KANSAS

Starter Fertilizer Interactions with Corn and Grain Sorghum Hybrids

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No-tillage crop production systems have become common in the central Great Plains. Advantages of reduced-tillage systems include reduced soil erosion and increased water use efficiency. The high residue levels associated with no-tillage production can cause soils to be cooler and wetter than in conventional tillage systems. Cool, wet soils can reduce nutrient uptake and crop growth. Starter fertilizer applications have been effective in improving nutrient uptake even on soil high in available nutrients. Recent work in other states has suggested that hybrids may exhibit differential response to starter fertilizer application.

The objective of these studies was to evaluate corn and grain sorghum hybrid response to starter fertilizer in a no-tillage, dryland environment on soils high in available phosphorus (P).

Field experiments were conducted at the North Central Kansas Experiment Field near Belleville, on a Crete silt loam soil (fine, montmorillonitic, mesic Pachic Arguistoll) from the spring of 1995 through the fall of 1997. Analysis by the Kansas State University (KSU) soil test lab in the corn experimental area showed that initial soil pH was

Increases in early growth are found when starter fertilizer is applied for many corn and grain sorghum hybrids.

6.1; organic matter content was 2.4 percent; Bray-1 P and exchangeable potassium (K) in the top 6 inches of soil were 43 and 380 parts per million (ppm), respectively (both very high). In the grain sorghum area, soil pH was 6.5; organic matter content was 2.5 percent; Bray-1 P was 45 ppm (very high); and exchangeable K was 420 ppm (very high).

The experimental design was a split plot arrangement of treatments in a randomized complete block. Main plot treatments were corn hybrids, or grain sorghum hybrids. Sub-plots were starter fertilizer or no starter fertilizer. The liquid starter fertilizer consisted of 30 lb nitrogen (N) and 30 lb P_2O_5 supplied as ammonium polyphosphate (10-34-0) and urea ammonium nitrate (UAN). This N:P combination was selected because of its superior performance in a previous experiment. Starter fertilizer was applied 2 inches to the side and 2 inches below the seed at planting. Immediately after planting, N was knife applied to bring the total applied to each plot to 180 lb/A in the corn experiment and 150 lb/A in the grain sorghum experiment. Corn was planted in mid to late-April, grain sorghum in mid-May each year of the experiment.

Results of Corn Experiment

The basic goal of dryland corn production in Kansas is to plant as early in the spring as possible, so that silking occurs in late June and seed-fill begins in early to mid-July. With normal temperatures and sufficient subsoil moisture through mid-July, the corn can reach its full yield potential. Any factor that delays silking until July, when temperatures are normally hotter and the probability of rainfall is less than in June, can severely reduce grain yield. When averaged over the 3 years of the experiment, starter fertilizer consistently increased grain yield, shortened the period from emergence to midsilk, decreased grain moisture content at harvest, and increased total P uptake (grain plus stover) of Pioneer 3489, Pioneer 3346, Pioneer 3394, Cargill 7777, DeKalb 591, Northrup King 6330, and Northrup King 7333, but had no effect on Pioneer 3563, Cargill 6327, DeKalb 626, DeKalb 646, and ICI 8599 (**Table 1**). Yield in responding hybrids (hybrids in which the 3-year average yield was increased by starter fertilizer) was increased by an average of 17 bu/A and time to midsilk was shortened by six days (**Table 3**). Starter fertilizer reduced grain moisture at harvest by 20 percent in

TABLE 1. Starter fertilizer effect on grain yield, number of days from emergence to midsilk and grain harvest moisture of corn hybrids, 1995-1997.

	Grain yield, bu/A		Days to midsilk		Harvest moisture, %	
Hybrid	with	without	with	without	with	without
Pioneer 3563	106	105	74	74	15.9	15.9
Pioneer 3489	135	116	72	78	16.1	19.2
Pioneer 3346	142	122	74	80	15.8	20.2
Pioneer 3394	144	127	75	80	15.6	19.8
Cargill 6327	124	124	79	80	16.8	16.4
Cargill 7777	161	149	76	82	16.8	20.2
DeKalb 591	141	122	72	79	15.4	19.5
DeKalb 626	124	124	79	79	16.4	16.5
DeKalb 646	127	126	81	82	16.6	16.8
Northrup King 7333	126	110	76	82	16.8	21.0
Northrup King 6330	137	120	75	79	16.1	19.0
ICI 8599	120	120	77	77	14.8	14.7
LSD (0.05)	9		2		1.9	

responding hybrids (**Table 3**) and doubled the amount of dry matter at the six leaf stage of growth of all corn hybrids included in the experiment. Nitrogen and P uptake at this growth stage was also significantly increased.

Results of Grain Sorghum Experiment

Delay in growth and development of grain sorghum in Kansas increases the risk of plants being exposed to freezing temperatures in the fall prior to physiological maturity, thus reducing yield and quality. On average, an early killing frost occurs statewide in Kansas one out of every two years. The large amount of surface residue present in no-tillage systems can slow growth. Fertilizer placed in close proximity to growing seedlings can hasten maturity and avoid late-season low temperature damage. Starter fertilizer consistently increased yields, reduced the number of days needed from emergence to midbloom, decreased grain moisture content at harvest, and increased total P uptake of Pioneer 8505, Pioneer 8522Y, Pioneer 8310, DeKalb 40Y, DeKalb 48, DeKalb 51, DeKalb 55, and Northrup King 735, but had no effect on Pioneer 8699, DeKalb 39Y, Northrup King 383Y, and Northrup King 735 (**Table 2**). When

Plots being planted in Kansas study of response to starter fertilzer.

averaged over the 3 years of the experiment, starter fertilizer increased yield of responding hybrids by 15 bu/A and reduced the time to midbloom by 5 days (**Table 3**). In responding hybrids, starter fertilizer reduced grain moisture content by 25 percent. It increased 6-leaf stage dry weight and N and P uptake of all hybrids tested.

Conclusion

On this high soil test P soil, starter fertilizer consistently improved early season plant growth and nutrient uptake of all corn and grain sorghum hybrids tested. This early season growth advantage did

TABLE 2. Starter fertilizer effect on grain yield, number of days from emergence to midbloom and grain harvest moisture of grain sorghum hybrids, 1995-1997.

	Grain yield, bu/A		Days to midbloom		Harvest moisture, %	
Hybrid	with	without	with	without	with	without
Pioneer 8699	109	107	54	55	15.4	15.5
Pioneer 8505	138	122	55	60	17.9	23.7
Pioneer 8522Y	127	115	60	66	17.1	23.6
Pioneer 8310	133	118	64	68	15.8	21.6
DeKalb 39Y	104	103	58	59	13.9	13.8
DeKalb 40Y	131	113	60	66	15.6	20.8
DeKalb 48	129	115	61	67	14.7	20.8
DeKalb 51	134	115	61	67	15.9	21.1
DeKalb 55	130	114	64	69	16.5	21.0
Northrup King 383Y	117	117	60	61	14.6	14.9
Northrup King 524	125	114	58	63	15.5	20.0
Northrup King 735	128	127	62	63	19.6	19.6
LSD (0.05)	8		2		1.1	

TABLE 3. Summary of starter responsive and non-responsive corn and grain sorghum hybrids, 1995-1997.

Hybrid type	Number of hybrids	Yield response, bu/A	Reduction in: days to midsilk/bloom	Reduction in: grain moisture, % points
Corn:				
Responsive	7	17	5.7	3.8
Non-responsive	5	0	0	0
Sorghum:				
Responsive	8	15	5.4	5.5
Non-responsive	4	1	1.0	-0.1

not last into anthesis for all corn and grain sorghum hybrids. In this high residue, no-tillage production system, starter fertilizer consistently improved grain yield and hastened maturity for some but not all hybrids evaluated. However, seven of the eight highest corn yields and nine of the ten highest sorghum yields were treatments including starter. This indicates it is unlikely that all of the yield loss from not using starter can be avoided by hybrid selection. Results of this work suggest that responses to starter fertilizer in high residue systems can be beneficial for most hybrids even on soils testing very high in available nutrients. BC

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Nutrient Management Planning Workshop Set for Danville, Illinois, August 17-18

In cooperation with the Illinois Fertilizer & Chemical Association (IFCA) and the Indiana Plant Food and Agricultural Chemicals Association, PPI and the Foundation for Agronomic Research (FAR) will sponsor a Nutrient Management Planning Workshop in Danville, Illinois, on August 17-18, 1998. The workshop will feature a step-by-step approach to building a complete farm nutrient management plan. Participants will learn how to collect, analyze and interpret site-specific data. Hands-on computer experience with several analytical and decision-making tools will provide an opportunity to work through the process with real farm data. Dr. Harold Reetz (PPI Midwest Director) and Dr. Scott Murrell (PPI Northcentral Director) are coordinating the program, which will focus on interpreting site-specific data from Midwest farms.

An exhibit area will feature the latest technology related to nutrient management planning and tools for crop and soil management.

For information, contact Dr. H.F. Reetz, PPI, 111 E. Washington St., Monticello, IL 61856-1640. Phone: 217-762-2074, FAX: 217-762-8655, and e-mail: hreetz@ppi-far.com.

This workshop is being held in conjunction with the Annual Midwest Ag Industries Expo (MAGIE), sponsored by IFCA and scheduled for August 19-20 at the Vermilion County Airport, north of Danville. BC