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Strip-Tillage: How does it affect yield in Wisconsin?

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Tillage is the mechanical manipulation of soil and plant residue to prepare a seedbed, kill weeds, incorporate nutrients, and modify soil circulation of air and water (Reicosky and Allmaras, 2003). The goal of tillage is to provide a proper environment for seed germination and root growth for crop production. Tillage systems have changed over the years as new technologies have become available and the costs of fuel and labor increased. As reduced tillage systems are adopted, many producers are realizing the benefits of leaving crop residue on the soil surface.

Farmers in Wisconsin are often challenged by cool, wet soils in the spring. Many farmers will chisel plow and field cultivate (2x) to prepare a seedbed to overcome these typical soil condition challenges. Over the last 40-50 years some farmers have sought ways to be less aggressive with tillage leaving more residue on the soil surface to protect it from erosion. Often though there is a "yield penalty" for growing corn in reduced tillage and no-till, especially for continuous corn.

No-till crop production systems leave the most residue and often prove to be the most profitable methods of crop production. Strip-till is considered a variation of no-till. The Conservation Technology Information Center's definition of no-till includes strip-till, provided less than one-third of the total row area is tilled. In strip-till, an 8-inch band in a 30-inch row spacing is aggressively tilled and fertilized using fluted coulters, knives and berm-forming baskets in either the fall or spring. The objective is to dry out and warm up soil in the seed placement zone before spring planting to encourage more uniform stand emergence and plant density.

Historically, most research in Wisconsin has concluded that aggressive tillage increases yield (Figures 1 and 2). The success of no-till was often location dependent. On average no-till yielded 2 to 11 bu /A lower than the most aggressive tillage treatment in the study. However, the economic differences between tillage systems are usually similar.

In the fall of 2000, we initiated a tillage trial to evaluate the impact of strip-tillage on corn yield. The most aggressive tillage operation in the trial was chisel plow followed by two field cultivator operations, while the least aggressive tillage operation was no-till which used a single 13-wave fluted coulter and trash whippers on the planter. Four strip tillage treatments based on tillage tool aggressiveness were applied. Treatment ST1 was the least aggressive fall strip tillage system (3 13-wave coulters). Treatment ST4 was the most aggressive fall strip tillage treatment (9-inch knife, 3 13-wave coulters and berm forming baskets). The strip-tillage treatments varied through the early years of the trial, however, from 2007 to 2015 the treatments were consistent. For Figure 1, we considered 2007 a "set-up" year and deleted it from the analysis. We analyzed 8 years of data (four 2-year cycles for the corn-soybean rotation).

No-till continuous corn yielded the least among the treatments at 164 bu/A. This treatment was used to compare all other treatments as a relative percentage. No-till in rotated corn yielded 6% more than no-till continuous corn (NT CC). Chisel plowing yielded 9-12% more than NT CC. Treatment ST4, yielded 9-10% more than NT CC. All of the strip-tillage treatments, except ST1 (the least aggressive tillage treatment) in continuous corn, yielded more than NT CC and were comparable to conventional tillage. These data are some long-term evidence that

strip-tillage can overcome cool, wet soils in the spring and have the potential to protect soil from erosion with little impact on grain yield.

Literature Cited

Reicosky, D.C., and R.R. Allmaras. 2003. Advances in Tillage Research in North American Cropping Systems. Journal of Crop Production 8:75-125.

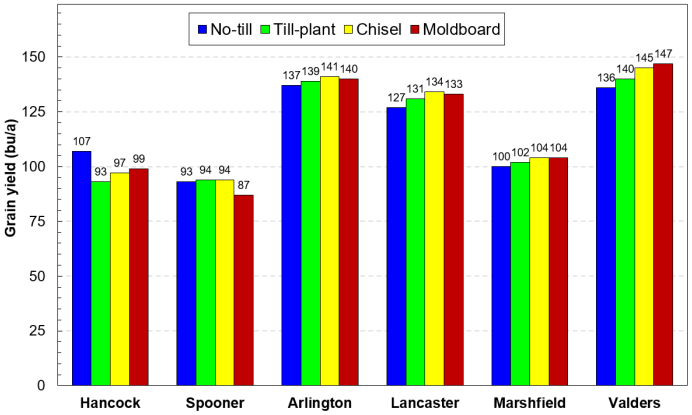

Figure 1. Effect of tillage system on corn yields in Wisconsin (1978-1984). Derived from Springman, Daniel and Mueller, 1986.

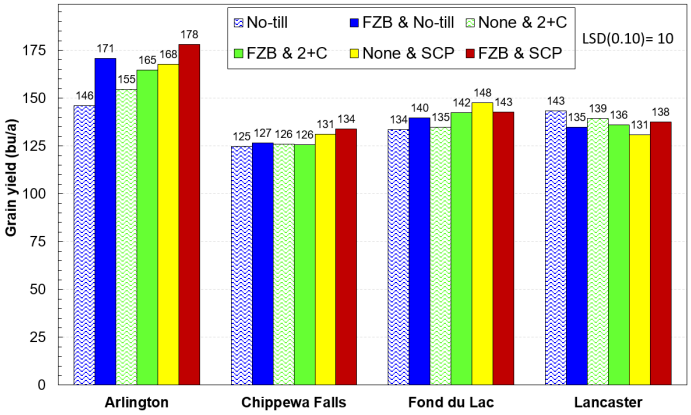

Figure 2. Effect of tillage system on corn yields in Wisconsin (1994-1996). Derived from Lauer and Wollenhaupt.

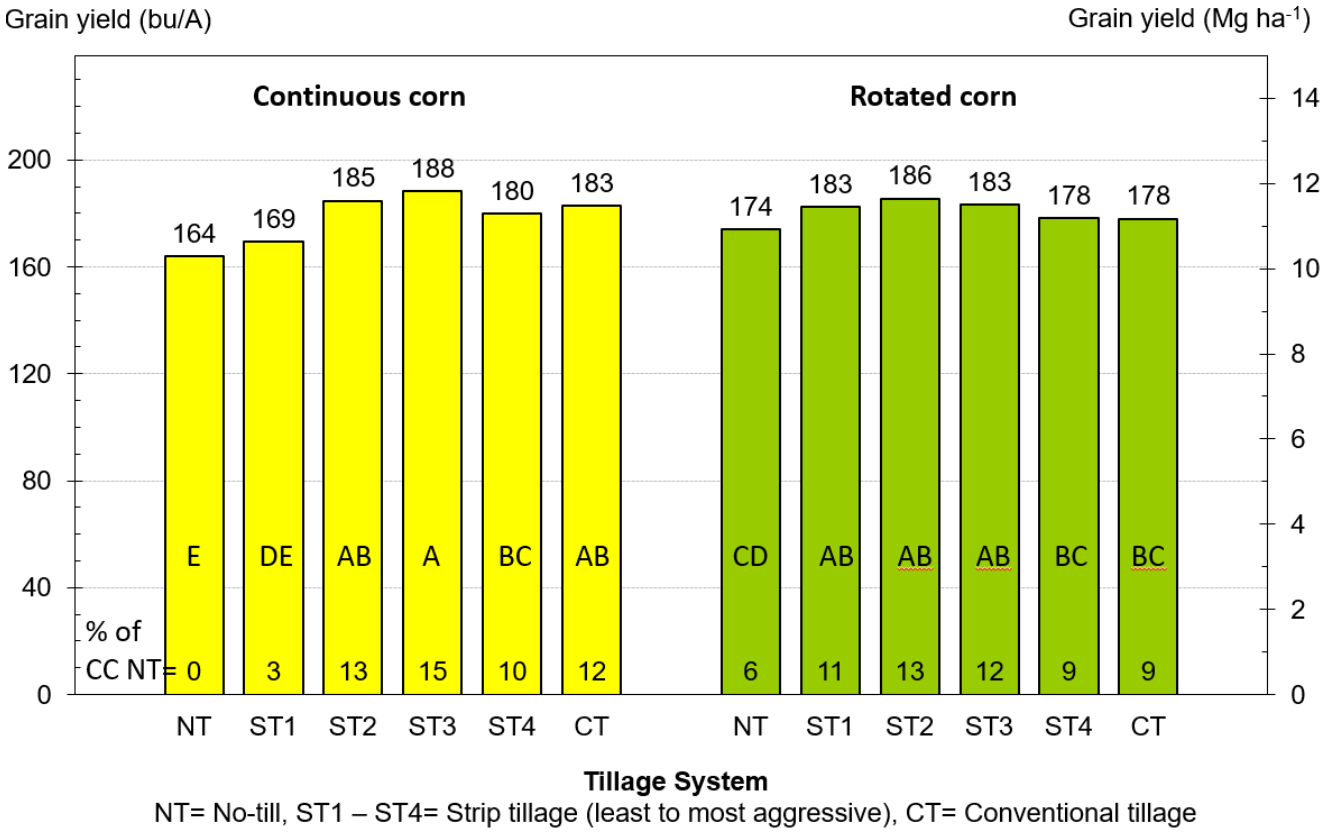

Figure 3. Corn grain yield response to no-till, strip-till and conventional tillage systems. Data are derived from 2008-2015 at Arlington, WI. Values are means of all split-split-plot treatments.