

SPECIFICATION GUIDE SHEET*for PASTURE AND HAY PLANTING (512)***SCOPE:**

This work will consist of establishing adapted and compatible native and introduced species, varieties, or cultivars to improve or maintain livestock nutrition and/or health, extend the length of the grazing season, to provide emergency forage production, to reduce soil erosion by wind and/or water or to improve water quality by reducing runoff.

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 Vermont 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 will pure stands of grass.

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

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

Longevity and persistence, yield and quality of forage will be increased by rotational grazing systems and harvest management that provide plant recovery periods, promote vigorous regrowth 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 will be applied and incorporated at least six months prior to seeding. (Allow longer than six months if a no-till planting is planned). If lime is not incorporated, apply 1 to 2 years ahead of seeding.

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, relatively free of competing vegetation and contain enough fine soil particles for uniform shallow coverage of the seed as well as contact with moisture and nutrients. As a general rule, a seedbed is firm when an adult's footprint is no more than one-half inch deep. Tillage should be limited to the minimum number of soil disturbing operations needed to prepare a seedbed.

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 (32-48 lbs.) per acre is a good companion crop for spring seedings. Use of 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.

Grass and legume seed shall be drilled uniformly over the area at a depth of ¼ to ½ inch 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 of seeding on level and sloping areas, but the preferred method

will depend on slope and conditions of the planting site. 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 end gate 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 Seeding – This method is used to introduce legumes such as the clovers or birdsfoot trefoil into pastures. Broadcast the seed during the spring period (March or early April) when the snow cover has melted off, but the soil surface is going through the daily freeze-thaw cycle. At this time of year, the soil surface is usually honey-combed with small cracks. Frost seedings shall not be made on areas covered with ice or snow but must be made before frost leaves the soil.

Frost seedings will mainly be used to inter-seed legumes into existing pasture areas. Competing grasses must be grazed close to approximately 3-4 in. so that legume seedlings are not shaded out. Refer to **Table 6** for seeding rates for frost seeding.

NOTE: Frost seeding establishment is not as reliable as other seeding techniques.

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.

When no-tilling into established sods, chemical control of the sod should be achieved the year prior to the seeding.

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. Preparation approximately 6 months in advance is needed to control competing vegetation. See the practice standard ‘Residue Management, No-Till/Strip Till/Direct Seed’ (329).

WEED CONTROL:

Identified weed problems will be controlled prior to seeding. For pesticide information or

recommendations contact the University of Vermont Extension System.

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. Discussion with the landowner regarding the physical characteristics of the sight will prove helpful. Spring seeding is recommended since late summer seeding is generally riskier than spring seeding.

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. See practice standard ‘Forage Harvest Management’ (511) for management of established stands.

WILDLIFE HABITAT IMPROVEMENT:

Where wildlife habitat improvement is an objective of the landowner, use the Wildlife Seeding Tech Note to plan appropriate seed mixtures by soil drainage class. The note is available at: https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1431076&ext=pdf

These grasses and forbs will provide food and or cover for a number of wildlife species that utilize grasslands for all or part of their life cycle.

REFERENCES:

Cornell Guide for Integrated Field Crop Management, Cornell University, Ithaca NY. https://cropandpestguides.cce.cornell.edu/Preview/2021/2021_Field_Crop_Preview.pdf

Vermont NRCS Pasture and Hay Planting, Code 512, Conservation Practice Standard.

University of Maine Bulletin #1006 ‘Equine Facts: Pasture and Hay for Horses’ 2002. <https://extension.umaine.edu/publications/1006e/>
Adapted from Penn State Agronomy Facts #32 by

Marvin H. Hall and Patricia Comerford,
 Pennsylvania State University. 1992.
https://extension.psu.edu/downloadable/download/sample/sample_id/470

USDA NRCS Plants database
<http://plants.usda.gov/java/>

University of New Hampshire fact sheets 'Hay and Haylage Production with Selected Forage Species', and 'Pasture Production with Selected Forage Species'
<https://extension.unh.edu/resource/pasture-production-selected-forage-species> written by Carl Majewski, UNH Extension Educator, Agricultural Resources

'Vegetating with Native Grasses in Northeastern North America' a guide'.
<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/plantmaterials/newsroom/feature/?cid=stelprdb1045509>.

TABLE 1 Crop Use Information								
Crop	Annual or Perennial	Mechanical Harvest		Pasture (Grazing)		Palatability ¹	Maturity <i>Early</i> <i>Medium</i> <i>Late</i>	Provides <i>Mid, Early, or Late</i> Extended 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 ²	Perennial	G	E	G	G	E	M-L	M
Hairy vetch	Winter annual used primarily as a cover crop						E-M	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	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
Red top	Perennial	F	F	F	F	F		N/A
Smooth brome grass	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
Millet	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

1 Palatability will improve with the newer varieties that are disease-free.
 2 When planting this species, in particular, but also all the species, one should use the newest disease-resistant varieties if no other plant species will meet the planting goal. Refer to Cornell Guide for Integrated Field Crop Management.

TABLE 2 Harvest Management First Year *	
Forage	First Year Clipping/Grazing Height
Alfalfa	20 inches
Smooth Bromegrass	10 inches
Red Clover	8 inches

Orchardgrass	10 inches
Timothy	10 inches
Birdsfoot Trefoil	12 inches
Perennial Ryegrass	8 inches

* Do not harvest or graze the crop until the vegetation reaches this minimum height. See CPS 511 Forage Harvest Management for more information.

TABLE 3 - Seed Mixtures for Pasture and Hay Seeding Rates of Pure Live Seed Per Acre ¹							
Legume Seed (if one legume only use high rate)				Grass Seed (One Only) (in mixes use lower rate) ²			
Primary Legume	Rate (lbs)	Secondary Legume	Rate (lbs)	Orchard Grass	Smooth Brome grass	Timothy	Kentucky Bluegrass
Alfalfa	8-10			5-10	4-6	5-8	
Alfalfa	12-18	(hayland only)					
Alfalfa	6-8	Red Clover	2-4	5-10	5-7	5-8	
Alfalfa	4-6	Red Clover	2	5			
Alfalfa	6-8	Ladino Clover	1/4	5-10	5-7	5-8	
Red Clover	6-8			5-10	5-7	5-8	
Red Clover	4-6	Ladino Clover	1/4	5-10	5-7	5-8	
Red Clover	6-8						
Red Clover	6-8	Alsike Clover	2	5-10	5-7	5-8	
Alsike Clover	3-5	Ladino Clover	1/4	5-10	5-7	5-8	
Birdsfoot Trefoil	6			5-10	4-6	5-8	4-8
Red Clover	6-10	Ladino Clover	1/2	5-10	4-6	5-8	
One Grass Only ²				12	10	10	15

Tabular information assembled with data from Purdue Extension Publication Ay-253 and UNH Extension Publication 'Hay and Haylage Production with Selected Forage Species'

¹ Make sure the minimum adequate drainage and area planting dates for the specific site are correct for the species chosen (Table 5).

Most certified and licensed Vermont seed companies selling cool season grasses and legumes have documented > 95 percent purity and > 95 percent germination for all species sold. In these cases, use their bulk rates as equal to PLS.

² 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.

Perennial Ryegrass, if used, takes special management and should be seeded at 15-20 pounds alone or 6 to 8 pounds per acre with 2 compatible legumes.

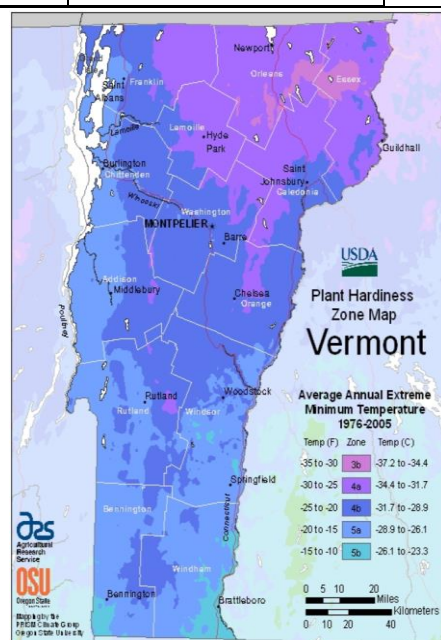
- Notes:**
- Smooth Bromegrass and Timothy can take 30 days of spring flooding. New seedlings shall not be grazed until at least 30 days after emergence.
 - Birdsfoot Trefoil may spread quickly in certain soils and conditions in Vermont.
 - Mixed stands generally have less insect and disease damage than monoculture stands.

TABLE 4 Common Hay and Pasture Seeding Mixtures For Vermont			
<i>Pure Live Seed Per Acre</i>			
Hay		Pasture	
Species	lbs/ac	Species	lbs/ac
<i>Moderately Well Drained to Well Drained Soils</i>		<i>Moderately Well Drained to Well Drained Soils</i>	
Alfalfa	10		
Orchardgrass, or Timothy or Smooth Bromegrass	6 6 8	Orchardgrass Birdsfoot Trefoil Ladino Clover	6 6 1

Orchardgrass	2	Kentucky Bluegrass	4
Medium Red Clover	6		
¹ Alsike Clover	2		
Timothy	6		
or Smooth Bromegrass	8		
<i>Somewhat Poorly to Poorly Drained Soils</i>		<i>Somewhat Poorly to Poorly Drained Soils</i>	
Red Clover	6	Medium Red Clover	4
Orchardgrass	3	Ladino Clover	2
Timothy	5	Kentucky Bluegrass	6
¹ Alsike Clover	2	Orchardgrass	4

TABLE 5 Suggested Seeding Dates by Major Land Resource Area (MLRA)

Plant Hardiness Zone	Spring	Late Summer
3b	May 1 To June 15	July 15 To August 10
4a	May 1 To June 15	July 15 To August 10
4b	April 15 To May 30	August 7 To September 15
5a	April 15 To May 15	August 7 To September 15
5b	April 15 To May 30	August 7 To September 15



If seeding warm season grasses use "Vegetating with Native Grasses in Northeastern North America" a guide. This document can be found in the Field Office Technical Guide References (Plant Materials and Application Reference #7).

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
Ladino Clover (White)	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
Smooth Bromegrass	<i>Not recommended for frost seeding</i>		
Timothy	8 - 10	5 - 7	3 - 4
<i>Not recommended for frost seeding</i>	<i>unless certain conditions or soils exist. If proper conditions exist, use these rates:</i>		

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

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 - 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	4.5 – 6.2	F	S	VPD	M	
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	
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
Growth Habit: T = Tall; M = Moderate; S = Short									
Anti-Quality (components that could be present in some varieties):									
<p>A = Alkaloids (decrease palatability)</p> <p>B = Bloat potential</p> <p>C = Coumarin (hemorrhagic agent, formed during spoilage of hay)</p> <p>CG = Cyanogenic Glycosides (may form hydrogen cyanide-HCN poisoning; also Prussic Acid Poisoning)</p> <p>G = Glycosides (decrease palatability)</p> <p>T = Tannins (decrease palatability)</p> <p>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 <i>Rhizoctonia leguminicola</i>. This fungus produces an alkaloid called slaframine, which is responsible for the excessive drooling and slobbering.</p>									
Drainage Categories (Natural Soil Drainage):					Footnotes				
MWD = Moderately Well Drained PD = Poorly Drained SPD = Somewhat Poorly Drained VPD = Very Poorly Drained WD = Well Drained					1 - Select erect varieties for hay and prostrate varieties for pasture. 2 - Select the more winter hardy varieties for use in Vermont 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/java/>