NRCS Natural Resources Conservation Service

Forage and Biomass Planting

Planting Specification Guide *NH-512*

SCOPE:
Establish adapted and compatible native and introduced species to improve or maintain livestock nutrition and/or health, provide or increase forage supply during periods of low forage production, reduce soil erosion, improve soil and water quality, and produce feedstock for biofuel or energy production.

GRASS AND LEGUME SELECTION:
Information about grass and legume types and suitability for mechanical harvest and grazing use is provided in **Table 1 and 2**.

Additional information regarding the relative tolerance of established forages to environmental hazards (cold/frost, drought, wetness) as well as ease of establishment, minimum drainage and fertility requirements, and anti-quality characteristics of various forage types is provided in **Table 7**.

These recommendations might not fit all situations. Consult UNH Cooperative Extension Field Crop Specialists for additional seeding alternatives that better meet the objectives of the farm, if desired.

PASTURE CONSIDERATIONS:
Generally, pasture mixtures containing perennial legumes will produce higher yields and better forage quality than pure stands of grass.

Bloat is a potential hazard when legumes are included in pasture mixes.

In many cases, pasture production will be increased more by proper management of existing stands of forage than by interseeding or reseeding.

Longevity and persistence will be increased by rotational grazing systems that provide plant recovery periods and discourage selective grazing.

SEEDING MIXTURES:
Guidance for seed mixtures and rates for pasture and hay seeding is provided in **Tables 3 and 4**.

Seeding rates will be calculated on a pure live seed (PLS) basis or percent germination. PLS is determined by multiplying the percent purity by the percent germination.

Certified seed will be used. Legumes will be scarified if necessary and inoculated with the proper, viable rhizobia before planting.

SOIL AND FERTILIZER:
Soil tests results will be available before establishment. Apply all plant nutrients according to soil test results.

Required lime or wood ash shall be applied prior to seeding to bring pH into an optimum range. Neutralizing materials should typically be applied 6 months prior to seeding, but may be applied 2-4 weeks before planting if there are time constraints.

Considerations:

1) use a faster reacting material like wood ash if there is a short window between application and seeding

2) no-till plantings generally require a longer time period (*e.g.* 6 months) between application and seeding to be successful

3) if reseeding a stand using conventional tillage, apply neutralizing material to sod *prior to tillage* to prevent soil compaction

4) avoid overliming – do not add more than 3 tons/acre of *limestone* in a single application.

Do not add nitrogen at the time of seeding when inter-seeding or no-till seeding (unless 100% cool season grasses).

CONVENTIONAL SEEDING:
Obstacles should be removed and the area smoothed as needed. Prepare a seedbed to a minimum depth of 3 inches. The seedbed should be firm, and relatively free of competing vegetation. As a general rule, a seedbed is firm when an adult's footprint is no more that one-half inch deep.

On fields where the predominant slope is greater than 8%, all tillage and planting operations must be on a contour and seeding will be done with the use of a companion (nurse) crop or by leaving at least 30% of the crop residue on the surface after planting.

Oats sown at a rate of 1 to 1½ bushels per acre is a good companion crop for spring seedings (not recommended for fall seedings). A companion crop is a good option where weeds may be a concern. Mow and remove oats at boot stage or graze lightly when oats are 10 inches high. The boot stage is when there is a lump in the stalk but the head has not yet emerged from the stem.

SEEDING (cont.)

Grass and legume seed shall be drilled uniformly using a grassland drill, grain drill with press wheels, cultipacker seeder, or by broadcasting and rolling or cultipacking before and after broadcasting the seed.

Drill – A grass drill is the best method for seeding. If the drill does not have a packer wheel system, a cultipacker or roller should be trailed behind.

Broadcast – Seed may be broadcast by using whirlwind or cultipack type seeders. Cover seed with ¼ inch of soil or less. Roll, cultipack or use some other suitable method to firm seedbed before and after seeding.

Frost & Dormant Seeding – Frost seeding involves broadcasting appropriate species just after snowmelt in late winter/early spring. The freeze-thaw action of the soil works the seed into the soil. Frost seeding should be done early in the morning when frost is still in the soil. Seed early enough allow for several freeze-thaw cycles.

Dormant seeding involves broadcasting appropriate species in the early winter just after the field has frozen and the air temperature is low enough to prevent germination. Ideally this is just prior to snowfall. Seeds remain dormant under the snow through the winter and emerge in the spring.

Both frost and dormant seeding are not completely reliable, but should be tried to introduce legumes and some grasses into **existing** pasture areas. Competing vegetation must be grazed or mowed close to approximately 3-4 inches in the fall prior to seeding. Do not plow or cultivate or operate heavy equipment on wet/thawed soils.

Broadcasting on top of a lot of snow cover is not recommended because the seed will wash away.

NO-TILL CONSIDERATIONS:

Consider the use of no-till planting methods to establish forage plants on land subject to erosion, to conserve soil moisture and organic matter, or on stony fields where conventional tillage methods will result in many surface stones and significant labor.

No-Till Drill – No-till seeding of forage crops can be used to replace rundown pastures and hayfields, to supplement existing forage resources, or to establish forages on land subject to erosion. When inter-seeding into existing sod, existing vegetation must be managed through mowing, grazing or herbicide application. Refer to Cooperative Extension recommendations to kill or suppress existing vegetation.

WEED CONTROL:

Identified weed problems will be controlled prior to seeding. For pesticide information or recommendations contact the University of New Hampshire Cooperative Extension Service or read http://extension.unh.edu/resources/files/Resource000025_Rep25.pdf

TIME OF SEEDING:

Seedings will be completed during the optimum seeding periods provided in **Table 5**. The specific date that provides for a successful seeding will vary based on geographic location, elevation, exposure, prevailing moisture and temperature conditions.

MANAGEMENT FOR ESTABLISHMENT YEAR:

Plants shall not be grazed or cut until the heights outlined in **Table 2** are reached. First year cutting should be minimal.

Weed competition can be minimized by careful use of sickle bar or rotary mowers. Clip the area with the mower set high to avoid cutting the seedlings, yet to still be effective in removing the shading effect of the weeds. Removing significant amounts of leaf material from the desired plants will hinder their development to a greater degree than the weeds.

WARM SEASON GRASSES:

If seeding warm season grasses use "Vegetating with Native Grasses in Northeastern North America" a guide.

REFERENCES:

University of New Hampshire fact sheets - Carl Majewski, UNH Extension
http://extension.unh.edu/resources/category/Agriculture#4

- 'Hay and Haylage Production with Selected Forage Species'
- 'Pasture Production with Selected Forage Species'
- 'Improving Pastures and Hayfields'
- 'Hay Quality'

Cornell Guide for Integrated Field Crop Management, Cornell University, Ithaca NY.
http://ipmguidelines.org/fieldcrops/

USDA-NRCS Plants Database

USDA-NRCS Plant Materials Center Publications
'Vegetating with Native Grasses in Northeastern North America' a guide.

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TABLE 1	**Crop Use Information**					***E*** *= Excellent*	***G*** *= Good*	***F*** *= Fair*	***P*** *= Poor*
Crop	**Annual or Perennial**	**Mechanical Harvest**		**Pasture (Grazing)**		**Palat-ability**[1]	**Maturity** ***Early Medium Late***	**Provides** ***Mid, Early*, or *Late* Extended Grazing**
		Hay	Silage	Continuous	Prescribed			
LEGUMES								
Alfalfa	Perennial	F-G	E	P	F-G	E	E-M	M
Alsike clover	Short-lived Perennial	G	G	P	G	E	L	M
Birdsfoot trefoil [2]	Perennial	G	E	G	G	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 [3]								
Kentucky bluegrass	Perennial	G	G	E	E	E	E	E&L
Orchardgrass	Perennial	E	G-E	G	E	E-F	E-M	E&M
Perennial ryegrass	Short-lived Perennial	E	E	E	G	E	E-M	L
Tall Fescue[2]	Perennial	G-E	E	G	E	F-G	M	M&L
Smooth bromegrass	Perennial	E	F	F	E	E	M-L	E&L
Timothy	Perennial	E	E	F	G	E-G	L	N/A
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&L
SorghumXSudan	Annual	P	G	F	G-E	G-E	M	M
Sudangrass	Annual	P	F	F	G-E	G-F	M	M
Teff	Annual	E	G	G	E	E	M-L	M

1 Palatability will improve with the newer varieties that are disease-free.
2 Use disease-free Birdsfoot Trefoil and endophyte-free Tall Fescue. Refer to Cornell Guide for Integrated Field Crop Management.
3 Festulolium (Fescue x Ryegrass) may be used; however, varieties widely in characteristics.

TABLE 2	**Harvest Management for Common Forages in First Year** *
Forage	**First Year Clipping/Grazing Height**
Alfalfa	20 inches
Smooth Bromegrass	10 inches
Red Clover	8 inches
Orchardgrass	10 inches
Tall Fescue	12 inches
Timothy	10 inches
Birdsfoot Trefoil	8 inches
Perennial Ryegrass	8 inches

* Do not harvest or graze the crop until the vegetation reaches this minimum height.

TABLE 3	Seeding Rates (lbs Pure Live Seed/Ac) and Dates						
Crop	Seeding Rate for Single Species		Planting Season	Crop	Seeding Rate for Single Species		Planting Season
	Drilled	Broadcast			Drilled	Broadcast	
Legumes				**Annual Forages**			
Alfalfa	15	18	Spring, E. Fall	Chicory	4	5	Spring
Alsike clover	8	10	Spring, E. Fall	Millets	20	30	E. Summer
Birdsfoot trefoil	6	8	Spring, E. Fall	Brassicas	10	15	E. Fall*
Ladino clover	3	4	Spring, E. Fall	SorghumXSudan	35	50	E. Summer
Red clover	10	12	Spring, E. Fall	Sudangrass	35	50	E. Summer
Sweet clover	15	20	Spring, E. Fall	Teff	8	10	E. Summer*
Grasses				Annual Ryegrass	20	30	Spring, E. Fall*
Kentucky bluegrass	15	18	Spring, E. Fall	Small Grains	100	150	Spring, E. Fall
Orchardgrass	12	15	Spring, E. Fall	**Warm Season Grass**			
Perennial ryegrass	12	15	Spring, E. Fall	Big Bluestem	12	15	E. Summer
Tall Fescue	15	18	Spring, E. Fall	Eastern Gamagrass	12	15	E. Summer
Smooth bromegrass	12	15	Spring, E. Fall	Indiangrass	12	15	E. Summer
Timothy	12	15	Spring, E. Fall	Switchgrass	10	12	E. Summer

- Pure Live Seed = (% germination x % pure seed) x 100
- Smooth Bromegrass and Timothy can take 30 days of spring flooding. New seedings shall not be grazed until at least 30 days after emergence.
- *Teff and Annual Ryegrass can also be planted during July and Mid-August. Tillage radish should be planted only during Aug 1-Aug 14th if goal is to reduce compaction.
- Mixed stands generally have less insect and disease damage than monoculture stands.

Use the seeding rates in Table 4 for crop mixtures, or else calculate mixture rates so the sum of the proportional rates (from the single species rate) is ≥ 100%. For instance, Red Clover broadcast at 6 lbs/ac is 50% of the 12 lbs/ac rate single species rate. If the clover was mixed with 5 lbs/ac of Timothy (50% of 10 lbs/ac), the mixture rate would equal 100%. This method can be used for 2 or more species.

TABLE 4	Common Hayland and Pasture Seeding Mixtures For New Hampshire *Lbs Pure Live Seed Per Acre*		
Hayland		***Pasture***	
Species	***lbs/ac***	***Species***	***lbs/ac***
Moderately Well Drained to Well Drained Soils		*Moderately Well Drained to Well Drained Soils*	
Alfalfa	12-15		
Orchardgrass,	6	Orchardgrass	6
or Timothy	6	Or Tall Fescue	8
or Smooth Bromegrass	8	Birdsfoot Trefoil	6
or Tall Fescue	8	LadinoClover	1
		Kentucky Bluegrass	4
Orchardgrass	2		
Medium Red Clover	6		
[1]Alsike Clover	2		
Timothy	6		
or Smooth Bromegrass	8		
Somewhat Poorly to Poorly Drained Soils		*Somewhat Poorly to Poorly Drained Soils*	
Red Clover	6	Medium Red Clover	4
Orchardgrass	3	LadinoClover	2
Timothy	5	Kentucky Bluegrass	6
[1]Alsike Clover	2	Orchardgrass	4

TABLE 5	**Suggested Seeding Dates by Major Land Resource Area (MLRA)**		
MLRA	**Spring**	**Early Summer**	**Early Fall**
143 Northeastern Mountains	Apr 21 To Jun 1	May 21 To Jul 1	Aug 1 To Sep 1
144A Southern NE Upland/ Coast	April 7 To May 15	May 7 To Jun 21	Aug 14 To Sep 14
144B Northern NE Upland	April 14 To May 21	May 14 To Jul 1	Aug 7 To Sep 7
145 Connecticut River Valley	April 7 To May 15	May 7 To Jun 21	Aug 14 To Sep 14

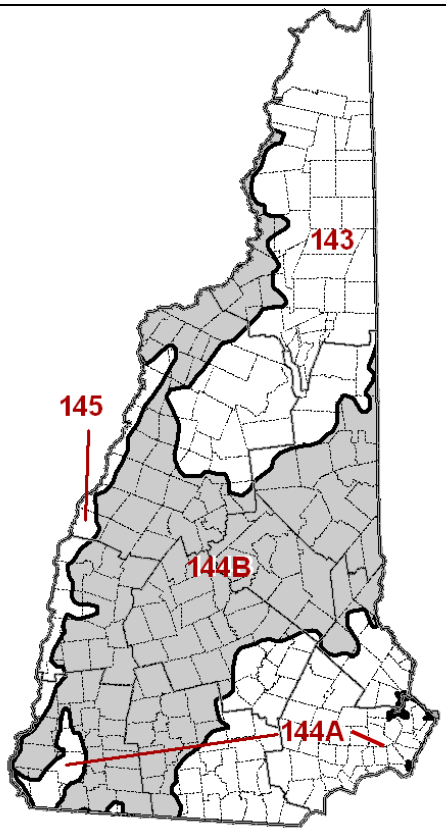

TABLE 6
Recommended Seeding Rates for FROST or DORMANT Seeding Into an Existing Sod

Species	**Rate (lb./acre)**	
	Seeded Alone	**As Part of Seed Mixture**
Red Clover	8	4
Ladino Clover (White)	4	2
Alsike Clover	4	2
Perennial or Annual Ryegrass	10	5
Orchardgrass	4	2

* Frost or Dormant is not completely reliable – (legume seeds are much more reliable than grass seed).

** Clover must be used (either alone or with grasses) for financial assistance with 512 – Frost Seed scenario

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

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TABLE 7 - 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	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,S
Alsike clover	F	P	G	6.0 – 6.5	F	M	PD	M	B,S
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
Ladino clover	F	P	G	6.0 – 6.5	G-E	S	PD	M	B,S
Mammoth red clover	P	F	F	6.2 – 6.8	G	M	SPD	M	B,S
Medium red clover	G	F	F	6.2 – 6.8	G-E	M	SPD	M	B,S
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 – 7.0	G	M-T	SPD	M	
Perennial ryegrass [2,3]	P	P	G	5.0 – 7.0	E	M-S	SPD	H	
Tall Fescue	F	G	F	5.5 – 6.5	G	T	SPD	M	E
Smooth bromegrass	E	G	F	5.5 – 6.5	F	M-T	MWD	H	A
Timothy	E	F	E	5.0 – 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
Millets	P	G	P	6.2 – 6.8	G	T	MWD	M-H	
Brassicas	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
Teff	P	E	F	5.3 – 6.8	E	S	MWD	L	

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)
- **E** = Endophyte (fungus that may cause health problems in animals). Use endophyte-free.
- **G** = Glycosides (decrease palatability)
- **T** = Tannins (decrease palatability)
- **S** = Slaframine alkaloid (slobbers) **<>** A concern especially in the spring and summer, slobbers results when horses eat legume forages, particularly clover, which have been parasitized by the fungus Rhizoctonia leguminicola. This fungus produces an alkaloid called slaframine, which is responsible for the excessive drooling and slobbering.

Drainage Categories (Natural Soil Drainage):

MWD = Moderately Well Drained
PD = Poorly Drained
SPD = Somewhat Poorly Drained
VPD = Very Poorly Drained
WD = Well Drained

Footnotes

1 - Select erect varieties for hay and prostate varieties for pasture.
2 - Select the more winter hardy varieties for use in New Hampshire
3 - Select the low-alkaloid varieties to improve palatability.

For more specific forage plant information, go to the NRCS Plants database at http://plants.usda.gov/