

Pasture and Hay Planting (Acre) 512

DEFINITION

Establishing native or introduced forage species.

PURPOSES

- Establish adapted and compatible species, varieties, or cultivars for forage production.
- Improve or maintain livestock nutrition and/or health.
- Extend the length of the grazing season.
- Balance forage supply and demand during low forage production.
- Reduce soil erosion and improve water quality.
- Increase carbon sequestration.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on lands where forage production and/or conservation are needed and feasible. This practice may be applied on lands where forage production is the primary goal or where forage production and wildlife habitat are equal in consideration.

This practice does not apply to plantings:

- Primarily intended for wildlife habitat, where livestock grazing and/or mechanical harvesting is a secondary consideration. For wildlife habitat plantings, refer to the conservation practice standard for Conservation Cover (327).
- Established on critical erosion areas that usually cannot be stabilized by ordinary conservation treatment. For stabilization on these areas, refer to the conservation practice standard for Critical Area Planting (342).

- On field edges or riparian buffers, for which other standards are applicable. Refer to the conservation practice standards for Field Border (386) and Filter Strip (393).

Refer to the Michigan NRCS electronic Field Office Technical Guide for these conservation practice standards.

CRITERIA

General Criteria Applicable To All Purposes

Select plant species and their cultivars based upon:

- Climatic conditions, such as annual rainfall, seasonal rainfall patterns, growing season length, humidity levels, temperature extremes, and the USDA Plant Hardiness Zones. Those species known to fit Michigan's zones are in Table 1.
- Soil condition and position attributes such as pH, available water capacity, aspect, slope, drainage class, fertility level, salinity, depth, flooding and ponding, and levels of toxic elements that may be present. See Table 2 for relative tolerances of selected soil conditions by plant species.
- Resistance to disease and insects common to the site or location.
- Livestock species for which the forage is needed.

Select plants that according to federal, state, or local regulations are not considered noxious species.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause.

Avoid selecting plant species that may be invasive or weedy. Birdsfoot trefoil, reed canarygrass, tall fescue, and smooth brome grass can be invasive in some situations and use in conservation work only when containment of the planting is feasible or when no other suitable alternative species can perform similar functions, as determined and approved by NRCS. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species list. Details for controlling invasive species can be found in the conservation practice standard Invasive Plant Species Control in Natural Habitats (797).

If native material of local origin will be used, consider only material that originated within a specific area surrounding the planting site (e.g., ecoregion, subregion or section).

If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used.

Select from the plant species shown in Tables 1, 7, and 8.

When planting forage mixtures, choose forage species and their selected cultivar(s) that are compatible in rate of establishment, maturity, palatability, and growth habit (Table 3).

Warm season grasses have been good and valuable choices as part of a forage system in other parts of the U.S. Research data in Michigan indicates that warm season grass is similar to the improved cool season grass in contributing to livestock gain. Warm season grass can provide forage when cool season grass production is reduced due to warmer weather. However, warm season grass management may require that livestock graze these grasses even when adequate cool season grass forage is available.

Warm season grasses should be seeded alone when the purpose is pasture or hay production.

Details about planting warm season grasses for wildlife purposes can be found in conservation practice standards Conservation Cover (327) and Upland Wildlife Habitat Management (645), as well as the Conservation Sheet "Native Grass Establishment for Wildlife."

Seed Rates and Planting Dates

Specified seeding/plant material rates, methods of planting, and date of planting shall be consistent with documented guidance cited by the plant materials program, research institutions, or agency demonstration trials for achieving satisfactory establishment.

Seeding rates will be calculated on a state approved method such as Pure Live Seed (PLS) or percent germination.

All pasture and hay planting rates will be given in pounds of PLS unless the percent germination and percent of live seed are both greater than 95 percent, then the bulk rates from seed from certified or licensed seed dealers can be used instead. The percent PLS is computed by multiplying the percent germination times the percent purity and dividing the product by 100.

$$\frac{\% \text{ Germ} \times \% \text{ Purity}}{100} = \text{Percent PLS}$$

Determine the amount of bulk seed to be applied based on the following formula:

$$\frac{\text{Required PLS lbs/ac}}{\% \text{ PLS in bulk seed}} = \text{Bulk lbs/ac to apply}$$

If more than 20 percent of the legume seed is hard seed, increase the seeding rate for legumes by the percent hard seed.

If using coated seed, recalibrate the planting equipment to deliver the same number of seed per area as would be applied with non-coated seed.

Seeding rates are based on the optimum amount of seed necessary to provide vegetative cover in a reasonable amount of time. The pure stand rates in Table 4 are the minimum rates for planting a single species stand into well-prepared proper fertility seedbed at the proper placement. However, when seeding grasses with legumes, the seeding rate of the grass species is usually reduced to minimize competition with the legume species. This allows the legume to persist longer.

Seeding rates for mixtures are usually composed to provide about 50-75 seeds per square foot for cool season grass and legume mixes, 30-60 live seeds per square foot for warm season grasses. To accomplish this mix, select the lower value found on Table 7 for each species desired. Alternatively, multiply the percent of species desired in the stand by the seeded alone rate for each species in the mix and add together to calculate the seeding rate.

Seeding rates for hay and pasture stand improvement should use the rates from Table 6, Frost Seeding, or Table 7 as appropriate.

Planting dates shall be scheduled during periods when soil moisture is adequate for germination and establishment (Table 5).

When wildlife habitat is of equal concern to the pasture or hay, adjust planting dates according to the Grassland Activity Dates found in the Ecological Specifications in the Field Office Technical Guide.

Fertilizer and Lime Requirements

Fertilizer and soil amendment recommendations shall be based on results from a current soil test. Application shall be appropriately placed and timed to be effective.

Soil testing will be by an approved testing laboratory (converted to MSU standards) from soil samples collected in the area to be seeded. Refer to MSUE Bulletin E2904 for soil sampling methods and fertilizer and lime recommendations for pasture or hay seeding establishment.

Companion or Nurse Crop

If erosion cannot be adequately controlled with one of the seedbed preparation options, a companion crop should be used in addition to the planned full seeding rate. Companion crop may be used with either spring or fall seedings.

For spring seedings of introduced species, oats can be seeded at a rate of 1-1/2 bushels/acre to reduce soil erosion and help control weed competition. The oats shall be clipped just before seed head emergence (boot stage) or grazed when oats are 10 inches tall to promote growth of the new permanent cover. The use of the companion crop is not required when interseeding and is optional for all other seeding periods. Follow MSUE recommendations for other small grain companion crop management.

Seedbed Preparation and Planting

Aerial Seeding (by airplane) or Broadcast Seeding can be used instead of a planter or drill in conventional clean tilled preparation methods, Frost Seeding, or Dormant Seeding situations provided the seedbed has been prepared as described below and could require packing with some type of equipment after the seed has been scattered on the soil.

New Seeding

The field or area to plant will have a firm, weed-free seedbed that ensures seed will contact soil. Plant to proper depth ensuring seed or planting material will contact soil moisture uniformly. Prepare site to provide a medium that does not restrict plant emergence.

1. **Conventional seeding**: for spring and late summer seeding periods where site conditions allow for safe operation of equipment. Conventional seeding will not be done on slopes greater than 10 percent, as erosion and seed loss risk are very high with this situation.

The conventional seedbed shall be worked to a depth of 3 inches before seeding. It shall be reasonably smooth as possible; friable; and free of rocks, stumps, and foreign objects that can damage the harvest equipment or put at risk the animals' health before seeding.

All tillage operations shall be performed across the general slope of the land.

On fields where the predominant slope is 6 percent or greater, all tillage and planting operations must be on the contour and/or by conservation tillage leaving at least 30 percent of the crop residue on the surface after planting.

Grass and legume seed shall be drilled uniformly or broadcast uniformly over the area and rolled into the seedbed. See Table 4 for seeding depth.

Use caution when using the newer, heavy no-till drills in a tilled seedbed, as the seed could be planted too deep.

2. **No-till seeding (greater than 30 percent previous crop residue on the soil surface)**: for spring, late summer, and dormant seeding periods where site conditions allow for safe operation of equipment. No-till seeding should be done on all slopes greater than 10 percent and may need to be done across the slope if slopes are not extremely steep. Use caution on extremely steep slopes, even going up and down slope in true no-till situations. This method is especially applicable on highly erodible soils. Preparation approximately 6 months ahead of time is needed to control competing vegetation.

MSU Extension approved herbicides shall be applied to kill or suppress existing weed competition, as necessary. Consult with MSU Extension Agriculture Educators or bulletin E0434 Weed Control Guide for Field Crops.

3. Frost Seeding

Broadcast seed for only those species approved for frost seeding as shown in Table 6. If frost seeding is not done into winter annuals or closely clipped, grazed, or herbicide killed pasture, then use seedbed preparation methods for conventional seedings the fall prior to seeding where erosion is not a concern.

New seedings shall not be grazed until at least 30 days after emergence.

Seeding Into Old Or Existing Stands

Note: Warm season grasses should be planted as complementary pastures or paddocks, and not seeded into the cool season grass pastures or paddocks.

This includes any stand modification that maintains some vegetative component of the original stand.

1. Incorporation of grasses and/or legumes with light tillage.

Weaken the existing stand in the fall or early winter by use of selective herbicides, grazing, or mowing to a 1 inch height or by a combination of these methods.

Use a disk, cultivator, or similar tool to disturb no more than 40-50 percent of the existing stand.

Remove early spring regrowth by mowing or “flash” grazing (1-2 days maximum) to reduce competition and allow the new seedlings to become established.

2. Incorporation of grasses and/or legumes with no-tillage (interseeding) for spring, late summer, and dormant seeding periods.

When interseeding into existing sod - graze, burn, mow, or apply herbicides to kill strips or suppress existing vegetation and to control weed competition.

- a. Prescribed burns should be completed in early to late spring according to the burn objective (see below) and supervised by qualified personnel. Consult NRCS Prescribed Burning Standard 338 for specifications to plan a spring burn for removing plant residue.

- b. Timing of burn according to objective and vegetation type live-growth height: **remove litter** of warm and cool season grasses, burn when 1 - 3” tall.

Excessive residue from mowing should be removed to prevent smothering of desired plants.

Control broadleaf weeds by applying herbicide in the fall prior to spring seeding. Consult with MSU Extension Agriculture Educators or bulletin E0434 Weed Control Guide for Field Crops.

Remove early spring regrowth by mowing or “flash” grazing to reduce competition and allow the new seedlings to become established.

3. Incorporation of grasses and/or legumes with frost seeding.

Broadcast seed for only those species approved for frost seeding as shown in Table 6. If frost seeding is not done into winter annuals or closely clipped, grazed, or herbicide killed pasture, then use seedbed preparation methods for conventional seedings the fall prior to seeding where erosion is not a concern.

Inoculation

Legume seed shall be inoculated with the proper, viable Rhizobia.

1. Inoculant shall be specific to the legume seeded.
2. When more than one legume species used, each species shall be inoculated separately, then mixed.

Seed Quality

All seed and planting materials shall meet state quality standards.

Seed quality of any species can change following initial seed tests. Germination may decline over time, especially when seed is subjected to uncontrolled humidity, moisture, or high temperature. If seed is held over for one year or longer, or subjected to adverse storage conditions, retest. PLS should be recalculated based on the most current seed test.

Weed Control During the Establishment Year

Weed control during the establishment year shall be provided to ensure survival of the new permanent seeding. If there is an existing broadleaf weed problem, use pest control measures to reduce the competition prior to establishing the new seeding.

1. To manage severe weed competition, clip cool season species no closer than 4 inches.
2. There are few approved herbicides for use on both grass legume mixtures to control weed species competition.
3. Mow when weeds reach 8 inches in height down to a 4-6 inch height. Mowing should be done before the weeds begin to compete for moisture or before the weeds produce a seedhead. If possible, the residue left from mowing should be removed from the field in order to avoid smothering the new seeding. Mowing at least once a month may be necessary if weeds are shading or robbing moisture from the new seeding until it reaches 8 inches in height.
4. Warm season grass stands may take as many as three years to improve after the establishment year.

Weed competition during the seeding year can be reduced by mowing. Mowing at a height of 3-4 inches can be done early in the season. At this time, the grass plants are small and will not be clipped off. During June and July, clip to at least 6 inches high. If much of the grass plant is clipped off, vigor will be markedly reduced. Avoid all clipping after August 1.

If broadleaved weeds are a serious problem, consider spraying with a selective herbicide. Spray after seedling grass plants have reached the 3- to 4-leaf stage.

It usually is best not to graze warm-season grasses during the year of seeding. Grazing young, immature plants is especially harmful.

Additional Criteria For Establishing Adapted And Compatible Species, Varieties, Or Cultivars For Forage Production

Select forage species based on the intended use, realistic expected yield, maturity stage, compatibility with other species, and level of management the client is willing to provide. Plant adaptation to the proposed planting area shall be verified prior to planting. Use the local NRCS Soil Survey and Forage Suitability Groups from the Field Office Technical Guide to accomplish this. Old or common cultivars/varieties should not be used in most cases. Newer cultivars/varieties of introduced cool season grasses and legumes are more disease resistant, winter hardy, more palatable, and higher yielding than are the older cultivars/varieties.

Additional Criteria For Improving Or Maintaining Livestock Nutrition And/Or Health

Establish forage species that are most capable of meeting the desired level of nutrition (quantity and quality) for the kind and class of livestock to be fed. Refer to conservation practice Prescribed Grazing, Practice 528 and Prescribed Grazing Conservation Sheets for additional information on forage quantity and quality.

Additional Criteria For Balancing The Forage Supply And Demand During Low Forage Production Periods

Select plants that will produce forage for use during periods when other on-farm forage does not meet livestock needs. Forage species selected shall balance or help balance the forage dry matter demand of the animals for the desired period of time.

Annual forages can be used as productive, high quality forage during the hot, dry period of the grazing season. Annual forages such as Brassicas (turnips and Swedes) and Cereal Grains also provide forage much earlier and much longer than the traditional “grazing season.”

Warm season grass pastures or paddocks can be another management strategy in the grazing system. Warm season grass may provide quality forage at a time when cool season grass production is low due to warmer temperatures. Consider using warm season grasses as complementary pastures when compatible with the landowner’s management objectives.

Plant monocultures of warm season grasses for pasture and hay production. If grasses of similar maturity are planned, mixes may be acceptable.

Additional Criteria For Reducing Erosion And Improving Water Quality

Plants shall provide adequate ground cover, canopy cover, root mass, and vegetative retardance to protect soil against wind and water erosion.

Erosion during the seeding year will cause roughness problems, as well as in subsequent years that the field is in hay or pasture. Seed highly erosive pastures in small plots over a period of years, so that the whole field is not exposed to erosion at the same time. If this is not possible and the field must be planted at one time, then no-till into heavy (greater than 70 percent) residue.

CONSIDERATIONS

Consider the potential effects of installation and operation of Pasture and Hay Planting on the cultural, archeological, historic, and economic resources.

The use of certified or source identified seed is recommended whenever possible.

Forage species planted in mixture should exhibit similar palatability and mature at similar times to one another to avoid spot or selective grazing.

Having a grass-legume mixture for pasture is encouraged. There can be some risk of bloat. MSU research results show that a 50 percent grass and 50 percent legume mix can reduce the risk of bloat.

Introduce grazing animals to brassica pastures slowly (over 3 to 4 days). Avoid abrupt changes from dry summer pastures to lush brassica pastures, such as turning hungry animals into brassicas for the first time.

Brassica crops should not constitute more than 75 percent of the animals' diet. Supplement with dry hay if continually grazing brassicas or allow grazing animals to access familiar grass pastures while grazing the brassicas.

Fertilizer spreaders may be used to broadcast seed along with the lime and fertilizer requirements. Inert materials such as cracked oats may be used as bulk material to aid in seed dispersal.

Brush Management, Forage Harvest Management, Prescribed Burning, and Prescribed Grazing practices may be used in combination with this practice.

In areas frequented by high density of animals, establish persistent species that can tolerate close, frequent grazing. Reseeding annually may need to be done on these areas.

Where wildlife management is an objective, use an approved habitat evaluation procedure to aid in selecting plant species and providing for other habitat requirements. Refer to conservation practice standard Upland Wildlife Habitat Management (645) for habitat evaluation procedures by wildlife species. When the objective is general wildlife habitat, the Michigan Habitat Appraisal Evaluation will be used to assess habitat (Michigan Biology Tech Note 12).

Tall fescue shall not compose more than 10 percent of the mixture if the secondary purpose is for wildlife, and even that should be an endophyte-free variety only.

Consider wetland restoration as an alternative to planting reed canarygrass, tall fescue, or smooth brome grass in wetland conditions.

PLANS AND SPECIFICATIONS

Specifications for the establishment of pasture and hay planting shall be prepared for each site or management unit according to the Criteria and Considerations described in this standard, and shall be recorded on specification sheets, job sheets, in narrative statements in the conservation plan, or other acceptable documentation.

Use Michigan NRCS Pasture and Hay Planting Conservation Sheet for documentation. When formal stand evaluation is done, use Michigan NRCS Biology Technical Note 15, Guideline for Herbaceous Stand Evaluation.

The following items shall be documented in a Pasture and Hay Planting Plan.

1. Purpose for using this practice.
2. Location of fields marked on the conservation plan map. Soils should be noted or mapped, including limitations for pasture and hay.
3. Number of acres to be seeded.

4. Seedbed preparation and weed control method, including pre- and post-herbicide recommendations (if any).
5. Seeding recommendations, including seeding species mix, planting rates per acre, seeding date windows, planting method, depth planned, and soil condition desired at planting.
6. Soil amendments such as lime or fertilizer applied and seed inoculants or stratification used, as appropriate.
7. Seed tags/invoice or licensed seed dealer documentation with seed bag contents and origin, percent purity, and percent germination.
8. Amounts of both PLS and bulk seed needed should be calculated.
9. Operation and maintenance planned.
10. Soil erosion control (tons before and after).

OPERATION AND MAINTENANCE

The operator will inspect and calibrate equipment prior to use to ensure proper rate, distribution, and depth of planting material.

Record the extent of application in acres and the quantities of seed and other materials used.

When natural reseeding is desired, short-lived legumes should be allowed time to reseed every 2 to 4 years.

Red Clover will need approximately 30 days of rest to allow for seed formation. Birdsfoot Trefoil will need approximately 45 days.

Growth of seedlings or sprigs shall be monitored for water stress. Depending on the severity of drought, water stress may require reducing weeds, early harvest of any companion crops, irrigating when possible, or replanting failed stands.

Evaluate forage stands each season or as needed to determine management or inputs (fertilizer, lime, etc.) needed to achieve the desired purpose(s).

Livestock shall be excluded from new seedings until the plants are well established.

Invasion by undesirable plants shall be controlled by cutting, using a selective herbicide, or by grazing management by manipulating livestock stocking rates, density, and duration of stay.

Insects and diseases shall be controlled when an infestation threatens stand survival. See conservation practice standard Pest Management (595) for details.

REFERENCES

Michigan Department of Natural Resources

- Managing Michigan's Wildlife: a landowner's guide

MSU-Extension Bulletins

- E0434 Weed Control for Field Crops
- E0489 Seeding Practices for Michigan Crops
- E0752 Pastures for Northern Michigan
- E2185 Improving Pastures in Michigan by Frost Seeding
- E2304 Pasture Calendars for the North Central United States
- E2307 Grasses and Legumes for Intensive Grazing in Michigan
- NCR 368 Sheep Pastures for the Midwest
- NCR474 Birdsfoot Trefoil for Grazing and Harvested Forage
- E2284 Forages for Swine
- E2904 Nutrient Recommendations for Field Crops in Michigan

MSU Forage Information Systems Papers by Dr. Richard Leep and Others

- "Perennial Legume and Grass Forage Variety Selection for Michigan"
- "Perennial Ryegrass Potential In Michigan"
- "Annual Forages to Supplement Pastures in Michigan"
- "Summer Annual Forage Grasses for Emergency Crops"
- "Fall Management of Alfalfa"

University of Wisconsin

- “Use of Brassica Crops in Grazing Systems”
- “Frost Seeding Legumes and Grasses into Pastures”

Michigan NRCS

- Biology Technical Note 12 - “Wildlife Habitat Appraisal Evaluation”
- Biology Technical Note 15 - “Guidelines for Herbaceous Stand Evaluation”

Websites

- MSU Forage Information Systems
<http://www.msue.msu.edu/fis/index.htm>
- Purdue Forage Information
<http://www.agry.purdue.edu/ext/forages/index.html>
- Wisconsin Forage Team
<http://www.uwex.edu/ces/crops/teamforage/index.html>

TABLE 1 – Varieties of Legumes, Forbs, Cool and Warm Season Grasses for Pasture and Hay ^{1/}	
Species	Variety
Alfalfa (Hay)	Consult MSU-E Bulletin E2787 Perennial Legume and Grass Forage Variety Selection for Michigan
Bromegrass, Smooth	Rebound, Barton, Lincoln, others
Canarygrass, Reed	Palaton, Venture, Vantage, Chief
Festulolium	Perun, Hykor, Spring Green, others
Tall Fescue	Barolex, Kora, Festival, Max Q (many new Endophyte-free varieties)
Orchardgrass	Megabite, Justus, Dart, Elsie, Potomac, others
Perennial Ryegrass	Bastion, Bison, Elgon, Mara, Herbie, others
Timothy	Climax, Tuukka, Clair, Farol (more)
Birdsfoot Trefoil	Norcen, Carroll, Maitland, others
Sorghum/Sudans and Crosses	Brown Midrib varieties preferred
Turnips and Turnip Crosses	Bulb-types: Sampson, Barkant, Dynamo Leaf-types: Rondo, Tyfon, Pasja, Appin
Eastern Gamagrass	Pete, Iuka, Highlander
Big Bluestem	Bonanza, Pawnee, Rountree, Southlow ^{3/}
Indiangrass	Osage, Oto, Southlow
Switchgrass	Niagra, Blackwell, Cave-in-rock, Trailblazer, Southlow
Forage Chicory	Puna ^{2/}

- ^{1/} To make the wisest selection for a particular species, one should consult the recommendations and field trial results in Michigan State University’s “Perennial Legume and Grass Forage Variety Selection for Michigan” at your local MSU-Extension Office.
- ^{2/} Forage chicory can bolt (flowers appear) within a few weeks of the first grazing cycle, use a very short grazing cycle to best maintain the chicory in a vegetative stage.
- ^{3/} Southlow is a Michigan genotype comprised of a diverse germplasm found in Michigan.

**TABLE 2 - Crop Description, Relative Tolerance of Established Forages to Environmental Hazards, and Ease of Establishment
(E = Excellent; G = Good; F = Fair; P = Poor)**

Crop ¹	Cold Frost	Soil Drought	Wet-ness	pH	Acid-ity	Estab-lishment	Growth Habit	Minimum Drainage	Minimum Fertility	Anti-Quality
LEGUMES										
Alfalfa	G	G	P	6.6-	7.2	G-E	T	WD	H	B
Alsike clover	F	P	G	6.0-	6.5	F	M	PD	M	B
Birdsfoot trefoil	G	F	G	6.0-	6.8	P	M-S	SPD	M	T
Hairy vetch	F	F	F	5.8-	6.5	G	VINY	MWD	M	B
Kura clover	E	F	G	5.5-	6.2	P	M-S	SPD	M	B
Ladino clover	F	P	G	6.0-	6.5	G	S	PD	M	B
Mammoth red clover	P	F	F	6.2-	6.8	G	M	SPD	M	B
Medium red clover	G	F	F	6.2	6.8	G-E	M	SPD	M	B
Sweet clover	G	G	P	6.8	7.2	F	T	MWD	M	C
GRASSES										
Kentucky bluegrass	E	P	G	5.8-	6.5	P	S	SPD	M	
Orchardgrass	F	G	F	5.5-	8.2	G	M-T	SPD	M	
Perennial ryegrass ^{2,3}	P	P	G	5.0-	8.3	E	M-S	SPD	H	
Red top	E	G	F	5.4-	6.2	F	S	VPD	H	
Reed canarygrass ³	E	G	E	5.8	8.2	P	T	VPD	M	A
Smooth bromegrass	E	G	F	5.8-	6.5	F	M-T	MWD	H	A
Tall fescue ⁴	F	G	G	5.4-	6.2	G	T	SPD	M	ET
Timothy	E	F	E	5.4-	6.2	F	M-T	PD	M	
ANNUAL FORAGES										
Annual ryegrass	P	P	G	5.6-	6.2	E	M-S	SPD	M-H	
Chicory	F	F	F	5.0-	8.3	G	S	MWD	H	G
Millet	P	G	P	6.2-	6.8	G	T	MWD	M-H	
Rape/Kale	E	F	F	5.3	6.8	G	S	MWD	L-M	G
SorghumXSudan	P	E	P	6.0-	6.5	E	T	MWD	M-H	CG
Sudangrass	P	E	P	6.0	6.5	E	T	MWD	M-H	CG
Turnips/Swedens	E	F	F	5.3	6.8	G	S	MWD	L-M	G, P

Growth Habit: T = Tall; M = Moderate; S = Short

Anti-Quality (components that could be present in some varieties):

A = Alkaloids (decrease palatability)

B = Bloat potential

C = Coumarin (hemorrhagic agent, formed during spoilage of hay)

CG = Cyanogenic Glycosides (may form hydrogen cyanide-HCN poisoning; also Prussic Acid Poisoning)

ET = Endophyte Toxicity (reduce blood circulation to appendages "dry gangrene")

G = Glycosides (decrease palatability)

P = Photosensitization (sunburn on animals with light color hair, reduce animal performance)

T = Tannins (decrease palatability)

Footnotes

1 - Select erect varieties for hay and prostrate varieties for pasture.

2 - Select the more winter hardy varieties for use in Michigan.

3 - Select the low-alkaloid varieties to improve palatability.

4 - Select the endophyte-free varieties to improve animal performance.

Primary production for legumes is spring, summer, and early fall.

Primary production for cool season grasses is early spring and late fall for short grasses and spring, early summer, and fall for tall grasses.

TABLE 3 - Crop Use Information (E = Excellent; G = Good; F = Fair; P = Poor)								
Crop	Annual or Perennial	Pasture (Grazing)				Palatability ¹	Maturity <i>Early</i> <i>Medium</i> <i>Late</i>	Provides <i>Mid, Early, or</i> <i>Late Extended</i> Grazing
		Hay	Silage	Continuous	Prescribed			
LEGUMES								
Alfalfa	Perennial	E	E	P	E	E	E-M	M
Alsike clover	Short-lived perennial	G	G	P	G	E	L	M
Birdsfoot trefoil *	Perennial	G	E	G	G	E	M-L	M
Hairy vetch	Winter annual Used primarily as a cover crop						E - M	M
Kura clover	Perennial	G	G	E	E	E-	M-L	M
Ladino clover	Perennial	F	G	E	E	E	E-L	M
Mammoth red clover	Short-lived perennial	F	G	P	P	G	M-L	M
Medium red clover	Short-lived perennial	G	E	P	G	E	M-L	M
Sweet clover *	Biannual	F-P	G	P	F	F	N/A	N/A
GRASSES								
Kentucky bluegrass	Perennial	G	G	E	E	E	E	N/A
Orchardgrass	Perennial	E	G	E	E	F	E-M	M
Perennial ryegrass	Short-lived perennial	E	E	E	G	E	E-M	L
Red top	Perennial	F	F	F	F	F		N/A
Reed canarygrass *	Perennial	E	E	G	E	G	M-L	E & L
Smooth brome grass *	Perennial	E	F	F	E	E	M-L	N/A
Tall fescue ^{1/} *	Perennial	G	G	G	G	F-P	M-L	L
Timothy	Perennial	E	E	F	G	E-G	L	N/A
Big bluestem	Perennial	G	P	G	E	G	M-L	L
Indiangrass	Perennial	F	P	G	G	G	M	L
Switchgrass	Perennial	F	P	F	G	G	M	M-L
Eastern Gamagrass	Perennial	G- E	P	G	E	E	M-L	M-L
ANNUAL FORAGES								
Chicory	Short-lived perennial	P	P	G	G	G-P	E-M	E & M
Millets	Annual	F	F	F	G	G-F	M	M
Rape	Annual	P	P	F	G	G-F	M	E
SorghumXSudan	Annual	P	G	F	G	G-F	M	M
Sudangrass	Annual	P	F	F	G	G-F	M	M
Turnips	Annual	P	P	G	G	G	L	L & Very L

^{1/} Palatability will improve with the newer varieties that are disease-free.

* When planting these species, one should use the newest disease-resistant varieties if no other plant species will meet the planting goal.

**TABLE 4 - Seeding Chart
Pasture Establishment**

Plant Species	Legal wt per bu (lb)	Seeds per lb	Seeds/sq ft At 1 lb/Ac	Seeding Rate PLS lbs/acre Pure Stand	Seeding Depth (Inches)
LEGUMES					
Alfalfa	60	225,000	5.0	15	1/4-1/2
Alsike clover	60	690,000	15.8	5 A	1/4-1/2
Birdsfoot trefoil D	60	380,000	8.7	8	1/4-1/2
Hairy vetch	60	20,000	0.5	25	1/4-1/2
Kura clover			5	8	1/4-1/2
Ladino clover	60	800,000	18.4	2 A	1/4-1/2
Mammoth red clover	60	295,000	6.8	10	1/4-1/2
Medium red clover	60	275,000	6.3	10	1/4-1/2
Sweet clover D	60	260,000	6.0	10 B	1/4-1/2
GRASSES					
Kentucky bluegrass	14	2,177,000	50.0	15	1/4-1/2
Orchardgrass	14	654,000	15.0	8	1/4-1/2
Perennial ryegrass		275,000	6.3	30	1/4-1/2
Red top	14	4,990,000	114.6	6 A	1/2
Reed canarygrass	46	530,000	12.2	8	1/4-1/2
Smooth bromegrass	14	136,000	3.1	16	1/2-1
Tall fescue	25	227,000	5.2	10	1/4-1/2
Timothy	45	1,200,000	27.5	4	1/4-1/2
Festulolium				4-10 in mixtures with tall fescue or orchardgrass; 10 with alfalfa	1/4-1/2
Big bluestem		165,000	4	10	1/4-1/2
Indian grass		175,000	4	10	1/4-1/2
Switchgrass		389,000	9	5-8	1/4-1/2
Little bluestem		140,800		8	1/4-1/2
Eastern Gamagrass				10 E	1-1 1/2
ANNUAL FORAGES					
Barley	48	14,000	N/A	2 C	1-2
Forage Chicory		Variable	N/A	6-8 with 5 lb/ac red clover and 3 lb/ac white clover	3/8-1/2
Millet		Variable	N/A	30	1/2-1
Oats		13,000	N/A	2-3 B	
Rape/Kale		Variable	N/A	3-4	1/4-1/2
Rye	56	18,000	N/A	1.5-2 C	1-2
Sorghum-Sudan		15-20,000	N/A	20	1
Sudangrass	32	Variable	N/A	25	1
Turnips/Swedens			N/A	1-3	1/4-1/2
Wheat	60	12,000	N/A	3-5 Pasja turnips 1.5-2 C	1-2

- A Not recommended as a pure stand.
- B Use scarified seed.
- C These rates are in bushels per acre NOT POUNDS.
- D These species may spread quickly in some conditions and soils in Michigan.
- E Recommended to use as a pure stand only. Use stratified seed or prechill seed as directed by seed company.

TABLE 5 - Seeding Dates For Cool Season Grass and Legumes, Brassicas, Warm Annuals, and Native Species			
Type of Seeding¹	Cool Season Introduced Species² (Grasses and Legumes) OR Warm Season Annuals³	Warm Season Native Species (Includes Prairie Restoration Mixtures)	Brassicas⁴ (Turnips, Rape, Kale)
UPPER PENINSULA			
Spring	May 1 - June 15	May 15 - June 30	
Late Summer	June 25 - August 1	Not Recommended	July 5 - August 10
Dormant	October 10 - Early Spring	Not Recommended	
Frost ⁵	February 20 - April 1	Not Recommended	
NORTH 1/2 OF LOWER MICHIGAN (north of US 10)			
Spring	April 20 - June 10	May 10 - June 15	
Late Summer	July 15 - August 10	Not Recommended	July 10 - August 15
Dormant	October 20 - Early Spring	Not Optimal ⁶	
Frost	February 10 - March 20	Not Recommended	
SOUTH 1/2 OF LOWER MICHIGAN (south of US 10)			
Spring	April 10 - June 5	May 5 - June 15	
Late Summer	July 15 - August 15	Not Recommended	July 15 - August 20
Dormant	November 1 - Early Spring	Not Optimal ⁶	
Frost	February 1 - March 15	Not Recommended	

- 1 All seeding should be done with good soil moisture levels - not saturated or too dry to germinate seed.
- 2 Includes all species generally considered introduced and Rape or Kale.
- 3 Add 10 days to the last planting date if planting warm annuals (Sorghums, Sudans, or their crosses and Millets).
- 4 Swedish Turnips and other Brassicas should be planted 60 to 90 days before planned grazing.
- 5 Refer to Table 1 for applicable plant species.
6. Only for Eastern Gamagrass and certain cultivars of Switchgrass. Only when bare soil is not an erosion risk. Seed November 1 - March 1.

TABLE 6 - Recommended Seeding Rates for Frost Seeding**
Into an Existing Grass or Legume Sod**

Species	Rate (lb./acre)		Expected Established Plants *
	Seeded Alone	As Part of Seed Mixture	Plants per Square Foot
Red Clover ***	6 - 12	4 - 8	2 - 5
Birdsfoot Trefoil ***	6 - 8	3 - 4	6 - 9 (in 2nd year)
Ladino Clover	2 - 3	1 - 2	1 - 2
Alsike Clover	2 - 4	1 - 2	2 - 3
Perennial Ryegrass	6 - 10 **	4 - 6	10 - 12
Orchardgrass	3 - 4	1 - 2	4

* Expected plants based on “alone” seeding rates.

** Use higher rate in “bare ground” situations and lower rate in existing sods. Only in unique and rare situations should ground be bare in a January through March time period. This should only be done where there is no chance of wind erosion, water erosion, or runoff causing damage to natural resources. If crop residue cover is less than 50 percent, use the bare ground rate.

*** Red Clover and Birdsfoot Trefoil if frost seeded into existing pasture, cut rates Seeded Alone by 50 percent.

**** Frost Seeding is rarely successful in very coarse textured soils such as sands, loamy sands, or very low organic matter sandy loams.

**TABLE 7 - Seed Mixtures for Pasture and Hayland
Seeding Rates of Pure Live Seed Per Acre ^{1/}
(pounds per acre= lbs/A)**

Legume Seed (If one legume only use high rate)				Grass Seed Pounds per Acre (In mixes use lower rate) ^{3/}					
Primary Legume	Lbs/A	Secondary Legume	Lbs/A	Orchard Grass	Tall Fescue ^{2/}	Smooth Brome grass	Reed Canary grass	Timothy	Kentucky Bluegrass
Alfalfa	8-10			4-6	6-8	4-6		2-4	
Alfalfa	12-18	(hayland only)							
Alfalfa	6-8	Red Clover	2-4	4-6	6-8	5-7		2-4	
Alfalfa	4-6	Red Clover	2	3					
Alfalfa	6-8	Ladino Clover	1/4	4-6	6-8	5-7		2-4	
Red clover	6-8			4-6	8-10	5-7		2-4	
Red clover	4-6	Ladino Clover	1/4	4-6	8-10	5-7		2-4	
Red clover	6-8				8-10				
Red clover	6-8	Alsike Clover	2	4-6	8-10	5-7	3-5	2-4	
Alsike clover	2	Ladino Clover	1/4	4-6	8-10	5-7	3-5	2-4	
Birdsfoot trefoil ^{5/}	5			2-4		4-6	6-8	2-4	2-4
Red Clover	6-10	Ladino Clover	1/2	4-6		4-6		2-4	
Alfalfa ^{4/}	4	Red Clover	2	3					
Birdsfoot Trefoil ^{5/}	3	Alsike Clover	2	4					
Grass Only				16		10			
Grass Only							14 ^{6/}		

- ^{1/} Most Cool Season Grass and Legume commercial seed has 95+ percent germination and 95+ percent purity. If this is the case, use the bulk seed rates.
- ^{2/} Endophyte free varieties.
- ^{3/} Additional grass seed species may be added to these first choices of grass seed species if determined by the conservation planner. If this is done, use the lower rate of PLS of the additional species but no lower than 50 percent of the full rate. Perennial Ryegrass takes special management and should be seeded at 15-20 lbs. alone or 6 to 8 lbs. per acre with 2 compatible legumes.
- ^{4/} This is a special mix for droughty, sandy soils. Annual Ryegrass at 2 lbs. PLS/acre can be added for quick forage in the seeding year OR Perennial Ryegrass can be added at 2 lbs. PLS/acre for increased perennial forage quality.
- ^{5/} These mixes can be used on organic soils that are drained. Birdsfoot Trefoil and Sweet Clover may spread quickly in certain soils and conditions in Michigan.
- ^{6/} For non-drained organic soils, use appropriate varieties of Reed Canarygrass with Timothy as a quick germination forage. Only Reed Canarygrass, Tall Fescue, Smooth Bromegrass, and Timothy can take 30 days of spring flooding.

TABLE 8 - List of Frequently Used Forage Seed Mixtures for Specific Livestock				
Many combinations and premixed pasture blends are available and comply with this standard. Additional recommendations may be developed with assistance of NRCS or other technical organization.				
Pasture for Horses No alsike clover Tall fescue should be endophyte free varieties when planted as brood mare pasture.	Alfalfa		6 lbs/ac	
	Kentucky bluegrass		2 lbs/ac	
	Smooth brome grass or Orchardgrass		8 lbs/ac or 4 lbs/ac	
	Ladino clover		1/2 lbs/ac	
	Kentucky bluegrass		4 lbs/ac	
	Timothy or Smooth brome grass or Orchardgrass		2 lbs/ac or 6 lbs/ac or 6 lbs/ac	
	Birdsfoot trefoil		6 lbs/ac	
Pasture for Beef and Dairy	Timothy		2 lbs/ac	
	Kentucky Bluegrass or Orchardgrass		4 lbs/ac or 2 lbs/ac	
	Timothy		4 lbs/ac	
	Smooth Brome grass		7 lbs/ac	
	Orchardgrass		4 lbs/ac	
	Tall fescue Orchardgrass Perennial Ryegrass Clovers	Smooth Brome grass Festulolium Birdsfoot Trefoil Alfalfa		Use endophyte free or endophyte friendly tall fescue cultivars.
	Pastures for Sheep	Birdsfoot Trefoil or Alfalfa or Red Clover with Timothy or Orchardgrass or Smooth Brome grass		6 lbs/ac with 2 lbs/ac 2 lbs/ac 2 lbs/ac
Kura Clover			8 lbs/ac	
Birdsfoot Trefoil			2 lbs/ac	
Timothy			4 lbs/ac	
Pasture for Hogs	Alfalfa		8 lbs/ac	
	Ladino clover		2 lbs/ac	
	Forage Rape		5 lbs/ac	
	Oats		1 1/2 Bu/ac	
Supplemental Pasture for Midsummer and/or to Extend the Grazing Season	Sudangrass/Sorghum-Sudan		25 lbs/ac	
	Milletts		35 lbs/ac	
	Oats		2-3 bu/ac	
	Wheat (for very late and very early season grazing)		2 bu/ac	
	Winter rye (fall planted, very late and early grazing)		1 1/2 bu/ac	
	Forage Rape		5 lbs/ac	
	Oats		1 1/2 bu/ac	
	Turnips		3 lb/ac	
	Big bluestem		10 lbs/ac	
	Switchgrass (not for horses or sheep)		5 lbs/ac	
	Eastern Gamagrass		10 lbs/ac	
	Big bluestem- Switchgrass mix		8 lb/ac bluestem with 2.5 lb/ac switchgrass	