Strip-Tillage: Fertilizer Placement, Applying Manure Addressed

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Last in two-part series

Strip tillage is gaining ground in Wisconsin, in part due to grower frustration with no-till's slower growth and lower yields. This week Agri-View concludes an examination of strip-till with UW-Madison Soil Scientist Dick Wolkowski, who recently shared research and recommendations at Soil, Water and Nutrient Management Meetings around the state.

Work at Arlington reveals late-afternoon soil temperature during planting in a fall strip treatment to be similar to ground that had been chiseled but considerably warmer than no-till. Emergence and early growth in this study were delayed in no-till compared to chisel and fall strip-tillage, at least until silking.

Wolkowski and fellow researchers have 10 years of data from the Arlington study comparing fall strip-tillage with fall chisel/spring field cultivator and no-till (without row clearing) in both continuous corn and a soybean/corn rotation. The strip-till tool is a mole knife run eight inches deep that builds a 2 to 3-inch ridge upon which the subsequent crop is planted. The no-till system is the minimal extreme of that practice; many no-tillers routinely use planter row cleaners to address the issues of soil warming and reduced yield. Both the strip-tillage and no-till rows were alternated 15 inches between years.

Covering 1997 to 2007, this study shows equal yield in first-year corn with chisel and strip-tillage (194 bushels on average across the years for both types of minimum tillage). No-till yields were about 5 percent lower (a 10-year average of 185 bushels). In continuous corn, yields were highest with chiseling (182 bushels on average). The chisel system yield was about 4 percent greater than strip-tillage (174-bushel average) and 8 percent above no-till (167 average).

Placement of P and K was a component of this study from 2001 to 2004, to see whether it's better to place fertilizer deeper than the standard planter-applied treatment or simply broadcast it on the surface. Treatments were: No fertilizer, 200 pounds per acre of 9-23-30 applied either fall broadcast, fall strip using the mole knife to put it at a depth of 6 to 7 inches, or planter-applied in a 2 X 2 placement. Soil test P was in the excessively high range; soil test K was optimum.

There was minimal difference between placement methods. However, corn after beans was much more responsive to fertilizer compared to continuous corn. Early season plant K concentrations were much lower in the no fertilizer control in first-year corn compared to continuous corn. It's presumed corn stubble from the previous year cycled much more K to the surface in continuous corn compared to what was supplied by bean stubble, making continuous corn less responsive to K fertilizer.

Here are the four-year grain yields from this fertilizer placement strip-till study:

- No fertilizer - Continuous corn, 169 bushels; soybean/corn rotation, 184

- Broadcast - Continuous corn, 166; soybean/corn, 208

- 2 X 2 - Continuous corn, 170; soybean/corn, 200

- Deep - Continuous corn, 163; soybean/corn, 202.

Strip-tillage helps conserve soil and enhances water infiltration. Arlington data from seven years, comparing the three systems, shows that chiseling fragile soybean residue reduces it to an average of around 15 percent, whereas strip-till and no-till both retained residue coverage in the range of 55 to 70 percent. The amount of residue after strip-tillage was about 15 to 25 percent less than no-till, but, as noted, substantially more than what remains after full-width tillage with a chisel plow.

Work at the Lancaster station with in-field runoff collectors reveal that in a year with substantial rainfall during the early part of the growing season prior to canopy closure, chiseling resulted in 4.67 tons of soil per acre lost, while only 0.28 ton washed away in the strip-till treatment.

Wolkowski concedes that dairy and meat-animal producers are often reluctant to adopt no-till because they want to incorporate manure to reduce odor, increase N credits and limit its interference with planting. Manure with heavy straw or stalk bedding, spread on top of existing stalks, challenges many planters.

He cites research at four locations, comparing no manure to 15 or 30 tons of straw-bedded dairy manure applied per acre early spring. Tillage was done shortly before planting (moldboard plow, chisel, disk or strip-tillage) and compared to no-till. The moldboard and chisel systems included a secondary tillage pass with a disk. Wolkowski reports that adding 30 tons of manure per acre increased surface residue 13 percent (averaged over all tillage treatments and locations).

This project shows considerable difference in corn yield to tillage, most of it attributed to specific soil characteristics at the sites. For instance, the low no-till yield at Marshfield is likely due to poorly drained silt loam that's easily compacted (105 bushels on average, compared to 128 for strip-till, 120 for disking, 131 for chiseling and 143 for moldboard plowing). No-till yield was lower at Spooner (138 bushels, compared to 181 for strip-till, 185 for disking, 196 for chiseling and 181 for moldboard plowing) because the planter was light and not designed to work in high residue.

This shows that some of the issues associated with unsuccessful no-till may be due to soil conditions, equipment limitations and management.

The comparison at Arlington is: 176 bushels, no-till; 180, strip-till; 176, disking; 182, chiseling; 187, moldboard plowing. At Lancaster, the systems turned in these yields with heavy manure/residue: 194, no-till; 191, strip-till; 195, disking; 199, chiseling; 174, moldboard plowing.