduce excess biomass and provide supplemental feed for livestock. Warm-season grasses are best suited for haying and grazing in the summer when they are actively growing.

Haying. For perennial warm-season grasses, take the first cutting when plants are in the late boot stage. For most species, it's important to leave at least a 6-inch stubble (at least 8 inches for eastern gamagrass). Allow grasses to reach a height of 8 to 10 inches before the first killing frost.

If the planting is intended primarily for wildlife habitat, harvest in a manner that will provide escape routes for wildlife (see *Mowing,* page 6), and do not cut hay during the primary nesting season (April 15 - August 15).

Grazing. Begin initial grazing when the plants are at least 12 inches tall. Graze down to 6 inches, and allow re-growth to 12 inches before grazing again. The final grazing height should be about 8 to 10 inches to allow sufficient recovery before dormancy.

If the planting is intended primarily for wildlife habitat:

- Do not hay or graze until after July 15th, and wait until after August 15th if possible.
- Hay or graze only 1/3 to 1/2 of the stand on a 3-year rotation.
- Do not overstock or overgraze the area.
- Exclude livestock from streams, wetlands, and other environmentally sensitive areas.

TECHNICAL REFERENCES

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