ONTARIO

Banded Potash Boosts No-Till Corn Yield

By Tony Vyn, Ken Janovicek, and Tom Bruulsema

Ontario corn producers are increasingly interested in using less tillage, both to conserve soil and to reduce costs. Their main rotation crops, soybeans and winter wheat, grow well without tillage. They find no-till corn more difficult to manage, but are adopting a variety of minimum tillage systems involving less disturbance and mixing of soil.

In no-till soils, immobile nutrients such as potassium (K) may accumulate at the surface and be less available to corn plants. Three years of field research on predominantly medium testing soils confirm that K needs are indeed higher with less tillage and that K placement can be critical.

With less tillage, immobile nutrients such as K become stratified. In 1996 we conducted a survey of 54 Ontario fields in continuous no-till for at least 5 years (and an average of 9 years). Exchangeable K levels in the top 2 inches were generally at least double those in the 4- to 8-inch layer. No-till soils warm more slowly in the spring, and the root system may expand more slowly in no-till soils because of higher bulk density.

The purpose of this research was to determine whether corn grown in these long-term no-till situations would have different requirements for K rate and placement. We chose three sites where corn was being planted into a soybean-wheat-corn rotation under no-till for at least 7 years.

At the Kirkton and Belmont sites, where fall tillage was appropriate, we applied both fall and spring K treatments. The fall application was broadcast. The spring-applied starter, placed in a band 2 inches beside and 2 inches below the seed (2x2), contained 45 lb K_2O/A for the high rate (54 lb/A in 1996), and none for the low rate (9 lb/A in 1996). The corn hybrid was Pioneer 3752.

At the Kirkton site, on a silt loam soil, corn responded to both fall and spring applied K. This was expected, as soil test K levels in the top 6 inches ranged from 65 to 90 parts per million (ppm), which fall into the responsive range. However, responses to starter K were twice as large for no-till corn than for corn grown after fall moldboard plowing (**Figure 1**). The extra response suggests that no-till corn had a greater need for added K.

At the Belmont site, on a silty clay loam

For no-till corn, K makes a difference. Dr. Tony Vyn inspects the plots in Paris, Ontario, during June of 1998.

TABLE 1. Annual differences in corn yield response to applied K at the Paris site.

Corn hybrid	Response, bu/A 1997	1998
DeKalb 385B	19	21
NK 3030	20	14
NK Max 357	22	1
Pioneer 3820	23	16
Pioneer 3893	5	11

soil with higher soil test K, responses were generally small and insignificant in 1997 and 1998. However, starter K increased no-till corn yields from 208 to 216 bu/A in 1998.

At the Paris site, one trial addressed differences among hybrids in responsiveness. Five additional hybrids were compared on a lighter-textured loamy soil that ranged from 50 to 60 ppm in exchangeable K. We applied K in the spring at 110 lb/A of K_2O by three different methods: broadcast, combination broadcast/band, and deep band (6 inches).

Application methods made no difference. In both 1997 and 1998, hybrids varied in their response to applied K, but not consistently (**Table 1**). Hybrid-specific K requirements are difficult to predict.

In a second trial at the Paris site, we compared K application methods in three tillage systems. In the first, corn was no-till planted. In the second, corn was planted into spring-tilled zones 10 inches wide by 6 inches deep. In the third, soil was mulch-tilled with two to three passes of a cultivator just prior to planting. For each, we applied K by the same three methods as for the hybrid trial.

In no-till, corn yields increased with both broadcast or combination broadcast/band K (**Figure 2**). It appears that no-till corn made good use of K applied on the surface, perhaps because the wheat stubble helped maintain soil moisture near the surface. In zone-till, the deep placed K was most effective. Perhaps zone tillage encouraged the roots to go downward, resulting in greater use of deep-placed K. Corn planted after mulch-tillage did not respond to K application by any method.

In both the Kirkton and Paris trials, overall response to K was stronger with no-till than with tillage. No-till corn producers should pay close attention to K in their starter fertilizer, particularly when their overall soil test levels are in the medium range or less.

This research was not designed to identify an optimum rate. Nevertheless it is clear that effective no-till corn starters should contain some K, and likely more than 9 lb K_2O/A.

The effective rates in this work approach the maximum safe rates for a 2x2 band, when K is accompanied by a reasonable rate of N. Some no-till producers are exploring placement in more than one band, placing small amounts close to the seed and banding the remainder at a greater distance. The foregoing considerations support that approach, particularly when higher K rates are required. BC

Dr. Vyn is Cropping Systems Agronomist, Agronomy Department, Purdue University, West Lafayette, IN (formerly at Guelph). Mr. Janovicek is a research assistant at the University of Guelph, Ontario. Dr. Bruulsema is Eastern Canada and Northeast U.S. Director, PPI, Guelph, Ontario, Canada.

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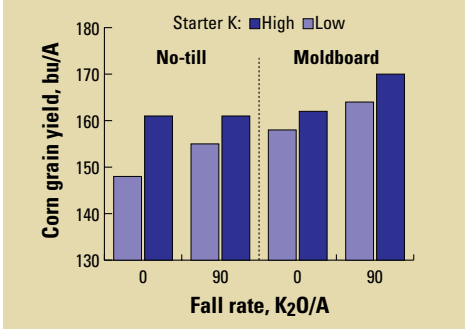

Figure 1. Corn grain yield response to K applied in the fall or as a spring starter at the Kirkton site. Average of 3 years, 1996-1998.

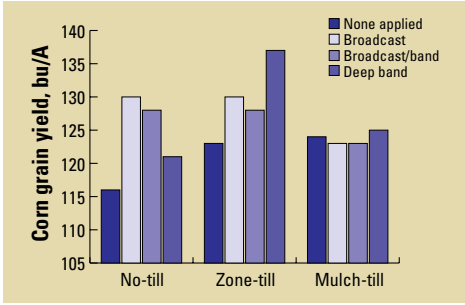

Figure 2. Corn yield response to K application method in three spring tillage systems at the Paris site. Average of 2 years, 1997-1998.