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Grassland Renovation with Slurry-Enriched Seeding of Red Clover

Tim Harrigan
Dept. of Biosystems and Agricultural Engineering

In recent years there has been renewed interest in the use of managed intensive grazing for beef and dairy cattle. Thinning stands are often a problem in pastures, particularly after a dry summer when over-grazing occurs. Manure slurry seeding is an innovative process that combines low disturbance aeration tillage, manure slurry application and the seeding of cover crops in one efficient operation. A short video of slurry seeding cover crops in wheat stubble can be seen by clicking this link, http://www.youtube.com/watch?v=3st0qZ_3vH0. When applied to pasture and hay crop restoration this new process can increase botanical diversity, yield and quality, and provide a more complete, balanced feed for grazing livestock.

Methods
Red clover (medium, 10 lb/ac Pure Live Seed, PLS) was sown in an established Smooth Bromegrass sod (Scout; 10 lb/ac PLS) in a Capac fine sandy loam soil at Michigan State University in East Lansing, MI. The seeding methods compared were: 1) no-till drilled Red Clover; 2) slurry-seeded Red Clover; 3) frost-seeded Red Clover; and, 4) undisturbed check -- no slurry, no aeration tillage (control).

The no-till red clover was sown with a Great Plains no-till drill with coulter openers and trailing semi-pneumatic press wheels in mid-August. The manure slurry seeding was done on the same day as the no-till drilling with a commercially available slurry tanker (3,000 gal) equipped with a rear-mounted rolling-tine aerator (12 ft, Aer-Way, Holland Equipment Ltd. Norwich, Ontario, Canada) and a sub-surface deposition (SSD) slurry distribution system (picture). A 2.50 gang angle was used for slurry seeding red clover. Red clover was surface broadcast in early March for frost seeding. No additional seedbed tillage or soil firming was used.

Seed-laden slurry was delivered through drop-tubes to the loosened and fractured soil behind the aeration tines.

The manure slurry seeding process involved mixing red clover seed in the slurry tank and passing the seed-laden slurry through a hydraulically driven, rotating chopper/distributor (300 rpm) with radially configured outlets, and then through drop tubes to the fractured and loosened soil behind each set of rolling tines (Harrigan et al., 2006). Dilute swine slurry (1.02% solids) was applied at 4,000 gal/ac to supply a moderate amount of nitrogen for crop growth, yet avoid excessive competition for light between the existing forage and seeded forages. The application supplied 70 lb/ac total nitrogen (N), 50 lb/ac N in ammonium form and 20 lb/ac N in the organic fraction. No commercial fertilizer was applied.

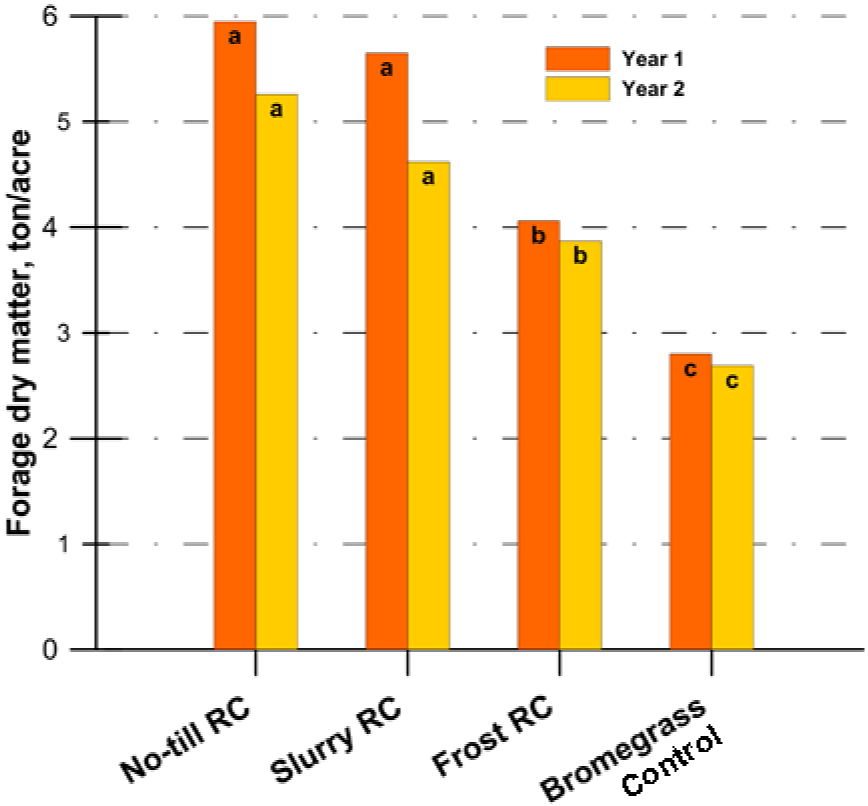
Forage Dry Matter Yield

The total forage dry matter over two growing seasons was significantly greater for no-till (11.2 ton/acre) and slurry seeded (10.3 ton/acre) red clover than the frost-seeded Red Clover (7.9 ton/acre; Figure 1). Compared with the untreated Bromegrass stand, the no-till, slurry and frost-seeded Red Clover plots increased dry matter yields by 105%, 87% and 43%, respectively.

In the first year after seeding, forage dry matter was increased by both the nitrogen in the manure slurry and the nitrogen fixed by the Red Clover. A uniform stand of red clover was expected to supply 40 to 70 lb/ac N to the growing crop. The annual dry matter yield of the no-till (6.0 ton/acre) and the slurry-seeded (5.6 ton/acre) treatments were greater than the frost-seeded and Control treatments. Compared with the untreated control (2.8 ton/acre), the no-till, slurry seeding and frost seeding of red clover increased dry matter yields by 112%, 102% and 43%, respectively.

The yield advantage from the nitrogen contribution of the red clover to the Bromegrass stand was clear in the second year after seeding. The Red Clover was not evenly distributed throughout the frost seeded plots. The no-till Red Clover increased forage yield by 96%, slurry seeding by 72%, and frost seeding by 44% compared with the untreated Bromegrass plots. The annual dry matter yield of the no-till (5.3 ton/acre) and slurry seeding (4.6 ton/acre) were not different, but each yielded greater than the frost seeding (3.9 ton/acre).

Figure 1: The 2-year forage dry matter yield of the no-till and slurry-seeded Red Clover (RC) were greater than the frost-seeded RC or Bromegrass Control.



Forage Quality

Forage quality was measured at each harvest and analyzed for crude protein (CP), acid detergent fiber (ADF) and neutral detergent fiber (NDF). Over the 2-year harvest period the CP of the no-till Red Clover was greater than the other treatments and averaged 3.7 percentage units greater than the untreated control. The slurry-seeded Red Clover was also greater than the untreated control (1.9 percentage units). The ADF and NDF were less predictable. The ADF of the no-till Red Clover was lower than the other treatments, but the reduction was great enough to be considered different. The NDF of the no-till Red Clover was less than the other treatments and averaged 5.1 percentage units less than the untreated control.

Conclusion

Manure slurry seeding of red clover was an effective way to recycle manure nutrients, increase forage yield and increase the botanical diversity of pasture and hay ground. No-till drilling and slurry seeding resulted in more uniform stands of red clover than frost seeding. Compared with the untreated bromegrass, the no-till, slurry- and frost-seeded Red Clover plots yielded 105%, 87% and 43% greater dry matter, respectively, over the 2-year trial. The crude protein (CP) of the no-till drilled red clover was greater than the other treatments and averaged 3.7 percentage units more than the untreated Bromegrass control. The CP of the slurry-seeded Red Clover was greater than the frost-seeded Red Clover.

Figure 2: The crude protein of the no-till and slurry-seeded Red Clover was greater than the frost-seeded Red Clover.