

Establishing and Maintaining Introduced Grasses and Legumes

INTRODUCTION

This technical note will provide guidance for the establishment of introduced (non-native) plantings of perennial herbaceous vegetation for the purpose of meeting the criteria in Wisconsin Natural Resources Conservation Service (NRCS), Field Office Technical Guide (FOTG), Section IV, Practice Standards 327, Conservation Cover; 645, Wildlife Upland Habitat Establishment; 342, Critical Area Planting; and 512, Forage and Biomass Planting. Additional ecological and engineering standards will reference this technical note. Refer to those standards for specific practice purposes and requirements.

BACKGROUND

Introduced stands of perennial herbaceous vegetation have the potential to control soil erosion and sedimentation, improve water quality, and create or enhance wildlife habitat if properly established and maintained.

Introduced species are typically easier and less expensive to establish than native grasses and forbs.

Seed sources are readily available, relatively inexpensive, and establishment methods are widely understood using common agricultural equipment.

Introduced plantings can provide high quality wildlife habitat with some degree of routine maintenance and cover management. These species will require some reoccurring interseeding to maintain a diverse plant community. Legumes adapted to wet and wet-mesic sites are typically short lived and will require routine reseeding to maintain plant diversity.

Introduced plantings are better adapted to the typical growing conditions in the Northern Planting Zone and tend to thrive in areas where sunlight intensity is moderate, temperature is moderate, and water is readily available. These plants produce most of their growth during the spring, late summer, and early fall when the soil and air temperatures are cooler. For this group of plants, the minimum air temperature for active shoot growth is 40-42 degrees F. Growth is maximized at 65-75 degrees F.

For erosion control, on critical areas, introduced species are the preferred vegetation.

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SITE ASSESSMENT

Introduced plants are generally adapted to one or more soil moisture regimes: wet, wet-mesic, mesic, dry-mesic, and dry. These moisture regimes correlate to some degree with both drainage classes and forage suitability groups.

Drainage classes refer to the frequency and duration of wet periods under conditions similar to those under which the soil formed naturally. Alterations of the water regime by human activities are not considered in this case. These soil moisture regimes fall into one or more of the seven natural soil drainage classes.

Forage suitability groupings are an additional tool to provide guidance to planners. Forage Suitability Groups (FSG) are pasture and hay land soil interpretation reports that provide users with forage production guidance for the soils and climatic conditions present in their area of interest. The vast majority of forage plants utilized in Wisconsin are introduced grasses and legumes. For the purpose of this technical note, FSGs will focus on available water capacity, water table, and runoff potential. FSGs are divided into ten categories.

There is often no sharp division between moisture regimes, drainage classes and forage suitability groups, and oftentimes they blend or overlap into multiple categories. Understanding soil conditions plays an important role when planning a successful introduced herbaceous planting.

Refer to Table 1 correlating the five moisture regimes, seven drainage classes, and ten forage suitability groups.

SPECIE SELECTION AND SEED QUALITY

Evaluate the winter hardiness of species selected for planting. To ensure stand longevity, species listed as Hardy (H) or Very Hardy (VH) in Tables 2-8 of Wisconsin Circular A-1525, Forage Crop Variety Yield Trials for Wisconsin, are preferred. Varieties listed as Moderately Hardy-Plus (MH+) are acceptable.

Select species based on the site conditions looking closely at soil type and moisture regime. Tables 1, 2 and 3 will provide additional guidance for selecting species appropriate for the site conditions.

The recommended introduced species, listed in Table 2, are not identified as prohibited or restrictive

for planting statewide in accordance with Natural Resource Law 40, Invasive Specie Control.

However, Kentucky Bluegrass, Smooth Bromegrass, Redtop, Birdsfoot Trefoil, Red and White Clover are species that can propagate and spread with little difficulty due to their growth characteristics and should be evaluated carefully when plantings are planned in the vicinity of native remnants or natural areas.

- It is suggested that seed purchased be harvested within a 250 mile radius of the area where the planting will occur. This suggestion is less critical for introduced versus native species.
- For pollinator habitat, the recommended introduced bunch grasses are Orchardgrass, Tall Fescue, Perennial Ryegrass, and Timothy. Refer to Table 9 for introduced pollinator habitat mixtures.
- Kentucky Bluegrass, Bromegrass, and Redtop are examples of sod-forming plants. Refer to Table 8 for additional examples.

Introduced mixtures for wildlife habitat must contain at least 50 percent grass seed per square foot. The exception to this criteria is the establishment of pollinator habitat.

Introduced mixtures for areas with shrub and tree plantings are not required to contain 25 percent sod forming grass seed per square foot. These seed mixtures must still contain at least 50 percent grass seed per square foot. Sod-forming grasses are not recommended in shrub and tree plantings.

Below are species with multiple scientific names. The underlined specie is the most recognized genus and specie in Wisconsin and is referenced as such in vegetative Standards 327, Conservation Cover; 342, Critical Area Planting; and 512, Forage and Biomass Planting.

- **Tall Fescue:** Schedonorus arundinaceus, Lolium arundinacea, Festuca arundinacea
- **Meadow Fescue:** Schedonorus pratense, Lolium pratense

Pure Live Seed

Pure Live Seed (PLS) is a means of expressing seed quality.

PLS is the percentage of seed in a seed lot that is both pure seed and viable seed. Pure seed is the percentage by weight of the seed (kind, cultivar,

variety) that is under consideration. Inert matter, weed seed, and other crop seed is excluded from pure seed. Total Viable Seed (TVS) is the percentage estimate of the potential for germination, which includes percent hard seed and/or dormant seed.

Example: Pure Live Alfalfa Seed

(1) XYZ Seed Company, 1000 Crop Seed Lane, Ft. Collins, CO	
(2) Alfalfa, VNS	(6) Germination: 92%
(3) Lot number: 1234	Hard seed: 5%
(4) Pure Seed: 99.00%	Dormant seed: --
Other Crop: 0.25%	T.V.S.: 97%
Weed Seed: 0.10%	(7) Date Tested: 10/2000
Inert material: 0.65%	(8) Origin: CO
(5) Noxious weed seed: dodder 1 per lb.	(9) Seed Treatment: none

$$\text{Pure seed} \times \text{TVS} = \text{PLS}$$

$$99\% \times 97\% = 96.03\%$$

The PLS for Lot number 1234 is 96.03%.

Nearly all species recommended for conservation plantings by NRCS uses PLS expressed in pounds or ounces per acre which is calibrated to seeds per square foot.

Seeding rates in this technical note are shown in pounds or ounces and seeds per square foot per acre.

Inoculation

Legumes are unique plants which have the ability to work with certain strains of bacteria (Rhizobia) to gather atmospheric nitrogen from the soil atmosphere and convert it to useable ammonia nitrogen. Nitrogen produced by this symbiotic relationship is virtually free and results not only in improved soil fertility, but increased protein and forage production in the legume host plant for the benefit of domesticated and wildlife heterotrophs.

Inoculate legume seed with the appropriate inoculant. Inoculants must not be exposed to sunlight or allowed to dry out prior to planting legumes.

CRITERIA FOR SEED MIXTURE DEVELOPMENT

Seed mixtures can consist of a grass component only or a grass and legume component, depending on the standard criteria and the purpose of the planting. Custom seeding mixtures can be developed from selected species listed in Table 2.

For other ecological Wisconsin standards such as Field Border (386), the planner will need to review the standard to determine the specific seeding

requirements for the intended purpose. The Field Border standard will direct the planner to use Standard 342, Critical Area Planting, for erosion concerns and Standard 327, Conservation Cover, when the purpose or concern is for establishing pollinator habitat. This also includes Wisconsin engineering standards such as Standard 635, Waste Treatment Strips.

It is important to reference program rules when determining seed mixtures. Some programs have preapproved required mixtures to meet program and cost requirements.

Conservation Cover (327)

Introduced Species

1. Wildlife Habitat Planting

A minimum of two grasses seeded at a minimum rate of 70 grass seeds per square foot, and at least one legume seeded at a minimum of 30 seeds per square foot.

Fifty percent of the seeds per square foot will comprise of grasses.

Refer to Table 7 for example mixtures.

For dormant and frost seedings, increase seeds per square foot by 15 percent.

2. Herbaceous Pollinator Habitat

At least one and a maximum of two bunch grasses seeded at a maximum rate of 30 seeds per square foot and a minimum of two legumes seeded at a minimum rate of 40 seeds per square foot.

Fifty percent of the seeds per square foot comprising of grasses is not a seed requirement for pollinator habitat planting mixtures.

For dormant and frost seedings, increase the seeds per square foot by 15 percent.

Critical Area Planting (342)

Introduced Species

- A minimum of 160 seeds per square foot for a solid grass planting or in combination with legumes.
- Fifty percent of the seeds per square foot will comprise of grasses and 25 percent of the seed

per square foot will consist of sod-forming grasses.

- For dormant seedings, increase the seeds per square foot by 15 percent.

Dormant seeding can be used when planting introduced species on concentrated and non-concentrated flow areas. When using dormant seedings on concentrated flow areas, the site must be mulched according to Standard 484, Mulching. Frost seeding is not an approved seeding method when using this standard.

Refer to Table 8 for example mixtures.

Forage and Biomass Planting (512)

Introduced Species

1. Pasture and Hayland Planting

- For pasture plantings, mixtures will have at least 1 grass and 1 legume. The mixture will have at least 50 percent grass seeds per square foot, and the total mix will have at least 60 seeds per square foot.
- For hayland establishment, mixtures and single specie plantings may be used as long as the total seeding rate is at least 60 seeds per square foot.

2. Interseeding of Grasses/Legumes Into Existing Pastures and Haylands

- Seeding rate is half of the pure stand seeding rate as specified in Table 2. Seeds per square foot for legumes will vary according to specie.
- Frost seeding is approved only for legumes into existing pastures at a seeding rate of two-thirds the recommended pure stand seeding rate.

Refer to Table 10 for pasture and hayland planting seed mixtures.

Table 1
Relationship Between Moisture Regimes, Drainage Classes, and Forage Suitability Groups

Moisture Regimes	Drainage Class	Forage Suitability Group
Wet Wet mineral or organic soils are typified by very poorly drained soil types.	Very poorly drained Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season and mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded.	FSG 7 High water holding capacity, seasonal high water table, excessively wet, subject to ponding and flooding. FSG 10 High water holding capacity, seasonal high water table, organic surface layers, subject to ponding and flooding.
	Very poorly drained Somewhat poorly drained Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops.	FSG 7, FSG 10 FSG 4 Moderate water holding capacity, generally sandy, seasonal high water table, excessively wet for half of growing season. FSG 7, FSG 10
Mesic Mesic sites will be found on most moderately well and well drained mineral soils which have moderate to very high Available Water Capacity. Mesic sites may occur on some somewhat poorly drained soils with low or very low Available Water Capacity.	Somewhat poorly drained Moderately well drained Water is removed from the soil somewhat slowly during some periods of the year. The soils are wet for only a short time within the rooting depth during the growing season.	FSG 4, FSG 7, FSG 10 FSG 1 Low water holding capacity, generally sandy, seasonal high water table. FSG 4 FSG 5 Moderate water holding capacity, no seasonal high water table, at times seasonal droughtiness, less than 12% slope. FSG 6 Moderate water holding capacity, no seasonal high water table, seasonal droughtiness, greater than 12% slope, runoff concerns. FSG 8 High water holding capacity, no seasonal high water table, less than 12% slopes.
	Well drained Water is removed from the soil readily but not rapidly. Water is available to plants throughout most of the growing season. Wetness does not inhibit growth of roots.	FSG 1, FSG 5, FSG 6, FSG 8 FSG 9 High water capacity, no seasonal high water table, runoff concern.
	Moderately well drained Well drained Somewhat excessively drained Water is removed from the soil rapidly. The soils are commonly coarse-textured.	FSG 1, FSG 4, FSG 5, FSG 6, FSG 8 FSG 1 FSG 2 Low water holding capacity, generally sandy, no seasonal high water table, 0 to 12% slopes. FSG 3 Low water holding capacity, generally sandy, no seasonal high water table, greater than 12% slopes, seasonal droughtiness. FSG 5, FSG 6 FSG 1, FSG 2, FSG 3, FSG 5, FSG 6
Dry Dry sites occur mostly on well to excessively drained soils.	Well drained Somewhat excessively drained Excessively drained	FSG 1, FSG 2, FSG 3, FSG 5, FSG 6 FSG 2, FSG 3, FSG 6 FSG 2, FSG 3

Table 2
Common Species and Recommended Pure Stand Seeding Rates

Name	Genus and species	Plant Type	Moisture Regime	Single Species Seeding Rate (PLS) Lbs./Acre	Seeds/Lb.	Seeds/Ft ² /Lb./Ac.
Chewings Red Fescue	Festuca rubra L. ssp fallax	Grass	D, DM, M	5	350,000	8
Creeping Red Fescue	Festuca rubra	Grass	DM, M, WM	5	350,000	8
Festulolium	Festuca X Lolium	Grass	DM, M, WM	12	227,000	5.2
Italian or Annual Ryegrass	Lolium perenne L. ssp. multiflorum	Grass	DM, M, WM	20	227,000	5.2
Kentucky Bluegrass	Poa pratensis	Grass	D, DM, M, WM, W	8	2,177,000	50
Meadow Fescue	Schedonorus pratensis	Grass	DM, M, WM	12	227,000	5.2
Orchardgrass	Dactylis glomerata L.	Grass	D, DM, M, WM	10	653,000	15
Perennial Ryegrass	Lolium perenne	Grass	DM, M, WM	20	227,000	5.2
Redtop	Agrostis gigantea	Grass	M, WM, W	4	4,990,000	114.5
Smooth Bromegrass	Bromus inermis	Grass	D, DM, M, WM	20	136,000	3.1
Tall Fescue	Schedonorus arundinaceus	Grass	D, DM, M, WM	12	227,000	5.2
Timothy	Phleum pratense	Grass	DM, M, WM, W	8	1,230,000	28.2
Alfalfa	Medicago sativa	Legume	D, DM, M	12	219,000	5.0
Alsike Clover	Trifolium hybridum	Legume	M, WM, W	3	680,000	15.6
Birdsfoot Trefoil	Lotus corniculatus	Legume	DM, M, WM, W	7	375,000	8.6
Red Clover	Trifolium pratense	Legume	DM, M, WM	10	275,000	6.3
White Ladino Clover	Trifolium repens	Legume	DM, M, WM	3	871,650	20

Table 3
Plant Morphology and Physiology Characteristics

Common Name <i>Scientific Name</i>	Plant Type	Growth Habit	Practice Recommendation	Pure Stand Rate	Seeds per Ft ² /Lb/Ac.	Wildlife Value	Retardance	Pollinator Habitat	Deep Rooted	Moisture Regime	Forage Suitability Group	pH	Flood Tolerance	Average Height at Maturity	Drought
Grasses															
Chewings Red Fescue <i>Festuca rubra L. ssp. fallax</i>	grass	perennial, cool season sod-forming	342, 512	5 lbs/ac	8	poor	D	no	no	D-M	2, 3, 5, 6, 8, 9	5.0 - 7.5	poor	1.5'	yes
Creeping Red Fescue <i>Festuca rubra</i>	grass	perennial, cool season sod-forming	342, 512	5 lbs/ac	8	poor	D	no	no	DM-WM	1, 4 to 9	5 - 7.5	poor	2'	yes
Festulolium <i>Festuca x Lolium</i>	grass	short-lived annual bunchgrass	342, 512	12 lbs/ac	5.2	fair	C	yes	no	DM-WM	1 to 9	5.0 - 7.5	moderate	1.5 - 2.0'	moderate
Italian (Annual) Ryegrass <i>Lolium perenne L. ssp. multiflorum</i>	grass	short-lived annual bunchgrass	327, 342, 512	12 lbs/ac	5.2	fair	C	yes	no	DM-WM	1, 4 to 9	5.0 - 7.5	moderate	1.5 - 2.0'	moderate
Kentucky Bluegrass <i>Poa pratensis</i>	grass	long-lived perennial cool season plant, sod-forming by rhizomes	327, 342, 512	8 lbs/ac	50	poor	D	no	no < 8"	D-W	1 to 9	5 - 7	fair	2.0'	yes
Meadow Fescue <i>Lolium pratense</i>	grass	perennial, cool season aggressive bunchgrass, with age produces thick sod	342, 512	12 lbs/ac	5.2	fair	D	no	no	DM-WM	1, 4 to 9	5 - 7.2	moderate	2 - 3'	yes
Orchard Grass <i>Dactylis glomerata</i>	grass	long-lived perennial bunchgrass, reproduces from seed	327, 342, 512	10 lbs/ac	15	fair	B	yes	no < 8"	D-WM	1 to 9	5.8 - 7.0	moderate	2.5'	yes
Perennial Ryegrass <i>Lolium perenne</i>	grass	short-lived perennial bunchgrass	327, 342, 512	20 lbs/ac	5.2	fair	C	yes	no	DM-WM	1, 4, 5, 6 to 9	5 - 7.5	moderate	1.5 - 2.0'	yes

Common Name Scientific Name	Plant Type	Growth Habit	Practice Recommendation	Pure Stand Rate	Seeds per Ft ² /Lb/Ac.	Wildlife Value	Retardance	Pollinator Habitat	Deep Rooted	Moisture Regime	Forage Suitability Group	pH	Flood Tolerance	Average Height at Maturity	Drought
Redtop <i>Agrostis gigantea</i>	grass	long-lived perennial cool season plant, sod-forming by stolons	327, 342, 512	4 lbs/ac	114.5	fair	C	no	yes < 2"	M-W	1, 4, 7	4.5 - 8.0	good	3'	no
Smooth Bromegrass <i>Bromus inermis</i>	grass	tall long-lived perennial cool season plant, sod-forming by rhizomes	327, 342, 512	20 lb/ac	3.1	fair	B	no	no < 12"	D-WM	1 to 9	6 - 7.5	brief fair	3 - 4'	yes
Tall Fescue <i>Schedonorus arundinaceus</i>	grass	perennial, cool season aggressive bunchgrass, with age produces thick sod	327, 342, 512	12 lbs/ac	5.2	fair	B	yes	yes > 14"	D-WM	1 to 9	5 - 9	moderate	2.5 - 3.0'	yes
Timothy <i>Phleum pratense</i>	grass	cool season short-lived perennial bunch grass, reproduces by seed	327, 342, 512	8 lbs/ac	28.2	fair	B	no	no < 8"	DM-W	1, 4 to 9	5.5 - 7.0	moderate	3.0'	no
Legumes															
Alfalfa <i>Medicago sativa</i>	legume	single crown, warm season perennial legume, has a deep tap root	327, 342, 512	12 lbs/ac	5	good	C	yes	yes > 14"	D-M	2-3, 5, 6, 8, 9	> 6.5	poor	2.5'	yes
Alsike Clover <i>Trifolium hybridum</i>	legume	perennial, single crown, upright short-lived legume	327, 342, 512	3 lbs/ac	15.6	good	D	yes	no < 8"	M-W	1, 4, 5, 7, 8, 9	> 6.2	moderate	1'	no
Birdsfoot trefoil <i>Lotus corniculatus</i>	legume	warm season perennial legume	327, 342, 512	7 lbs/ac	8.6	good	D	yes	no < 10"	DM-W	1, 4 to 9	> 5.5	moderate-good	.5 - 1'	moderate
Red Clover <i>Trifolium pratense</i>	legume	upright short-lived perennial legume, produces runners, deep taproot	327, 342, 512	10 lbs/ac	6.3	good	C	yes	yes > 14"	DM-WM	1 to 9	> 6.0	poor	2.0'	no
White Ladino Clover <i>Trifolium repens</i>	legume	shallow-rooted perennial legume, prostrate, spreads by stolons	327, 342, 512	3 lbs/ac	20	fair	D	yes	no	DM-WM	1, 4, 5, 7 to 9	> 5.5	fair to poor	1.0'	no

Table 4
Summary of Seeding Requirements for Standards 327, 342, 512 (Introduced Species)

327 - Conservation Cover									
Mix Type	Grasses		Legumes^a		Seeding Periods				Notes
	No.	seeds/ft²	No.	seeds/ft²	Spring	Late Summer	Dormant^b	Frost^b	
Wildlife Habitat	≥2	≥70	≥1	≥30	X	X	X	X	Grasses must be at least 50% of mix.
Pollinator Habitat	1-2	≤30	≥2	≥40	X	X	X	X	Grasses must be bunch-type.

(a) If more than 20% of legumes are hard seed, increase rate by % of hard seed.

(b) Increase rate 15% for frost and dormant seedings.

342 - Critical Area Planting									
Mix Type	Grasses		Legumes^a		Seeding Periods				Notes
	No.	seeds/ft²	No.	seeds/ft²	Spring	Late Summer	Dormant^b	Frost	
Grasses Only	≥1	160			X	X	X	NR	At least 25% of the total seeds must be sod-forming grasses.
Mixtures	≥1	≥80	≥1	See Notes	X	X	X	NR	Grasses must be at least 50% of the mix. Mix must be at least 160 seeds/ft ² total. At least 25% of the seeds in the mix must be sod-forming grasses.

(a) If more than 20% of legumes are hard seed, increase rate by % of hard seed.

(b) Increase rate 15% for dormant seedings. Seedings in concentrated areas must be mulched.

512 - Forage & Biomass Planting									
Mix Type	Grasses		Legumes^a		Seeding Periods				Notes
	No.	seeds/ft²	No.	seeds/ft²	Spring	Late Summer	Dormant	Frost	
Pasture	≥1	See Notes	≥1	See Notes	X	X	NR	NR	Mix must be at least 60 seeds/ft ² total. Grasses must be at least 50% of the mix.
Hayland	Single species or mixture with ≥60 seeds/ft ²				X	X	NR	NR	
Interseeding		See Notes		See Notes	X	X	NR	Legumes Only	Use 1/2 the pure stand rate for spring or late summer seeding. Use 2/3 pure stand rate for frost seeding.

(a) If more than 20% of legumes are hard seed, increase rate by % of hard seed.

SEEDING DATES

Date of seeding is a critical factor in determining whether a seeding will succeed or fail. The specific date that provides the best chance for success will vary from south to north and from year to year with prevailing moisture and temperature conditions. Late summer seeding is generally riskier than spring seeding. Planting at either end of the allowable range is riskier than the middle of the range. Refer to Table 5 for the recommended seeding dates.

Seeding outside of the established dates must be approved by the NRCS State Agronomist or Area Resource Conservationist prior to seeding. All variance requests shall provide documentation of the current soil moisture conditions and proposed timeframes for seeding to be completed.

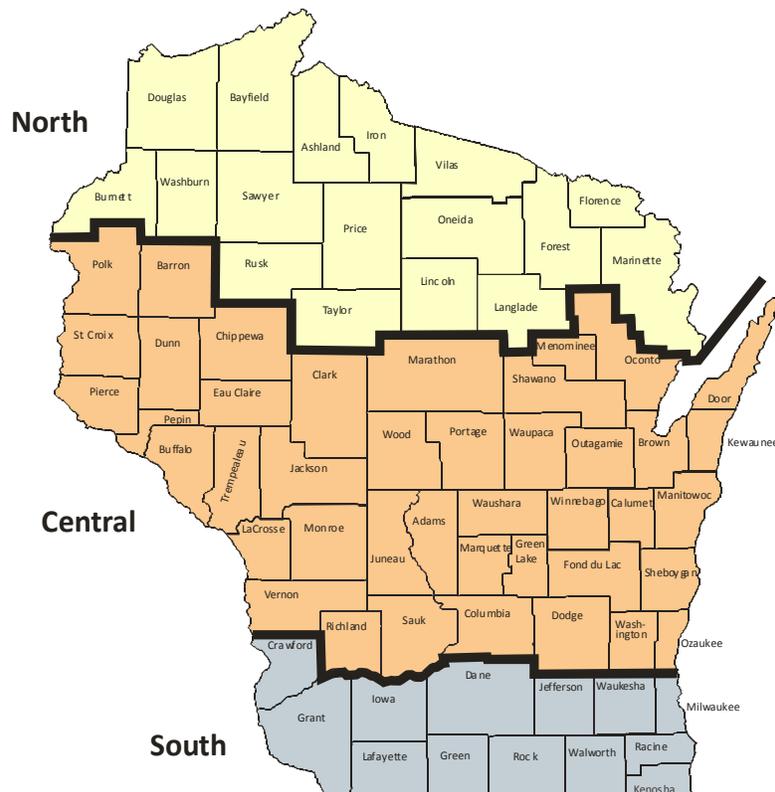
The frost seeding period in Wisconsin ranges from mid February to early March and will vary from year to year depending on the weather. Frost seeding is only allowed during active freezing and thawing cycles.

Table 5
Recommended Seeding Dates by Planting Zone

Planting Zone*	Spring	Late Summer	Dormant
North	5/1 – 6/15	7/15 – 8/10	11/1 – Freeze up
Central	4/15 – 6/1	8/1 – 8/21	11/1 – Freeze up
South	4/1 – 5/15	8/7 – 8/29	11/1 – Freeze up

*See Figure 1

Figure 1
Planting Zone Map



TEMPORARY COVER AND COMPANION CROPS

Temporary Cover Crop

All land will be established to permanent vegetative cover during the first year of the land use conversion, when possible. Temporary cover, during the first year, may be used if:

- the required seeds or plant stock are not available,
- the normal planting period for the species has passed, or
- where herbicide carryover will not allow establishment of permanent cover immediately.

If temporary cover is used, the permanent vegetative cover must be established by the end of the normal planting period of the following year.

Temporary Seeding Recommendations

1. Fields where planting is delayed due to lack of suitable seed or late planting, select one of the following species:
 - Forage sorghum – ½ bushel per acre (5/15 to 7/15)
 - Sorghum - Sudangrass hybrid – 1 bushel per acre (5/15 to 7/15)
 - Sudangrass – 1 bushel per acre (5/15 to 7/15)
 - Winter wheat - 2 bushels per acre (8/1 to 10/1)
 - Winter cereal rye - 2 bushels per acre (8/1 to 10/15)
 - Oats - 2 bushels per acre (4/1 to 9/1)
 - Annual ryegrass - 20 pounds per acre (4/1 to 9/1)
2. For fields with triazine herbicide carryover, select one of the following species:
 - Forage sorghum – ½ bushel per acre (5/15 to 7/15)
 - Sorghum - Sudangrass hybrid – 1 bushel per acre (5/15 to 7/15)
 - Sudangrass – 1 bushel per acre (5/15 to 7/15)

A bioassay test may be used to better determine chemical carryover.

A temporary cover will typically not be necessary on those areas where at least 50 percent of the ground is covered with either crop residue or vegetative cover.

Temporary cover crops must be clipped or destroyed before the plant produces viable seed, preventing excessive competition to the scheduled permanent seeding. Winter wheat and rye must be terminated by tillage, crimping, herbicides, or a combination before planting the permanent seeding.

Companion Crops

Companion crops can be used to reduce the amount of erosion on critical sites, suppress weeds, and provide added protection for permanent perennial vegetation seeded during first year plantings.

Companion crop recommendations:

- Oats - 2 bushels per acre (4/1 to 9/1)
- Winter wheat - 1 bushel per acre (8/1 to 10/1)
- Annual ryegrass - 6 pounds per acre (4/1 to 9/1)
- Spring wheat - 1 bushel per acre (4/1 to 6/1)

Companion crops shall be clipped after jointing or boot stage. Second and subsequent clippings are necessary when re-growth provides competition to the new planting. Clipping height should be above the developing seedlings. Where excessive growth has accumulated, the vegetation should be mowed and vegetation distributed uniformly. Companion crops seeded with late summer introduced grasses and legumes in most cases will not require clippings prior to the first killing frost. When the growing season is prolonged, clipping may be required for late summer plantings.

Winter cereal rye is not recommended as a companion crop with introduced season grasses. Biotoxin compounds secreted by cereal rye may inhibit germination or suppress introduced grass seedlings.

SPECIAL EROSION CONTROL MEASURES

Evaluate the need for additional soil erosion controls prior to and during the establishment period. Where erosion is determined to be a concern, alternatives shall be developed to divert water from the site or stabilize the soil surface.

When soil erosion control is an identified resource concern, increase grass composition above 50 percent of the mixture and increase the percentage of sod-forming grasses above 25 percent of the mixture.

Introduced mixtures for areas with shrub and tree plantings are not required to contain 25 percent sod forming grass seed per square foot. These seed mixtures must still contain at least 50 percent grass seed per square foot. Sod-forming grasses are not recommended in shrub and tree plantings.

Mulching

Wisconsin NRCS Standard 484, Mulching, shall be followed if program or practice design requires mulching.

Mulch shall consist of either natural and/or artificial materials such as plant residue (including cereal grain straw, grass hay, wood chips, bark and wood fiber), plastic, fabric, or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended effect for the required time period. Mulch material shall be relatively free of disease, pesticides, chemicals, noxious weed seeds, and other pests and pathogens.

The type of mulching material selected should be based on cost, time of year, soils, percent slope, anticipated runoff velocities, and landscape position.

Mulching will be applied as soon as possible after seeding. Prepare the seedbed, apply the fertilizer and seed, then apply and anchor the mulch material.

When construction is completed and a permanent seeding delay is anticipated, plant temporary cover or apply a temporary mulch to the site to control erosion, or seed permanent vegetation and evaluate the status of the seeding, especially when seeding outside of the recommended dates. Reseeding may be required. All dormant plantings planned on concentrated flow areas will be mulched.

Hydroseeding

Hydroseeding typically consists of applying a mixture of cellulose fiber, seed, fertilizer, and stabilizing emulsion with hydromulching equipment to provide permanent or temporary protection to disturbed areas that are susceptible to erosion by water and wind. Hydroseeding may be used as the primary mulching method only when there is sufficient time remaining in the season to ensure adequate vegetation establishment and will provide adequate erosion control. Hydroseeding can be used

in conjunction with other mulching techniques. Hydroseeding advantages include:

- the protection of seeds from heat and birds during the germination process,
- a stabilized soil temperature,
- more even application of seeds than broadcast seeding,
- effective in keeping seeds from being washed away on slopes,
- provide added organic components to enrich the soil after the critical area is established,
- retention of moisture as seeds sprout, and
- allows for a better root formation as opposed to sodding.

Follow seeding dates outlined in Table 5 of this technical note.

Sodding

Specifications for site preparation, topsoiling, seedbed preparation and fertilizing are the same as conventional seeding. Sod shall consist of a dense, well rooted growth of a perennial desirable specie. All sod used shall be free of noxious weeds, diseases and insects. Only moist, fresh sod shall be used. The sod shall be sufficiently moist to withstand exposure during transport and transplanting operations. Sod should be placed on site within 24 hours after cutting and sod strips shall not have dry or dead edges.

Wet soil to a depth of two inches or more prior to laying the sod. Lay the sod from the lower end of the slope and work up slope. On steep slopes, stake the sod or peg with at least 6 inches or longer anchoring staplers. Tamp or roll the laid sod to insure uniform contact between the roots and soil surface. Outside edges of sodded areas shall be rolled in or banked flush with soil. On sites where surface drainage may try to follow sodded edges, extend sod strips 1 foot beyond the edges of the area sodded.

After laying sod, water thoroughly to wet the sod pad and the soil to a depth of 4 inches. In the absence of adequate rainfall, water during the first 30 days to keep underlying soil moist and allow the sod to become established. After the initial 30 day period, water as necessary to maintain adequate moisture in the root zone.

NUTRIENT AND SOIL AMENDMENT RECOMMENDATIONS

Fertilizer

Fertilizer will be applied according to a current soil test and will be consistent with University of Wisconsin recommendations found in Publication A-2809, Nutrient Application Guidelines for Field, Vegetable and Fruit Crops. A current soil test is defined as test results no older than four years from the time last tested to the date of the planned seeding. Guidelines for soil testing in Wisconsin can be found in Publication A-2100, Sampling Soils For Testing. In lieu of soil testing, apply 150 pounds of 20-10-10 fertilizer per acre, applicable only to Practice Standards 327, Conservation Cover; and 342, Critical Area Planting.

Lime

When alfalfa is part of the seeding mixture, the soil pH must be corrected to a minimum of 6.5. When birdsfoot trefoil, red clover or white ladino clover is a component of the seeding mixture, pH must be corrected to a minimum of 6.2. Liming material will be applied according to soil test recommendations. In lieu of soil testing, apply 2 tons of 80-89 lime or equivalent per acre, applicable only to Practice Standards 327, Conservation Cover; and 342, Critical Area Planting..

SEEDBED PREPARATION AND SEEDING RECOMMENDATIONS

Conventional Seeding

The seed is broadcasted or drilled into a partial or clean seedbed.

For conventional seeding, prepare a fine, firm seedbed to a minimum of 3 inches. All tillage operations shall be performed across the general slope of the landscape.

The seedbed should contain enough fine soil particles to provide uniform shallow coverage of the seed as well as contact with moisture and nutrients. It is important to have a firm seedbed. As a minimum, cultipack or roll before and after seeding. When walking on a properly prepared seedbed, the depth of your footprints should not exceed ¼ inch. Do not use heavy, no-till type drills to seed on conventionally prepared seedbeds. Heavy drills tend to sink into the soil and seeding depth will be difficult to control. Do not plant seed deeper than ¼ inch. The use of a drag

or similar equipment after seeding is not advised when small seeds are included in the mixture.

Advantages:

- May incorporate nutrients and soil amendments such as lime.
- Provides the opportunity to destroy perennial weeds.

Disadvantages:

- Soil erosion risk increases greatly.
- Erosion can wash away new seedlings or cover and smother the seedling with sediment.
- Higher field preparation cost.
- Annual weed competition can be greater.
- A nurse crop is often needed for erosion control and to suppress weed competition.
- Requires more trips across the field resulting in higher fuel cost.

No-Till Planting

No-till is the seeding of grasses and/or legumes in the absence of tillage using planting tools capable of drilling into an undisturbed soil surface and interseeding into existing herbaceous cover or prior-year crop residue.

No-Till Planting Into the Prior-Year Crop Residue

On cropland, leave the existing crop residue on the field without tillage. Soybean stubble is the preferred residue of choice. No-tilling into large amounts of non-fragile residue such as corn and small grain will reduce germination and seedling vigor. For spring weed control, when no-tilling introduced grasses and legumes, use a burndown chemical prior to or within four days after planting to kill weeds. Keep in mind that quackgrass and many broadleaf weeds are more consistently controlled when herbicides are applied early fall and a follow-up application in the spring.

Site Preparation for No-Till Interseeding Into Existing Grass Cover

Interseeding is a good way to improve existing stands of single species on fields utilized for pasture, wildlife, or idle land. Interseeding yields a mixture of grasses and legumes that gives the greatest benefit for wildlife or forage for livestock.

Land that has been in grass for many years usually has a thick layer of residue on the soil surface. In order to prepare a good seedbed for no-till interseeding and improve herbicide effectiveness, the litter or residue must be removed or altered. Existing vegetation shall be evaluated prior to seeding and a

management strategy developed to limit competition with new seedlings. Reducing competition of the existing stand is important for a successful interseeding. Options to prepare existing cover for no-till interseeding include herbicide application, grazing, mowing, haying, or burning the site.

- **Mowing:** Mow the site using a rotary mower or flail chopper to a height of 3 inches. The timing and type of mowing equipment selected shall be planned to uniformly distribute the mowed plant material over the field surface. Mowing should be planned before any known weeds produce mature seeds.
- **Burning:** Carry out a Prescribed Burn according to the requirements outlined in the plan. The burn plan must address safety concerns and document the appropriate timing for the burn to provide the maximum control of weeds and protect any existing desirable plants on the site.
- **Haying:** Harvest a hay crop from the site the year before the planned interseeding. The timing of the hay harvest should be planned to minimize the amount of re-growth that will occur prior to interseeding.
- **Grazing:** Graze the site immediately prior to herbicide application, if herbiciding is planned. The timing and duration of the grazing must be managed to prevent erosion or damage to sensitive environmental areas, but must be intensive enough to significantly reduce the existing vegetative cover. If possible, begin the grazing at a time of the year when the standing vegetation is green and growing to increase the palatability and feed value of the forage, resulting in a more uniform removal of the vegetation by grazing animals.
- **Herbicide Application:** Apply approved herbicides to kill or suppress existing vegetation and control weeds. The effectiveness of herbicides improves when combined with haying, grazing, or mowing.

A drill equipped for no-till planting shall be used to allow consistent penetration of disk openers.

Advantages:

- Soil erosion is minimized.
- Reduced energy usage.
- No nurse crop is required.
- Greater moisture availability due to lack of tillage.

- Drilling can occur under adverse conditions.
- Carbon sequestration improves.
- Seed placement is ensured.

Disadvantages:

- Increased herbicide use.
- No-till drill required.
- Nutrients and soil amendments cannot be incorporated.

To ensure success of the interseeding, regardless of the options selected above, the field will need constant maintenance by mowing and removal of the existing vegetation until the interseeded planting becomes well-established and can survive the competition of the existing vegetation.

Dormant Seeding

Seed is broadcasted and incorporated, no-tilled, or drilled into a partial or clean seedbed after the growing season and before freeze-up. The seed remains dormant until the following spring.

Seedbed preparation and conditions are similar to conventional seeding. A firm seedbed is strongly recommended for broadcast dormant seedings. Seed broadcasted without incorporation is more risky, and relies on snow, freezing, and thawing to embed seed. The approved dormant seeding date for introduced species statewide is November 1.

Advantages:

- Occurs at a time of year when labor is more available.
- Seedlings take advantage of early spring moisture.
- Soil erosion is minimized.

Disadvantages:

- Seeding rates should be increased.

Refer to the section, "Criteria for Seed Mixture Development," to determine when dormant seeding is allowed.

Frost Seeding

Broadcast seed on top of existing stands of introduced grass species or on seedbeds prepared the previous fall. Frost seed in February to mid March when the freezing and thawing cycle is active to help incorporate the seed into the soil.

The soil surface is usually "honeycombed" with small cracks at this time during the year. Frost seeding SHALL NOT occur on fields covered with

solid ice or a snow cover depths greater than 2 inches. Frost seeding must be completed before the freeze and thaw cycle ends. Do not frost seed into winter wheat or winter rye cover crops. All commonly grown legumes can be frost seeded because of their greater seedling vigor, such as red clover, alsike clover, and white ladino clover. Alfalfa and birdsfoot trefoil are approved for frost seeding; however, these species at times are less successful and slower to establish.

Advantages:

- No special drill is required.
- Labor is more available in late winter.

Disadvantages:

- Stand establishment is normally less successful, particularly in dry years.
- The seeding rate must be increased.

Frost seeding is only recommended under the following conditions:

- legumes seeded into established pastures,
- seedbeds prepared in fall, and
- undisturbed sites that consist of fragile residue such as soybean stubble.

Frost seeding is not recommended in undisturbed non-fragile residue such as corn and small grain.

Refer to the section, “Criteria for Seed Mixture Development,” to determine when frost seeding is allowed.

STAND EVALUATION

To determine the overall success of the planting, a monitoring program should consider the number of seedlings across a field, seeding vigor, height, and growth stage and overall diversity of plants. Preliminary evaluation of spring and fall plantings should be completed four to six weeks after germination. This inspection of seeding density and distribution can be combined with an inspection for post planting weed control recommendations.

Several methods can be used to evaluate stand adequacy. Density measurements are taken by counting the number of individual plants and species within a standard one foot quadrant. As a general rule, there should be at least two sample sites per acre.

**Table 6
Plant Density and Stand Evaluation One Year
After Planting**

Average Seedlings/Ft ²	Action/Condition
<1	Reseed.
1-3	Wait and re-evaluate next year.
4-5	Successful planting.
>6	Very good.

COVER MAINTENANCE

Weed Control - Establishment Year

Weed control during the establishment year is required to ensure survival of the new permanent seeding. Weed control during the seeding year will have precedent over nesting season concerns and is allowed until stand is established. Activities should be minimized when possible during the nesting season.

Mow early before weeds have a chance to smother out the new seeding. Mow before the companion crop or undesirable vegetation reach boot stage. Mow introduced plantings to a height of no less than 4 inches. Depending on the weather, mowing every 2 or 3 weeks throughout the growing season may be required to increase the probability of a successful stand. In addition, approved herbicides may be used on introduced plantings for additional weed control.

Weed Control - Established Cover

Any planned maintenance after establishment, should be done before May 15 or after August 1 to protect nesting species and reduce disruption of nesting activities. The impact of any disturbance to existing cover on wildlife and threatened or endangered species must be assessed and mitigated to the extent practicable or as required by law. In the majority of situations, established plantings will only require spot treatment without disturbing the entire unit.

To control undesirable plants during the primary nesting season, utilize one or more of the following spot treatment options:

- Spot mowing can be used to control annual weeds and to suppress perennial weeds. Spot mowing must be done before the target plant produces viable seed and must continue throughout the growing season as needed. Spot mowing is not the most effective treatment

option for biennial and perennial weeds but can be used to contain these plants until other control treatments can be implemented.

- Spot treatment of herbicides is often necessary for controlling invasive plants in introduced plantings. Spot treatment should be timed to treat weeds during active growth periods. Effective herbicide spot treatment can prevent the target plants from setting seed and spreading and dominating introduced stands. NRCS staff is prohibited from making herbicide recommendations.
- Spot Treatment by hand pulling or digging can be an effective control if the entire root is removed from the soil. Hand pulling/digging is most effective in the spring when the soil is moist and loose from the winter freeze/thaw cycle.

REFERENCES

Curtis, J. T., 1959. The Vegetation of Wisconsin: an Ordination of Plant Communities. University of Wisconsin Press, Madison.

USDA NRCS, Wisconsin Field Office Technical Guide, Section IV, Conservation Practice Standards and Specifications.

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section III, Conservation Management Systems.

University of Wisconsin Extension Publication A1525, Perennial Forage Crop Variety Update for Wisconsin.

University of Wisconsin Extension Publication A2809, Nutrient Application Guidelines for Field, Vegetable and Fruit Crops.

University of Wisconsin Extension Publication A2100, Sampling Soils For Testing.

Wisconsin Administrative Code, Department of Agriculture, Trade and Consumer Protection, Chapter ATCP 20, Seed Labeling and Sale.

Wisconsin State Statutes, Chapter 94, Plant Industry, ss. 94.38 to 94.46.

**Table 7
Wildlife Habitat Mixes**

Seed Calculator Code*	Mixtures	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
327-16A	Timothy	2.5	71	DM, M
	Smooth Bromegrass	3.0	9	
	Alfalfa	6.0	30	
327-16B	Timothy	2.0	56	M, WM, W
	Orchardgrass	2.0	30	
	Red Clover	5.0	32	
327-16C	Timothy	2.0	56	DM, M
	Orchardgrass	2.0	30	
	Alfalfa	6.0	30	
327-16D	Timothy	2.5	71	M, WM
	Smooth Bromegrass	3.0	9	
	Red Clover	5.0	32	
327-16E	Timothy	2.0	56	M, WM
	Smooth Bromegrass	2.0	6	
	Orchardgrass	1.0	15	
	Red Clover	5.0	32	
	White Ladino Clover	0.5	10	
324-16F	Timothy	2.0	56	M, WM
	Orchardgrass	2.0	30	
	Red Clover	5.0	32	
	White Ladino Clover	0.5	10	
327-16G	Timothy	2.0	56	DM, M, WM
	Orchardgrass	2.0	30	
	Birdsfoot Trefoil	4.0	34	
327-16H	Tall Fescue	3.0	15	M, WM
	Red Clover	4.0	25	
	White Ladino Clover	1.0	20	
	Timothy	2.0	56	

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 8
Seeding Mixtures Suitable for Critical Area Plantings

Seed Calculator Code*	Moisture Regimes	Common Name	Scientific Name	Seeding Rate in lb/ac PLS	Seeding Rate in Seeds/Ft ² PLS	Capacity Retardance	Type of Site**
342-1	Dry-Mesic and Mesic Sites	Smooth Bromegrass	Bromus inermis	10	31	B	EB, WW, CSB
		Creeping Red Fescue	Festuca rubra	3	24		
		Alfalfa	Medicago sativa	3	15		
		Red Clover	Trifolium pratense	3	19		
		Kentucky bluegrass	Poa pratensis	1.5	75		
342-2	Dry-Mesic and Mesic Sites***	Smooth Bromegrass	Bromus inermis	15	47	B	EB, WW
		Alfalfa	Medicago sativa	7	35		
		Timothy	Phleum pratense	3	85		
342-3	Dry-Mesic and Mesic Sites	Kentucky bluegrass	Poa pratensis	1	50	B	CSB, EB, WW
		Smooth Bromegrass	Bromus inermis	10	31		
		Timothy	Phleum pratense	2	56		
		Tall Fescue	Schedonorus arundinaceus	2	10		
		Perennial Ryegrass	Lolium perenne	5	26		
342-4	Dry-Mesic and Mesic Sites	Smooth Bromegrass	Bromus inermis	20	62	B	EB, WW, CSB
		Creeping Red Fescue	Festuca rubra	5	40		
		Alfalfa	Medicago sativa	8	40		
		Red Clover	Trifolium pratense	4	25		
342-5	Dry-Mesic and Mesic Sites	Smooth Bromegrass	Bromus inermis	30	93	B	EB, WW, CSB
		Alfalfa	Medicago sativa	14	70		
342-6	Dry-Mesic, Mesic, and Wet Mesic Sites	Smooth Bromegrass	Bromus inermis	7	22	B	CSB, EB, WW
		Timothy	Phleum pratense	2	56		
		Creeping Red Fescue	Festuca rubra	1	8		
		Kentucky Bluegrass	Poa pratensis	1	50		
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
342-7	Mesic Sites***	Smooth Bromegrass	Bromus inermis	7	22	B	EB, WW
		Creeping Red Fescue	Festuca rubra	2	16		
		Kentucky bluegrass	Poa pratensis	3	150		
		Birdsfoot trefoil	Lotus corniculatus	2	17		
342-8	Mesic Sites***	Smooth Bromegrass	Bromus inermis	15	47	B	WW, EB
		Creeping Red Fescue	Festuca rubra	2	16		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-9	Mesic Sites***	Kentucky Bluegrass	Poa pratensis	3	150	C	WW, EB
		Creeping Red Fescue	Festuca rubra	4	32		
		Perennial Ryegrass	Lolium perenne	10	52		
342-10	Mesic Sites	Smooth Bromegrass	Bromus inermis	14	43	B	EB, WW, CSB
		Timothy	Phleum pratense	3	85		
		Red Clover	Trifolium pratense	3	19		
		Perennial Ryegrass	Lolium perenne	4	21		
342-11	Mesic Sites	Smooth Bromegrass	Bromus inermis	32	99	B	EB, WW
		Creeping Red Fescue	Festuca rubra	8	64		

Seed Calculator Code*	Moisture Regimes	Common Name	Scientific Name	Seeding Rate in lb/ac PLS	Seeding Rate in Seeds/Ft ² PLS	Capacity Retardance	Type of Site**
342-12	Mesic Sites	Kentucky bluegrass	<i>Poa pratensis</i>	4	200	C	EB, WW
		Creeping Red Fescue	<i>Festuca rubra</i>	3	24		
342-13	Mesic Sites	Smooth Bromegrass	<i>Bromus inermis</i>	14	43	B	EB, WW, CSB
		Timothy	<i>Phleum pratense</i>	4	113		
		Red Clover	<i>Trifolium pratense</i>	3	19		
342-14	Mesic Sites	Smooth Bromegrass	<i>Bromus inermis</i>	15	43	B	EB, WW, CSB
		Timothy	<i>Phleum pratense</i>	3.5	99		
		Alsike Clover	<i>Trifolium hybridum</i>	2	32		
342-15	Mesic Sites	Smooth Bromegrass	<i>Bromus inermis</i>	15	47	B	EB, WW
		Timothy	<i>Phleum pratense</i>	3.5	99		
		Birdsfoot trefoil	<i>Lotus corniculatus</i>	3	26		
342-16	Wet Mesic Sites	Tall Fescue	<i>Schedonorus arundinaceus</i>	5	26	B	CSB, EB, WW
		Timothy	<i>Phleum pratense</i>	3	85		
		Perennial Ryegrass	<i>Lolium perenne</i>	3	16		
		Red Clover	<i>Trifolium pratense</i>	3	19		
		Smooth Bromegrass	<i>Bromus inermis</i>	6	19		
		Kentucky Bluegrass	<i>Poa pratensis</i>	2	100		
342-17	Wet Mesic Sites	Redtop	<i>Agrostis gigantea</i>	1	115	C	WW, CSB, EB
		Timothy	<i>Phleum pratense</i>	3	85		
		Red Clover	<i>Trifolium pratense</i>	5	32		
342-18	Wet Mesic Sites	Timothy	<i>Phleum pratense</i>	3	85	B	WW, CSB, EB
		Perennial Ryegrass	<i>Lolium perenne</i>	3	16		
		Red Clover	<i>Trifolium pratense</i>	3	19		
		Smooth Bromegrass	<i>Bromus inermis</i>	6	19		
		Kentucky Bluegrass	<i>Poa pratensis</i>	2	100		
342-19	Wet Mesic Sites	Redtop	<i>Agrostis gigantea</i>	1	115	C	WW, CSB, EB
		Timothy	<i>Phleum pratense</i>	1	28		
		Red Clover	<i>Trifolium pratense</i>	4	25		
		Kentucky Bluegrass	<i>Poa pratensis</i>	2	100		
342-20	Wet Sites***	Redtop	<i>Agrostis gigantea</i>	2	229	C	WW
		Alsike Clover	<i>Trifolium hybridum</i>	2	31		
		Kentucky Bluegrass	<i>Poa pratensis</i>	2	100		
342-21	Wet Mesic Sites	Redtop	<i>Agrostis gigantea</i>	3	344	C	WW
		Alsike Clover	<i>Trifolium hybridum</i>	3	47		

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

**EB = Embankments; WW = Waterways; CSB = Channel and Streambanks

***Mixtures can be used on other site descriptions when not listed.

Table 9
Introduced Pollinator Habitat Mixes

Seed Calculator Code*	Mixtures	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
327-17A	Timothy	0.5	14	DM, M
	Orchardgrass	1.0	15	
	Alfalfa	4.0	20	
	White Ladino Clover	1.5	30	
327-17B	Tall Fescue	3.0	16	WM, W
	Perennial Ryegrass	3.0	16	
	Red Clover	4.0	25	
	Alsike Clover	1.5	23	

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 10
Forage and Hayland Planting Recommendations

Forage Suitability Group	Seed Calculator Code ¹	Species	Lbs. PLS per Acre	Seeds per Square Foot
Hay Crop				
Group 1: Low water holding capacity, seasonal high water table.	512-H1	Red Clover	6	38
		Tall Fescue	6	31
		Timothy	1	28
Group 2: Low water holding capacity, 0 to 12 percent slopes.	512-H2	Alfalfa	12	60
	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 3: Low water holding capacity, greater than 12 percent slopes.	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 4: Moderate water holding capacity, seasonal high water table.	512-H4	Alsike Clover	3	47
		Tall Fescue	6	31
		Timothy	1	28
Group 5: Moderate water holding capacity, less than 12 percent slopes.	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 6: Moderate water holding capacity, greater than 12 percent slopes.	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 7: High water holding capacity, seasonal high water table.	512-H4	Alsike Clover	3	48
		Tall Fescue	6	31
		Timothy	1	28
Group 8: High water holding capacity, less than 12 percent slopes.	512-H5	Alfalfa	8	40
		Timothy	2	56
Group 9: High water holding capacity, greater than 12 percent slopes.	512-H6	Alfalfa	8	40
		Smooth Bromegrass	4	12
		Timothy	1	28

Forage Suitability Group	Seed Calculator Code ¹	Species	Lbs. PLS per Acre	Seeds per Square Foot
Group 10: Organic soils, wetlands, ledge outcrop.	---	Planting not feasible.	---	---
Rotation and Permanent Pastures				
Group 1: Low water holding capacity, seasonal high water table.	512-PP1	Alsike Clover Meadow Fescue	2 6	31 31
	512-PP1A	Alsike Clover Orchardgrass	2 3	31 45
	512-PP1B	Alsike Clover Timothy	2 1.5	31 42
Groups 2: Low water holding capacity, 0 to 12 percent slopes.	512-PP2	Alfalfa Smooth Bromegrass Orchardgrass	6 4 4	30 12 60
Group 3: Low water holding capacity, greater than 12 percent slopes.	512-PP2	Alfalfa Smooth Bromegrass Orchardgrass	6 4 4	30 12 60
Group 4: Moderate water holding capacity, seasonal high water table.	512-PP4	Alsike Clover Meadow Fescue Timothy	2 6 1	31 31 28
	512-PP4B	Birdsfoot Trefoil Meadow Fescue Timothy	3 6 1	26 31 28
Group 5: Moderate water holding capacity, less than 12 percent slopes.	512-PP5	Red Clover White Ladino Clover Orchardgrass Meadow Fescue	5 1 3 6	32 20 45 31
	512-PP5B	Red Clover White Ladino Clover Festulolium Meadow Fescue	5 1 7 6	32 20 36 31
Group 6: Moderate water holding capacity, greater than 12 percent slopes.	512-PP6	Red Clover Orchardgrass Smooth Bromegrass	5 4 4	32 60 12
Group 7: High water holding capacity, seasonal high water table.	512-PP7	Alsike Clover Meadow Fescue Timothy Redtop	2 6 1 1	31 31 28 115
	512-PP7B	Birdsfoot Trefoil Meadow Fescue Timothy Redtop	3 6 1 1	26 31 28 115
Group 8: High water holding capacity, less than 12 percent slopes.	512-PP8	White Ladino Clover Orchardgrass Meadow Fescue	1 3 6	20 45 31
	512-PP8B	White Ladino Clover Festulolium Meadow Fescue	1 7 6	20 36 31
Group 9: High water holding capacity, greater than 12 percent slopes.	512-PP9	Red Clover Orchardgrass Meadow Fescue	5 3 6	32 45 31

Forage Suitability Group	Seed Calculator Code ¹	Species	Lbs. PLS per Acre	Seeds per Square Foot
Group 10: Organic soils, wetlands, ledge outcrop.	---	Planting not feasible.	---	---
Pasture for Horses/Sheep				
Groups 1, 4, 7: Seasonal high water table.	512-PHS1	Kentucky Bluegrass Meadow Fescue White Ladino Clover	4 4 1	200 21 20
	512-PSH1A	Kentucky Bluegrass Meadow Fescue Birdsfoot Trefoil	4 4 3	200 21 26
Groups 5, 6, 7, & 8: Moderate to high water holding capacity.	512-PHS2	Kentucky Bluegrass Festulolium White Ladino Clover	2 7 1	100 36 20
	512-PHS2A	Kentucky Bluegrass Perennial Ryegrass White Ladino Clover	2 7 1	100 36 20
Groups 2 & 3: Low water holding capacity.	512-PHS3	Alfalfa Orchardgrass	6 3	30 45
Pasture for Hogs				
		Alfalfa OR Red clover Forage Rape OR Oats OR Sudangrass OR Hybrid Pearl Millet	12 10 25 35 2 bu/ac	60 63 --- --- ---
Summer Annuals for Supplemental Forage				
		Hybrid Pearl Millet Winter rye (fall planted) Forage Rape Forage Turnips and Swedes Rape and Kale	25 1½ - 2 bu/ac 4 bu/ac 1½-2 lbs./ac 4 lbs./ac	--- --- --- --- ---

¹These codes represent the mixtures used in the Wisconsin Seed Calculator.