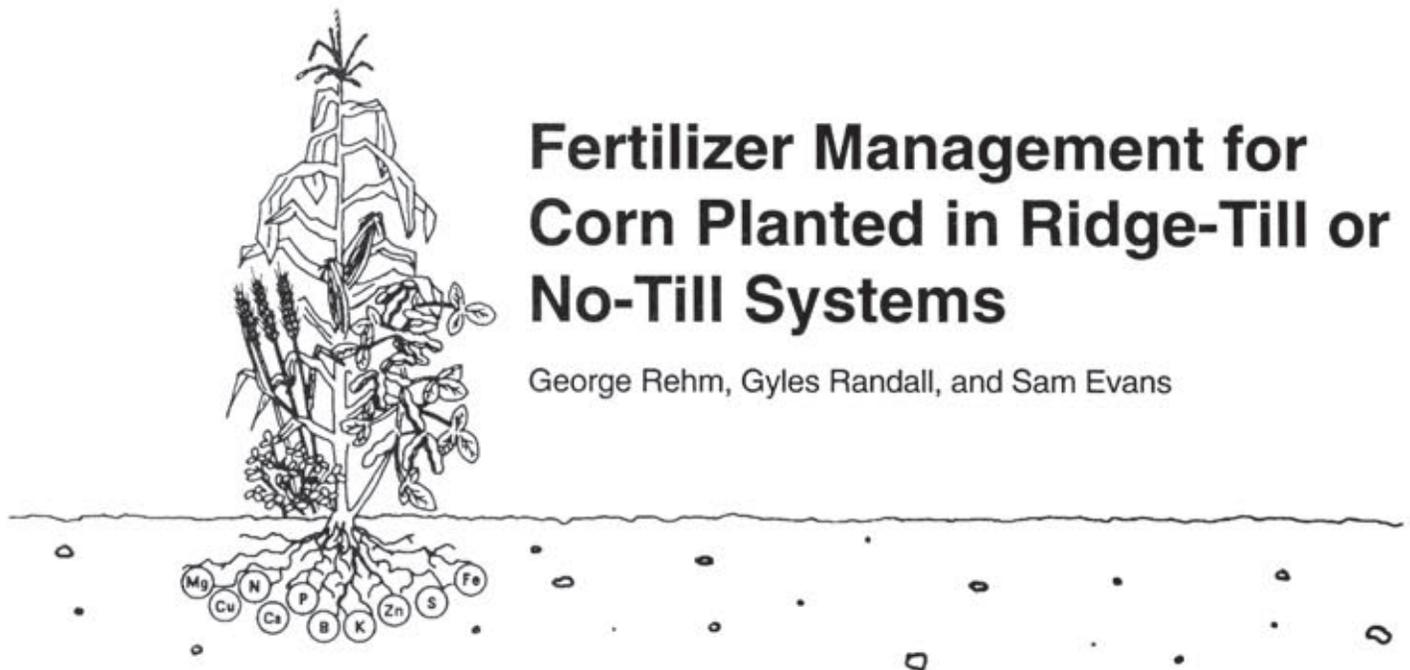


Fertilizer Management for Corn Planted in Ridge-Till or No-Till Systems

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The use of ridge-till and no-till planting systems for corn production is increasing in Minnesota. There are many questions to be answered and problems to be solved as growers switch to these conservation tillage production systems. There is no doubt that the switch will dictate some changes in fertilizer use and management practices. Current suggestions for fertilizer use in ridge-till and no-till planting systems will be discussed in the following sections.

Starting With A Soil Test

Regardless of the planting system used, there is no substitute for routine soil sampling and analysis as a firm basis for making decisions about fertilizer use. With conventional tillage systems, samples can be collected from the surface soil (0-6 inches) at random throughout the field. If the grower chooses, a grid sampling approach or sample by soil type system can be used. On the other hand, the location of the row is known in ridge-till and no-till planting systems. Therefore, each soil core can be taken from a known position with respect to the row and this should lead to more precise soil sampling procedures if phosphate and potash fertilizer has been applied in a band.

The most precise sampling scheme for these conservation tillage production systems has not been determined yet. Most of those who advise farmers planting in ridge-till and no-till systems suggest that the core be taken at a distance of about 6 inches from the row to a depth of 6 inches. With this sampling scheme, the soil sample is not collected from an area

where high soil test values might exist because of the previous use of banded fertilizer. The suggested location of the soil probe when sampling the ridge-till planting system is illustrated in **Figure 1**.

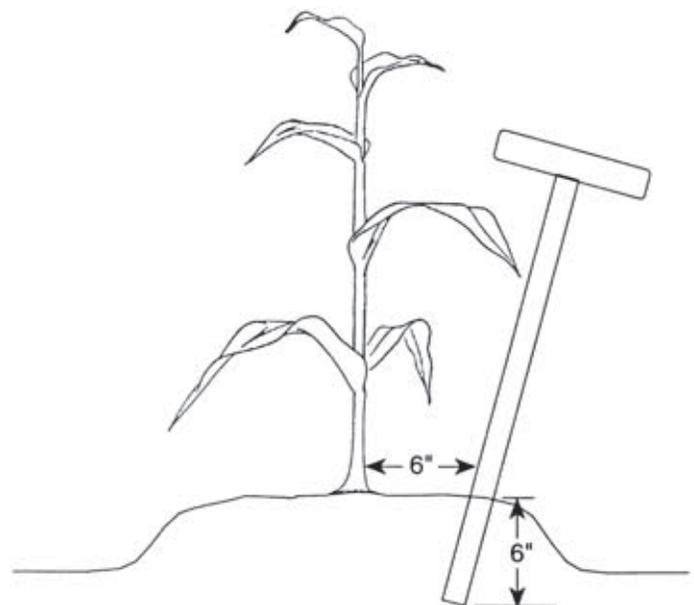


Figure 1. Suggested location of soil probe for collecting soil samples in ridge-till and no-till planting systems.

A minimum of 10-15 cores per field is thought to be an appropriate sample size unless the grid system or sample-by-soil-type system is used. For the routinely used field sampling scheme, the samples should be collected at random avoiding old fence rows, roads, feedlots, etc.

Special Attention to Nitrogen

As in the case with conventional tillage systems, effective and efficient use of nitrogen fertilizers has a major impact on potential profit from these conservation tillage systems. Consequently, a substantial amount of research has focused on nitrogen use in these systems and the results can be used as a basis for nitrogen fertilizer recommendations.

There is not a large amount of strong evidence to suggest that the amount of fertilizer nitrogen required for optimum yields changes with the switch in tillage systems. In western Minnesota, fertilizer nitrogen should be based on the results of the soil nitrate test (**Figure 1**). For this test, soil is needed from depths of 0-6 and 6-24 inches. A 0-24 inch sample can also be collected if the grower does not need or is not interested in recommendations for phosphate and potash use. This sample will be analyzed for nitrate-nitrogen and fertilizer nitrogen recommendations will be adjusted accordingly. At the present time, the best advice available suggests that these samples should be collected from the shoulder of the ridge in the ridge-till planting system or 6 inches from the row in the no-till planting system.



Figure 2. The soil nitrate test should be used for nitrogen recommendations in the counties that are shaded.

At this time, nitrogen rate suggestions for the remainder of Minnesota are based on yield goal, soil organic matter content, and previous crop. Some attention is also given to the amount of nitrogen supplied by the manure if there is a history of manure use.

Compared to chisel plow and fall plow tillage systems, there is no need to change the timing of the nitrogen application. Split applications are strongly suggested if ridge-till or no-till planting systems are to be used on irrigated sandy soils. If sandy soils are not irrigated, the needed nitrogen should be applied as a sidedress treatment. Nitrogen can be applied in the fall, before planting, or as a sidedress treatment for southern, southwestern, and western Minnesota. Anhydrous ammonia is the preferred source for southern Minnesota. Both anhydrous ammonia and urea can be applied in the fall for the western and southwestern part of the state. Spring preplant applications of nitrogen are suggested for the well drained soils of southeastern Minnesota.

Placement of the nitrogen fertilizer is a major concern when ridge-till and no-till planting systems are used. Research trials from several universities show that yields are reduced if nitrogen fertilizers remain in contact with crop residues for an extended period of time. This is a primary concern if liquid N (28-0-0) is chosen as the nitrogen source.

When in contact with the crop residue, nitrogen is either lost by volatilization or immobilized (tied up) either by soil microorganisms or by the residue itself. Therefore, nitrogen fertilizer used in ridge-till and no-till planting systems should be applied below the soil surface. It's easy to knife in anhydrous ammonia (82-0-0) or 28-0-0 before planting if soil conditions permit and equipment is available. Preplant broadcast applications of 28-0-0 and 46-0-0 are discouraged because of the potential for losses due to volatilization and/or immobilization.

Many who use the ridge-till planting system prefer the application of nitrogen with a cultivator. This is an acceptable practice because the nitrogen applied is incorporated with the cultivator or knifed in between existing rows as 82-0-0. It is possible to apply anhydrous ammonia as well as liquid and dry forms of nitrogen with the cultivator. If June weather is dry, the nitrogen applied with the cultivator may not be used most efficiently and subsequent yields may be reduced. If nitrogen is to be applied with a cultivator, some nitrogen (about 20 lb./acre) should be applied in a band in the fall, in a starter fertilizer, or as part of a weed and feed program.

Emphasis on Banding

In contrast to nitrogen, phosphorus and potassium do not move over large distances in the root zone. They are essentially immobile. Therefore, with no opportunity for incorporation in ridge-till and no-till planting systems, these two nutrients will remain at or near the soil surface if broadcast applications are used. If broadcast, these nutrients would be moved into the ridge with cultivation. This system of fertilizer application would, however, reduce the efficiency of use of both and return on fertilizer investment would be reduced.

The subsurface banded application can be easily substituted for broadcasting. This method of application places the fertilizer below seed level. The applied phosphate and potash are placed in a concentrated zone. This reduces soil to fertilizer contact, reduces fixation (tie up), and improves the efficiency of use.

There are several methods that can be used for banded fertilizer in the ridge-till and no-till planting systems. The use of a starter fertilizer at planting is certainly one option. For this option, the band can be placed either directly below the seed or to the side of and below the seed. The negative effect of fertilizer placed too close to the seed on germination is a concern. This problem can be avoided if placement is such that there is approximately 1 inch of soil between seed and fertilizer. There are some limitations to the use of starter fertilizers in ridge-till and no-till planting systems. Frequently, starter attachments bring moist soil to the surface which interferes with a uniform seeding depth. The uneven seeding depth produces uneven emergence.

The banding of the fertilizer in the fall after harvest is a management practice that has gained popularity in recent years. This option is well suited for the corn/soybean rotation. With this placement option, the fertilizer is placed in a band in the center of the ridge following corn or soybean harvest. For no-till systems, this band can be placed under existing rows. The corn or soybean crop is then planted over the band. This option has worked very well when the band is applied in the fall of the soybean year of the rotation. This option substitutes for the use of starter fertilizer and associated equipment needed to apply the starter.

Research has shown that there is no ideal placement for the banded phosphate and/or potash fertilizer. The band can be placed in the center of existing ridges in the fall, near the seed as a starter fertilizer, or midway between existing rows. It is important to place any banded fertilizer somewhere below the level of the seed.

Compared to broadcast applications, the rate of phosphate needed can be reduced by 1/3 or 1/2 if applied in a band. There is no need to change suggested rates when switching from a conventional to a ridge-till or no-till planting system. Specific suggestions for phosphate rates are listed in AG-FO-3790, *Fertilizing Corn in Minnesota*.

There are special concerns for the use of potash fertilizer in ridge-till and no-till planting systems. In Minnesota, potassium deficiency symptoms have been observed with some hybrids planted in these systems even though the soil test values for potassium are classified as being high. This situation occurs more frequently in ridge-till and no-till planting systems that have been in place for 3 or 4 years. Some hybrids do not show the K deficiency symptoms but respond positively to the banded application of potash fertilizer.

Results of current research projects show that an application of 40 to 50 lb. K_2O per acre in a band will correct the problem for corn production. The soybean crop has also

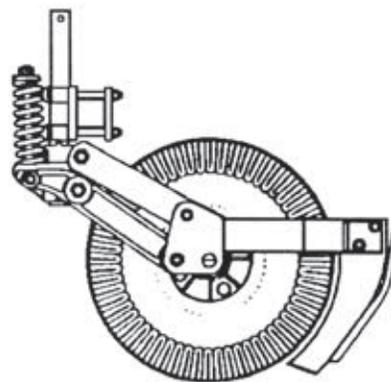


Figure 3. Coulter and knife assembly that can be used to band fertilizer in ridge-till or no-till planting systems.

responded positively, but less frequently, to the banded potash applied in the fall of the previous year. The equipment used for placement of the fertilizer in a banded application is illustrated in **Figure 3**.

To avoid annual banded applications, an application of 80 to 100 K_2O per acre should be satisfactory for 2 years of production in a corn-soybean rotation. These suggestions are appropriate for situations where soil test values for potassium are in the medium and high range. Additional potash may be needed when soils test low or very low in K. Additional research is needed before suggested rates of potash for all soil test levels can be finalized.

Special Placement Concerns

There are some special situations that should be considered when crops are planted in ridge-till or no-till systems. It is possible to place fertilizer in direct contact with the seed. However, there is a limit to the amount that can be applied in this way. For sandy soils, the amount of N plus K_2O applied with the seed should not exceed 5 lb. per acre. This limit increases to 10 lb. per acre for fine textured soils. **CAUTION! Do not** apply boron or ammonium thiosulfate (12-0-0-26) in direct contact with the seed. There can also be germination problems if urea is placed in contact with the seed.

Some growers would prefer to place all of the fertilizer needed for crop production in a band. This placement can be used to meet the requirements for phosphate and potash. There is a potential for problems if there is a plan to apply all of the nitrogen needed in a band either in the fall or at planting. The band application in the fall of some of the nitrogen needed for corn production is a recommended practice. The amount of nitrogen applied in this way, however, should not exceed 40 lb. per acre.

A Summary of Changes

Some changes are needed in fertilizer management practices when switching from the more conventional planting systems to ridge-till and no-till systems. A brief summary is provided below.

Nitrogen:

- no need to change rate of application for ridge-till systems; may need higher rates for continuous no-till corn.
- no change in selection of sources; all sources should be placed below the soil surface.

Phosphate:

- no need to change rate of application.
- banding will be more effective than broadcast applications.
- several possible locations for the band.

Potash:

- added K_2O may be needed even though soil test values are high.
- banding will be more effective than broadcast applications.

Soil Sampling:

- collect sample from in the ridge 6 inches to the side of the row.
- collect soil from 0-6 inches for analysis for pH, organic matter content, phosphorus, potassium, and zinc.
- in western Minnesota, use standard soil nitrate test (0-6, and 6-24 inches). Samples from 0-24 inches can also be analyzed for nitrate-nitrogen.

Related Publications

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