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It's Frost-Seeding Season

By Laura Paine, Crops and Soils Agent

March is frost seeding season. Across the Upper Midwest, graziers are gearing up to spread seeds over thousands of acres of pasture. Frost seeding is a nearly universal practice among graziers, recommended by most forage experts and consultants, but there's remarkably little hard data out there documenting its effectiveness. Lots of recommendations, but very little research has been done on how to make sure you're successful.

When I looked through the scientific literature back in 2001, I found a total of four published studies evaluating frost seeding methods and species, the most extensive of which was done in 1977 in Iowa. We haven't added to our research experience since then and the best source of information on this practice remains graziers and their on-farm experience.

Which Species Work

In general, legumes work well and grasses don't. Aside from ryegrass, grasses have not performed well in studies or in the experience of many graziers. It's mostly a matter of competition. A grass seedling is competing directly with existing grass plants for moisture, sunlight, and nutrients. A legume seedling, because it has somewhat different requirements and is able to utilize resources not needed by the existing grass, has an easier time getting established. With a few exceptions, you should expect minimal results.

In contrast, legumes have a proven track-record. Researchers in Iowa, Michigan, and Wisconsin have looked at a number of legume and grass species for frost seeding, including red clover, birdsfoot trefoil, alfalfa, white (ladino) clover, sweet clover, and others. The primary species listed by my respondents were red, ladino, and alsike clover, birdsfoot trefoil, and alfalfa. By far most commonly used species is red clover, although white clover is increasingly used.

How Much to Seed

Most of the research that has been done involves newly introducing legumes into a pure grass sward whereas many graziers view frost-seeding as an ongoing process of enhancing and maintaining an existing legume component. It is typical to frost seed legumes every year or every other year.

Thus, seeding rates reported in the literature were high—8 to 16 lb/a for red clover, 6 to 12 lb. for BFT, and 3 to 6 lb. for white clover. For more frequent seedings, probably 2 to 4 lb. is more common for red clover and BFT and just 1 lb/a for white clover. However, extra seed is considered cheap insurance by many, and there's data that suggest that the more seed you put out, the better success you'll have..

The Wisconsin study, conducted by Dave West, Mike Casler, and Dan Undersander (1997, 1999) compared red clover seeding rates of 1, 2, 4, 8, and 16 lb/a. Not surprisingly, their work shows that the more seed you put out there, the more seedlings are established. The relationship

is nearly linear. Establishment ranged from 0.5 plants/square foot for 1 lb/a to 5 plants/square foot for 16 lb/a. Note, though, that it took a 16-fold increase in seed to obtain a 5-fold increase in establishment!

How Often to Seed

Data from Iowa (George 1977) and Michigan (Leep 1989) suggest that, contrary to conventional wisdom, hard seed contributes little to future stands of clovers. Hard seed is that small proportion of legume seed that does not germinate readily. The seed is viable, it just does not germinate. In these frost-seeding studies, plant density in the second season was similar to seedling density in the seeding year, suggesting that there was little or no germination of hard seed in the second year. This is why many graziers routinely frost seed every year or every other year. What germinates that first spring is basically what you're going to get.

Seed to Soil Contact

Overwhelmingly graziers emphasize that the single most important factor in frost seeding success is seed to soil contact. Timing is critical and the timing will vary with your location and the year. Seeding must be done during those spring days when the sun warms and thaws the top 2 to 3 inches of soil, but before the frost goes entirely out of the ground. This means that you must plant on a day that promises to be sunny but get out there early in the day, when the ground is still frozen. Most people simply broadcast seed for frost seeding. The point is, after all, to take advantage of the freezing and thawing of the ground to work the seed into the soil. Some years these conditions never occur and this is one reason why frost seeding sometimes fails.

I often get questions about spreading seed over snow or in late fall. Both of these options can work, but your potential for success is reduced that much more. The longer the seed is out there, the more likely it is to lose viability. Legume seeds tend to be more resilient than grass seed, but when you're talking in terms of only 20 or 30% establishment under the best circumstances, you're better off putting the seed down just before it's going to germinate.

Control Competition

Successful establishment depends on reducing competition from established grasses. This involves both pre- and post-seeding management. Most graziers begin preparing the sward the fall before seeding by grazing close, even overgrazing, to expose as much bare soil as possible. Clearly, you'd want to take care with this step, because exposed soil on sloping ground will be vulnerable to erosion. Both your seed and your soil could end up at the bottom of the hill!

Some people also graze newly frost-seeded pastures after grass growth begins. Reasons for this practice include trampling the seed in (improving seed-soil contact) and further reducing grass competition. This is tricky business, though. As long as you catch the sward before the seed begins to germinate, this is likely to be beneficial. If grazing occurs as the seedlings begin to grow, you've wasted your time and money. Trampling damage severely reduces establishment rates. In fact, several of the studies suggest that the best establishment is achieved if frost seeded paddocks are mowed for first cutting rather than grazed.

Success with Grasses

There's little evidence that frost seeding grasses is worth the effort. You're not going to achieve a significant shift in pasture composition without suppressing existing grass growth with a herbicide, tillage, or very heavy grazing. In Dave West's study, none of the frost seeded grasses established at even 20% (orchardgrass was the best at 17%). Somewhat better results were obtained when the frost seeded pasture was mowed for hay the entire year after frost seeding. Under those conditions, orchardgrass ended up at 35% of the stand; in the ryegrass plots, they

had 26% establishment. Probably the most successful method of introducing new grasses into existing pasture is frost seeding into winter feeding areas where the ground is made bare and waste hay creates a mulch for the seeds. Obviously, you're not going to get uniform distribution of the new species using this method, but, in reality, you don't with any method of frost seeding.

Other Observations

Aside from the principles listed above, graziers list a few other factors that can affect frost seeding success. These include adequate soil moisture availability, limited amounts of thatch, the lower proportions of sod-forming grasses in the sward, using coated seed, and withholding of nitrogen fertilizer in the establishment season. Frost seeding is a method whose success is dictated largely by weather conditions. Some years it just doesn't work, while in others, an excellent stand is achieved. There is universal agreement the two most important factors are achieving good seed-soil contact and reducing competition from established plants.

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