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No-Till Corn Grain Yield Responses to Band Applications of Potassium

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> Recent Iowa studies indicate corn yield benefits with deep banding of potassium (K) in no-till corn-soybean rotation systems. The advantage, related to increased K availability, was detected even on soils testing optimum to very high in K.

Managing nutrients in no-till systems can be a challenging task. No-till usually creates higher levels of K at the surface of the soil and lower levels of K just a few inches below the surface. This stratification can result from minimal mixing of broadcast and shallow band applications, as well as from cycling of nutrients from deep to shallow soil layers.

Under normal conditions, corn grown under no-till generally draws a higher percentage of its nutrients from the soil nearer the surface, because of the higher nutrient and moisture levels present. However, this uptake can be affected by weather conditions. When surface soil layers become drier, root development in deeper portions of the soil profile increases. When this happens, the portion of the root system actively taking up nutrients can be below the zone of highest nutrient concentration. Conversely, under more moist conditions, the surface residue cover will keep the soil surface wetter and cooler. These conditions can inhibit root growth and nutrient uptake early in the season. In no-till systems, proper placement of fertilizer K may be critical for optimizing yields.

To investigate the effects of K placement in no-till corn-soybean rotation systems, long-term trials were established at Iowa research centers. The two crops were grown each year, and treatments were applied every year for both crops. Only results for corn and for the first 3 years of the study (1994 to 1996) are presented in this article. Each trial included two K fertilizer application rates (35 and 70 lb K_2O/A), three fertilizer application methods...planter banding (S), deep banding (D), and broadcast (B)...and two control treatments...no fertilizer (BO) and one

TABLE 1. Long-term research sites showing positive corn grain yield responses to banded applications of K.

Soil test K category	Soil test K range, ppm	Number of site-years in category	Number of site-years showing corn grain yield increases in the following comparison: Deep banding compared to broadcast	Planter banding compared to broadcast	Deep banding compared to planter banding
Optimum	91-130	4	4	2	3
High	131-170	5	5	3	5
Very High	171+	6	4	2	4

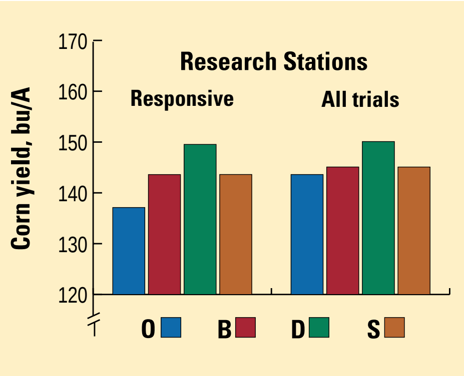

Figure 1. The effects of K placement on corn grain yields at research stations when combined over responsive sites only as well as over all sites. O = combination of both control treatments, B = broadcast, D = deep band, and S = planter band.

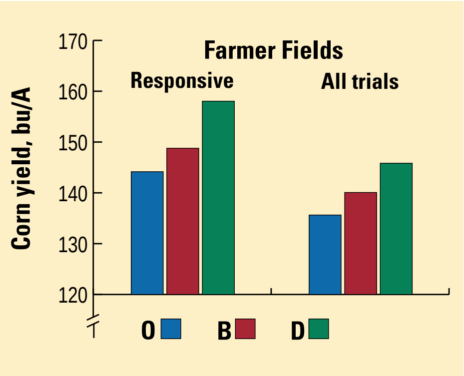

Figure 2. The effects of K placement on corn grain yields in farmer fields when combined over responsive sites only as well as over all sites. O = combination of both control treatments, B = broadcast, and D = deep band.

pass with a deep band applicator without fertilizer (DO). The planter bands were placed 2 inches to the side and 2 inches below the seed. Deep bands, 30 inches apart, were placed 6 to 8 inches below the soil surface. Corn was planted directly above the deep band. In the first two years, broadcast and deep band treatments were applied in the spring, 3 to 5 weeks before planting. In the last year, both treatments were applied in the fall.

In addition to the research centers, 11 short-term (1-year) trials were conducted on farmer fields. Treatments were similar to those at the research centers, except that the planter band treatment was excluded. In addition, the two K rates were 35 and 140 lb K_2O/A. Two trials received fertilizer applications in the spring, prior to planting. Potash was applied to the remaining trials in the fall.

All research center sites were first analyzed separately and then combined in an overall analysis. Separate analyses for each site showed that K fertilization increased grain yields significantly at 4 of the 5 research sites. Yield response to fertilizer **placement** was statistically significant at only one site, where deep banding produced higher yields than other placement methods. However, when the data from all sites were analyzed together, K fertilization was found to produce significantly higher yields than where no K fertilizer was applied. The reason that only the combined analysis detected these significant increases may be that yield increases to K fertilization and deep band placement were small, but fairly consistent.

Table 1 shows that deep band applications increased yields above those where K was broadcast at 13 of the 15 site-years. In addition, deep banding outperformed planter banding at 12 of the 15 site-years. Planter band applications increased yields above broadcast applications at seven sites.

The data in **Figure 1** show that when only the responsive sites were considered, broadcast and planter band K applications both increased yields by about 6 bu/A. However, deep banding increased yields by approximately 11 bu/A. When responsive and non-responsive sites were considered, broadcast and planter band applications increased yields by about 2 bu/A, while deep banding increased yields by approximately 6 bu/A. Yield increases were observed on soils testing in the optimum and high categories.

Results from the studies conducted on farmer fields were similar to those from the research sites. As before, significant yield increases from K fertilization and deep banding were detected only when a combined analysis was performed. **Table 2** shows that deep banding was fairly consistent in increasing yields above those from broadcast applications. When only the responsive sites were considered, broadcast applications increased yields by about 5 bu/A, whereas deep banding increased yields by approximately 13 bu/A (**Figure 2**). Across all sites, broadcast applications and deep banding increased yields by 4 and 9 bu/A, respectively.

TABLE 2. Short-term research sites showing positive corn grain yield responses to banded applications of K.

Soil test K category	Soil test K range, ppm	Number of short-term sites in category	Number of sites with an average corn grain yield increase from deep banding compared to broadcast
Optimum	91-130	4	3
High	131-170	3	3
Very High	171+	4	3

It is likely that the responses to deep banding were related to weather conditions, particularly soil moisture. The increase in yield observed for deep banding above that of broadcast applications increased with higher May rainfall, but decreased with higher June rainfall.

Other correlation analyses suggest that May rainfall may have sometimes been excessive, while June rainfall may have sometimes been deficient for optimum corn growth. It is likely that plant uptake from shallow soil layers was reduced during the drier conditions in June. Deep banding provided K at lower levels, and could have alleviated the uptake deficiency. The results from these studies show that deep banding may provide distinct yield advantages by making K more available, even on soils that test optimum to very high in K. BC

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A new signpost marking system uses identification decals applied to a plastic sheath that fits over a steel post. The user can mark individualized stickers or obtain custom pre-printed stickers for identification of crops and fields. This deters application mistakes and aids in tracking crops. The system is also compatible with bar coding and electronic identification systems which can retain and transfer information. The product is called POSTMARK™ Field Identification Systems. BC

Source: Agricultural Information Technologies, Inc., Iroquois, South Dakota.