Effect of N and P Starters on Short-Season Corn Grown in Conservation Tillage Systems on a Claypan Soil

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Introduction

Recent use of short-season cultivars to avoid mid-summer drought has increased corn acreage on the upland, claypan soils of southeastern Kansas. However, fertility and tillage options are not well defined on these soils. Optimum corn production results from use of proper management options that include soil fertility and tillage selections. Reducing tillage has the potential to reduce losses to the environment, but maintaining proper plant nutrition is critical for crop production. Starters have been used to improve early plant growth in no- or reduced-tillage systems and this often translates to additional yield. However, data are limited regarding the effect of starter fertilization on yield of short-season corn grown on the claypan soils found in areas of the eastern Great Plains.

Procedures

The experimental design was a split-plot arrangement of a randomized complete block with three replications. The whole plots were tillage system (reduced and no-till) and subplots were starter N-P combinations. All plots except the no N-P control were balanced to receive a total of 120 lb N/a and 50 lb P_2O_5/acre. Pioneer 35P80 Roundup-Ready® corn was planted at 25,000 seeds/a on April 3, 2006 and Pioneer 35F37 Roundup-Ready® corn was planted at 25,000 seeds/acre on April 16, 2008. Excessive rainfall in 2007 prevented planting. Starter solutions were applied 2 x 2 with the planter. Grain was harvested for yield on August 14, 2006 and September 19, 2008. During the growing season at V6, V12, R1 (silk), and R4 (dough) growth stages, whole plant samples were collected and dry matter determined.

Objective

The objective of this research was to determine the effect of N and P rates in starter fertilizers on short-season corn planted with reduced or no tillage.

Treatments

The two tillage systems were reduced-till (disk twice) and no-till. The fertilizer treatments in each tillage system were starter fertilizer combinations consisting of N rates of 20, 40, and 60 lb/acre and P rates of 0, 25, and 50 lb P_2O_5/acre. In addition, there were two reference treatments: a no starter treatment (all N and P applied preplant) and a no N or P control.

	2-Year Average			
Starter	Yield	Population	Kernel Weight	Kernels /ear
	bu/a	plants/a	mg	
N Rate, lb/a				
20	114	25300	263	507
40	116	25300	260	515
60	114	25300	263	504
LSD (0.05)	NS	NS	NS	NS
P Rate, lb/a				
0	117	25300	263	506
25	114	24900	262	511
50	113	25600	261	509
LSD (0.05)	NS	NS	NS	NS
All N-P Preplant	118	25400	258	524
Control (No N/P)	101	25100	255	451

	2-Year Average			
Tillage	Yield	Population	Kernel Weight	Kernels /ear
	bu/a	plants/a	mg	
Reduced	116	24900	262	513
No-till	111	25600	260	497
LSD (0.05)	NS	NS	NS	NS

	Dry Weight (2-Yr Avg.)			
Treatment	V6	V12	R1	R4
	lb/a			
Tillage				
Reduced	350	3540	5960	11100
No-till	290	2820	5060	10100
LSD (0.05)	50	390	550	NS
P Rate, lb/a				
0	320	3210	5650	10900
25	320	3150	5500	10400
50	390	3440	5780	10800
LSD (0.05)	30	230	NS	NS
All N-P Preplant	290	3200	5310	10600
Control (No N/P)	170	2410	4480	9700

Summary

Rainfall was variable in both 2006 and 2008 and though yield and yield components were affected by year, there were few treatment effects. Average yield was about 15% greater with the fertilizer treatments than with the no N or P control, likely due to a similar increase in the number of kernels per ear. There were no differences in yield or yield components between tillage systems, starter N rates, or starter P rates, nor were there any meaningful interactions between tillage and starter fertilizer treatments. In contrast to yield, average dry matter production was affected by tillage at V6, V12, and R1 growth stages and by P starter early in the season prior to reproductive growth. However, the response was greater in 2006 as indicated by significant interactions of tillage and P starter with year. At V6, reduced tillage resulted in about 20% more growth than with no tillage. Reduced tillage resulted in significantly greater dry matter production throughout the season, but the difference became non-significant as the plant reached late growth stages. Early in the season, increasing P rate in the starter resulted in significantly greater dry matter production. However, this response declined rapidly and was not significantly different by the time the corn plant entered reproductive growth.