Frost Seeding Legumes and Grasses into Pastures

Mike Rankin
Crops and Soils Agent
UW Extension - Fond du Lac County

Why Frost Seed?

Frost seeding legumes and grasses is increasingly being used by graziers as a means to improve pasture yields or change forage species composition within the pasture. Frost seeding offers several potential advantages. These include the ability to establish forage in an undisturbed sod, a reduced need for labor and energy compared to conventional seeding methods, the ability to establish forages with minimum equipment investment, a shortened "non-grazing" period, and it is a method to maintain stands at productive levels with both grasses and legumes.

Keys to Successful Frost Seedings

1. Seed - soil contact

As with any method of forage establishment, seed to soil contact is critical for successful frost seedings. There are several management practices that can be done to help insure good seed-soil contact. The first involves fall grazing management. Pastures should be closely grazed in the fall or winter to open stands and expose soil. Sod-type grasses like bluegrass are the most difficult to make successful frost seedings, especially where a thick layer of thatch covers the soil surface. It is in these situations where short duration animal hoof action is sometimes needed to help "plant" the seed.

2. Reduce plant competition with new seedlings

New seedlings must be given a chance to establish without excessive competition from plants already present in the stand. Reducing competition can be done in several ways. First, grazing pastures down to 2 inches in the fall will help to slow regrowth in the spring. Frost-seeded pastures need to be grazed regularly in the spring and summer to allow for light penetration into the plant canopy. However, it is also beneficial to move animals off pastures before young seedlings are consumed prior to adequate root development.

The importance of reducing plant competition during the year of establishment is seen in research done at Michigan State University (Leep, 1989). In this study, red clover and birdsfoot trefoil were frost-seeded into a sod that was either suppressed with a herbicide or cut from zero to four times following seeding. The more frequent cutting regime resulted in stand densities similar to or better than those of the herbicide-treated field plots (Table 1).

3. Species selection and seeding rates

In many cases, frost seedings are made to introduce or increase forage legume species into a grass stand.

Research and farmer experience has shown good results with red clover and birdsfoot trefoil. Alfalfa, alsike clover, and white or ladino clover have also been frost-seeded with varying degrees of success. Do not frost seed alfalfa in situations where alfalfa plants already exist in the stand. Autotoxicity will prevent new seedlings from becoming established. Several studies have indicated that frost seeding both red clover and birdsfoot trefoil together offer the advantage of long-term legume presence in a pasture. In an Iowa State University research trial (George, 1984), red clover established quickly and remained productive for the first two years while birdsfoot trefoil became productive in the second and subsequent years following seeding (Table 2). Many producers routinely frost seed red clover every two to three years to sustain legume production.

Table 1. Stand Density of Two Forage Legumes Following Frost Seeding (Michigan State University)

	Red Clover		Trefoil	
	----------months after seeding----------			
Treatment	3	15	3	15
	Established plants as % of herbicide treatment stand			
0 cuts	69	51	74	52
2 cuts	79	82	88	96
4 cuts	103	107	117	114
Herbicide	100	100	100	100

Data averaged over 3 grass sods (smooth bromegrass, reed canarygrass, and orchardgrass

Table 2. Plant Density and Percentage Establishment for Legumes Frost-Seeded into Grass in March, 1977 (Iowa State University)

			Legume Plant Density			
Legume Type	**Seeding Rate**		**Sept. 1977**		**Sept. 1978**	
	Lbs./acre	Seeds/ft.2	Plts./ft.2	%*	Plts./ft.2	%*
Red Clover	8	46	5.1	11	4.9	11
Red Clover	16	92	8.2	9	8.7	9
B. Trefoill	6	48	3.1	6	9.4	20
B. Trefoil	12	96	4.9	5	12.0	13

* Legume plants as a % of seeding rate

Frost seeding grasses.....

Wisconsin graziers sometimes find themselves in a position to try and introduce grasses into old alfalfa stands. This offers some unique challenges because most cool season grasses do not establish from frost seeding with the success of legumes. A recent University of Wisconsin study compared frost seeding establishment of several cool-season grass species into older, established alfalfa stands (West and Undersander, 1997). In this two year trial, perennial ryegrass and orchardgrass exhibited the best establishment success, smooth bromegrass was intermediate in establishment, while reed canarygrass

and timothy had the fewest productive seedlings develop. Although smooth bromegrass was only intermediate in establishment, its sod-forming growth habit would likely result in additional plant formation from rhizomes.

Both perennial and annual ryegrass are good choices for frost seeding where fast establishing, high quality pasture is desired. However, both of these species will not typically overwinter in Wisconsin and should be seeded with the intent of filling single season forage needs. Based on Wisconsin studies, there does seem to be variety differences for annual ryegrass establishment success with frost seeding. Current recommendations are to select forage-type, late maturing annual ryegrass varieties. Reference Perennial Forage Variety Update for Wisconsin (A1525) for additional information and ryegrass variety performance data.

Some grass species establish more rapidly than others. The ryegrasses and orchardgrass contribute to forage yield during the seeding year. Smooth bromegrass and reed canarygrass often need a full growing season before plants become productive.

Broadcasting grass seed can pose some unique problems. When mixed with legume seed, grass seed will not "throw" as far and result in alternating strips of grass and legume plants. For this reason, it is recommended to seed grasses separate from legumes (i.e. make two passes) when using a broadcast seeder. Grass species like smooth bromegrass are often more easily established into an existing sod using a no-till drill early in the spring instead of a broadcast seeder. Where grasses are drilled into existing forage stands, mix light, large-seeded species like smooth bromegrass with oats to prevent bridging and insure uniform flow through the drill.

Determining seeding rates.....
At equal seeding rates, the number of seeds that establish into productive plants will be a lower percentage with frost seeding compared to conventional methods. However, frost seeding pastures almost always involves a resulting forage composition that will be a mixture since it is being done into some type of established sod. For this reason, even seeding only one species usually does not require rates as high as those seeded with conventional methods in a tilled seedbed where a full stand is desired. Frost seeding rates then become a function of existing sod condition, species being seeded, and the desired number of seedlings in the final stand. Optimum seeding rates for specific pasture situations sometimes need to be determined by trial and error over several years. Based on research experience, recommended guidelines for seeding into existing forage stands are presented in Table 3.

Table 3. Recommended Seeding Rates for Frost Seeding into an Existing Grass or Legume Sod

	Rate (lb./acre)		*Expected Established Plants**
Species	**Seeded Alone**	**As Part of Seed Mixture**	**Plants per square foot**
Red Clover	4 - 8	3 - 4	2 - 5
Birdsfoot Trefoil	4 - 6	2 - 3	6 - 9 (in 2nd year)
Alfalfa	5 - 8	3 - 4	4 - 6
Ladino Clover	2 - 3	1 - 2	1 - 2
Alsike Clover	2 - 4	1 - 2	2 - 3
Perennial/Annual Ryegrass	8- 15**	2 - 3	10 - 12

Orchardgrass	3 - 4	1 - 2	4
Smooth Bromegrass	12	8 - 10	1 - 2
Reed Canarygrass	Not recommended for frost seeding		
Timothy	Not recommended for frost seeding		
* Expected plants based on "alone" seeding rates ** Use higher rate in "bare ground" situations and lower rate in existing sods			

4. Seeding Time and Method

The fundamental principle behind frost seeding is that alternating freezing and thawing, along with spring rains, will help to incorporate the broadcast seed into the soil surface. Seeding on top of snow is acceptable if the depth is not too great. The risk of seeding on top of snow is that a rapid meltdown may result in runoff of both water and seed. In Wisconsin, most frost seeding is accomplished during March.

Be certain to inoculate legume seeds prior to seeding. Bacterial inoculant is specific for each legume species. For example, alfalfa inoculant is not effective on red clover.

There are many excellent tools for making broadcast frost seedings. These include seeders that mount onto ATV's and tractor 3-point hitch mounted seeders. Conventional roller and grain drill seeders can also be used but will require more trips across pastures. When using spinner-type seeders, be sure to determine the effective seeding width for each seed type or mixture. This will vary between species.

Summary

Frost seeding can be an effective, low-cost method to introduce new forage species into an existing sod or maintain the current forage composition of pastures. To be successful, good seed-soil contact needs to be accomplished by grazing or clipping pastures close to the soil surface in the fall prior to seeding. Best results are obtained in forage stands of non-sod forming species without a thatch barrier. After frost seeding, keep competition to a minimum by frequent grazings or machine harvests. Frost seeding success is usually obtained with legume species like red clover or birdsfoot trefoil but some grasses such as perennial or annual ryegrass, orchardgrass, and smooth bromegrass can be successfully frost seeded with proper management. Base seeding rates on the current condition of pastures and the desired density of forage species being established.

References

1. George, J. R., 1984. Grass sward improvement by frost-seeding with legumes. Proceedings of the American Forage and Grassland Conference. p. 265-269.

2. Leep, R. H., 1989. Improving pastures in Michigan by frost seeding. Extension Bulletin E-2185. 4p.

3. Undersander, D. J. et al., 1997. Perennial forage variety update for Wisconsin. Extension Bulletin A1525. 29p.

4. West, D. and D. J. Undersander. 1997. Spring frost seeding. Proceedings of the Wisconsin Forage Production and Use Symposium. Wisconsin Dells. p. 93-95.

For more information contact Mike Rankin

Return to FdL Agronomy Home Page