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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

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

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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 1. Tillage and nitrogen (N) side-dress application effects on yield and yield components of corn in 2017

Treatment	Yield	Stand	Kernel weight	Ears/plant	Kernels/ear
	bu/a	number/a	mg		
Tillage					
Conventional[1]	147.3	22300	225	0.93	789
No-till	129.0	19200	230	0.90	800
LSD (0.10)	16.6	1300	NS	NS	NS
N timing[2]					
No-N control	56.1	20900	178	0.82	483
150 PP	134.8	20900	220	0.92	814
100 PP/50 V6	152.0	20500	232	0.95	866
100 PP/50 V10	151.1	20600	240	0.92	850
150 PP/50 V6	157.8	20800	246	0.96	826
150 PP/50 V10	177.0	20900	250	0.94	929
LSD (0.05)	15.2	NS	19	0.08	80

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

[2]Nitrogen 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.