



Introduction

Cropping systems that use conservation tillage have been shown to reduce soil erosion due to wind, water and tillage passes, and has improved water infiltration. However, in the poorly drained glacial till and lacustrine soils of Minnesota, cooler temperatures and higher moisture conditions under the heavy residue can delay planting and reduce growth rates. It is perceived from the producers that no-till planting of corn into soybean residue increases the risk of reduced yields compared with more aggressive tillage. Strip tillage is a relatively new method of tillage that has been developed where the residue is cleared in a 7 to 9 inch berm in the row and the residue is untouched between the row.

Methods

Four tillage systems were compared at 10 farms in 2004 and 9 farms in 2005 in the southern half of Minnesota. Tillage treatments were applied in field-length strips, three replicates per farm, using farmer-owned or custom-hired commercial-scale equipment. Four treatments, no-till (NT - photo 1), spring field cultivate (one pass, OP - photo 2), strip-till (ST - photo 3), and chisel plow plus spring field cultivation (CP+ - photo 4) were compared at 7 sites in 2004 and 6 sites in 2005, while strip-till was compared only to chisel plow at the other 3 sites in both years. Sites were farmer-managed in partnership with University of Minnesota Extension (6 of the locations each year) or Monsanto Corporation.

Field days were held at all on-farm trial locations in 2004 and at 4 locations in 2005 (photos 5 & 6). Topics included yield comparisons of tillage systems from research plots, crop nutrient and machinery management for high residue systems, economics of conservation tillage, and incentive payment programs. Field demonstrations of strip-till equipment were usually featured.

Cross-location trial results have been presented at winter crop management meetings and published in 2007 as a University of Minnesota Extension bulletin #BU-08483 - <http://www.extension.umn.edu/distribution/cropsystems/DCS483.html>.

In 2006, two large Strip-Till Expos were held at University of Minnesota Research and Outreach Centers in southern Minnesota. In 2007, another large Strip-Till Expo was held near Fergus Falls, MN.



Photo 1 - Residue remaining after planting in a no-till system.



Photo 2 - Residue remaining before planting after a one-pass with a spring field cultivator.



Photo 3 - Residue remaining after planting in a strip till system.



Photo 4 - Residue remaining after planting in a chisel-plow-plus spring field cultivation system.

Results: On-Farm Yield Trials

Residue Cover: Residue counts were collected shortly after planting at each site (Fig. 1). On average, the chisel-plow plus treatment left less than 30% residue after planting, not meeting USDA standards for conservation tillage. The one-pass field cultivator treatment met the 30% standard only in 2005. Strip-till and no-till left averages exceeding 45% residue cover.

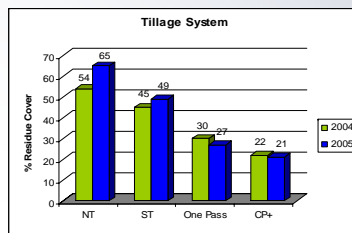


Fig. 1. Average percent residue cover after planting for four tillage treatments.

Yield: Corn grain yields were significantly affected by tillage treatments at six of the ten sites in the record cool growing season in 2004 (Fig. 2). In contrast, corn grain yields were not significantly affected by tillage treatments at eight of the nine sites in the warmer than normal growing season of 2005.

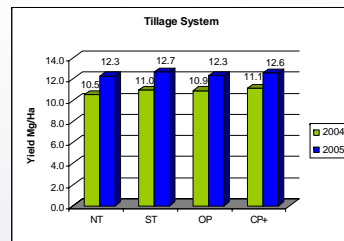


Fig. 2. Average yield for four tillage systems, 7 locations 2004, and 6 locations 2005.

Summary

Tillage research for corn following soybean conducted on farmer's fields in 2004 and 2005 has shown:

- Tillage treatments had a greater impact on crop yield in the cooler-than-normal growing season (2004) than in the warmer-than-normal growing season (2005).
- Residue coverage after planting corn varied considerably among sites and averaged 60, 47, 29, and 21% for no-till, strip-till, one-pass, and chisel-plow-plus, respectively.
- Significant differences in final plant populations among tillage treatments were rare, and when they occurred, were generally small (data not shown).
- Averaged over years, corn yields were greatest for chisel-plow-plus and strip-till, intermediate for one-pass, and least for no-till.

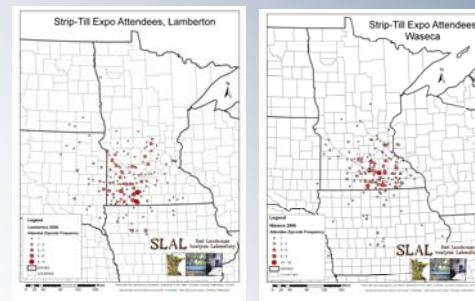
Conservation tillage can greatly reduce soil erosion, with minimal effect on crop yields and often at lower production costs than conventional tillage. With appropriate adjustments to crop management, conservation tillage offers a low-risk means of achieving substantial reductions in sediment and phosphorus losses from cropland to streams, rivers, and lakes.

Results: Field Days & Expos

Over 300 participants at each of two Strip-Till Expos in 2006 watched 9 strip-till implements in the field (photo 7 & 8). Auto-guidance systems were also demonstrated. Inside presentations addressed research results from yield trials, fertility management, guidance systems, and farmer experience with strip-tillage.

Farmers attending managed approximately 350,000 acres, while acres managed by attending crop consultants exceed 500,000, as reported on registration cards.

In 2007, over 450 people attended in Rothsay, MN. Educational topics were similar to 2006 with 12 strip-till implement demonstrations in the field. Farmers attending manage a total of 520,000 acres while acres managed by crop consultants exceeded 1.1 million acres as reported on registration cards.



Producer interest at field days centered on tillage system yield, economic comparisons, machinery selection and management, soil fertility management for high residue systems, and the interaction of tillage with soil compaction. Farmers with substantial conservation tillage experience were the primary presenters for equipment selection and management, while University of Minnesota Extension faculty and industry agronomists addressed the other areas. Approximately 1,200 people attended field days in 2004 and 2005.



Photo 5 - Host farmer discussing high residue planting equipment at field day.



Photo 6 - Extension soil specialist Jodi DeJong-Hughes addresses soil structure and compaction.



Photo 7 - Farmers checking berm height in a strip till demonstration plot at the Waseca Strip-Till Expo in 2006.



Photo 8 - Farmers listening to Strip-Till manufacturers at the Lamberton Strip-Till Expo in 2006.

Funding and Contacts

Project funded by EPA Sec 319 grant, administered by the MN Pollution Control Agency.

Contact Author: Jodi DeJong-Hughes, dejon003@umn.edu