

Pre-Plant Nitrogen Rate and Application Method and Side-Dress Nitrogen Rate Effects on No-Till Corn Grown on a Claypan Soil

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Summary

Average corn yield in 2019 was increased by 14 bu/a with knife application of pre-plant nitrogen (N) fertilizer compared with broadcast application. Applying N more than doubled yield of corn grown without N. In general, applying side-dress N increased yields compared to yields obtained with only pre-plant applications.

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. Pre-plant N application method, pre-plant N rate, and side-dress N rate selections create opportunities to provide N during rapid growth periods and 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 pre-plant and side-dress N fertilization options on corn grown no-till on a claypan soil.

Experimental Procedures

The experiment was established in spring 2018 on a Parsons silt loam soil at the Parsons Unit of the Kansas State University Southeast Research and Extension Center that had been in continuous no-till for more than 10 years. The experiment was a factorial arrangement of a randomized complete block design with four blocks (replications). The two factors were pre-plant N fertilizer placement of broadcast and knife (subsurface band at 4 inches deep) and pre-plant/side-dress N rates of 0-0, 0-150, 100-0, 100-50, 100-100, 150-0, 150-50, 150-100, and 200-0 lb/a. Side-dress applications were broadcast at the V10 growth stage using 7-stream pattern, fertilizer nozzles dropped to less than a foot above the soil surface. The N source for all treatments was liquid urea-ammonium nitrate (UAN; 28% N) fertilizer. Pre-plant N fertilizer was applied on March 19, 2019, and side-dress N was applied at V10 on June 20, 2019, to appropriate plots. Corn was planted on April 11 and harvested on September 4, 2019.

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Results and Discussion

Knife application of the N applied pre-plant resulted in 14 bu/a greater yields than when the pre-plant N was broadcast applied (Table 1). This was partially because of approximately 7% greater number of ears per plant with knifing than with broadcasting. The other yield components were not affected by pre-plant application method ($P = 0.05$). Applying N at any rate and time more than doubled corn yield in 2019 compared to the 84 bu/a yield with the no-N control. In general, applying side-dress N increased yields compared to yields obtained with only pre-plant applications; however, the increase from side-dress appeared greater when the pre-plant N was 100 lb N/a than when the pre-plant N was 150 lb N/a. Increasing total N rate to greater than 100 lb N/a resulted in increased yield regardless of individual rates of pre-plant/side-dress N applications, with few differences in combinations where total N was 150 lb/a or greater. Stand was not affected by pre-plant/side-dress N rates, but fertilizing with N increased kernel weight, the number of ears/plant, and the number of kernels/ear compared with corn grown in the no-N control.

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Table 1. Pre-plant application method and pre-plant/side-dress nitrogen (N) rates effects on yield and yield components of corn planted no-till on a claypan soil in 2019

Treatment	Yield bu/a	Stand plants/a	Kernel weight mg	Ears/plant	Kernels/ear
Pre-plant N method					
Broadcast	176	21,700	257	1.17	675
Knife ¹	190	21,400	261	1.25	691
LSD (0.10)	6	NS	NS	0.05	NS
Pre-plant/side-dress ²					
N rates (lb/a)					
0-0 (No-N control)	84	21,000	220	0.91	510
0-150	188	21,300	277	1.11	730
100-0	174	21,900	262	1.15	674
100-50	197	22,200	262	1.20	721
100-100	201	21,100	271	1.34	677
150-0	195	21,800	264	1.26	692
150-50	205	21,700	272	1.29	691
150-100	208	21,800	240	1.33	772
200-0	194	21,200	266	1.29	681
LSD (0.05)	13	NS	20	0.10	67

¹Knife: subsurface band at 4 inch depth.

²Side-dress applications were made at the V10 growth stage.