



## No-Till Series

# No-till Wheat Management



No-till has been used successfully for summer row crops in western Kansas. Many producers would like to convert all their acres to no-till, but they often encounter difficulties planting no-till wheat after wheat or row crops. Several management factors such as fertility, planting, variety selection, weather, pest management, and grazing concerns are important to the success of no-till wheat. This publication discusses some of these issues.

### Fertility

One of the most common problems in no-till wheat is poor fertility. In the spring, some no-till wheat fields have a pale green color, grow poorly, and yield less than conventional-till fields in the area because of nutrient deficiency. Because there is more residue on the surface, nitrogen can be immobilized by microbes as they decompose plant residue, making the nitrogen unavailable to wheat.

Also, less nitrogen is mineralized from organic matter in the soil with no-till since there is no tillage to aerate the soil. For this reason, nitrogen requirements are generally higher with no-till wheat. An immobile nutrient like phosphorus may not be available to the plant due to shallow placement in the soil from a broadcast application on the soil surface. To overcome these problems, take a soil test to provide guidance on fertilizer needs.

Fertilizer should be knifed into the soil below the residue if possible. To get wheat off to a good start, a fall

application of two-thirds of the total nitrogen required by the crop injected below the residue, followed by a band placement of phosphorus at planting close to the seed with the drill, will provide adequate fertility.

In the spring during green-up and at least four weeks before jointing, the additional one-third of nitrogen (typically 20 to 40 pounds nitrogen per acre) can be topdressed. Some farmers have injected nitrogen below the residue during green-up. This will ensure optimum nutrient uptake as long as the wheat stand does not incur substantial damage from the operation. Also, the injection points should be no wider than 15 inches to minimize the potential for uneven growth.

If injecting nitrogen is not an option, farmers should either broadcast urea or surface dribble urea ammonium nitrate (UAN). Both of these options can have similar results to injecting nitrogen, although these options will not be as consistent.

The final and least favorable option available to farmers is to broadcast apply UAN. This method is commonly used because few modifications need to be made to the sprayer, and it allows for a dual application of herbicide and fertilizer. However, nitrogen in this application method has the potential to become bound-up (immobilized) on surface residue, and a substantial portion of it may not reach the roots of wheat. For more information on soil fertility, read K-State Research and Extension publication

*Soil Test Interpretations and Fertilizer Recommendations*, MF-2586.

### Planting

In western Kansas, most conventional-till drills are hoe drills, which dig into the soil allowing deep seed placement. However, no-till drills are characterized by either a single- or double-disc opener.

Adequate down-pressure is crucial with disc openers. Most current no-till drill designs allow for at least 300 pounds of down-pressure to be applied per row unit. The more rows, the more weight is needed by the drill to ensure adequate down-pressure. For example, a 20-foot drill on 10-inch centers (24 rows) needs to weigh 7,200 pounds empty; whereas a 20-foot drill on 7.5-inch centers (32 rows) needs to weigh 9,600 pounds empty. Some "modified" no-till drills may have excellent seed placement in moist soil conditions, but do a poor job when soil conditions are dry due to inadequate down-pressure.

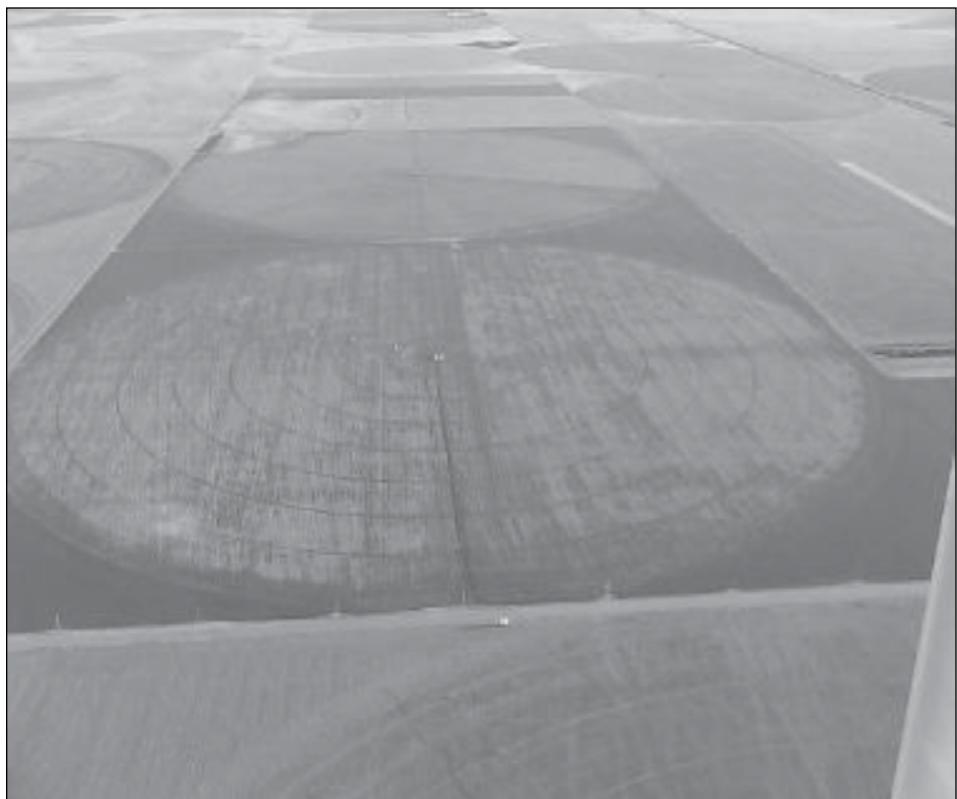
Planter speed is another critical factor when planting no-till wheat. Because the discs cut through residue, an increase in drill speed will actually decrease seeding depth. This change in depth may not be noticeable in moist soils. In dry soil conditions, however, the change in seeding depth may be quite noticeable and detrimental to the wheat plant. Seed placement within  $\frac{1}{2}$  inch of the surface will cause the wheat crown to develop either on the soil surface or near the surface. Wheat

crown development close to the soil surface may increase susceptibility to freeze damage or winterkill.

Excessive crop residue also may cause problems. When residue is abundant, it may interfere with proper soil coverage, even when seeding depth is adequate. In addition, excessive residue over the row may impede proper seedling development. The coleoptile stops elongation when it intercepts light at the soil surface and the crown will develop about one-half inch below the soil surface. However, when residue is excessive, the wheat coleoptile may not intercept light until it is above the soil surface. This can cause the crown of the wheat plant to develop in the residue, which increases the chance the plant will be injured by freezing temperatures (Figure 1).

Environmental conditions at planting also can affect seed placement in no-till. If the residue on the soil surface is moist, it is difficult for the disc openers to cut through the residue. Often the residue will become hair-pinned or pushed into the seed slot, instead of being cut (Figure 2). This results in the seed being placed among residue in the seed slot and does not allow for good seed-to-soil contact. This hair-pinning of residue also can prevent good closure of the seed slot. The results of these soil conditions are often seen later in the season with damage to the wheat crown from cold temperatures or poor stands.

Wheat seeding rate should be increased until the producer becomes familiar with the challenges of planting no-till wheat and is familiar with the equipment. Adding an additional 15 to 30 pounds of seed per acre to the typical seeding rate will help ensure an adequate stand. The increased seeding rate will not adversely affect yield.



**Figure 1.** A wheat field severely injured by cold weather because the wheat crown developed above the soil surface due to excessive residue over the row.



**Figure 2.** A wheat plant growing in an open seed slot closure with a corn leaf hair-pinned underneath it.

## Variety

No differences have been observed in the response of wheat varieties to conventional-till and no-till systems. Therefore, farmers should pick varieties best adapted to their farming situation. However, tan spot, a residue-borne disease, has the potential to be more of a problem in continuous no-till wheat. Thus, it is important to select varieties that have resistance to problems that are likely to occur in no-till situations.

## Environmental Concerns

Wheat planted no-till is slower to green-up in the spring than wheat planted conventional-till. Many farmers notice this difference, but this should not be of great concern. As the wheat approaches heading, there will be little difference in plant development.

Bitterly cold weather during the winter can be a problem when soil conditions are dry or seed placement is shallow. Both no-till and conventional till wheat is typically planted 1.5 to 2.0 inches deep. In conventional-till wheat, however, the seed is also placed at the bottom of a furrow made by the hoe drill. This slight difference in depth may not appear to be a big difference until soil conditions are dry. Once the soil is dry, cold temperatures can cause the soil temperature to change quickly, providing little protection from the cold for wheat planted on level ground in no-till conditions. However, in conventional-till, the seed is planted at the bottom of the furrow where there may be slightly more moisture captured by the furrow. More moisture and the furrow itself may buffer some of the temperature fluctuations of the soil.

Late spring freezes have been observed to affect no-till wheat more frequently. In side-by-side comparisons, no-till wheat typically suffered more freeze injury than conventional-till wheat. In no-till with heavy residue, heat from the soil does not radiate and provide protection to plants from cold temperatures. In addition, spring growth is often delayed, and the wheat canopy in no-till may not be as developed. The lack of plant cover and reduced heat radiating from the soil surface allows for freezing temperatures to penetrate the canopy for a longer period of time over the night hours, thus enhancing the possibility of freeze damage. Whereas, in conventional-till, heat is radiated easily from the soil surface, and the wheat canopy is more developed, which provides more protection for plants.

## Physical soil condition

Most no-till farmers agree there is a 4- to 8-year transition period, from conventional-till to a complete no-till system in which soil conditions can be difficult. Invariably, the "transition" time causes the most problems when planting wheat.

Hot, dry, windy weather is common in August and September for Kansas, which can cause residue to blow off the soil surface exposing macro and micro-pores. Once the macro and micro-pores are exposed, no-till fields will likely dry to a deeper depth than conventional-till fields.

These conditions can cause no-till fields to become extremely difficult to penetrate with a no-till drill, and the dry soil may extend deeper than the planting depth possible with no-till drills causing poor stands. As the soil surface accumulates more residue and more macro- and micro-pores develop, the soil will become more mellow and planting wheat will become easier.

## Pest Management

Continuous no-till wheat greatly enhances the opportunity for a number of pests to become a problem. Disease and insects such as tan spot, Hessian fly, brown wheat mite, and winter grain mite live or feed on wheat residue. In a continuous no-till wheat system, wheat residue is kept on the soil surface all year, allowing these pests to increase and potentially cause substantial losses.

Other problems, such as jointed goatgrass or cheatgrass, increase over time in continuous wheat with conventional and no-till, and can cause significant losses until the field is rotated out of wheat.

Crop rotation is the number one cultural practice that farmers can employ to combat pests. Farmers need to rotate to other crops such as grain sorghum, corn, or sunflowers to minimize a pest outbreak.

## Grazing

Grazing no-till wheat is possible, but timely management is needed. Producers need to remove cattle from fields when the soil becomes too wet as cattle can cause significant ruts and deep tracks. A good time to graze cattle is when the ground is frozen or dry so cattle will have minimal impact on the soil surface.

## Conclusion

No-till wheat can be successful, but the margin of error appears to be less for no-till than for conventional-till wheat. Mismanagement of only one factor, such as a misapplication of fertilizer or an incorrect seeding depth adjustment, can dramatically decrease potential yield in no-till wheat. With careful management, wheat can be successfully produced in a no-till system.



A photograph of wheat plants in a field, showing green leaves and tan, seed-filled spikes.

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