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Zone-tillage an Alternative to No-till And Chisel Plow?

Wisconsin scientist makes case for practice, citing it meets conservation goals with less potential of depressing yields.

Summary: *In our studies, early-season growth and silking were significantly delayed in no-till, and were only slightly delayed in zone-till when compared to chisel plow. Zone-tillage resulted in residue levels of about 30 to 50 percent in the row and 80 to 90 percent in the inter-row. Residue in the chisel (averaging 26%) and no-till (averaging 89%) systems was relatively consistent across the row. Corn yield was not significantly affected by tillage treatment except in 1994 where yield in fall zone was greater than spring zone treatment: There was significant response to row fertilizer treatment in early growth measurements, grain moisture, and yield. A significant interactive effect showed crop response to row fertilization in all tillage treatments except chisel.*

Cool growing seasons, such as those experienced in 1992 and 1993, have reduced grower interest in no-till continuous corn production in Wisconsin. Where high residue conditions exist, yields are commonly inferior to those where tillage systems leave less residue at the surface. Cooler and wetter spring soil conditions resulting from high crop residue have been well documented. These conditions not only result in slower emergence and growth, but also may affect stand because of poor planting slot closure. Equipment manufacturers have addressed this problem by developing many different attachments, which either mount on the planter or on a separate tool bar. These are designed to clear residue from the row, as well as perform tillage to some depth at varying levels of intensity.

Interest in zone-tillage has increased dramatically in the last several years as growers search for tillage practices that provide sufficient residue to meet conservation goals, without production loss. Zone-tillage offers a compromise between no-till and other reduced tillage systems by working the soil in a narrow band (approximately 8 inches wide) in the seed row. Fall zone-tillage strips warm up and dry out sooner, reducing problems with planter slot closure in early spring planting. Fertilizer banding while conducting zone-tillage prior to planting may replace the need to use row fertilizer at planting, thereby improving the efficiency of both tillage and planting operations.

There is little information to evaluate row fertilizer placement in zone-tillage systems. Fluid fertilizers are ideally suited to this practice. Objectives of our three-year study, initiated in 1994, were to:

- determine yield effects of a zone-tillage system on corn
- evaluate the effect of row-placed fluid fertilizers on the growth, development, and nutrient uptake of corn grown in zone-tillage
- monitor early-season soil temperature in several tillage systems.

Results mixed

A significant interaction between tillage and fertilizer placement was observed for both the 1996 season and the three-year yield average. This effect for the average yield is shown in Figure 1. These data show a response to row

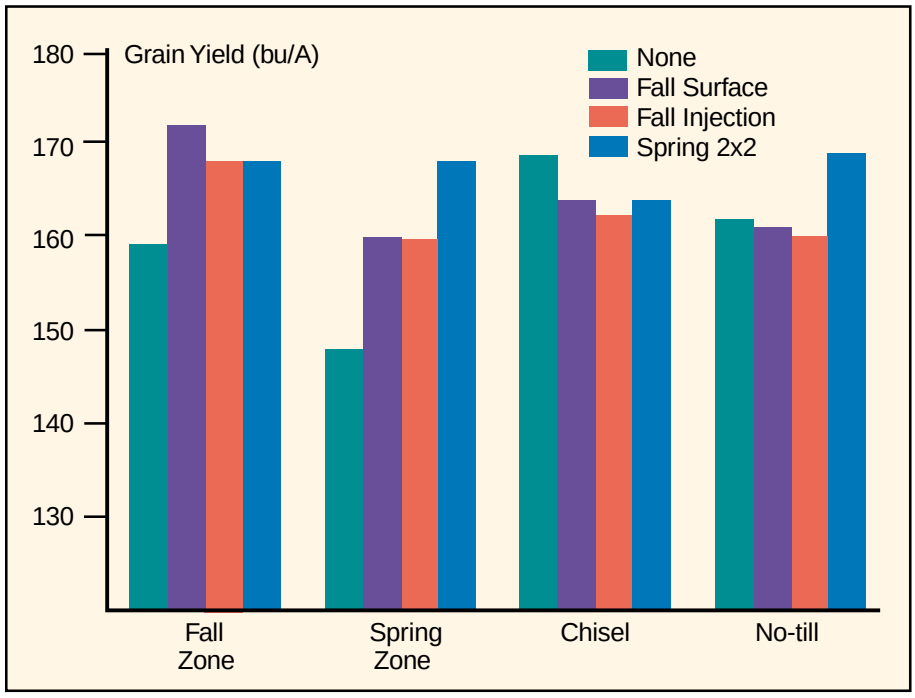

Figure 1. Interactive effect of tillage and row-placed ferilizer on corn grain yield at Arlington, WI, Wolkolwski, 1994-96.

fertilization in all tillage systems except chisel. It is possible that some lack of response to fall row fertilization in the chisel system was due to the disruption of the band caused by spring disking, although this would not explain why the spring 2 x 2 placement did not increase yield. Spring zone-tillage tended to be inferior to fall zone-tillage.

The row fertilizer response in the no-till and zone-tillage systems, while mixed, lead me to recommend a spring 2 x 2 placement over fall treatments. The small amount of material applied in this study (approximately 9 gallons/A of 7-21-7) would not likely reduce the planting efficiency. The initial P and K soil tests at this location were both in the excessively high range for corn, under Wisconsin conditions. Perhaps at lower soil test levels a program that combined both fall and spring banded treatments would have been optimal.

Residue levels drop

Residue levels, as affected by tillage, were similar in all years of the study. In 1995, for example, no-till left 86 percent residue, compared to 73 percent for fall zone and 77 percent for spring zone. Chisel plow left only 24 percent residue. The methodology used provided a residue profile across the row, as well as the average residue level for each tillage treatment.

Residue distribution in the fall zone-tillage treatment was wider than that found in the spring zone-tillage treatment possibly because of the drier condition of the soil and residue in the fall that allowed equipment to move more residue. Residue clearing treatments left between 30 and 50 percent in the row area. The difference between the average residue levels for the zone-tillage treatments was not significant. Residue levels for both chisel and no-till were typical for those systems.

Viable alternative

For growers disenchanted with no-till systems in the cooler climates of Wisconsin because of crop production losses, three years of research have demonstrated that fall zone-tillage can offer a high residue alternative to a chisel plow system. To remove any guesswork, measurements over the three-year study at the 2- and 4-inch soil depths also verified again the cooler conditions normally experienced during the early growing season under no-till in Wisconsin.

Although economics were not considered in this study, considerable savings would be realized in the zone treatment because of at least two fewer trips over the field compared to chisel plow. Furthermore, the zone treatment would be more appropriate than a low-residue chisel system for use on erodible land.

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