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Winter Seeding Methods to Establish Clover in Permanent Pasture

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Introduction

The benefits of establishing clover in grass pasture are well-known. They can include increased forage yield, improved forage quality, reduced nitrogen fertilizer costs, dilution of toxic fescue, and good livestock performance. Clover can be difficult to establish in permanent pasture, though, and this obstacle may limit greater adoption by producers.

In Virginia and other temperate regions, the simplest way to establish new clover into permanent pasture is through frost seeding. This method involves broadcast seeding of clover in winter so that freeze/thaw cycles of the soil surface help to incorporate seed. Although simple and relatively inexpensive, this method is notoriously unreliable for establishing clover.

A better strategy to ensure good clover establishment may involve no-till drilling. This method involves a no-till drill that cuts through existing sod to make a furrow where clover seeds are planted. This precision planting method provides for more uniform seed placement and stronger seed/soil contact that should help to ensure successful germination. On the downside, no-till drilling can be more expensive, time consuming, and difficult to implement on steep or rough land. No-till drilling also has potential to place clover seed too deep (below .25 inch), which can reduce seedling emergence.

Information is limited about the relative benefits of frost seeding versus no-till drilling of clover seed. More information comparing these methods should help producers choose the best seeding method for their situation. To address this issue, a field experiment was initiated at Kentland Farm near Blacksburg, Va., in 2009. The study's primary objective was to compare the effectiveness of frost seeding and no-till drilling to establish clover in permanent pasture. A secondary objective sought to identify possible factors that might influence this success. The following information summarizes results from the critical first year of establishment.

Procedures

In winter 2009, four 2.5-acre replicate pastures were chosen for the seeding experiment. The pastures consisted of mostly tall fescue, bluegrass, and some orchardgrass. No clover had been sown into experimental pastures in recent years. Before establishment of seeding treatments, each pasture was heavily grazed by cattle to remove standing dead vegetation. Pastures were then fertilized with phosphorus and potassium, as recommended by a soil test. Soil pH was above 6.5 on all pastures, so no lime was added. On Feb. 4, 2009, one-half of each pasture was sown with a mixture of red (Juliet), ladino white (Pinnacle), and white clover (Kopu II) using a broadcast seeder. On March 10, the remaining half of each pasture was planted with the same legume mixture using a no-till drill. The seeding rate was 4 pounds per acre for red clover, 2 pounds per acre for ladino clover, and 2 pounds per acre for red clover.

Some standing dead forage still remained after winter grazing, and we estimated this quantity by harvesting small plots. In early April 2009, we counted clover seedlings in randomly located plots. Pastures then were divided into six paddocks using single-strand electric fence and rotationally grazed by beef cows. Initially, we grazed each pasture with five cows (average weight

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approximately 1,400 pounds), moving them through the paddocks every one to two days. This intensive rotational grazing was done to help suppress grass growth, yet still allow clover to grow. In midsummer, the stocking rate was gradually reduced to two cows per pasture that were moved every five to six days. In June and August, we moved cows from pastures for two and four weeks, respectively, and they grazed different experimental pastures. After the two rest periods (in June and August), forage samples were harvested to document clover contribution to yield. Within these plots, we also visually estimated the proportion of groundcover occupied by each forage species.

Results From the Establishment Year

The number of clover seedlings varied among pastures, with slightly more seedlings emerging in frost-seeded plots. The amount of standing dead vegetation that remained at planting likely affected clover emergence. Pastures with more standing dead vegetation tended to have fewer clover seedlings. Our data also points to a potential threshold of standing dead mass at approximately 220 pounds per acre. Reducing standing dead mass below this threshold (i.e., less than 2 inches of stubble) seemed to encourage clover emergence, especially in frost-seeded plots (table 1). Leaving more standing dead vegetation above this threshold appeared to suppress clover emergence.

Pastures with few seedlings also produced less clover biomass later in the season. Of the four pastures, pasture "D" had the fewest seedlings in April and the lowest clover biomass in August (table 1). In contrast, pastures "A" and "B" had the most seedlings in spring and the highest clover mass in August. These results suggest that initial seedling emergence may limit clover establishment later in the season. Providing sufficient open space in the pasture canopy that encourages emergence during spring may be critical to achieve good clover yield later in the season.

Although we initially found more clover seedlings in frost-seeded pastures, this did not translate into greater clover abundance as the growing season progressed. In terms of the percentage of groundcover occupied by clover, we found no statistical differences between seeding methods. The groundcover data show a dramatic increase in clover abundance from spring to summer, however. In spring, clovers accounted for only about 4 percent of the pasture species composition, but by August that had increased to nearly 40 percent in some pastures (table 2).

Clover yield also did not differ statistically between the two seeding methods in either June or August. Although means were numerically different, there was a wide variation in clover yield among replicate pastures. The high variation contributed to the lack of statistical difference. All yield components increased substantially from June to August (table 3). This increase was partly

Table 1. Clover seedling density, mean winter forage mass, and August clover mass in the four experimental pastures. Mean seedling density was statistically different between seeding treatments ($P < 0.10$)*.

	Seeding Method (clover seedlings/sq feet)		Forage Variables (lb/acre)	
Pasture	Frost seed	No-till drill	Standing dead mass	Clover yield in August
A	13	8	103	593
B	16	7	155	520
C	10	5	212	327
D	4	5	245	162
Mean*	11	6		

Table 2. Percent of groundcover occupied by clovers during the 2009 growing season. No significant statistical differences were found between seeding methods in any month.

	April		June		August	
	Frost seed	No-till drill	Frost seed	No-till drill	Frost seed	No-till drill
	%					
Red clover	1	1	8	12	14	13
White clovers*	3	3	28	17	26	20
Total	4	4	36	29	40	33

**White clovers included both sown ladino and white clovers, as they could not be visually separated.*

Table 3. Dry matter yield of grasses, red clover, white clovers (ladino and white), and weeds harvested in June and August 2009.

June

	Grasses	Red clover	White clovers	Weeds	
	lb/acre				Total
Frost seed	867	41	127	22	1057
Drill	890	26	64	29	1009
Difference	NS*	NS	NS	NS	NS

August

	Grasses	Red clover	White clovers	Weeds	
	lb/acre				Total
Frost seed	2214	207	215	45	2681
Drill	2131	181	197	72	2581
Difference	NS	NS	NS	NS	NS

** "NS" indicates no statistical difference between seeding treatments.*

in response to the high summer rainfall we received at this location and from resting these pastures from grazing in midsummer. In August, each clover type accounted for about 8 percent of the total yield. We could not visually separate white and ladino clover varieties in the ground cover or yield analysis. Subsequent destructive harvests, however, indicated that ladino clover accounted for the majority of white clover present in pastures.

Conclusions

We successfully established new clover into these permanent pastures. The clover component in pastures increased more than 20-fold from April to August 2009. Broadcast frost seeding and no-till drilling were equally effective for establishing clover. We suspect successful clover establishment was related to a combination of factors:

1. Heavy, mob grazing in winter that reduced standing dead vegetation and helped seedling emergence.

2. Timely frost seeding during the first week of February.

3. Aggressive rotational grazing in spring that simultaneously reduced grass competition and allowed clovers to grow enough to establish.

4. Good soil fertility (adequate phosphorus, potassium, and pH) to stimulate clover growth.

5. Rainfall, which was abundant during the 2009 growing season.

The exact factors that determine successful clover establishment remain elusive though, as there are probably combinations of events involved. The good news is that producers can control most of these variables through management (i.e., seeding time, stocking rate), and by doing so, should increase their chances of successful clover establishment in permanent pasture.