

# TECHNICAL

# NOTES

U. S. DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

IOWA STATE OFFICE  
DES MOINES, IOWA

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Agronomy #34

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Subject: FORAGE AND BIOMASS PLANTING

This technical note provides basic information on planting forages for forage and biomass. It reviews species selection, seeding rates, seeding dates, use information, seedbed preparation, interseeding options and weed management. Much of this information will be presented in table format.

Seeding dates are shown in Table 1. They may be extended two weeks by the District Conservationist and are based upon long-term averages. Extending the deadlines is based upon favorable moisture, temperature for seed germination and professional judgment.

*Table 1. Seeding dates for introduced species, native species and annuals*

Type of	Cool Season Species <sup>2</sup>	Warm Season Species <sup>3</sup>
Seeding	(Grasses and Legumes)	(Includes Prairie Restoration Mixtures)
Spring	March 1 - May 15	April 1 – July 1
Late Summer	August 1 - September 15	Not Recommended
Dormant	November 15 - Freeze-up	November 15 - Freeze-up
Frost <sup>1</sup>	February 1 - March 15	February 1 - March 15

1 - Refer to Table 2 for applicable plant species.  
2 - Includes all species generally considered introduced.  
3 - Includes all warm and cool season natives when planted in mixture.

Seedbed quality and planting method are critical for seeding success. Apply fertilizer and lime according to a soil test. Nutrient Management Standard 590 contains fertilizer and lime recommendations for forage and biomass seeding establishment and management if a soils test has not been done and no cost-share is involved. When legumes are a part of the seeding mixture soil pH is very important. Legume seed need to be inoculated. Refer to *Agronomy Technical Note #11 Legume Inoculation* for more specific guidance. Tables 2 and 3 provide guidance for species selection.

Table 2. Crop Use Information (E=excellent, G=good, F=fair, P=poor).

CROP	Lifespan	HAY	Silage	Pasture (Grazing)		Palatability
				Slow Rotation	Fast Rotation	
<b>LEGUMES</b>						
Alfalfa	Perennial	E	E	F	E	E
Alsike clover	Short-lived perennial	G	G	G	E	E
Birdsfoot trefoil	Perennial	G	E	E	G	G
Crown vetch	Perennial	F	G	P	F	G-F
Hairy Vetch	Reseeding Annual	F	G	G	E	G-F
Kura clover	Perennial	G	G	E	E	G-E
Lespedeza (Korean)	Annual	F	F	F	F	G
Red clover (Medium)	Short-lived perennial	G	E	G	E	E
Sweet clover	Biennial	F-P	G	P	G	F
White (Ladino) clover	Perennial	F-P	F-P	E	E	E
<b>COOL SEASON GRASSES</b>						
Canada wildrye,	Short-lived perennial	F	F	P	F	F
Intermediate wheatgrass	Perennial	G	G	P	F	F
Kentucky bluegrass	Perennial	F-P	F-P	F	P	E
Orchard grass	Perennial	E	G	E	E	G
Perennial ryegrass	Short-lived perennial	E	E	E	G	E
Reed canary grass	Perennial	G	G	F	G	G
Smooth brome grass	Perennial	E	E	F	E	E
Tall fescue (endophyte free)	Perennial	G	G	G	G	G
Timothy	Perennial	E	E	F	G	G
<b>WARM SEASON GRASSES</b>						
Big bluestem	Perennial	F	F	F	E	G
Eastern gamma grass	Perennial	G	G	P	E	E
Indiangrass	Perennial	F	F	F	E	G
Little bluestem	Perennial	F	F	F	F	F
Red top	Perennial	F	F	F	F	G
Sideoats grama	Perennial	F	F	F	G	G
Switchgrass	Perennial	G	F	F	F	G
<b>ANNUAL GRASSES</b>						
Annual Ryegrass	Annual	F	P	F	F	F
Corn	Annual	G	E	P	E	G
Foxtail/German Millet	Annual	P	P	P	P	F
Hybrid Pearl Millets	Annual	F	F	F	G	G-F
Oats	Annual	F	F	F	F	E
Triticale	Annual	F	F	F	F	F
Sorghum-Sudan grass	Annual	P	G	F	G	G-F
Sudan grass	Annual	P	F	F	G	G-F
Wheat	Annual	P	P	F	G	G-E
<b>OTHER</b>						
Rape	Annual	P	P	P	G	P-F
Turnips	Annual	P	P	F	G	P-E
Chicory	Annual	P	P	F	G	F-G

Table 3. Crop description, relative tolerance of established forages to environmental hazards, and ease of establishment (E=excellent, G=good, F=Fair, P=poor).

	Cold	Soil			Ease of	Growth		Anti-Quality
CROP	Frost	Drought	Wetness	Acidity	Establishment	Habit	Palatability	Component
<b>LEGUMES</b>								
Alfalfa	G	G	P	P	G-E	M	E	B
Alsike clover	F	P	G	G	F	M-S	E	B, P
Birdsfoot trefoil	G	F	G	G	P	S	G	T
Crown vetch	G	G	P	E	P	M-S	G-F	G
Hairy Vetch	F	G	F	F	E	M-S	E	B
Kura clover	E	F	F	F	P	M-S	E	B
Lespedeza (Korean)	P	G	P	F	G	M-S	G	T
Red clover (Medium)	F	P	G	F	F	S	E	B
Sweet clover	G	F	F	F	G-E	M	E	B
White (Ladino) clover	G	G	P	P	F	S	F	B, C
<b>COOL SEASON GRASSES</b>								
Canada wildrye	G	F	F	G	G	T	F	---
Intermediate wheatgrass <sup>6</sup>	E	G	P	F	F	T	G	---
Kentucky bluegrass	E	P	G	F	P	S	E	---
Orchard grass	F	F	F	F	G-E	M	G	---
Perennial ryegrass <sup>3, 4, 5</sup>	P	P	G	F	E	M-S	E	E
Reed canary grass <sup>4</sup>	E	G	E	G	P	M	G-P	A
Smooth brome grass	E	G	F	F	F	M	E	---
Tall fescue <sup>5</sup>	G	G	G	E	G	M	F-G	A, ET
Timothy	G	P	P	G	F	M	E	---
<b>WARM SEASON GRASSES</b>								
Big bluestem <sup>7</sup>	G	E	P	G	P	T	G	---
Eastern gamma grass	G	E	F-G	G	P	T	E	---
Indiangrass	F	E	F	G	P	T	G	---
Little bluestem	G	E	F-P	G	P	M	F	---
Red top	E	G	G-E	E	F	M-S	G-F	---
Sideoats grama	G	E	P	G	P	M	G	---
Switchgrass	G	E	G	G	F	T-M	G	---
<b>ANNUAL GRASSES</b>								
Annual Ryegrass	F	F	G	G	E	M	F	---
Corn	P	P	P	F	E	T	G-E	EN
Foxtail/German Millet	P	G	P	F	G	M	G	---
Hybrid Pearl Millets	P	E	P	F	E	M	g	---
Oats	P	E	P	F	E	M	E	---
Triticale	G	G	F	G	G	M	G	E
Sorghum-Sudan grass						T		CG
Sudan grass						T		CG
<b>OTHER</b>								
Rape	E	F	F	F	G	S	G	P
Turnips	E	F	F	F	G	M-S	G	P
Chicory	F	F	F	G	G	M-S	G	---

**Growth Habit:**

**Anti-quality components:**

A = Alkaloids (decrease palatability)

B = Bloat potential

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

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

G = Glycosides (decrease palatability)

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

T = Tannins (decrease palatability)

N= Nitrate accumulation in the stalk (poisoning)

E= Ergot in some varieties (found on seed head) can decrease ADG or poison animals

T = Tall (4 Feet plus) M = Moderate (2-4 Feet) S = Short (> 2 Feet)

**Footnotes:**

1. Select erect varieties for hay and prostrate for pasture
2. Limited to extreme southern Iowa, must be allowed to mature and reseed stand for the next year.
3. Select the more winter hardy varieties for use in Iowa.
4. Select the low-alkaloid varieties to improve palatability.
5. Select the endophyte-free varieties to improve Animal performance.
6. Only recommended for western one-half of Iowa at this time.
7. Select a variety that is adapted to the appropriate MLRA. See Table 5 of the 327 Standard for recommended varieties.

Plantings consist of a single species or a mixture of species. Base species selection on the following criteria:

1. Climatic conditions such as annual rainfall, seasonal rainfall, growing season length, humidity levels, temperature extremes and the USDA Plant Hardiness Zones.
2. Soil condition and position attributes such as pH, percent slope, available water holding capacity, aspect, drainage class, inherent fertility, flooding and ponding, and levels of salinity and alkalinity.
3. Plant characteristics such as season of growth, vigor, ease of establishment, longevity of the species, growth habit, adaptation to soil conditions, and conservation value.
4. Resistance to diseases and insects common to the site or location.
5. Compatibility with other plant species and their selected cultivars in rate of establishment and growth habit when planted together as a mixture.

In general, prepared mixes offered by many seed companies should not be used. They often include species that may not be desirable for the intended use. These prepared mixes may not include the most adapted, disease and weather resistant species. Use the information included in Tables 2 & 3 to select the species and then use information from Table 4 to determine the amount of each component. Select species from this list and the appropriate seeding rate to develop your seeding mixture.

All seed should be high quality and comply with Iowa Seed and Weed Laws. All seeding rates are expressed in Pure Live Seed (PLS) pounds per acre. PLS is calculated with the following equation:

$$\text{PLS} = (\% \text{ germination} + \text{dormant seed} \times \% \text{ purity}) \div 100.$$

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 of this standard are the minimum rates for planting a single species stand into a well-prepared seedbed at the proper placement. The pure stand rates are decreased to a percentage of the desired stand, when used to calculate a mixture of two or more species. Mixtures are usually composed to provide about 50-75 or more seeds per square foot. Select combinations of plant species and cultivars best adapted to site conditions. Refer to Table 2 for forage use, Table 3 for site hazards and Table 7 for species compatibility when selecting species to be used for seeding. Attention needs to be made to cultivar selection. Some cultivars within a species may have more resistance to disease or may be later maturing. In general varieties developed within ten years or less will generally have more disease resistance than older cultivars.

Commonly planted forage and biomass species, allowable mixture compositions and pure stand seeding rates are shown in Table 4. A designed seeding mixture shall meet the criteria specified in Table 4. Seeding mixtures with wildlife as a secondary purpose should not have more than 10% of the mixture as tall fescue or more than 20% as switchgrass. Native grass plantings can include up to 20% introduced legumes. However, legumes tend to establish much more quickly and can act as a "weed" to the native grass. So it might be preferable to interseed introduced legumes after the native grass has become established.

Tall fescue can be noxious to grazing livestock, especially horses, if it is endophyte infected. The seed should be identified as to being "endophyte free" or "novel endophyte". If the seed tag does not say, assume the seed is endophyte infected.

To determine the seeding rate for a species when the producer is improving a stand versus establishing a new stand, decide what percent of the stand the introduced species will comprise. Then use that percent of the full seeding rate for that species. For example if red clover is going to be interseeded into a brome grass pasture and the producer would like to have 50% legume multiply 8# (full seeding rate of red clover) X 50% and the producer should seed 4#/acre of red clover. If frost seeding increase the PLS pounds by an additional 50% and in the example it would be 6#/acre.

Table 4. Seeding chart.

Plant Species	Legal wt per bu. (lb)	Seeds per lb	Seeds/sq ft at 1 lb/Ac	Seeding Rate PLS pounds/acre <sup>b</sup>	
				Alone	In Mixture
<b>LEGUMES</b>					
Alfalfa <sup>a</sup>	60	225,000	5.0	10-15	4-12
Alsike clover <sup>a,b</sup>	60	690,000	15.8	4-6	1-4
Alyce White Clover	60	728,000			
Birdsfoot trefoil <sup>a</sup>	60	380,000	8.7	5-8	2-5
Crown vetch <sup>a</sup>	60	120,000	2.8	8-15	5-10
Kura clover	---	---	5	8-10	---
Lespedeza (Korean) <sup>a,c</sup>	40	235,000	5.4	20-25	10-15
Red clover <sup>a</sup> (Medium)	60	275,000	6.3	8-12	4-8
Sweet clover <sup>a,c</sup>	60	260,000	6.0	8-15	4-8
White (Ladino) clover <sup>a,b</sup>	60	800,000	18.4	1-3	1/4-1
<b>COOL SEASON GRASSES</b>					
Bluegrass, Kentucky	14	2,177,000	50.0	5-10	4-6
Canada Wildrye	---	115,000	2.8	10	0.5-4.0
Orchard grass	14	654,000	15.0	8-12	4-6
Ryegrass * Perennial <sup>b</sup>	24	275,000	6.3	15-20	5-10
Red top <sup>b</sup>	14	4,990,000	114.6	3-6	1-3
Reed canary grass	46	530,000	12.2	8-12	4
Smooth brome grass	14	136,000	3.1	10-16	4-10
Tall fescue	25	227,000	5.2	8-15	4-8
Timothy	45	1,200,000	27.5	4-8	2-4
<b>WARM SEASON GRASSES</b>					
Big bluestem	---	165,000	3.8	10-12	5-6
Eastern gamma grass <sup>c</sup>	---	7,500	2	10	---
Indiangrass	---	175,000	4.0	10-12	5-6
Intermediate wheatgrass <sup>b</sup>	---	88,000	2.0	10-12	7-10
Little bluestem <sup>b</sup>	---	255,000	5.5	7-12	1-5
Sideoats grama <sup>b</sup>	---	191,000	4.4	9	2.5-5
Switchgrass <sup>a</sup>	55	280,000	8.9	5-7	3
<b>ANNUAL GRASSES</b>					
Pearl Millet	48	85,000	---	15 drilled, 30 broadcast	
Ryegrass, Italian	24	224,000			
Sorghum - sudan grass	48	35,000		20-25 drilled, 30-35 broadcast	
Sudan grass	40	43,000	---	25-30	---
Triticale	48	15,000			

a. Species suitable for frost seeding increase seeding rate by a factor of 1.5.

b. Not recommended as a pure stand.

c. Use scarified seed.

Pounds of pure live seed (PLS). PLS % = (%Germination X % Purity)/100.

There may be other species available that have shown to be successful in a local area. These species can be used as a part of a mix if approved by the Area Resource Conservationist.

\* Do not use more than 25% Perennial Ryegrass in grazing mixture due to its short lifespan. In Iowa, drainage is the most limiting factor for selection of forages. PH level is very important in establishing legumes. However, the affect of drainage, pH, and fertility on legumes will vary between legume species. Use Table 5 as a guide to help select legumes for a specific site.

*Table 5 Key for Selecting the Most suitable Legumes to Plant on Hay or Pasture Lands Differing in Soil Drainage, Fertility and pH level*

Drainage Condition	Fertility Level	pH Level	Adapted Legumes (most to least desirable*)
Good Drainage	High Fertility	pH >6.5	Alfalfa, Red Clover, Trefoil, White Clover
		pH <6.5	Red Clover, Trefoil, White Clover
	Moderate Fertility	pH >6.5	Alfalfa, Red Clover, Trefoil, White Clover
		pH <6.5	Red Clover, Trefoil, White Clover
	Low Fertility	pH >6.5	Red Clover, Trefoil, White Clover
		pH <6.5	Red Clover, Trefoil, White Clover, Lespedeza*
Moderate Drainage	High Fertility	pH >6.5	Alfalfa, Red Clover, Trefoil, White Clover
		pH <6.5	Red Clover, Trefoil, White Clover, Lespedeza*
	Moderate Fertility	pH >6.5	Alfalfa, Red Clover, Trefoil, White Clover
		pH <6.5	Red Clover, Trefoil, White Clover, Lespedeza*
	Low Fertility	pH >6.5	Red Clover, Trefoil, White Clover, Lespedeza*
		pH <6.5	Trefoil, White Clover, Lespedeza
Poor Drainage	High Fertility	pH >6.5	Trefoil, White Clover
		pH <6.5	Trefoil, White Clover, Lespedeza*
	Moderate Fertility	pH >6.5	Trefoil, White Clover
		pH <6.5	Trefoil, White Clover, Lespedeza*
	Low Fertility	pH >6.5	Alsike Clover, Trefoil, White Clover, Lespedeza
		pH <6.5	Alsike Clover, Trefoil, White Clover, Lespedeza
* Lespedeza is generally adapted only to the lower tiers of counties in Iowa.			

Most plantings for grazing should be a mixture of three to four grasses and up to three legume species. Hay or Biomass plantings may include one or more species depending upon resource needs and objectives of the producer. Forage species planted in a mixture should exhibit similar palatability and mature at similar times to avoid spot or selective grazing. High management levels can be used to graze or harvest dissimilar plant types and maturities using rapid rotation-long rest grazing management or carefully planned haying for biomass harvest systems. Table 7 shows forages that are compatible and Table 6 is a list of commonly used mixtures that research and experience have shown to be compatible.

Table 6 List of frequently used forage seed mixtures for specific site conditions and uses

<p><b><u>Hay Crop</u></b></p> <p>Moderately to well drained Limed or nonacid, 6.6 – 7.3 pH. Fertile soils</p>	Alfalfa	10-15 lbs/ac
	Alfalfa Smooth brome grass or Orchard grass or Reed canary grass	8-10 lbs/ac 6-8 lbs/ac or 4-6 lbs/ac 6-8 lbs/ac
	Kura clover Smooth brome grass Orchard grass or Timothy	8-10 lbs/ac 6-8 lbs/ac 3-4 lbs/ac 3-4 lbs/ac
	Alfalfa Red clover Smooth brome grass or Orchard grass or Reed canary grass or Timothy	5-6 lbs/ac 3-4 lbs/ac 6-8 lbs/ac 4-6 lbs/ac 6-8 lbs/ac 3-4 lbs/ac
Somewhat poorly drained, slightly acid soils, 6.1 – 6.5 pH	Red clover Smooth brome grass or Orchard grass or Reed canary grass or Timothy	6-8 lbs/ac 6-8 lbs/ac 4-6 lbs/ac 6-8 lbs/ac 3-4 lbs/ac
	Red clover Alsike clover Smooth brome grass or Reed canary grass or Timothy	5-7 lbs/ac 2 lbs/ac 6-8 lbs/ac 6-8 lbs/ac 3-4 lbs/ac
Poorly drained soils	Ladino White Clover Birdsfoot trefoil Timothy	1-3 lbs/ac 5-6 lbs/ac 2-4 lbs/ac
	Reed canary grass	8-12 lbs/ac
	Alsike clover Timothy or Red top or Reed canary grass or Tall fescue	4 lbs/ac 4-5 lbs/ac 4 lbs/ac 6-8 lbs/ac 6-8 lbs/ac
	Kura Clover Smooth brome grass or Orchard grass or Tall fescue	8-10 lbs/ac 6-8 lbs/ac 4-6 lbs/ac 6-8 lbs/ac
Excessively Drained Soils	Alfalfa * Smooth brome grass or Orchard grass or Tall fescue	6-8 lbs/ac 6-8 lbs/ac or 4-6 lbs/ac 6-8 lbs/ac
<p><b><u>Permanent Pastures</u></b></p> <p>Moderately to well drained Limed or nonacid Fertile soils, 6.6 – 7.3 pH</p> <p>* Red clover at 4 lbs/ac can be substituted for ½ of the alfalfa seed or 6-8 lbs/ac red clover in place of alfalfa.</p>	Alfalfa * Tall Fescue Smooth brome grass Orchard grass	6-8 lbs/ac 4-6 lbs/ac 6-8 lbs/ac 4-6 lbs/ac
	Red clover White clover Birdsfoot Trefoil Smooth Brome grass Orchard grass or Tall fescue	6-8 lbs/ac ½ lbs/ac 3 lbs/ac. 6-8 lbs/ac 4 lbs/ac 6-8 lbs/ac

Somewhat poorly drained, slightly acid soils, 6.1 – 6.5 pH	Red clover	6-8 lbs/ac
	White clover	½ lbs/ac
	Orchard grass	4 lbs/ac
	Perennial Ryegrass	2 lbs/ac
	Tall fescue	6-8 lbs/ac
	White clover	½-1 lbs/ac
	Smooth brome grass	8-10 lbs/ac
Poorly drained soils	Orchard grass	6-8 lbs/ac
	Birdsfoot trefoil	5 lbs/ac
	Smooth brome grass	6 lbs/ac
	Smooth brome grass	10 lbs/ac
	Orchard grass	4 lbs/ac
	Big bluestem	10-12 lbs/ac PLS
	Switchgrass	5-7 lbs/ac PLS
Excessively Drained Soils	Tall Fescue	10-15 lb/ac
	White Clover	1 lb/ac
	Birdsfoot trefoil	6 lbs/ac
	Ladino White Clover	½ lb/ac
	Tall fescue and Orchard grass or Timothy	8 lbs/ac 5 lbs/ac 4 lbs/ac
	Alsike clover	2-4 lbs/ac
	White clover	½ lbs/ac
	Timothy or Tall fescue or Reed canary grass	4 lbs/ac 8 lbs/ac 8 lbs/ac
Tall fescue	10-15 lbs/ac ac	
Excessively Drained Soils	Switchgrass	5-7 lbs/ac
	White clover	1-2 lbs/ac
	Kentucky bluegrass	6-8 lbs/ac
	Reed canary grass	8 lbs ac
	Smooth brome grass	15-20 lbs/ac
	Alfalfa	6-8 lbs/ac
<b><u>Pasture for Horses</u></b>	Smooth brome grass or Orchard grass or Tall fescue	6-8 lbs/ac 6-8 lbs/ac 4-6 lbs/ac 6-8 lbs/ac
	Tall fescue	10-15 lbs/ac
	Birdsfoot Trefoil	5 lbs/ac
	Indiangrass	8 lbs/ac PLS
	Big Bluestem	8 lbs/ac PLS
	Alfalfa	6-8 lbs/ac
	Kentucky bluegrass	2 lbs/ac
<b><u>Pasture for Hogs</u></b>	Smooth brome grass or Orchard grass	6-8 lbs/ac or 4-5 lbs/ac
	White clover	½ lb/ac
	Kentucky bluegrass	3-5 lb/ac
	Timothy or Smooth brome grass or Orchard grass	2-4 lb/ac 6-8 lb/ac 4- lb/ac
	Birdsfoot trefoil	6lb./ac
	Timothy	4 lb/ac
	Alfalfa	8 lb/ac
	White clover	2 lb/ac



	Perennial Ryegrass	4 lb/ac
	Forage Rape Oats	4-6 lb/ac 1-2 bu/ac
<b><u>Supplemental Pasture</u></b>	Sudan grass	25-30 lbs/ac
	Hybrid Pearl Millet	30-35 lbs/ac
	Oats	2-3 bu/ac
	Foxtail/German Millet	20-25 lbs/ac
	Winter rye (fall planted)	1 ½ bu/ac
	Forage Rape Oats	4-6 lbs/ac 1-2 bu/ac
	Annual Ryegrass or Oats or Winter Wheat Forage Turnips and Radishes	10 lb/ac 2 bu/ac 2 bu/ac 3-4 lb/ac 10-12 lb/ac
<b><u>Pasture for Goats</u></b>	Big Bluestem Indiangrass Little Bluestem (Could include native legumes and forbs, but don't use switchgrass.)	5 5 3
	Red Clover Birdsfoot Trefoil Orchard grass Tall Fescue	4-5 3-4 5 4-5

Table 7 Compatibility of Species Commonly Used for Pastures, Hayland, and Biomass Plantings in Iowa

SPECIES	LEGUMES							C/S GRASSES							W/S GRASSES									
	Alfalfa	Alsike Clover	An. Lespedeza	Birdsfoot Trefoil	Crown vetch	White Clover	Red Clover	Sweet Clover	Canada Wildrye	Kentucky Bluegrass	Orchard grass	Redtop	Reed Canary grass	Smooth Brome grass	Tall Fescue	Timothy	Western Wheatgrass	Big Bluestem	Eastern Gamma grass	Indiangrass	Little Bluestem	Side-oats Grama	Switchgrass	
<b>LEGUMES:</b>																								
Alfalfa	G	F	F	G	P	G	F	G	F	P	G	P	F	G	F	G	F	F	F	F	F	F	F	F
Alsike Clover	F	G	F	F	P	F	G	F	G	G	G	G	F	G	G	G	F	P	F	P	P	P	P	F
An. Lespedeza	F	F	G	F	P	F	F	F	F	G	F	G	P	F	G	G	F	P	P	P	F	F	F	P
Birdsfoot Trefoil	G	F	F	G	F	G	F	G	F	F	G	F	P	G	G	G	F	G	G	G	G	G	G	G
Crown vetch	P	P	P	F	G	G	P	P	F	F	G	F	P	F	F	G	F	F	F	F	F	F	F	F
White Clover	G	F	F	G	F	G	G	G	F	G	G	G	F	G	G	G	F	F	F	F	F	F	F	F
Red Clover	F	G	F	F	P	G	G	F	F	G	G	G	F	G	G	G	F	P	P	P	P	P	P	P
Sweet Clover	G	F	F	F	P	G	F	G	G	G	F	G	P	F	F	F	G	F	F	F	F	F	F	F
<b>COOL-SEASON GRASSES</b>																								
Canada Wildrye	F	G	F	F	F	F	F	G	G	P	P	F	F	P	P	F	G	G	G	G	G	G	G	G
Kentucky Bluegrass	P	G	G	F	F	G	G	G	P	G	P	F	P	F	P	F	F	P	P	P	P	P	P	P
Orchard grass	G	G	F	G	G	G	F	P	P	G	F	P	G	G	G	F	F	F	F	F	F	F	F	F
Redtop	P	G	G	F	F	G	G	G	F	F	F	G	P	F	F	F	F	G	G	G	G	G	G	G
Reed Canary grass	F	F	P	P	P	F	F	P	F	P	P	P	G	P	P	P	P	P	P	P	P	P	P	P
Smooth Brome grass	G	G	F	G	F	G	G	F	P	F	G	F	P	G	F	G	P	P	P	P	P	P	P	P
Tall Fescue	F	G	G	G	F	G	G	F	P	P	G	F	P	F	G	G	P	P	P	P	P	P	P	P
Timothy	G	G	G	G	G	G	G	F	F	F	G	F	P	G	G	G	F	G	G	G	F	F	F	G
Western Wheatgrass	F	F	F	F	F	F	F	G	G	F	F	F	P	P	P	F	G	G	G	G	G	G	G	G
<b>WARM-SEASON GRASSES</b>																								
Big Bluestem	F	P	P	G	F	F	P	F	G	P	F	G	P	P	P	G	G	G	G	G	G	G	G	G
Eastern Gamma grass	F	F	P	G	F	F	P	F	G	P	F	G	P	P	P	G	G	G	G	G	G	G	G	G
Indiangrass	F	P	P	G	F	F	P	F	G	P	F	G	P	P	P	G	G	G	G	G	G	G	G	G
Little Bluestem	F	P	F	G	F	F	P	F	G	P	F	G	P	P	P	F	G	G	G	G	G	G	G	G
Side-oats Grama	F	P	F	G	F	F	P	F	G	P	F	G	P	P	P	F	G	G	G	G	G	G	G	G
Switchgrass	F	F	P	G	F	F	P	F	G	P	F	G	P	P	P	G	G	G	G	G	G	G	G	G

**Companion Crop**

A companion crop can be used with any new seeding, especially if the site cannot be adequately protected from erosion. It can be used with either spring or fall seeding. Oats and annual ryegrass will reduce soil erosion and also provide some weed control. Oats or annual Ryegrass must be clipped at the time of seed head emergence. This promotes the growth of the new permanent cover. A companion crop is not required with frost seeding or interseeding and is optional for all other seeding periods.

## **Seedbed Preparation and Seeding**

**Conventional Seeding** for spring and late summer seeding periods where site conditions allow for safe operation of equipment.

1. The seedbed shall be worked to a depth of three inches before seeding. It shall be reasonably smooth, friable and firm before seeding. A footprint in the soil should be barely visible before the planting operation as a check on firmness.
2. Perform all tillage operations across the general slope of the land
3. Grass and legume seed shall be drilled uniformly over the area at a depth twice the diameter of the seed. Using a grass-drill with a small seed box is preferred. Alternately broadcast uniformly over the area and roll into the seedbed.
4. Where erosion is a concern and tillage is needed, prepare the seedbed with chisel, disk or similar tool that will leave enough residue to provide adequate protection and/or use a companion crop.

**No-till Seeding** for spring, late summer and dormant seeding periods where site conditions allow for safe operation of equipment.

1. Approved herbicides will be applied to kill or suppress existing vegetation and weed competition, as necessary.
2. A grass or no-till drill designed for no-till planting will be used to plant the seed at a depth of approximately twice the average diameter of the seed to be planted. This is usually  $\frac{1}{4}$  (one quarter) inch.

**Frost Seeding** for late winter dormant seedings.

1. Broadcast seed for only those species approved for frost seeding as shown in Table 4.
2. Seeding rate will be increased by a factor of 1.5.

**Spray Smother Spray** – for spring or late summer seeding date: may be used for highly erosive soils with enough nuisance or noxious plants that tillage is either unsafe or infeasible due to excessive erosion.

1. Spray the entire pasture with a contact herbicide at labeled rates to kill as much of the vegetation as possible when the target vegetation reaches the 5-8 leaf stage or generally about six inches in height. Note: the pasture may be heavily grazed just prior to this operation and allowed to regrow to the 5-8 leaf stage to further weaken existing plants.
2. During the spring or late summer planting dates. Drill (preferably) or broadcast a cover crop as soon as possible to shade surviving plants that escaped the herbicide. Graze or hay as appropriate until either the beginning of the next spring or late summer seeding dates. The last haying or grazing operation should remove as much of the cover crop as possible.
3. Allow resprouts or new seedlings to reach the 5-8 leaf stage and repeat Step #1.
4. Repeat Step #2 (now 12 months from initial step)
5. Choose a seeding method above and plant the desired mixture of species or single species as needed.

## **Stand Improvement Seedings (interseeding)**

This includes any stand modification that maintains some vegetative component of the original stand. This is predominantly incorporating more legumes into an existing stand of forage, hay or biomass. Typically done by either using a no-till drill to interseed grass or legumes, frost seeding, or using a broadcast seeder and incorporating the seed using some form of light tillage or roller/packer.

Regardless of the method used it is beneficial to clip, graze or apply herbicides to suppress the existing plant cover. This causes some stress to existing vegetation and makes it less competitive. It also makes it easier to get good seed to soil contact with the new seeding. If clipping is used exercise care not to leave a mulch on the soil surface that would prevent the seed from coming in contact with the soil during the planting operation.

**No-till Interseeding** can incorporate legumes and/or grasses during the spring, late summer and dormant seeding periods.

1. When seeding into an existing sod graze, burn, mow, or apply herbicides to suppress existing vegetation and control weed competition.
2. Broadleaf weeds can be controlled by grazing or applying labeled broadleaf herbicides at least 2 weeks prior to applying contact herbicides and prior to seeding. Be sure to check the label to insure this will not negatively affect legumes being interseeded due to any residual effects.
3. Use a grass or no-till drill designed for no-till planting to plant the seed at a depth of approximately twice the average diameter of the seed to be planted. This is usually  $\frac{1}{4}$  (one quarter) inch.
4. After seeding remove early spring growth of existing vegetation by haying or grazing to reduce competition and allow the new seedlings access to sunlight so they can become established. Exercise caution to not overgraze or too closely hay the area. Maintain plant heights between 6 and 3 inches until new seedling reach the 5-8 leaf stage or a height equal to the existing vegetation.

**Frost Seeding** to incorporate grass and/or legumes.

1. Broadcast only species approved for frost seeding as shown in Table 4. Small smooth (shiny) seeded species are best for incorporation into the soil during freezing and thawing.
2. Frost seeding is likely to be more successful if the existing stand is weak and the seed can get to open ground.

**Light Tillage** to incorporate grass and/or legumes.

1. Weaken the existing vegetation by grazing, haying, herbicides, or a combination of these methods.
2. Use a disk, cultivator or similar tool to disturb 40-50 percent of the existing stand.
3. Use a grass or no-till drill designed for no-till planting to plant the seed at a depth of approximately twice the average diameter of the seed to be planted. This is usually  $\frac{1}{4}$  (one quarter) inch.
4. After seeding remove early spring growth of existing vegetation by haying or grazing to reduce competition and allow the new seedlings access to sunlight so they can become established. Exercise caution to not overgraze or too closely hay the area. Maintain plant heights between 6 and 3 inches until new seedling reach the 5-8 leaf stage or a height equal to the existing vegetation.

There are other methods to seed forages, especially if the producer is seeding into existing forage instead of establishing a new seeding. Producers have been successful including seed in a fertilizer spreader and combining the seeding and fertilizing process. However, if there is nitrogen included in the fertilizer this will result in giving extra growth to the existing grass and provide more competition to any legumes that are trying to be established. Many producers have included legume seed with loose mineral they are giving the grazing animals. As the animals defecate they deposit legume seed. This works if there are areas within a pasture that are not accessible with a seeder it might be the only way to get legumes introduced. However, the uniformity of legumes in the pasture will only be as uniform as the animals defecate in the pasture. These methods can be effective but are typically very inefficient methods to introduce seed into an area.

Weeds can be very competitive to a new seeding. The type of weeds and the composition of the new seeding help determine the choices available to control the weeds. Noxious weeds, such as Musk and Canada thistle, often require an herbicide treatment. When using herbicides read and follow all label directions and heed all precautions. If herbicides are handled or applied improperly, or if unused portions are not disposed of safely, they may contaminate water and soil, injure humans, domestic animals, desirable plants, and fish or other wildlife. Follow label directions when herbicides are used directly adjacent to ponds, lakes or streams. Cooperators

should be aware of and adhere to the provisions of local, county, state or federal laws and regulations concerning the use of agricultural chemicals. Refer to Pest Management, Practice code 595 for additional information on pesticide use and safety. Herbicides are not a viable alternative if legumes are included in the seeding.

Other weeds can often be controlled by the grazing animals. Many weeds at a vegetative stage are edible by grazing animals and can be nutritious. Managed grazing in a rotational system with appropriate graze and rest cycles provide production to the producer during the seeding year and a less expensive alternative for weed control than other methods. Care needs to be taken so that grazing animals do not damage the new seeding and it may not be a viable option with a new seeding of native forages.