EFFICIENT, SUSTAINABLE AND ENVIRONMENTALLY SENSITIVE LAND APPLICATION OF MANURE [1]

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Physical barriers to movement of sediment and nutrients

Management practices that capture land-applied manure in the root zone will make the nutrients available for the next crop, improve soil quality, and prevent sediment and nutrient loss in runoff. Soil conservation practices that stabilize soil and prevent runoff will help keep manure nutrients in the root zone for use in the following crop. Some practical ways to reduce erosion and manure nutrient loss in runoff include:

- Increase surface roughness and infiltration with low-disturbance tillage. Aeration tillage loosens the soil, improves infiltration, conserves crop residue and roughens the surface. Aeration tillage in the fall does not interfere with no-till planting in the spring.
- Vegetative filter strips, grass waterways, buffer strips and cover crops are effective in preventing or slowing water movement across the landscape. If runoff does occur, vegetative covers have been shown to be very effective in preventing erosion and filtering bacterial contaminants from runoff water.

Figure 1 Aeration tillage loosened the soil, conserved crop residue, increased surface roughness and improved infiltration of the manure. Spring no-till planting was not a problem.

Slurry-enriched seeding of cover crops

Cover crops have not been used widely in livestock-based cropping systems because establishment costs, competition for labor and added management needs have discouraged their use. Because cover crops are an effective barrier to overland flow, sedimentation, and manure contamination of waterways, interest in the use of cover crops is increasing. At Michigan State University we have developed a new process for cover crop establishment that combines seeding, manure land application and aeration tillage in one sustainable, efficient, and environmentally sensitive operation. Wheat and cereal rye cover crops were established in corn silage stubble in September, 2005

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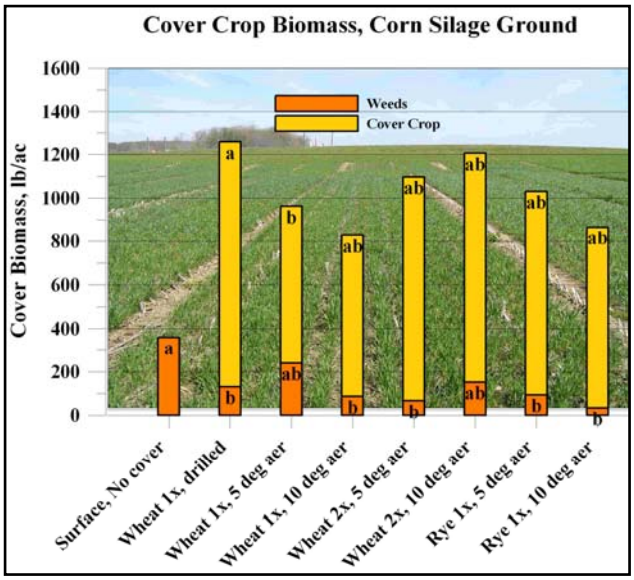
The slurry seeding was done with a slurry tanker (3000 gal) equipped with a rear-mounted rolling-tine aerator (12 ft; Aer-Way) and SSD (sub-surface deposition) slurry distribution system. The seed (wheat or rye @ 2 to 4 bu/ac) was placed in the spreader tank where bypass flow provided tank agitation and seed mixing. The seed-laden dairy slurry was applied at 5000 gal/ac. The slurry (9.5% solids, sawdust bedding) provided 125 lb/ac total N (65 lb/ac as NH_4-N; 60 lb/ac as organic N), 43 lb/ac P as P_2O_5, and 140 lb/ac K as K_2O. The aeration tines were adjusted from a 5 to 10 degree gang angle to vary the level of tillage intensity and soil loosening. Drop tubes placed the seed-laden slurry in the fractured and loosened soil behind each set of rolling tines. No additional tillage or soil firming was used.



Above-ground plant mass for the eight treatments are shown in the adjacent figure. Each of the slurry-seeded treatments provided a uniform cover that suppressed weed growth. Although our primary interest was in cover crop establishment, we will maintain the plots and measure grain yield in July.

Manure has value if you know how much, where and when

Based on current prices (N @ 30¢/lb, P @ 28¢/lb and K @ 17¢/lb), the value of manure nutrients applied in the slurry seeding of the wheat and cereal rye cover crops was about $73/acre. No manure was applied to the no-till drilled wheat plots, but 60 lb/ac N as urea was applied in the spring. In the following corn crop, a PSNT test revealed an N credit of about 125 lb/ac for all treatments. All corn plots were side dressed with 25 lb/ac N.

Manure has value if the rate, timing, uniformity and method of application reduce commercial fertilizer use. Spreader calibration, manure testing and record keeping are needed to document manure use and capture those savings. Choose a calibration and record keeping method to suit your budget and application needs:

- *Area covered.* Calibration based on spreader volume, length and width of application. A simple process with reasonable results per load as long as travel speed remains constant. Keep written records of field area, number of loads applied and manure nutrient content.
- *Flow meter*. Continuous readout of manure flow rate in the tractor cab. Simplifies calibration process and can adjust flow rate to match changes in travel speed or soil properties. Some will log and store the total volume applied. No electronic recording or mapping capability, so write down volume, area and spreading condition notes.
- *Flow meter with GPS.* Continuous in-cab display of flow rate with georeferenced application mapping. Provides permanent record and application verification that may have value in a nuisance or water quality impact challenge. As-applied map can be used with soil and manure test results to guide VRT fertilizer applications.
- *Variable rate control.* Includes flow meter, GPS, controller and actuator to vary flow rate. Provides permanent, georeferenced application map, rate controlled by soils map or spread/no-spread areas for protection of environmentally sensitive areas.