Fertilizer Options for Corn Grown with Fall Zone Tillage

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CORN PRODUCERS can often make more profit by minimizing tillage. However, in many situations no-till reduces corn yield. When corn follows wheat or on heavy-textured or poorly-drained soils, the soil stays cool too long in the spring. Fall zone tillage is one way to overcome some of the problems with no-till. It also opens up new fertilizer placement options.

The concept of tilling narrow strips in the fall is attractive because:

- ✔ It requires only one-third to one-half the time and fuel of a fall moldboard plow/spring secondary tillage system
- ✔ It provides a zone of bare soil that warms more quickly in the spring
- ✔ It retains residue cover on the untilled land, protecting against erosion and maintaining infiltration

Equipment is available that uses air delivery to combine fall application of fertilizer with fall zone tillage. This could be an economical way to supply some of the crop's nutrient requirements, particularly for nutrients like phosphorus (P) and potassium (K) that are not easily lost from the soil. Getting some of the nutrient application job done in the fall helps streamline spring field operations, resulting in better chances of timely planting.

In Ontario, Dr. Tony Vyn carried out research comparing K placement in fall zone-tilled systems from 1996 to 1998. Of three tillage systems shown in **Table 1**, fall zone tillage yields were comparable to those with no-till and less than 4 percent lower than those with moldboard plowing. Two of the three years had warm and dry weather in the spring. Advantages of fall zone tillage might be expected in years with cooler and wetter conditions.

In the fall, zone tillage to a depth of about 6 inches creates a strip of bare soil with good tilth.

Table 1. Corn yield in three tillage systems, averaged across five site-years from 1996-1998.

Tillage	Corn yield, bu/A
No-till	165
Fall zone-till	164
Moldboard plow	170

The performance of fall zone tillage in **Table 1** could have been better had it been done with more ridging. Farmers and experimenters have since found it important to build at least a small ridge. If planting into the soft zone in the spring creates a depression, it can delay emergence, especially if water accumulates. Newer equipment is designed to ridge during the tillage operation. Some growers have found it useful to pack the tilled zone as well.

One drawback of zone tillage is that it disturbs the network of fungal hyphae that can help the corn seedling take up nutrients. These fungi are called mycorrhizae. Pure no-till may take better advantage of these biological partners of the corn plant, but the drawbacks of colder soils and later planting might outweigh the benefits.

In these same trials, corn responded better to K applied in the spring with the starter than to K applied in the fall, banded into the tilled zones (see **Table 2**). It is possible that utilization of the fall-applied banded K could have been greater if it had been applied with P and a little nitrogen (N) to enhance root growth.

Table 2. Corn yield in response to applied potash in fall zone tillage.

Applied potash, lb K_2O/A		Corn yield[1],
fall	spring	bu/A
0	0	160
0	45	167
90	0	164
90	45	167

[1] Average of five site-years in Ontario; soil test K ranged from medium to high.

The Ontario research confirms that fall-banded K is available, but it also suggests that it may not be quite as available as spring band-applied K. Extensive research in Iowa involving no-till and ridge-tillage has indicated a slightly greater yield response to fall banded K than to spring-banded K. For P banded in the same way, there was no yield advantage.

Especially in shorter season growing environments, it appears important to place P as close to the developing seedling as possible to ensure its early nutrition. Seed-placed P will often give yield responses of 2 to 6 percent in soils where other application methods give no response.

Fall zone tillage equipment should ridge the soil to create an optimum seedling environment for the following spring.

Fertilizer with the seed, even though it's often called "pop-up", delays emergence. Despite that delay, Ontario corn yields have often responded. Don't apply more than necessary to get the response. Most studies indicate no benefit to exceeding 5 to 10 lb P_2O_5/A with the seed. Since a good crop typically removes 60 lb P_2O_5/A or more, one strategy for maintaining soil fertility would be to apply the remainder in the fall band. Below-surface fall application of P helps avoid the risk of contaminating watercourses with P runoff.

In recent research in Wisconsin, row-applied starter boosted corn yields an average of 8 bu/A, even in soils testing excessively high in P and K. It was most effective applied in the spring, in a band 2 inches beside and below the seed, but it was also effective applied in the fall, whether dribbled as a surface band or injected 2 inches deep. The starter fertilizer supplied 8-23-8 lb N-P_2O_5-K_2O/A. Response occurred in no-till, but not in fall chisel plowed soils.

In addition, in the spring of 2000, enhanced seedling growth in corn was observed with NPK starter compared to N starter alone, even following fall-banded P and K in fall zone-tilled soils. The complex systems that many producers are adopting to place fertilizers at various distances from the seedling appear to be justified.

We need to learn more about optimum placement and timing for each nutrient in modified tillage systems. So far we can conclude that band placement of P and K in fall zone tillage systems is a viable option, but it may not fully remove the need for some spring starter. ■

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