

How Well Does Frost Seeding Really Work?

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March is frost seeding season. Across the Upper Midwest, graziers are gearing up to spread legume seed (mostly red clover) over thousands of acres of pasture. But how well does frost seeding work? It's 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 this common practice.

Going into the scientific literature, 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. To bolster this information, I solicited observations and recommendations from our virtual grazing community via Grazersedge and Graze-L list serves. I received responses from 9 graziers and 6 research/agency people from Iowa, Kentucky, Maryland, Minnesota, Missouri, Ontario, and Wisconsin. Let's summarize what we've collectively learned about frost seeding in the last quarter century.

Species.

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. Aside from ryegrass, grasses have not performed well in studies or in the experience of many graziers, so for this article I'll focus on legumes. 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. The research suggests that birdsfoot trefoil (BFT) deserves to be considered. It needs to be managed somewhat differently than the clovers, but performs well once established.

Seeding rates.

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.

Data from Iowa (George 1977) and Michigan (Leep 1989) suggest that, contrary to conventional wisdom, hard seed contributes little to future stands of clovers. Plant density in the second season after seeding was similar to seedling density in the seeding year. The exception to this was BFT, which increased in plant density 2- to 3 fold between the first and second years.

Seeding method.

Overwhelmingly my respondents emphasized 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 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 graziers have experimented with using a drill to frost seed red clover to improve establishment. The Michigan study compared broadcast versus drilled red clover and birdsfoot trefoil and found no differences in establishment rates. Here again, though, weather conditions play a significant role and you may want to consider drilling your seed when more marginal conditions exist. There is no doubt that better seed-soil contact will be achieved using a drill.

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. Spring freezing and thawing generates more than half the annual runoff from pastures and cropland.

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.

If you've got a very dense grass sward and low cost methods have not worked for you, you might want to consider herbicide suppression of established grasses. The Michigan data suggest that this is probably the most effective method of reducing competition and achieving a legume component. Michigan and Wisconsin research also showed that post-seeding mowing can achieve similar results. The studies suggest that grazing in the seeding year does reduce the establishment of frost seeded legumes. The best seedling establishment was achieved by providing a longer rest period and mowing the first year in a 4-cut system. Of course, both of these approaches must weigh the need to introduce legumes against the costs in terms of both money and management flexibility.

Rest periods and mowing are also keys to establishing and maintaining BFT in a pasture. Birdsfoot trefoil needs a longer grazing cycle than most of us use. Those who have success with it suggest that major grazing management changes are unnecessary. It only requires that one of the 6 or 7 cycles each season be 4 to 6 weeks rather than our normal 3 to 4 weeks or less. These long rest periods favor root establishment and self-seeding, two important factors in maintaining BFT plant populations. Many people find it too difficult to manage for BFT, but this is a trade-off. Red clover, while easy to establish is very short-lived, requiring reseeding every two to three years. Birdsfoot trefoil will remain in a sward indefinitely with proper management. Other graziers are having good success with some of the new ladino clovers which respond to the same management as red clover but are more persistent.

Other observations.

Aside from the principles listed above, my respondents listed 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. Several people have had success frost seeding into winter feeding areas where the ground is made bare and waste hay creates a mulch for the seeds. 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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