

MANURE SLURRY-ENRICHED SEEDING OF BIOSUPPRESSIVE COVER CROPS

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The development of cropping systems that reduce tillage intensity, increase the use of cover crops and make efficient use of manure can protect the environment and improve soil quality in many ways. Low-disturbance tillage and soil conservation practices that stabilize soil will keep manure in place and protect water quality. Cover crops prevent erosion and filter contaminants in runoff. They have also been shown to improve water-stable aggregation of soil and increase water infiltration compared to soil without cover crops (McVay et al., 1989). As soil aggregation improves, soil structure and tilth also improve (Allison, 1968).

In Michigan, growers often use winter cereals as cover crops to protect the soil from wind erosion, but stand establishment costs and the additional management requirements have limited their widespread use. Cover crops in the *Brassica* (mustard) family may offer benefits beyond soil conservation in some rotations. Oilseed radish has been shown to suppress sugarbeet cyst nematodes. The incorporation of oriental mustard (*Brassica juncea* L., variety Pacific Gold) in the spring before planting potatoes suppressed *Rhizoctonia solani* by 73%, and the cover was highly suppressive of fungal activity by *Pythium ultimum*, and *Fusarium solani* (Snapp, S.S. and K.U.Date, 2004). Manure that is high in nitrogen and soluble (available) carbon has been shown to suppress soil borne pathogens (Conn and Lazarovits, 1999; Tenuta, 1999). These studies reported that poultry and swine manure were the most consistently beneficial manure sources for reducing *Verticillium dahliae* and common scab in potato. Recent findings from long-term research trials at MSU have shown a consistent and significantly greater yield response of potatoes, vegetables and field crops to manure applied with a winter cover crop than manure to bare soil alone (Sanchez et al., 2004; Snapp et al., 2004).

Goals and Objectives

Goals of this project were to improve the efficiency of manure use, expand the land based available for land application by encouraging cover crop use in diverse cropping systems, and prevent manure contaminant loss to the environment. The specific objective was to compare stand establishment and biomass yield of oilseed radish and oriental mustard established as a summer seeding in wheat stubble with conventional no-till drilling, and a new process--manure slurry-enriched micro-site seeding-- whereby aeration tillage, manure application and seeding were done in a single, efficient operation.

Materials and Methods

Replicated plots (13 x 60 ft) were established in a Capac fine sandy loam at Michigan State University. Two oilseed radish varieties (*Raphanus sativus* L., varieties Common and Colonel,

15 lb/acre PLS) and one oriental mustard variety (*Brassica juncea* L., variety Pacific Gold, 10 lb/acre PLS) were sown on August 13, 2004 in untilled wheat stubble. Each crop was sown with a no-till drill and with the new manure slurry-enriched micro-site seeding process. The slurry seeding treatments were established with a commercially available slurry tanker (3,000 gal) equipped with a rear-mounted rolling-tine aerator (12 ft; Aer-Way) and SSD (sub-surface deposition) slurry distribution system. Swine manure was applied at 6000 gal/acre. Seed was placed in the spreader tank where bypass flow provided tank agitation and seed mixing. The seed-laden slurry was delivered through drop tubes to the fractured and loosened soil behind each set of aeration tines. The plots were harvested on October 13, 2004.



Figure 1. Seed-laden slurry was delivered through drop-tubes to the fractured soil behind each set of aeration tines. No additional seedbed tillage was used.

Biomass yield

Above-ground plant mass, root mass and total biomass from the six treatments are shown in Figure 1. There was little difference in above-ground plant and root mass between no-till and manure slurry enriched micro-site seeding with either variety of Oilseed radish. However, the above-ground plant mass, root mass and total biomass of the oriental mustard was significantly greater with the slurry seeding process. Presumably, the oriental mustard made efficient use of the readily available nitrogen from the manure slurry in close proximity to the seed. Additional work is in progress to develop guidelines for the new manure seeding process; to evaluate the potential benefits of cover crops for soil conservation, pest and disease suppression, and improvements in soil quality; and to quantify nutrient uptake and release by the cover crop.

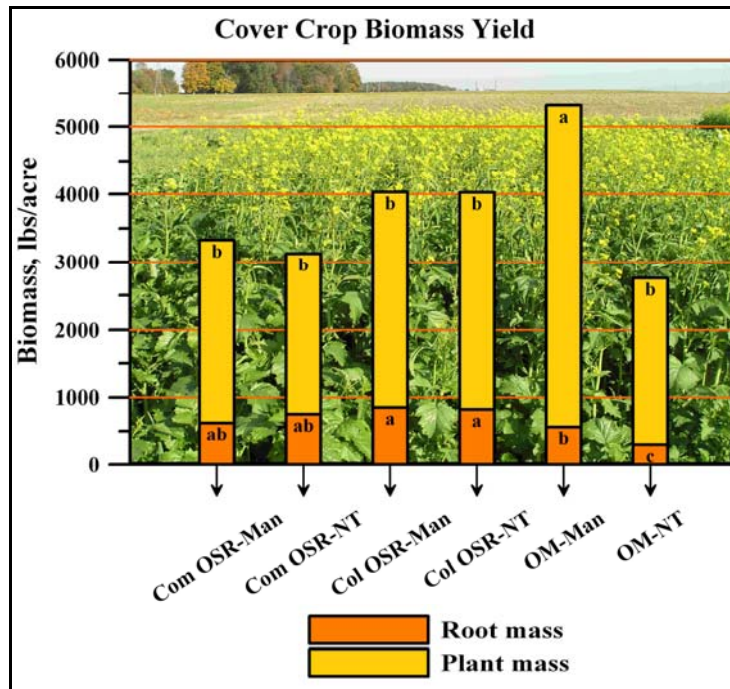


Figure 2. There was no difference in biomass yield between no-till and slurry-till seeding of oilseed radish, but there was a significant increase with slurry seeding of oriental mustard. The slurry seeding of oriental mustard is shown in the background.

Conclusions

This article provides an update of on-going work by MSU researchers Tim Harrigan, Dale Mutch and Sieglinde Snapp in developing a manure application method that effectively incorporates cover crop seeding, manure application and low-disturbance aeration tillage. Such a process offers considerable labor and machinery efficiencies that will encourage the use of manure and cover crops in diverse crop rotations. Reducing tillage intensity, including manure and a biosuppressive cover crop such as oilseed radish or oriental mustard in some rotations may improve soil quality and plant stands, and may suppress certain soil-borne fungal diseases. Based on our work at Michigan State University in 2004:

- The biomass yield of oilseed radish and oriental mustard established as a late summer seeding in untilled wheat stubble with the experimental manure slurry-enriched micro-site seeding process was equal or better than conventional no-till seeding.
- There was no significant difference in biomass yield of the oilseed radish varieties between the no-till and manure slurry-enriched micro-site seeding methods.
- The biomass yield of oriental mustard was significantly greater with manure slurry-enriched micro-site seeding than no-till seeding.

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