Drs. W. B. Gordon, D. L. Fjell, and D. A. Whitney

Corn Hybrids Vary In Response To Starter Fertilizers

Possibility of different rooting characteristics in hybrids prompts this two-year study of selected corn varieties grown under no-till, dryland conditions.

Summary: *The objective of this study was to evaluate the response to starter fertilizers of corn hybrids grown in a dryland, no-till production system on a soil high in available phosphorus. Five corn hybrids were treated with or without starters in 1993. The experiment was repeated in 1994, adding a sixth hybrid this time. Starter improved the growth of all hybrids at both the V6 and V1O stages of growth. Both V6 stage whole plant N uptake and P uptake were also improved by the use of starter. Leaf N and P concentrations at silking were higher in all hybrids with starter Starter improved grain yield, improved total P uptake (grain plus stover), and reduced the number of days from emergence to mid-silk in some hybrids but not others. Starter increased the two-year average grain yield of Pioneer 3346 and Dekalb 636 by 15 bu/A. In 1994, starter increased the grain yield of Pioneer 3394 by! 15 bit/A. The yields of ICI 8599 and Pioneer 3563 were not significantly affected by the application of starter.*

Dryland corn in central Kansas is normally planted as early in the spring as possible. This enables pollination in June when temperatures are more moderate and moisture conditions arc more favorable than in July when conditions are normally hot and dry. Such early-planted corn often shows poorer growth in conservation tillage systems than in conventionally tilled systems. This can be a serious problem with dryland corn planted in early April when soil temperature is less than optimum for plant growth.

Cool soil temperatures at planting time can reduce N and P uptake of corn. Slow plant growth at low soil temperature may be due to limited root growth and reduced nutrient availability. Placing fertilizer in proximity to the seed at planting time has been shown to alleviate the detrimental effects of cool soil temperature on corn growth and development. Though response to such placement has been shown to be positive, studies also show responses to starters can vary among corn varieties. One postulation for such variance is corn hybrids may differ in rooting characteristics and ability to extract and use nutrients.

To further explore the behavior of different varieties under the conditions described, we set up experiments in 1993 and 1994 to evaluate the effects of starter fertilizer on corn hybrids with maturities ranging from 2530 to 2850 growing degree units (GDU) grown under no-till. dryland conditions.

Interaction

Yields up. Starter fertilizer x hybrid interactions for yield, days to mid-silk, and total P uptake were significant for both 1993 and l 994. Starter fertilizers improved yields of some corn hybrids but not others, as shown in Figure 1. Pioneer Brand 3346 yielded 12 bu/A higher with starter than without in 1993 and 19 bu/A higher in 1994. Dekalb Brand 636 yielded 13 bu/A higher with starter than without in 1993 and 18 bu/A higher in 1994. Pioneer 3394 yielded 15 bu/A higher with starter than without in 1994. Starter had no significant effect on yields of ICI 8599 and Pioneer 3563 both years.

Screening. Patterns of corn hybrid response to starters suggest that hybrids can be screened for responsiveness, perhaps using company descriptions of hybrid early-season vigor. Thus, Pioneer 3394 was added to the experiment in 1994 because of the

Table 1. Effect of hybrid and starter fertilizer on total P uptake (grain plus stover) of corn, Gordon, et al., Belleville, KS 1993-94.

Hybrid	Starter	Total P Uptake(lbs/A)	
		1993	1994
ICI 8599	with	35	40
	w/o	35	41
Pioneer 3563	with	39	42
	w/o	38	41
Pioneer 3346	with	51	44
	w/o	41	40
Dekalb 636	with	44	43
	w/o	38	37
Dekalb	with	42	45
	w/o	37	39
Pioneer 3394	with		48
	w/o		43

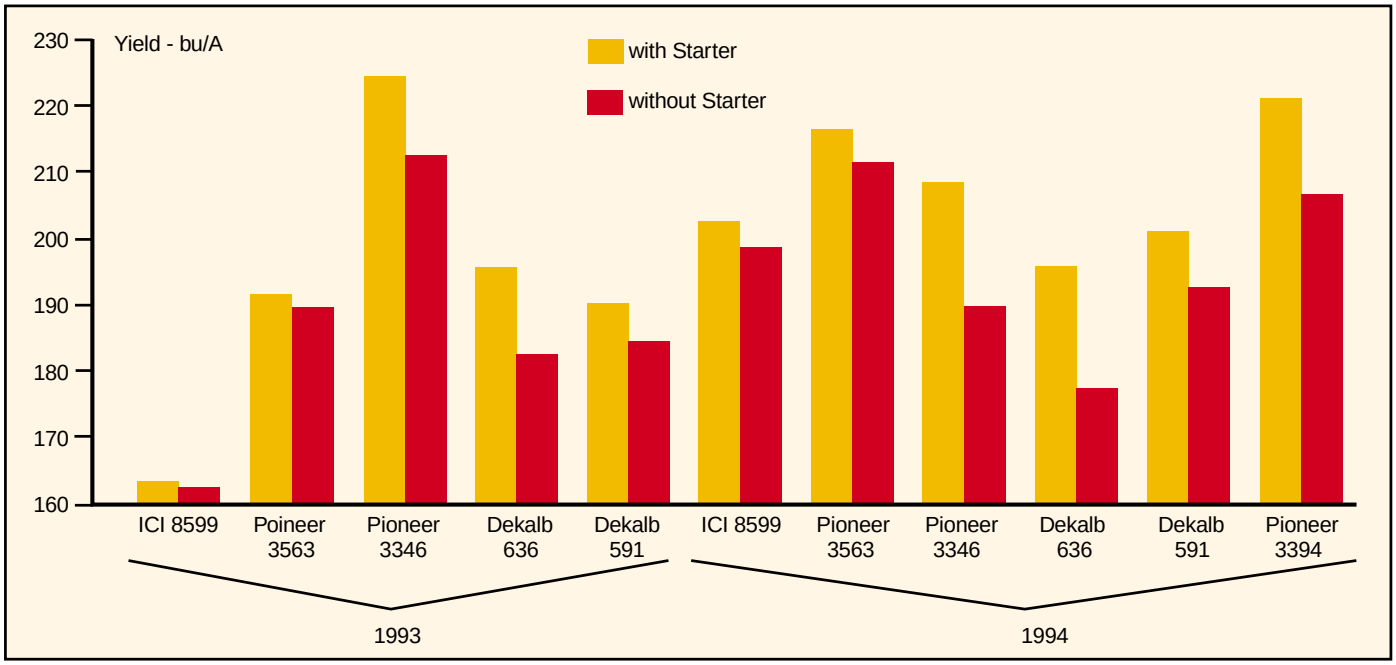

Figure 1. Effect of hybrid and starter fertilizerrrrr on grain yield of corn, Gordon, et al., Belleville, KS 1993-94.

company's description of outstanding early-season growth characteristics under cool soil temperature conditions. The yield of Pioneer 3394 in 1994 was 15 bu/A higher with starter than without.

Early-season vigor. When averaged over starter treatments, early-season dry matter production was greater for Pioneer 3394 (rated good early-season vigor) than for ICI 8599 (rated poor early-season vigor), yet starter fertilizer consistently improved grain yield of Pioneer 3394 but not of ICI 8599. Early-season vigor rating does not appear to be a good indication of grain yield response to starter fertilizer.

Mid-silk. For dryland corn production, it is important to have the crop pollinate before the hot, dry period that usually occurs in early July. Number of days from emergence to mid-silk was reduced in all hybrids except IC! 8599. When averaged over all hybrids, the number of days from emergence to mid-silk was reduced by five days.

P uptake. Starter improved total P uptake (grain plus stover) in some hybrids but not in others as shown in Table 1.

Dry matter. Starter fertilizer improved dry matter production at the V6 growth stage in all hybrids. When averaged over all hybrids and years. starter fertilizer increased dry matter production by 358 lbs/A. Growth differences to starter fertilizer were still evident at the V10 growth stage.

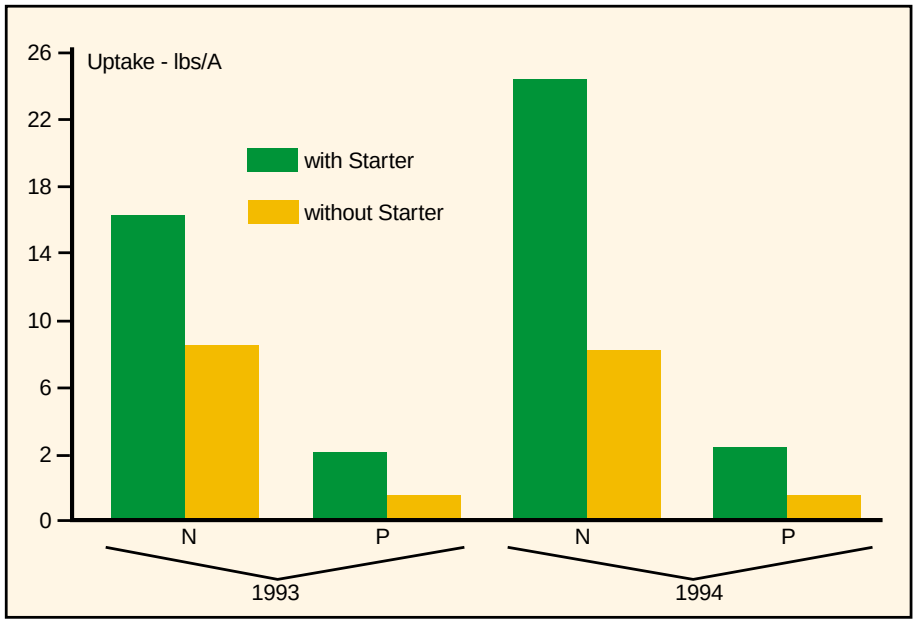

Figure 2. Effect of starter fertilizer on V6 stage whole plant P and N uptake of corn, averaged over all hybrids, Gordon, et al., Belleville, KS 1993-94.

NP uptake. Starter increased N and P uptake at the V6 growth stage in all hybrids. When averaged over all hybrids, starter nearly doubled N and P uptake in 1993 and almost tripled N and P uptake in 1994 (Figure 2).

Earleaf concentrations. In both 1993 and 1994, earleaf N and P concentrations at silking were improved by the use of starters.

Methodology

Site. Field experiment was conducted at the North Central Kansas Experiment Field near Belleville, Kansas, starting in the spring of 1993. The no-till site had been in sorghum for two years prior to the establishment of this study.

Soil at the site was Crete silt loam. Analysis by the KSU Soil Test Lab showed that initial soil pH (April 1993) was 6.1. Organic matter was 2.4 percent, Bray-1 phosphate 43 ppm, and exchangeable potassium 380 ppm in the surface 6 inches.

Plot design was split with hybrids as the main plots.

Hybrids were ICI 8599 (2530 GDU), Pioneer 3563 (2600 GDU), Pioneer 3346 (2850 GDU), Dekalb 636 (2830 GDU), Dekalb 591 (2590 GDU), and Pioneer 3394 (2690 GDU).

Fertilizer. Starter was applied two inches to the side and two inches below the seed at planting at the rate of 30 lbs/A of nitrogen and 30 lbs/A of P_20_5. Starter sources were 10-34-0 and 28-0-0 UAN.

Planting. Corn was planted on April 26, 1993 and April 19, 1994. Seed rate per acre was 24,000 into crop residue without tillage.

Variance confirmed

On cool no-till soils testing high in P, starter fertilizer improved early season growth and nutrient uptake in all hybrids tested. Only for some hybrids did this response translate into an increased grain yield. Thus, these tests confirm that hybrids do respond to starter fertilizer differently.

Dr. Gordon is associate professor Dr. Fjell is professor, and Dr. Whitney is professor, Department of Agronomy, Kansas State University, Manhattan, KS.