Starter Fertilizer/Hybrid Interactions in No-Till Corn and Grain Sorghum

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Kansas studies show that no-till corn and grain sorghum hybrids differ in response to nitrogen (N) and phosphorus (P)-containing starter fertilizers. However, a majority of hybrids show increased yield even with high P soil tests.

CONSERVATION TILLAGE production systems are being used by an ever-increasing number of farmers across the United States. Conservation tillage is really a general phrase that includes any production system designed to leave a protective residue cover on the soil surface. Examples include no-till, ridge-till, reduced till, and others. The value of residue in protecting the topsoil from wind and water erosion has been well documented. Residue cover can impact nutrient management significantly. The efficiency of surface applied N, for example, can be affected by heavy residue cover. The potential for N immobilization in decomposing residue and N volatilization is increased.

Production systems that leave a heavy residue cover on the soil result in cooler and wetter soils, particularly early in the growing season. These conditions increase the importance of using P-containing starter fertilizers. Recent work in other states has suggested that hybrids may react differently with respect to nutrient uptake under certain conditions. This article summarizes recent research in Kansas that evaluated the use of starter fertilizers on corn and grain sorghum hybrids grown under no-till conditions.

Corn

A dryland corn production system that has gained considerable popularity in Kansas over the past several years

Table 1. Hybrid and starter fertilizer effects on dryland, no-till corn, North-Central Experiment Field, Republic County, KS.

Hybrid	Starter	Days to mid-silk		Grain Yield, bu/A	
		1993	1994	1993	1994
ICI 8599	With	63	58	164	203
	Without	65	60	163	199
Pioneer 3563	With	63	57	192	217
	Without	67	62	190	212
Pioneer 3346	With	65	58	225	209
	Without	69	64	213	190
Dekalb 636	With	66	60	196	196
	Without	72	64	183	178
Dekalb 591	With	64	58	191	202
	Without	67	63	185	193
Pioneer 3394	With	–	58	–	222
	Without	–	63	–	207

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involves early planting, from mid-March in southern Kansas to early to mid-April in the north, of early maturing (85-105 days) corn hybrids. The concept is to get the corn crop through pollination before the extremely hot and dry part of the growing season. When this production scheme is employed in no-till systems, there is a high risk of cool, wet soils interfering with N and P uptake. Low soil temperatures limit plant growth due to slow root growth and reduced nutrient availability, even though the soil may have high residual fertility levels.

Table 1 summarizes results of two years of work evaluating the effects of starter fertilizer on six corn hybrids grown in an environment ranging from 2,530 to 2,850 growing degree units under dryland, no-till conditions. The soil was a Crete silt loam that had a Bray-1 P level of 85 lb/A (high range). The corn hybrids were grown without or with liquid starter fertilizer (30 lb N/A and 30 lb P_2O_5/A) as urea ammonium nitrate (UAN) solution and ammonium polyphosphate (10-34-0). The starter was applied 2 inches to the side and 2 inches below the seed at planting. Nitrogen was balanced at 180 lb/A on all treatments as knifed UAN just after planting. Corn was planted on April 26 in 1993 and April 19 in 1994.

Results show that the use of starter fertilizer reduced the number of days to mid-silk for all hybrids both years. Grain yields of some hybrids were dramatically

STARTER FERTILIZER is an important input in conservation tillage production systems. Corn on the left received N-P starter, resulting in faster plant development and increased grain yields.

increased by starter fertilizer, while other hybrids showed little response to starter.

Grain Sorghum

With the dramatic differences observed on some corn hybrids, we decided to examine effects on grain sorghum hybrids. The experiment was also conducted on a Crete silt loam soil with a high Bray P-1 soil test (62 lb/A). The grain sorghum hybrids Pioneer 8699 (medium-early maturity), Pioneer 8505 (medium maturity), Pioneer 8310 (late maturity), Dekalb 40Y (medium-early maturity), and Dekalb 48 (medium maturity) were grown in a no-tillage system with and without starter fertilizer. Starter fertilizer (30 lb N and 30 lb P_2O_5/A) was

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Table 2. Hybrid and starter fertilizer effects on dryland, no-till grain sorghum, North-Central Experiment Field, Republic County, KS.

Hybrid	Starter	Yield, bu/A	Days to Mid-Bloom	6-Leaf Dry matter	6-Leaf P_2O_5 Uptake	Total P_2O_5 Uptake
				lb/A		
Pioneer 8699	With	136	61	662	2.3	35
	Without	120	67	517	1.7	26
Pioneer 8505	With	152	63	655	2.5	38
	Without	142	68	513	1.9	31
Pioneer 8310	With	151	68	644	2.6	37
	Without	151	74	529	2.1	37
Dekalb 40Y	With	151	63	575	2.5	37
	Without	131	72	492	2	30
Dekalb 48	With	147	64	648	2.6	36
	Without	147	69	520	2.1	36

Total includes uptake in grain and stover at maturity.

WHEAT GROWTH RESPONSE to P fertilization is demonstrated here. Plot at right received 40 lb/A P_2O_5, while plot at left received none (gray wooded soil near Grand Prairie, AB).

Summary

Alberta soils are deficient in available P and will respond to P fertilization. From 1991 to 1993, P fertilization of spring wheat, barley and canola was evaluated in 427 field trials scattered across six different soil zones in the province. Yield responses of at least 2 bu/A occurred in about 75 percent of the trials.

The crop response data generated in this study are currently being correlated with various P soil test methods in use in the prairies. This extensive data base will improve soil testing laboratory recommendations for prairie farmers and should increase farmer confidence in profitability of P fertilization. ■

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applied 2 inches to the side and 2 inches below the seed at planting. Liquid ammonium polyphosphate (10-34-0) and UAN were used as the starter fertilizer sources. Nitrogen was knife applied as UAN immediately after planting in order to supply a total of 160 lb N/A to all plots. Grain sorghum was planted no-till on May 18 at the rate of 50,000 seed/A into residue from a previous corn crop.

Results of this 1994 study are summarized in **Table 2**. Starter fertilizer improved dry matter production and P uptake at the 6-leaf stage in all hybrids. When averaged over hybrids, 6-leaf dry matter production was 20 percent greater with starter than without. Hybrids differed in the amounts of dry matter and P uptake at the 6-leaf stage. When averaged over all hybrids, starter fertilizer decreased the time from emergence to mid-bloom by 6 days. Starter fertilizer hastened maturity in Dekalb 40Y by 9 days and in Dekalb 48 and Pioneer 8505 by 5 days. Starter fertilizer improved total P uptake (grain plus stover) in three of the five hybrids. Grain yields also were improved by starter fertilizer in three of the five hybrids, one response being 20 bu/A. Yields of Dekalb 40Y were 20 bu/A greater with starter than without. However, yields of Pioneer 8310 and Dekalb 48 were not improved with starter fertilizer.

Summary

Results show that some corn and grain sorghum hybrids respond dramatically to N-P starter fertilizer while others do not. This work suggests that responses to starter fertilizer can be very economical even on high P soils—at least with some hybrids, particularly when corn or grain sorghum is planted early in high residue production system. Other aspects of this work emphasize the importance of high $N:P_2O_5$ ratios (1:1) in the starter fertilizer. The impact of starter fertilizer in conservation tillage systems for corn and grain sorghum suggests that starter use should be considered regardless of the soil test value for P. ■