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Strip Till, No-Till and Conventional Tillage Comparisons – Does Planting Date Affect Results?

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Introduction

Numerous tillage studies have been conducted in Iowa, the Midwest, and throughout the U.S. with a wide range of results. The tillage system that results in the highest yield depends on several factors including soil type and weather during the study. Generally, systems with little soil disturbance are favored on coarser textured soils and/or in drier years (Eckert 1987; Beyaert et al. 2002). For soil and water conservation purposes, as well as for economic reasons, extending successful use of no-till or similar systems to finer textured soils seems advantageous.

Strip tillage offers selected advantages of no-till and more intensive tillage systems. Soil disturbance is considerable, but limited to the row zone- the area of greatest farmer concern. The interrow zone remains undisturbed, with surface conditions similar to those of no-till. This system has been compared to other tillage systems with generally favorable results in the Midwest (Vetsch and Randall, 2002). Yields are generally similar to those of chisel plow/full width systems and tend to be higher than those of no-till.

A potential weakness of nearly all published tillage system comparisons lies in methodology. Early season row zone soil warming and drying favoring early planting is a major difference between strip tillage and no-till. Furthermore, planting date has a well-recognized effect on yield. Producers and researchers also recognize soil conditions that first favor early season planting seldom occur concurrently for different tillage systems. Yet tillage studies consistently plant all tillage systems on a single day and base producer recommendations on these results. Can we reliably ignore planting date differences that normally occur between tillage systems when we conduct tillage research? This paper will address this question and results are based on a study conducted near Newton, Iowa in 2002 and 2003.

Methods

Two experiments were established on soils of the Noadway–Zook–Nevin association near Newton, IA in 2002 and 2003. Three soils were present on the experimental site; a Judson silt loam, a Nevin silty clay loam, and a Zook silty clay loam. In both experiments a split plot design was used with whole plots arranged in four randomized complete blocks. Three tillage
treatments were whole plots, conventional tillage (CT), strip tillage (ST), and no tillage (NT). Three planting dates were applied as split plot.

In both experiments ST occurred the preceding fall. The distance between strips was 30-inches and the disturbed area over the row was approximately 12 inches. For CT a field cultivation and a ripping operation was conducted in November 2001 and field cultivation in April 2002. On November 2002 a disk-chiseling and a field cultivation in April 2003 were done. Nothing was done on NT from harvest to planting.

Corn planting date was determined based on soil temperature at 2-inches and soil water content at two inches. Soil temperature was monitored every hour from April 4 in 2002, and from April 9 in 2003 until the planting date. The lower plastic limit soil water content was selected as the criteria to define soil water content for planting (Mc Bridge, 2002). If the soil was at, or more than 50 °F for twelve continuous hours and the soil water content was at the lower plastic limit (or lower), planting was conducted. Soybean planting date was based on the same criteria than corn planting date, but 55°F was used instead of 50°F as the soil temperature limit.

Three separate planting dates were used for this project. The soil temperature and water content conditions appropriate for planting occurred on a common day in for strip tillage and conventional tillage plots. On this day all three tillage treatments were planted. The second planting date occurred when the no-till plots were ready based on the planting conditions identified above. Again all three treatments were planted. A third, and later, date was selected when all three systems were ready for planting. This date is referred to as a calendar planting date. In 2002, planting dates for corn were April 11, April 17, and May 6. For soybeans in 2002, planting dates were May 6, May 22, and June 7. In 2003 corn planting dates were April 15, May 13, and May 19 and soybean planting dates were May 6, May 22, and June 7. All corn plots within each year were harvested on a common date, as were all soybean plots.

Results

Planting date significantly affected corn yield both years and significantly affected soybean yield only in 2003. Yields for both crops and for each tillage system are given in Table 1. In 2002 corn yields were reduced by the April 11 planting date, even though soil conditions were suited for planting on that early planting date for two of the three tillage systems. Yield reductions associated for the early planting date were similar across tillage systems.

In 2003, the earliest planting date, April 15, resulted in the highest average corn yields across tillage systems. Again, differences in yield between planting dates were similar across tillage systems. Note that even though soil conditions were not suitable for planting on April 15, 2003 this planting date for no-till produced an average of 30 bu/A higher corn yield than did the other planting dates. Late summer water stress likely limited corn yields for the later planting dates.

Soybean yields were similar for all planting dates and tillage treatments in 2002. In 2003 the highest average yield was observed for the earliest planting date. Statistically, a significant tillage x planting date interaction occurred. This resulted from different tillage sensitivities to different planting dates. No till yields were quite stable across planting dates, varying by only two bu/A. Conventional tillage and strip tillage varied five and six bu/A, respectively.
Table 1. Effect of planting date and tillage system on corn and soybean yields for 2002 and 2003.

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>Corn Yield (bu/A)</th>
<th>Soybean Yield (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CT*</td>
<td>NT</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April 11</td>
<td>200</td>
<td>186</td>
</tr>
<tr>
<td>April 17</td>
<td>210</td>
<td>194</td>
</tr>
<tr>
<td>May 6</td>
<td>202</td>
<td>195</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April 15</td>
<td>182</td>
<td>175</td>
</tr>
<tr>
<td>May 13</td>
<td>166</td>
<td>144</td>
</tr>
<tr>
<td>May 19</td>
<td>157</td>
<td>145</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 6</td>
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<td>45</td>
</tr>
<tr>
<td>May 22</td>
<td>49</td>
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<td>May 27</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>June 11</td>
<td>27</td>
<td>31</td>
</tr>
</tbody>
</table>

* CT, NT, and ST stand for Conventional Tillage, No-till, and Strip Tillage, respectively.

Summary

Data from one site, two crops, and two years gives us four ‘plot years’ of information. Tillage did not significantly affect either corn or soybean yield either year. In three of the four years it seemed planting date differences that typically would occur between tillage systems had little impact on conclusions drawn about tillage system yield performance. In other words, the typical method of planting all tillage systems on a given day gives the same results as if each tillage system was planted on the day that soil temperature and water content conditions were most appropriate.

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References


