NATURAL RESOURCES CONSERVATION SERVICE

MAINE SPECIFICATION GUIDE

COVER CROP

(Ac.)

CODE 340

SCOPE

Establishing grasses, legumes, and other herbaceous materials for seasonal cover, organic matter additions, weed control, or conservation purposes.

SPECIAL CONSIDERATIONS

Cover crops and mixes can be used to achieve one or more objectives. When choosing species, consider planting dates/timing, plant lifecycle, frost sensitivity, termination method, nutrient addition or scavenging, soil building, and other attributes listed in the charts that follow. Cover crops and mixes can also be used to add biological diversity to a crop rotation. Consider plant attributes such as warm season vs. cool season, grasses, broadleaved plants, and physical stature when developing mixture. For more information, see the "Cover Crop Chart" at the end of this document.

Herbicide carryover: Herbicides used to control weeds may have a carryover effect which can be detrimental to cover crop establishment. This may be especially important when planning to interseed a cover crop. Knowing the half-life of the chemical in the soil is helpful in making a determination. In addition - and of significance - herbicides may have legal label restrictions for plant-back times after application.
Producers need to take all of this into consideration when planning the timing of cover crop establishment. See the *Herbicide Carryover Table* from Penn State University.
http://extension.psu.edu/plants/crops/soil-management/cover-crops/herbicide-persistence/herbicide-carryover-table

The producer is responsible for adhering to herbicide label restrictions that may limit the timing of cover crop establishment.

CONVENTIONAL SEEDING TECHNIQUES
(Drill, Broadcast)

Seedbed Preparation: A seedbed will be prepared if needed. Seedbed shall be adequate to ensure seed/soil contact.

Legume and grass cover crops can be established by broadcasting seed onto freshly disturbed ground, preferably followed by a light incorporation or rolling/packing. On more compacted cropland, small grain cover crops may be established after harvest by either broadcasting of the seed followed by light disking, or by using a grain drill.

Cover crops in corn can be established by broadcasting seed at last cultivation, seeding after harvest as described above, by interseeding, or by aerial seeding as described in this document.

Seeding depth: Plant seed at the following depths:

Grasses and legumes: ¼ to ½ inch
Small Grains: 1 to 1-1/2 inch

Lime and Fertilizer: Lime and fertilizer will be applied on the basis of needs as determined by a soil test whenever possible. Without a soil test,

determinations of the needs will be met as follows:

1. For annual crops, apply lime based upon the need of the next crop to follow.
2. Nitrogen applications should be based on crop needs (see Maine Soil Testing Guide – **HTTP://ANLAB.UMESCI.MAINE.EDU/SOILLAB_FILES/FAQ/HANDBOOK.PDF**).
3. For permanent crops, soil amendments will be based on soil tests results.

Cover and Green Manure Crops: Crops most commonly used for cover and green manure are included in **Table 2** and other information below. They will be seeded at the rates and no later than the dates shown to provide adequate annual cover.

Biennial and perennial grasses and legumes will be considered within the intent of this practice when they are established on croplands and are managed to provide protection during a definite hazardous period, are grown for the primary purpose of returning organic matter to the soil, or to provide a method of weed control or suppression in rotational systems.

Cover and green manure crops shall be plowed, disked under, or killed as late as feasible to maximize plant biomass production, allowing time needed to prepare the field for planting of the next crop, unless no-tilled. See "Terminating Cover Crops", below. (Caution: Winter cereal grains may produce a large volume of carbonaceous material that may tie up nitrogen for the following crop.)

AERIAL SEEDING

Seed Quality and Rate:

1. Use high quality seed free of disease, insects, and weed seed.
2. Minimum germination of 80 percent.
3. Use minimum germination of 2 bu./acre (112 lbs.)

Aircraft

Aircraft must be calibrated carefully and fly at a uniform height above ground.

This practice involves seeding cover crops into actively growing cash crops using a helicopter or airplane.

Aerial application also allows seeding to be done when it is physically impossible to use ground equipment, such as when crops are present, or when the soil is too wet.

When aerial application is used to interseed into a standing crop, germination and growth of the cover crop begins before the existing crop has been harvested – this helps ensure that the cover crop is planted during the appropriate time.

Another benefit with aerial seeding is that more acres can be seeded in less time. Helicopters typically seed between 300-500 acres per day. Many farmers find that the labor savings to be very valuable.

Although there are many advantages with aerial seeding, it can also be more risky than drilling or incorporation. Soil conditions (compaction, residue, and moisture), shading, harvest operations, and weather can all impact the success of the cover crop.

Seed Selection and Rate

Producers should select cover crop seed based on resource concerns (e.g. erosion, low organic matter) using this Specification Guide. If interseeding into existing crop, shade tolerance should also be considered. Cover crop termination method and timing is an important consideration in species selection.

Typically winter rye seeded at 110 pounds per acre will be the most common cover crop to be planted by aerial application. This is often the best choice for producers who have no experience with aerial seeding.

Do not plant larger seeds like field pea using aerial methods.

Producers may use multi-species mixes (blends) from seed companies and may plant at rates recommended by the seed company, providing that all species in the mix are planted during the appropriate seeding dates outlined in ME 340

Cover Crop Planting Specification Guide. However, small-seeded species are not recommended and should be used with caution.

Target Crops

Aerial seeding is appropriate for interseeding or post-harvest establishment of a cover crop.

Timing

Timing of cover crop establishment **is critical.**

- **Small grain crops should be flown on at 3 to 6 weeks prior to harvest**.
    - Shading for longer than 6 weeks will cause the cover crop to lose energy needed for recovery after harvest operations.
    - Seeding should take place a **minimum of 3 weeks prior to harvest** to prevent damage from harvest operations during early growth stages.
- The success rate of the cover crop decreases the later corn is harvested in the season.

Harvesting to Protect Cover:

1. Minimize number of trips across the field.
    a. Change trucks, chuck-wagons, etc., at edges of field only.
    b. Use two-row choppers, if available.
2. Do not harvest when fields are too wet to support the harvesting equipment.

Chemical Residue Effects: Ensure that herbicides used will not interfere with cover crop establishment.

INTERSEEDING

Consider shade tolerance of cover crops when interseeding into standing crops.

Corn

Interseeding a cover crop into an existing corn crop has been successful in Maine. The species most often recommended for this purpose is annual ryegrass.

The key to successful seeding is to get the seed in contact with moisture. Under dry conditions, drilling is essential. If the soil surface is moist, broadcasting without covering is effective. Good seedling growth requires continued moisture. Often seeding can be combined with a final cultivation. Annual ryegrass will mostly overwinter, especially when there is a good snow cover. Winter survival varies considerably among varieties: Southern types will winter kill in Maine and Midwestern ones will survive. The variety is often not specified in the Northeast market, so winter survival may not be consistent.

Other Crops

Annual Ryegrass can be interseeded into crops that will be harvested in late August or September. If conditions are moist, simply broadcasting seed on the surface is enough. Interseeding is best done just before the crop fills the canopy. The cover crop will begin to establish a shallow root system, but will not be overly competitive due to shading by the major crop. This early sod can reduce damage from harvest traffic, and can help speed the recovery of the soil after harvest. Interseeding into a vegetable crop allows the cover crop to establish better in the fall than does a grain sown well after vegetable harvest.

Broadcasting Annual Ryegrass requires 15-20 lb/ac. On dry soil, rates may be increased as high as 30 lb/ac.

SELECTING COVER CROPS

Select cover crops, planting dates and seeding rates. See section titled, “Characteristics of Some Common Cover Crops,” and **Tables 1, 2, and 3** at the end of this guide.

Ensure that crops are compatible with the cropping system and soils.

Cover crop termination method and timing is an important consideration in species selection, especially for organic farms.

Brief descriptions of the cover crops can be found at the end of this guide, and more detailed information can be found in "Managing Cover Crops Profitably" http://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition, and "Cornell Cover Crop Guide" http://covercrops.cals.cornell.edu

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Label (or tested) Germination % should be greater than 80%. If it is less than 80%, the seeding rate should be increased to compensate.

Consider using regional seed sources (certified) for improved reliability and performance.

Mixes

It is always wise to trial unfamiliar combinations on a small scale to determine if they will work.

Common mixes include a small grain like winter rye or oats with hairy vetch, red clover or peas. Other common mixes include annual ryegrass and clovers, timothy and alfalfa, and sorghum sudangrass or millets with soybean or cowpea. See **Table 3** for some simple mixes. Use the **Maine Cover Crop Workbook (FOTG/Sec IV/Tools)** to develop mixes, or calculate by hand, below. The Midwest cover Crop Council cover Crop Decision Tool may also be helpful.

When calculating a seeding rate for cover crop mixtures, *ensure that the sum of the proportional rates used is greater than or equal to 100% using the following formula:*

(Desired lbs of Crop A / full rate Crop A) + (Desired rate crop B / full rate Crop B) ≥ 1.0 (or 100%).

Example:

Crop A = Oats, full seeding rate =140 lbs/ac
Crop B = Hairy Vetch, full seeding rate = 35 lbs/ac

Mix of 80 lbs/ac oats + 20 lbs vetch (80/140) + (20/35) = 1.14. This is an adequate mix rate.

A mix of 80 lbs/ac oats + 10 lbs/ac vetch (80/140) + (10/35) = .86. This is not an adequate mix rate.

Grazing

See **Herbicide Carryover** on page one of this document.

A number of cover crops can be grazed prior to termination to improve the overall value of the cover crop. Check each cover crop to ensure that the crops pose no danger to livestock. A few examples are: (i) sorghum-sudan grass may cause prussic acid and nitrate poisoning if the young growth is grazed or if the crop is grazed after frost, (ii) seed of chickling vetch contain a neurotoxin that may cause illness, (iii) alsike clover may cause photo-sensitivity in horses and other livestock (especially white-skinned animals), (iv) turnips may cause copper toxicity in sheep, (v) red clover contains phytoestrogens that may complicate sheep breeding, and (vi) many of the legumes may cause bloat and should not be grazed when wet.

Living Mulches

Vegetable crop producers may consider using living mulches to prevent erosion, improve soil structure and microbial population, improve water relations, and provide beneficial insect habitat. Legume living mulches like Berseem clover provide supplemental N if they are mown and blown to adjacent cash crop rows.

Living mulches can be established before or after the cash crop is planted, and can be used alone or in combination with plastic mulch.

Typically, living mulches should be low-growing and tolerant of mowing. Living mulches should be mowed if becoming overly competitive or if going to seed.

TERMINATING COVER CROPS

Cover crops can be terminated as much as 5 days *after* the main crop is planted, but must be terminated prior to *crop emergence*.

In general, terminate cover crops at least 1-2 weeks prior to planting the cash crop. Note that winter cereal grains, such as rye, may produce a large volume of carbonaceous material that may tie up nitrogen for the following crop.

Monitor crop maturity carefully to time termination. When terminating cover crops by mowing or crimping, plants must often be in full flower or fully mature in order to completely kill. Avoid future weed problems by ensuring that cover crops are terminated prior to seed set (unless a reseeding of cover is the goal).

WEED CONTROL STRATEGY

The Maine Organic Farmers and Gardeners Association (MOFGA) (1), recommends the following: Plant Oats very early spring. Till in early summer. Plant a smother crop (buckwheat, Japanese millet or sorghum-sudan grass). In late summer, till in smother crop and plant oats or rye for fall cover. Between each crop, perform a weekly tillage of the ground for one to three weeks depending on weed severity. Be vigilant to prevent weeds from going to seed.

USDA United States Department of Agriculture
USDA-ARS Northern Great Plains Research Laboratory

Cover Crop Chart

AREA 4 SCD Cooperative Research Farm

GROWTH CYCLE	PLANT ARCHITECTURE	RELATIVE WATER USE
A = Annual	♈ = Upright	= Low
B = Biennial	✱ = Upright-Spreading	= Medium
P = Perennial	〰 = Prostrate	= High

COOL								WARM	
-- GRASS --	BROADLEAF								-- GRASS --
A BARLEY								A AMARANTH	A FOXTAIL MILLET
A OAT	A/B CANOLA	A/B CAMELINA	LEGUME					A BUCKWHEAT	A PEARL MILLET
A WHEAT	A/P MUSTARD	A PHACELIA	A FIELD PEA	A BERSEEM CLOVER	A/B VETCH	A SUNNHEMP	A CLUSTER BEAN	A QUINOA	A PROSO MILLET
A CEREAL RYE	A RADISH	A FLAX	A LENTIL	A CRIMSON CLOVER	P BIRDSFOOT TREFOIL	A CHICKPEA	A FAVA BEAN	P CHICORY	A GRAIN SORGHUM
A TRITICALE	B TURNIP	A KALE	A LUPIN	B/P RED CLOVER	A/B SWEET CLOVER	A COWPEA	A MUNG BEAN	A CUCURBITA	A SUDAN GRASS
A ANNUAL FESCUE	B BEET	A SPINACH	A/P MEDIC	P WHITE CLOVER	P SAINFOIN	A/P FENUGREEK	A SOYBEAN	A SAFFLOWER	A TEFF
P SALINE TOLERANT	A/B CARROT	A/B CHARD	P ROUNDHEAD LESPEDEZA	P KURA CLOVER	P ALFALFA	P PIGEONPEA	A/P PEANUT	A SUNFLOWER	A CORN

Characteristics of Some Common Cover Crops

Cool-Season Annual Grains

Winter Rye (*Secale cereale*)
Is the most reliable cool season cover crop. Rye establishes easily, produces a lot of biomass, and suppresses weeds. It can be planted the latest in fall and is the hardiest. The 'Aroostook' variety was developed for the Northeast for seeding after late harvested crops, and is recommended over Common Rye (VNS).

Rye may be killed by mowing or crimping after it forms a head, or earlier by chemical means. It may tie up N if not grown with a legume or if incorporated when too mature. It is generally incorporated when it is 12-18" tall, about 2 weeks before planting, or chemical killed prior to no-till planting. May be allelopathic if vegetables seeds are planted immediately after rye termination. Commonly mixed with hairy vetch or red clover.

Winter Wheat, Triticale, and Spelt (*Triticum spp.*)
Winter varieties of these grains are hardy cover crops that can suppress weeds and produce a moderate to high amount of biomass. Triticale is a cross between wheat and rye, and spelt is an ancient subspecies of wheat. Commonly mixed with peas, vetch, and clover. Hessian fly can be a problem with wheat and spelt harvested for grain, but is generally not a problem if used solely as a cover crop.

Wheat, Triticale, and Spelt will not produce as much biomass as rye, and therefore may not tie up as much N in the spring. Wheat is a good nutrient catch crop and prefers well-drained, fertile soils. Spelt may perform better on poor soils, and often out-performs other winter grains when seeding is late. Spring wheat can be planted in the early spring and will produce a lot of biomass later into the summer.

Spring Barley (*Hordeum vulgare*)
Is an easy to grow, deep-rooted crop that is good at controlling erosion, suppressing weeds, and producing biomass. It does poorly in wet, heavy soils, and is more drought tolerant than other small grains. It is commonly mixed with peas, oats, and crimson or red clover. Barley can be killed by mowing or rolling at milk stage. It will also winter kill in Maine.

Oats (*Avena sativa*)
Are commonly used as a spring and fall cover. Oats establish rapidly and are easily killed. They will winterkill in Maine. They provide good erosion control, and tend to leave a clean seedbed. Oats can be used by vegetable growers prior to early spring crops. They are commonly used as a nurse crop for permanent seedings that are done in spring.

Warm-Season Annual Grains

Buckwheat (*Fagopyrum esculentum*) is one of the quickest growing summer annuals, and is commonly used as a smother crop, nurse crop and insectary. Buckwheat tolerates poor soils and can extract nutrients from the soil. Plants mature in 6-8 weeks, and residue degrades rapidly. If mown prior to flowering, the crop should regrow. Buckwheat should be mown or incorporated into the soil before seed set so that it does not become a weed problem.

Sudangrass and **Sorghum-Sudangrass** (*Sorghum bicolor x S. bicolor var Sudanese*), Also known as Sudax, is a vigorous warm season grass that produces large amounts of biomass, increases organic matter, reduces compaction and nematodes, and can provide excellent forage and insect habitat. Can be mixed with a buckwheat nurse crop or with forage soybeans and cowpeas.
Sudax can be mowed 2-3 times when it reaches a height of 3-5 feet (leave at least 6" or 2 nodes for regrowth). Very responsive to nitrogen fertility. Sudax planted in mid-July will frost kill. Also good for emergency forage to replace a failed crop.

Japanese Millet (*Echinochloa esculenta*)**, Pearl Millet** (*Pennisetum glaucum*) and **Foxtail Millet** (*Setaria italica*)
Are drought and heat tolerant summer annuals

that produce a lot of biomass quickly. Plant Japanese and Foxtail millet early in June. Later plantings may be weak due to day length response. Commonly mixed with forage soybeans and cowpeas. Pearl millet is very tall and produces the most biomass. Pearl and Foxtail millet should mow kill, but Japanese millet will regrow. May also be used as emergency forage.

Teff (*Eragrostis tef*)
Is a fine-leaved African grain that shows a lot of potential as a living mulch. It is very drought tolerant, can be surface broadcast, does not need much mowing, and will not go to seed. Ensure a firm seedbed prior to planting. Teff is also a quality forage that can be grazed/hayed during dry summers.

Legumes

Red Clover (*Trifolium pratense*)
Is a short-lived cool season perennial that is often used as an annual. Red clover is deep-rooted, produces a lot of N, and provides beneficial insect/pollinator habitat. It tolerates poorly drained and acidic soils. It can be interseeded with many crops, such as small grains after planting, silage corn at last cultivation, or into vegetables before harvest. Red clover does very well when frost-seeded and mixed with small grains or annual ryegrass.

White Clover (*Trifolium repens*)
Is a low growing perennial that produces moderate levels of N, and tolerates traffic and close mowing. Common white clover is the lowest growing type that tolerates the most traffic and compaction. Dutch and New Zealand are intermediate, widely available types that are commonly used as living mulches. Ladino clover is the tallest white clover and produces the most nitrogen. White clover does well interseeded or frost seeded, and is often mixed with annual ryegrass, small grains, or red clover.

Alsike Clover (*Trifolium hybridum*)
Is an upright hybrid of red and white clover that produces more N than intermediate types and does the best in poorly drained soil. Alsike can cause sun sensitivity in horses and some other livestock, especially white animals.

Yellow Sweetclover (*Melilotus officinalis*) is a highly productive biennial legume and **White Sweetclover** (*Melilotus alba*) is an annual. Sweetclover produces a lot of N and biomass, has a deep root that breaks up hardpan, scavenges phosphorus, and provides beneficial insect habitat. It is better suited for well drained and droughty sites. Yellow sweetclover will mow-kill after flowering in the second year. Use yellow sweetclover only if it will be grown through the second year, otherwise use annual or 'Hubam'. Prefers spring seeding*. Caution: Hard seed may remain viable in soil for years.*

Crimson Clover (*Trifolium incarnatum*)
Is an annual legume that will winter kill like oats. It establishes easily, produces a moderate to high amount of N and biomass, suppresses weeds, and has beautiful flowers that attract a lot of beneficial insects and pollinators. Select regionally-adapted varieties for improved cold hardiness.
Crimson clover is easily crimped with a lasting residue. It has potential to be frost seeded, crimped, and used as mulch for late planted no-till pumpkin transplants. Often mixed with annual ryegrass, small grains, and brassicas. *Caution: may support nematodes that impact tomatoes.*

Subterranean Clover (*Trifolium subterraneum*)
Is a low growing, self-seeding annual hardy to 0-15º F. It produces a moderate amount of N, provides beneficial insect habitat and is best used as a living mulch. It is a shade tolerant crop that tolerates wet soils, acidic soils, mowing and grazing. Subterranean clover and teff may make a great living mulch. Subterranean clover will reseed and should be mowed or killed prior to seeding if growing leafy greens or other crops where it could be a problem.

Berseem Clover (*Trifolium alexandrinum*)
Is a summer annual with traits similar to subterranean clover. It is a quick growing, heavy N producer that tends to be used as a living

mulch. It establishes well with an oat nurse crop, and tolerates most soils except sands. Mix with teff, ryegrass or small grains.

Hairy Vetch (*Vicia villosa*)
Is the most commonly used cool season legume. It is very winter hardy, an excellent N producer, increases nutrient availability, and provides beneficial insect habitat. It is slow to establish and often needs to be grown late into the spring/early summer to produce maximum N. It can provide sufficient nitrogen for many vegetable and late planted crops, and can supply a portion of N for corn. Requires a lot of P and K. Smothers spring weeds. Commonly planted with winter cereals. Can be mow-killed when it reaches full flowering.

Chickling Vetch (*Lathyrus sativus*)
Is an annual legume used that is a heavy N producer and is commonly used as a living mulch. It nodulates earlier than most legumes and produces a lot of nitrogen early on. It does well under low soil moisture and most soil conditions, yet does not establish well if broadcast. Mow before flowering if regrowth is desired.

Field Pea (*Pisum sativum*)
Is also known as Canadian Field Pea or Austrian Winter Pea. It is a large seeded, cool-season annual that produces a large amount of nitrogen. Peas generally require support from another cover crop, and should be grown with another small grain like oats. Peas make for a good companion crop as long as the seed is planted deep enough. Though they are cold-tolerant, peas will winterkill.

Soybean (*Glycine max*) **and Cowpea** (*Vigna unguiculata)*
Are summer legumes that produce a lot of N and are best grown with sorghum- sudangrass or millets. Soybean is more cold tolerant than cowpea and tends to produce more biomass and N, though it is more susceptible to pests and drought. Use regionally adapted forage varieties for maximum benefit. Cowpea requires warmer conditions than soybean, but is more tolerant of poor soils, drought, heat, and pests. Cowpea grows quickly, suppresses weeds, and provides beneficial insect habitat.

Alfalfa (*Medicago sativa*)
Is a perennial cool- season legume that is a superior N fixer, reduces soil compaction, and provides habitat for beneficial insects. It prefers well-drained, fertile soils near pH 7, and is best grown with a small grain nurse crop or perennial grass. Choose varieties with a fall dormancy class of 1-4. More hardy varieties (closer to class 1) tend to yield higher in the spring, but mature later.

Brassicas

Brassicas can be especially useful for planting after early vegetable crops. Brassica cover crops are well-suited for scavenging residual nitrogen in the fall because they grow rapidly during periods of cool weather. Some Brassicas are used to reduce the level of soil pathogens through biofumigation; however, ***Brassica cover crops should not be used before or after other Brassica vegetables***. Mix with annual ryegrass and clovers.

Forage Radish (*Raphanus sativus*) , **Forage Turnip** (*Brassica rapa*), and **Tillage Radish**
Are deep-rooted cover crops that can reduce surface and subsoil compaction, scavenge nitrogen, and suppress weeds. Plant early enough to ensure that roots mature and grow deep. Will winterkill and leave a clean seedbed for early vegetable crops. Can also spring seed for early cover. *Do not let it go to seed.*

Mustard and Canola (*Brassica* spp.) Grows rapidly in the spring and fall and can produce abundant biomass. These species are effective at scavenging nutrients, preventing erosion, and decreasing soil-borne pathogens. *Caution: do not let them go to seed and become a weed problem.*

Arugula (*Eruca sativa*)
Is an effective biofumigant that will overwinter. Mow and incorporate in the spring before seed

set and seal soil with plastic, irrigation, or by rolling for at least 10 days.

Grasses

Annual and **Perennial Ryegrass** (*Lolium* spp.)

Are cool season grasses with a high utility value because they establish easily when surface broadcast and can be interseeded, frost-seeded, and dormant seeded. Ryegrass produces a tremendous amount of biomass, reduces surface compaction, scavenges nutrients, and is a strong erosion fighter. Annual varieties tend to be cheaper than perennial, are used as cool- and warm-season cover, and are used as living mulches. Southern varieties will winterkill, whereas regionally adapted annual varieties may overwinter in warmer areas of northern New England. Perennial rye may be short-lived. Both are heavy feeders and will not do well in poor soils.

Orchardgrass (*Dactylis glomerata*) and **Timothy** (*Phleum pratense*)

Are perennial grasses that are commonly used as forages. They are highly productive and should be planted with clovers. Like alfalfa and sweetclover, these grasses are best used as a cover crop if grown for a full season and terminated in the second year. *Caution: May become a weed problem if allowed to go to seed.*

RESOURCES

MOFGA's "Using Green Manures" factsheet http://www.mofga.org/Publications/FactSheets/tabid/133/Default.aspx

Clark (ed.). 2007. Managing cover crops profitably. 3rd ed. Sustainable Agriculture Network Handbook Series. http://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition

Magdoff, F. and H. van Es. 2009. Building Soils for Better Crops. 3rd ed. Sustainable Agriculture Network Handbook Series. http://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition

Table 1. "Aroostook" Winter Rye Rates – Bushels/Acre*

Location	September				October			
	15	20	25	30	5	10	15	20
Caribou	2.0	3.5	5.5	---	--	--	--	--
Houlton	2.0	2.5	4.5	5.5	--	--	--	--
Corinna	2.0	2.0	2.0	3.5	5.5	--	--	--
Bridgton (1)	2.0	2.0	2.0	2.0	3.0	--	--	--
Portland (1)	2.0	2.0	2.0	2.0	3.0	4.0	5.0	--

The "Aroostook" variety performs better for short establishment time frames of Maine. These rates and dates do not apply to other varieties. One Bushel weighs approximately 56 pounds.

 Rating: Above Average (✓+); Average (✓); Below Average/Unknown (✓-). Blank = Not Recommended

Table 2 - Choosing a Cover Crop	Purpose									Other Roles & Characteristics										
Cover Crop	Reduce Erosion	Increase SOM	Recycle Nutrients	Fix Nitrogen Save Energy	Improve Biodiversity	Suppress Weeds	Remove Excess Soil Moisture	Loosen Topsoil	Reduce Subsoil Compaction	Grazing Potential	Living Mulch	Broadcast Interseed	Companion Crop	Nurse Crop	Reduce Soil Diseases	Rapid Growth	Drought Tolerant	Flooding Tolerant	Shade Tolerant	Reseeds (Potential Weed!)
Cool-Season Grains																				
Winter Rye (Common)	✓+	✓+	✓+			✓+	✓+	✓+		✓-		✓		✓	✓	✓	✓	✓-	✓	✓
Winter Rye (*Aroostook*)	✓+	✓+	✓+			✓+	✓+	✓+		✓-		✓		✓	✓	✓+	✓	✓-	✓	✓
Triticale and Spelt	✓	✓+	✓			✓	✓+	✓	✓-	✓				✓+		✓	✓-			
Wheat	✓	✓+	✓			✓	✓+	✓	✓-	✓				✓+		✓	✓-		✓-	✓-
Barley	✓+	✓+	✓		✓-	✓	✓	✓	✓-	✓				✓+	✓-	✓	✓		✓-	✓
Oats	✓-	✓	✓-			✓+	✓	✓		✓-	✓-	✓-	✓+	✓+	✓-	✓+		✓-		
Warm-Season Grains																				
Buckwheat		✓-	✓+		✓+	✓+		✓					✓+	✓		✓+				✓+
Sorghum/Sudangrass	✓+	✓+	✓+		✓-	✓+	✓-	✓-	✓+	✓					✓	✓+	✓+	✓-	✓-	✓-
Japanese/Foxtail Millet	✓	✓+	✓			✓+		✓		✓+				✓		✓	✓+			✓-
Pearl Millet	✓	✓+	✓			✓+		✓		✓-						✓	✓+			✓-
Teff	✓+	✓	✓-			✓-		✓+		✓+	✓+	✓-	✓-	✓			✓+			
Legumes																				
Red Clover	✓-	✓	✓	✓	✓+	✓-	✓	✓-	✓	✓+		✓+	✓+					✓-	✓	
White or Alsike Clover	✓	✓		✓	✓	✓	✓	✓		✓+	✓	✓	✓				✓-	✓	✓	✓+
Berseem Clover	✓	✓+	✓+	✓+	✓-		✓+	✓		✓+	✓+	✓	✓	✓		✓+	✓-	✓-	✓	
Sweetclover	✓	✓+	✓+	✓+	✓+	✓	✓	✓+	✓+	✓						✓-	✓+			✓-
Crimson Clover	✓	✓		✓	✓+		✓-	✓-		✓+		✓+	✓+			✓-			✓	✓+
Subterranean Clover	✓	✓		✓	✓	✓+	✓+	✓-		✓	✓+	✓+	✓+			✓-	✓	✓-	✓	✓+
Alfalfa	✓	✓+		✓+	✓		✓		✓+	✓+										
Hairy Vetch	✓-	✓+	✓-	✓+	✓	✓	✓	✓	✓-	✓-	✓-	✓	✓		✓-		✓-		✓-	✓-
Chickling Vetch	✓	✓	✓-	✓+	✓-	✓	✓	✓		✓+	✓	✓	✓				✓-		✓-	✓-
Field Pea	✓	✓		✓+	✓		✓	✓		✓			✓+	✓	✓	✓	✓-			
Soybean	✓-	✓		✓+				✓		✓			✓+				✓			
Cowpea	✓+	✓	✓-	✓+	✓	✓+		✓	✓-	✓-			✓			✓	✓		✓-	
Brassicas																				
Radish or Turnip	✓	✓	✓+			✓+		✓-	✓+	✓-		✓	✓-			✓			✓-	✓-
Mustard or Canola	✓	✓	✓		✓-	✓-		✓		✓-		✓	✓-	✓-	✓+	✓	✓		✓-	✓+
Arugula	✓	✓-	✓-					✓				✓			✓+	✓			✓-	✓-
Grasses																				
Annual Ryegrass	✓+	✓+	✓+			✓+	✓+	✓+		✓+	✓	✓+	✓+	✓+	✓-	✓		✓	✓	✓+
Perennial Ryegrass	✓+	✓+	✓+			✓	✓+	✓+		✓+	✓	✓+	✓	✓	✓-	✓		✓	✓	✓
Orchardgrass	✓+	✓+	✓-			✓	✓+	✓		✓+		✓				✓		✓	✓-	✓
Timothy	✓+	✓+	✓-			✓	✓+	✓		✓		✓-						✓-		✓

Table 3	Min. Seeding Rate (lbs/acre)		Seeding Depth	Latest Seeding Dates* (USDA Hardiness Zones 3b – 5a)			Primary Purpose**			Termination Method				
Individual Cover Crops	**Broadcast (Includes aerial apply)**	**Drilled or Planted**	**Inches**	**Fall Cover**	**Winter Cover**	**Summer Cover**	**Erosion**	**Nitrogen Fixation**	**Nutrient Scavenge**	**Mow**	**Till**	**Crimp**	**Winter**	**Chemical**
Cool-Season Grains														
Winter Rye	112	75	1-2	Aug. 15	Oct. 1	NA	x		x	x	x	x		x
Winter Triticale/Wheat/Spelt	112	75	1-2	Aug. 15	Oct. 1	NA	x		x	x	x	x		x
Spring Wheat, Triticale, Barley	100	75	1-2	Aug. 15	Sept 15	June 1	x		x	x	x	x	x	x
Oats***	112	75	1-2	Aug. 15	Sept 15	June 1	x		x	x	x	x	x	x
Warm-Season Grains														
Buckwheat	70	60	½-1½	Sept 15	April 15	June 1	x		x	x	x		x	x
Sorghum/Sudangrass	50	35	½-1½	Aug. 15	Aug. 15	July 1	x		x	x	x		x	x
Japanese/Foxtail Millet	40	25	½-1½	Aug. 1	Aug. 1	July 1	x		x	x	x		x	x
Pearl Millet	30	20	¼-½	Aug. 1	Aug. 1	July 1	x		x	x	x		x	x
Legumes														
Red Clover	12	10	¼-½	Aug. 15	Aug. 15	May 15		x			x			x
White or Alsike Clover	10	8	¼-½	Aug. 15	Aug. 15	May 15		x			x			x
Berseem Clover	18	10	¼-½	Aug. 15	Aug. 15	May 15		x			x		x	x
Sweetclover	15	8	¼-½	Aug. 15	Aug. 15	May 15		x		x	x			x
Crimson Clover	25	20	¼-½	Aug. 15	Aug. 15	May 15		x			x	x	x	x
Subterranean Clover	25	15	¼-½	Aug. 15	Aug. 15	May 15		x			x			x
Alfalfa	20	15	¼-½	Aug. 15	Aug. 15	May 15		x			x			x
Hairy Vetch	35	20	½-1½	Aug. 15	Sept 15	April 15		x		x	x	x		x
Field Pea/Winter Pea***	100	65	½-1½	Aug. 15	Sept 1	April 15		x		x	x		x	x
Soybean	120	90	1-2	Aug. 1	NA	June 15		x		x	x		x	x

Table 3 (Continued)	Min. Seeding Rate (lbs/acre)		Seeding Depth	Latest Seeding Dates* (USDA Hardiness Zones 3b – 5a)			Primary Purpose**			Termination Method				
Individual Cover Crops	**Broadcast (Includes aerial apply)**	**Drilled or Planted**	**Inches**	**Fall Cover**	**Winter Cover**	**Summer Cover**	**Erosion**	**Nitrogen Fixation**		**Mow**	**Till**	**Crimp #**	**Winter**	**Chemical**
Sunn Hemp	50	30	½-1	July 15	NA	June 15				x	x	x	x	x
Cowpea	100	60	¾-1½	July 1	NA	June 15		x		x	x		x	x
Brassicas														
Forage Brassicas (Radish, Turnip, Spring Canola)	15	10	¼-½	Aug. 15	Sept 1	May 15	x				x		x	x
Mustard	10	6	¼-½	Aug. 15	Aug. 15	May 15	x				x		x	x
Winter Canola	10	6	¼-½	Aug. 15	Sept 15	May 15	x				x			
Grasses														
Annual Ryegrass	30	20	0-½	Aug. 15	Sept 1	May 15	x				x		1	x
Perennial Ryegrass	35	25	0-½	Aug. 15	Sept 1	May 15	x				x			x
Orchardgrass	20	15	0-½	Aug. 15	Sept 1	May 15	x				x			
Timothy	15	10	0-½	Aug. 15	Sept 1	May 15	x				x			
Teff	8	5	0-¼	Aug. 1	Aug. 1	July 1	x		x	x	x		x	x

**Locations in USDA Hardiness Zone 5b may plant up to 5 days later for the Fall and Winter Cover dates.*
***Other purposes may also be accomplished, but this is meant to help you select cover crops to address the primary resource concern in the conservation plan.*
**** If using as a nurse/companion crop, seed at half the rate.*
 # Crimping must be done at the proper physiological stage of the plant to be effective. A combination of crimping and spraying may be most effective.
1 May not winter kill

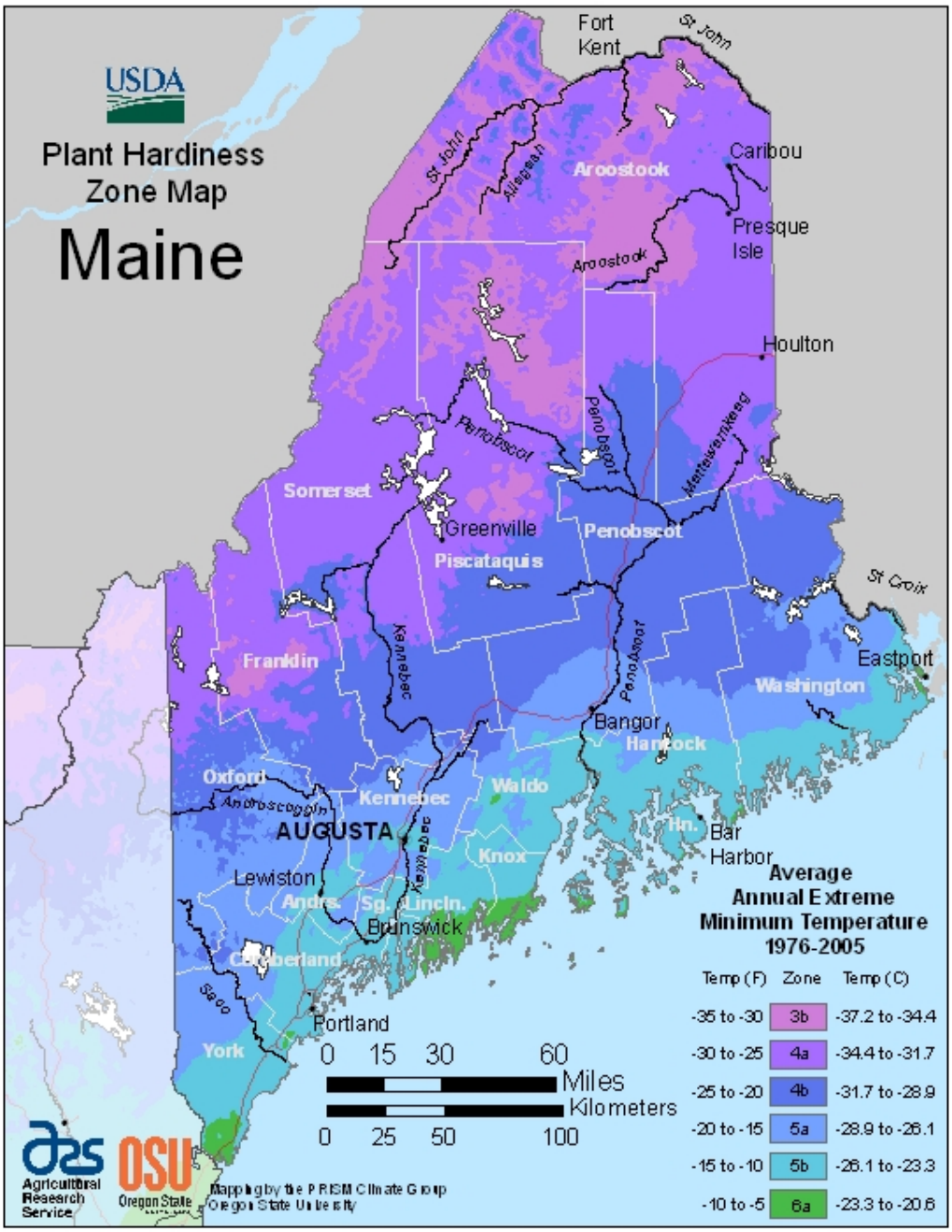
See Plant Hardiness Zones Map last page.

Table 4	Min. Seeding Rate (lbs/acre)		Seeding Depth	Latest Seeding Dates* (USDA Hardiness Zones 3b – 5a)			Primary Purpose**		
Cover Crop Mixes	**Broad - cast (Includes aerial apply)**	**Drilled or Planted**	**Inches**	**Fall Cover**	**Winter Cover**	**Summer Cover**	**Erosion**	**Nitrogen Fixation**	**Nutrient Scavenging**
1									
Ryegrass-annual or perennial	20	15	¼-½	Aug. 15 ∞	Sept 1	May 15	x		x
Radish/Canola/Turnip/Rapeseed	4	3		Aug. 1					
2									
Winter Small Grain	85	60	½	Aug. 15 ∞	Sept 15	NA	x		x
Radish/Canola/Turnip/Rapeseed	4	3		Aug. 1					
3									
Spring Small Grain	85	60	½	Aug. 15 ∞	Sept 1	May 15	x		x
Radish/Canola/Turnip/Rapeseed	4	3		Aug. 1					
4									
Spring Small Grain	85	60	¾	Aug. 15 ∞	Aug. 15	May 15	x		x
Mustard	4	3		Aug. 1					
5									
Winter Small Grain	60	40	½	Aug. 15 ∞	Sept 1	NA	x	x	x
Red Clover	6	5		Aug. 1					
Radish/Canola/Turnip/Rapeseed	4	2							
6									
Ryegrass-annual or perennial	15	12	¼-½	Aug. 15	Sept 1	May 1	x	x	x
Red Clover	8	6							

Table 4 (continued)	Min. Seeding Rate (lbs/acre)		Seeding Depth	Latest Seeding Dates* (USDA Hardiness Zones 3b – 5a)			Primary Purpose**		
Cover Crop Mixes	**Broad - cast (Includes aerial apply)**	**Drilled or Planted**	**Inches**	**Fall Cover**	**Winter Cover**	**Summer Cover**	**Erosion**	**Nitrogen Fixation**	**Nutrient Scavenging**
7									
Winter Small Grain	70	56	1-1½	Aug. 15	Sept 1	May 1	x	x	x
Hairy Vetch	20	15							
8									
Winter Small Grain	85	60	½	Aug. 15	Sept 1	April 1	x	x	x
Clover- Red, Ladino, Berseem,	8	6							
9									
Winter Small Grain	70	56	1	Aug. 15	Sept 1	NA	x	x	x
Austrian Winter Pea	60	40							

**Locations in USDA Hardiness Zones 5b and 6a may plant up to 5 days later for the Fall and Winter Cover dates.*
***Other purposes may also be accomplished, but this is meant to help you select cover crops to address the primary resource concern.*
∞ In Plant Hardiness Zones 3b and 4a, mixes with brassicas should be seeded by Aug. 1 for fall cover.

See Plant Hardiness Zones Map last page.


USDA
Plant Hardiness Zone Map
Maine
Fort Kent
St John
Caribou
Aroostook
Presque Isle
Houlton
Penobscot
Somerset
Greenville
Piscataquis
Penobscot
St Croix
Eastport
Washington
Franklin
Kennebec
Bangor
Hancock
Oxford
Androscoggin
Kennebec
Waldo
AUGUSTA
Kennebec
Knox
Bar Harbor
Lewiston
Andrs.
Sg.
Lincln.
Brunswick
Cumberland
Saco
Portland
York
0 15 30 60 Miles
0 25 50 100 Kilometers
Average Annual Extreme Minimum Temperature 1976-2005
Temp (F) Zone Temp (C)
-35 to -30 3b -37.2 to -34.4
-30 to -25 4a -34.4 to -31.7
-25 to -20 4b -31.7 to -28.9
-20 to -15 5a -28.9 to -26.1
-15 to -10 5b -26.1 to -23.3
-10 to -5 6a -23.3 to -20.6
Agricultural Research Service
OSU Oregon State University
Mapping by the PRISM Climate Group Oregon State University