Timing of Side-Dress Applications of Nitrogen for Corn in Conventional and No-Till Systems

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Abstract
Environmental conditions vary widely in the spring in southeastern Kansas. As a result, much of the N applied prior to corn planting may be lost before the time of maximum plant N uptake. Side-dress or split applications to provide N during rapid growth periods may improve N use efficiency while reducing potential losses to the environment. The objective of this study was to determine the effect of timing of side-dress N fertilization compared with pre-plant N applications for corn grown on a claypan soil.

Keywords
Nitrogen, side-dress, corn, tillage

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Timing of Side-Dress Applications of Nitrogen for Corn in Conventional and No-Till Systems

D.W. Sweeney, D. Shoup, and D. Ruiz-Diaz

Summary
Corn yield and yield components were affected by tillage and nitrogen (N) side-dress options in 2017. Corn yields were 14% greater with conventional tillage than with no-till. Yields were improved by either splitting N rate between pre-plant and side-dress or adding additional side-dress N as compared with applying 150 lb/a pre-plant. Side-dress applications of 50 lb N/a at V10 following 150 lb/a applied pre-plant resulted in greatest corn yield.

Introduction
Environmental conditions vary widely in the spring in southeastern Kansas. As a result, much of the N applied prior to corn planting may be lost before the time of maximum plant N uptake. Side-dress or split applications to provide N during rapid growth periods may improve N use efficiency while reducing potential losses to the environment. The objective of this study was to determine the effect of timing of side-dress N fertilization compared with pre-plant N applications for corn grown on a claypan soil.

Experimental Procedures
The experiment was established in spring 2015 on a Parsons silt loam soil at the Parsons unit of the Kansas State University Southeast Agricultural Research Center. The experiment was a split-plot arrangement of a randomized complete block design with four blocks (replications). Whole plot tillage treatments were conventional tillage (chisel, disk, and field cultivate) and no tillage. Sub-plot nitrogen treatments were six pre-plant/side-dress N application combinations that include 1) a no-N control, 2) 150 lb N/a applied pre-plant, 3) 100 lb N/a applied pre-plant with 50 lb N/a applied at the V6 (six-leaf) growth stage, 4) 100 lb N/a applied pre-plant with 50 lb N/a applied at the V10 (ten-leaf) growth stage, 5) 150 lb N/a applied pre-plant with 50 lb N/a applied at the V6 growth stage, and 6) 150 lb N/a applied pre-plant with 50 lb N/a applied at the V10 growth stage. The N source for all treatments was liquid urea-ammonium nitrate (28% N) fertilizer. Pre-plant N fertilizer was applied on March 16, 2017, side-dress N at V6 on May 25, 2017, and side-dress N at V10 on June 12, 2017, to appropriate plots.

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All N was broadcast applied with 7-stream pattern fertilizer nozzles. Corn was planted on April 11 and harvested on September 11, 2017.

**Results and Discussion**

In 2017, corn yielded 18 bu/a more with conventional tillage than with no-tillage, likely because of 16% greater stand (Table 1). Adding N fertilizer, generally, more than doubled yields obtained in the no-N control. Splitting the N fertilizer to apply 100 lb N/a preplant followed by 50 lb N/a at the V6 or V10 growth stages improved yields by more than 15 bu/a greater than all N applied pre-plant. Adding 50 lb N/a extra at the V6 growth stage to a 150 lb N/a preplant application did not improve yields more than that obtained with 150 lb N/a applied split pre-plant and side-dress. However, delaying the extra 50 lb N/a side-dress application to the V10 stage improved yield by nearly 20 bu/a. These effects of N timing on corn yield in 2017 appeared to be related to the combined responses in kernel weight, ears/plant and kernels/ear.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (bu/a)</th>
<th>Stand (number/a)</th>
<th>Kernel weight (mg)</th>
<th>Ears/plant</th>
<th>Kernels/ear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional⁠¹</td>
<td>147.3</td>
<td>22300</td>
<td>225</td>
<td>0.93</td>
<td>789</td>
</tr>
<tr>
<td>No-till</td>
<td>129.0</td>
<td>19200</td>
<td>230</td>
<td>0.90</td>
<td>800</td>
</tr>
<tr>
<td>LSD (0.10)</td>
<td>16.6</td>
<td>1300</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>N timing⁠²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-N control</td>
<td>56.1</td>
<td>20900</td>
<td>178</td>
<td>0.82</td>
<td>483</td>
</tr>
<tr>
<td>150 PP</td>
<td>134.8</td>
<td>20900</td>
<td>220</td>
<td>0.92</td>
<td>814</td>
</tr>
<tr>
<td>100 PP/50 V6</td>
<td>152.0</td>
<td>20500</td>
<td>232</td>
<td>0.95</td>
<td>866</td>
</tr>
<tr>
<td>100 PP/50 V10</td>
<td>151.1</td>
<td>20600</td>
<td>240</td>
<td>0.92</td>
<td>850</td>
</tr>
<tr>
<td>150 PP/50 V6</td>
<td>157.8</td>
<td>20800</td>
<td>246</td>
<td>0.96</td>
<td>826</td>
</tr>
<tr>
<td>150 PP/50 V10</td>
<td>177.0</td>
<td>20900</td>
<td>250</td>
<td>0.94</td>
<td>929</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>15.2</td>
<td>NS</td>
<td>19</td>
<td>0.08</td>
<td>80</td>
</tr>
</tbody>
</table>

¹Conventional tillage: chisel, disk, and field cultivate.

²Nitrogen treatments: Control, no N fertilizer; 150 PP, 150 lb N/a applied pre-plant with no side-dress N; 100 PP/50 V6, 100 lb N/a applied pre-plant with 50 lb N/a side-dress applied at V6 (six-leaf) growth stage; 100 PP/50 V10, 100 lb N/a applied pre-plant with 50 lb N/a side-dress applied at V10 (ten-leaf) growth stage; 150 PP/50 V6, 150 lb N/a applied pre-plant with 50 lb N/a side-dress applied at V6 growth stage; and 150 PP/50 V10, 150 lb N/a applied pre-plant with 50 lb N/a side-dress applied at V10 growth stage.