• • • MICHIGAN STATE UNIVERSITY EXTENSION • • •

AGRICULTURAL ENGINEERING INFORMATION SERIES

671 18.751 December 2004

Slurry Enriched Micro-Site Seeding of Biofumigant Cover Crops [1]

Improving pest management strategies, soil quality, and stand establishment are top priorities of the sugar beet industry. The development of crop management alternatives that reduce tillage intensity and encourage the use of cover crops will improve soil quality by increasing soil organic matter. Manure has been shown to improve soil quality by increasing soil organic matter and hydraulic conductivity, and by decreasing soil bulk density. A lower bulk density allows more extensive root growth and a favorable pore size distribution which increases water infiltration, water holding capacity and soil aeration.

Cover crops are generally grown for soil conservation, but cover crops also improve soil quality by adding organic matter and increasing soil biological activity. 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 sugar beet rotations. Forage radish crops have been used to alleviate compaction in coastal plain soils in Maryland. In Michigan, sugar beet yields increased two tons/acre following an oil seed radish cover crop (Poindexter and Van Sickle, 2004; personal communication). And, oil seed radish has been shown to suppress soil-borne nematodes in sugar beets. In related work, 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**.** Mustard, rye and fumigation for healthy potato roots. The Michigan Potato Industry Commission. MPIC Newsline, November Issue). A similar level of disease suppression may be possible in sugar beets. There is a need to better integrate Brassica cover crops in sugar beet rotations.

The objective of this work was to evaluate Brassica cover crops (oriental mustard and oil seed radish) seeded in untilled wheat stubble. No-till seedings were compared with an experimental method whereby the seed was mixed with swine manure in a commercially available slurry tanker for delivery to seeding micro-sites. A low-disturbance rolling-tine aerator was mounted on the back of slurry tanker, and the seed-laden slurry was delivered through drop tubes to the loosened soil behind each set of aerator teeth. This process incorporated low-disturbance aeration, manure application, and the seeding of cover crops in one efficient operation.

The seeding process incorporated low-disturbance aeration tillage, manure application, and the seeding of cover crops in one efficient operation.

[1] The authors are **Dr. Tim Harrigan**, Biosystems and Agricultural Engineering Department, and **Dr. Dale Mutch**, Kellogg Biological Station, Michigan State University.

Methods

A replicated trial comparing two oil seed radish varieties (*Common* and *Colonel*, 15 lb/ac PLS) and one oriental mustard variety (*Pacific Gold*, 10 lb/ac PLS) were sown in untilled wheat stubble on a Capac sandy loam soil at the University Farm in East Lansing. Each crop was sown with a Great Plains no-till drill, and also with a new method that used swine slurry to carry the seed to seeding micro-sites. The plots were arranged in a randomized complete block with six treatments and four replications.

The rolling-tine aerator loosened and fractured the soil while the drop tubes flooded the loosened soil with seed-laden swine slurry.

The slurry seeding treatments were established using a commercially available slurry tanker (3000 gallon capacity) equipped with a rear-mounted Aer-Way SSD low-disturbance aeration and slurry distribution system. Swine manure was applied at 6000 gal/acre. The aerator gang angle was set at 10° for maximum soil disturbance. The seed was placed in the spreader tank where bypass flow provided tank agitation and seed mixing. Drop tubes delivered the seed-laden slurry from the chopper/distributor to the fractured and loosened soil behind each set of rolling tines. The 6000 gpa application of swine slurry provided 78 lb of total N (73 lb as NH_4-N), 37 lb P as P_2O_5, and 61 lb K as K_2O. Because commercial fertilizer is not often used in cover crop establishment, no fertilizer was applied to the no-tilled plots. The plots were seeded on August 13 and harvested on October 13 2004.

Results and Discussion

Above-ground plant mass, root mass, and total biomass from the six harvested 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 oil seed radish. The oriental mustard biomass yield was significantly greater with the slurry seeding process, presumably in response to the readily available nitrogen in the manure slurry.

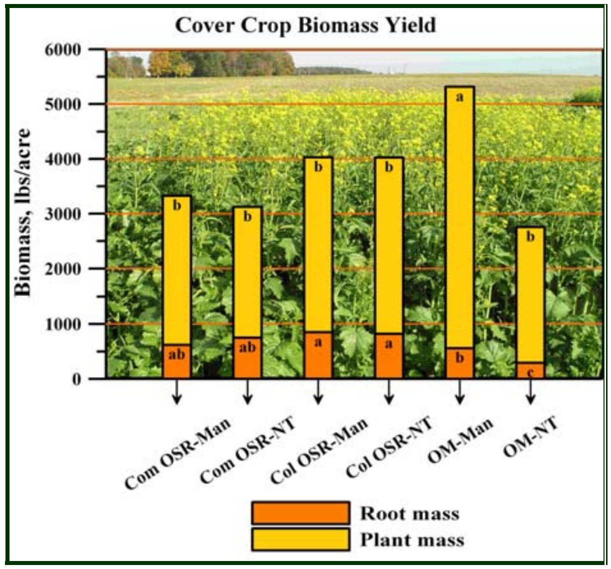

Figure 1. Biomass yield of Brassica cover crops established with conventional no-till and manure slurry enriched micro-site seeding.

The 2004 biomass yield indicated that the manure slurry enriched micro-site seeding process can provide yields equivalent to conventional no-till seeding. A process that combines manure application, low-disturbance tillage and cover crop establishment in one efficient operation will encourage more widespread use of Brassica cover crops. Additional work is needed to develop guidelines for the new manure seeding process, and to evaluate the potential benefits of Brassica cover crops in pest and disease suppression, soil conservation, and in improving soil quality in sugar beet rotations.