



No-Till Small Grain Production in Kentucky



No-Till Small Grain Production in Kentucky



Developed by:

University of Kentucky Multidisciplinary Extension and Research Team

Written by:

John H. Grove, Agronomy, Editor

James Herbek, Agronomy

Donald Hershman, Plant Pathology

Douglas Johnson, Entomology

James Martin, Agronomy

Sam McNeill, Biosystems and Agricultural Engineering

Lloyd Murdock, Agronomy

Richard Trimble, Agricultural Economics

David Van Sanford, Agronomy

William Witt, Agronomy



Contents

No-Till Small Grain Production in Kentucky	5
Residue Management	5
Drill Management	5
Drill Calibration	6
Seeding Rates and Varieties	6
Disease Management	7
Insect Management	7
Weed Management	7
Soil Factors That Impact Winter Survival	8
Soil Compaction	8
Fertilization and Liming	8
No-Till Wheat's Yield Potential	9
Long-Term Effects on Yields of Other Crops in the Rotation	9
No-Till Wheat Economics	10
Ten Steps to Successful No-Till Small Grain Production	11

No-Till Small Grain Production in Kentucky

Winter annual small grains, particularly wheat and barley, are an important part of the cropping systems used in Kentucky. Small grains are usually planted into a tilled seedbed, where various amounts of primary and secondary tillage cause a large percentage of residues from the previous crop to be buried below the soil surface. Many fields of small grains are planted on sloping soils. Small grains are established at a time of year when there is a great demand for labor, time, and management due to other important field operations. Eliminating one or all of these tillage operations would reduce soil erosion, as well as labor, machinery, and energy costs. Fewer tillage trips would increase the opportunity for timely planting of small grains, especially when wet weather causes delays in corn and soybean harvesting. No-tillage planting of small grains offers these advantages to growers, but they need to be vigilant about managing no-till small grains to achieve an excellent stand and a high yield potential.

Interest in no-till small grain production has increased among growers and is strongly supported by the Kentucky Small Grain Growers Association. Currently, more than 25 percent of the small grain acreage in Kentucky is seeded without tillage. This publication is designed for those considering no-tillage soil management for wheat and barley production. The information presented in this guide is largely based on University of Kentucky research and field trial observations.

Residue Management

Successful no-till small grain production begins with the harvest of the previous crop. Crop residues from the combine must be spread evenly over the harvest swath so that grain drills can operate more effectively, placing the seed uniformly at the proper depth. Planting depth will vary widely over a field with uneven residue distribution. Uneven residue distribution is one of the major causes of poor stand establishment and nonuniform small grain growth and development. Combine chopper and chaff spreaders can improve residue distribution.

Soybean residue is low in volume and easily cut with the available no-till drills, a practice which usually results in excellent no-till wheat stands. Long-term research has shown that no-till wheat yields are somewhat negatively related to the yield of the previous corn crop. This is believed to be due to the greater levels of residue following high yielding corn crops. Although the best method to manage corn residue for no-till small grain establishment is not clear, research and grower experience have provided helpful information.

One commonly used planting method is to drill directly into standing corn stalks. Many successful no-till farmers leave the corn residue standing and plant at an angle to the old corn rows. Research indicates this is a good method of seeding. When this method is used, the corn combine header should not be operated too low to the ground. This allows the heavy, thick lower portion of the corn stalk to remain attached to the soil, where it is less likely to tear loose and obstruct the drill. Attached stalks may even act as a rigid “comb,” retaining other pieces of loose residue near the soil surface, which could otherwise bind in the drill and hinder the planting operation.

Mechanical chopping of stalks, just after corn harvest, can sometimes be beneficial. Limited research at the University of Kentucky shows that flail shredding of the stalks close to the ground results in a more even distribution of the residue and may help achieve a better stand. The research also indicates that use of a rotary mower to chop stalks did not improve wheat stands, compared with non-chopped treatments, because the rotary mowing process left an uneven distribution of stalk residues.

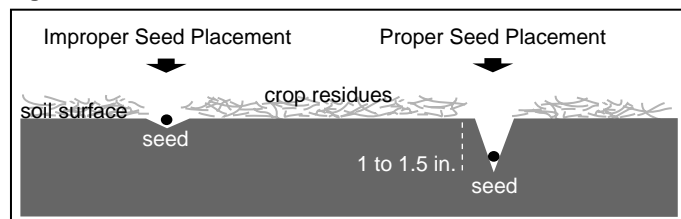
Early shredding also hastens residue decomposition, which can aid planter penetration. Shredding corn residues may also help in the management of *Fusarium* head blight (head scab), as indicated in tests performed by the University of Tennessee and recent field surveys conducted in Kentucky. However, no evidence exists to indicate that shredding corn residues will deter a head scab “epidemic” when conditions favor disease development (see the Disease Management Section).

Drill Management

Narrow-row (10 inches or less) planting equipment is now available to drill seeds directly through crop residues. Most no-till drills use one or more disk openers to cut through residue and place the seeds appropriately. No-till drills with hoe openers and air seeders mounted over field cultivators have also been used to seed small grains into existing residues. Coulters are used on many drills to help cut through residue ahead of the seed delivery units. Because of the need to strongly secure coulters and seed delivery disks or shoes to the frame, residue clearance may be sacrificed in some drills. Other models offset every other row to improve trash movement through the drill assembly.

However, proper seed placement remains a major challenge in no-till small grain production, especially in high levels of corn residue. Grain drills designed for no-till seeding are equipped to cut through crop residues to ensure proper seed placement. Residue management, planting speed, soil moisture, soil density, drill weight, and row spacing are all factors in seed placement. Placing the seed at the proper depth (1 to 1.5 inches) below the surface of the **soil, not the residue** (Figure 1), is critical to achieving good seed-to-soil contact and proper crown development. Drill settings may need to be changed as soil characteris-

Figure 1.



tics change within a single field. As soils begin to dry, lighter drills may need additional weight to improve penetration into both residue and soil.

The drill's cutting units may not slice through all the residue if the soil and residue are wet or if the previous crop's harvest has left the residue unevenly distributed. In heavy residue situations, pieces of residue may be "hair-pinned" into the slit, causing the seed to be dropped into a "cradle" of plant debris and/or resulting in a shallow planting depth. Without adequate seed-to-soil contact, germination and emergence will be reduced. Observations also suggest shallow-planted no-till wheat is more prone to winter injury because the wheat crowns are at or near the soil surface. Thus, a seeding depth of 1 to 1.5 inches is important in no-till small grain establishment.

Although research data indicate that a row spacing as narrow as 4 inches gives some yield advantage in winter wheat production, narrower rows and heavy crop residues become more difficult to manage in a no-till situation. As row spacing narrows, less space is available for residues to pass between coulters, double disk openers, seed tubes, press wheels, and other parts of the drill assembly. These residues may build up in front of the drill and disrupt seed placement. Narrow spacing also tends to dilute the weight delivered per row, and even heavy drills may be limited to a shallow seeding depth when the soil is dry and firm. Row spacings of 10 inches or wider help the flow of residue, but they also result in a yield disadvantage. A row spacing of 7 to 8 inches seems to be a good compromise for maintaining high yields while allowing the residue to flow through the drill.

The suggested range for planting speed is 4 to 7 miles per hour, depending on the type of drill. Refer to the operator's manual or manufacturer's representative for the specific speed range for your drill. Planting speeds above the suggested range will tend to raise the grain drill and reduce the planting depth.

Drill Calibration

Calibrating the drill to achieve desired seeding rates is one of the most important steps in obtaining optimal (and uniform) stands. Just as no two drills are alike, each seed lot/variety can differ in seed size, purity, and germination level. The few hours spent calibrating your drill with the seed lots to be used during the planting season can be the difference between economical seed use and potential replanting. Drills should be calibrated either in the field or by counting wheel revolutions (stationary drill method) that equal 200 feet of linear distance. Start by using the drill settings suggested for the desired seeding rate (usually listed in pounds of seed per acre). Follow the procedures given in AEN-81, *Grain Drill Calibration Procedures for Winter Wheat* or in ID-125, *A Comprehensive Guide to Wheat Management in Kentucky* to achieve seeding rates within 5 percent of the target rate.

Seeding Rates and Varieties

Because conditions are often less optimal for seed placement, the small grain seeding rate for no-till fields may need to be 10 to 15 percent greater than that for tilled soils. An increased seeding rate for no-till is needed when poor stands could result from large amounts of residue, uneven residue distribution, or drills not being properly operated or adjusted to penetrate residue. However, the seeding rate may not have to be increased under these conditions:

- where the corn residue level is light
- when planting into soybean residue
- when the operator is experienced with no-till planting, has a properly adjusted and calibrated drill, and is planting in properly managed corn residue.

Recent research at similar seeding rates (35 seed/ft²) has shown that no-till wheat seeded into corn residue averaged 2 to 3 fewer plants/ft² in final stand than that seeded into a tilled seedbed (Table 1). Seeding rates for no-till should be 35 to 40 seeds/ft² with the goal of obtaining 25 to 30 plants/ft². In most cases, this will require 100 to 150 lb of seed/acre, depending on seed size. This also means that seed size can have a large effect on per acre seed cost, because small grain seed is still sold by weight. Growers should ask seed retailers for seed size information on chosen varieties and seed lots or should calculate this important information themselves (see AEN-81, *Grain Drill Calibration Procedures for Winter Wheat*).

Limited research data indicate that good small grain varieties do well in all tillage systems. Varieties should be

Table 1. Effect of Tillage System on Wheat Yield, Fall Stand, and Head Number (UKREC – Princeton, Kentucky – 1993-1999).

Wheat Tillage System	Wheat Yield (bu/acre)	Fall Stand (plants/ft ²)	Head Density (heads/ft ²)
No-Tillage*	88	26.7	64
Chisel Plow**	93	29.0	64

*No-Tillage = planted directly into corn stalk residue.

**Chisel Plow = chisel plow, two diskings, and a finishing tool.

chosen according to local adaptation, yield potential, and disease resistance. Producers should plant two or three high-yielding varieties, with different maturities, that are resistant to the most commonly occurring diseases. The University of Kentucky is continuing to evaluate wheat varietal performance under tilled and no-till conditions. Refer to the annual *Kentucky Small Grain Variety Trials* progress report <<http://www.ca.uky.edu/agc/pubs/respubs.htm>> for information on varieties.

Disease Management

Generally speaking, the management of foliar fungal diseases in no-till wheat is the same as in a tilled crop, provided crop rotation is used. This is because wheat residue breaks down rapidly in non-wheat years, and, consequently, levels of residue-borne pathogens also decline. In contrast, if a field is planted no-till into wheat stubble, the levels of certain pathogens, especially fungal pathogens, may be greater in a no-till environment.

Some producers are concerned that using no-tillage practices for planting wheat into corn stubble will lead to elevated levels of *Fusarium* head blight (FHB). This concern does, in fact, have a biological basis since the fungi that cause FHB (head scab) also cause stalk and ear rots in corn. However, there is no evidence that FHB will be substantially higher in no-till wheat behind corn, but there is the possibility that FHB levels might be slightly elevated when wheat is planted into corn stubble. Nonetheless, tillage and previous crop are not the main factors that determine the severity of localized FHB epidemics. Environmental conditions before and during flowering are much more influential in the development of FHB epidemics.

Another aspect of no-till wheat has to do with how that system can influence seed- and soil-borne diseases. No-till soils have considerable levels of surface residues that keep them warmer in the fall and cooler in the winter and early spring than tilled soils. In the fall, warmer soils may increase the length of time that certain fungal pathogens remain active. Thus, there is a longer period for these fungi to infect wheat and cause disease. Examples of this situation are take-all disease and the soil-borne, fungal-vector virus diseases, wheat spindle streak mosaic and wheat soil-borne mosaic. In the spring, cooler, wetter soils frequently associated with no-till wheat may enhance the severity of wheat spindle streak mosaic.

Insect Management

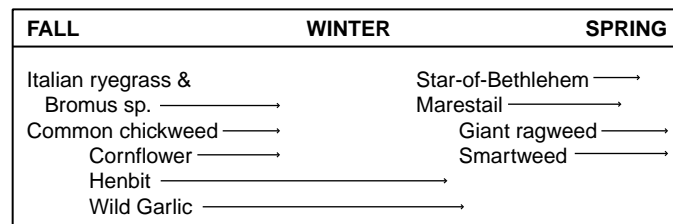
The effect of tillage on insects that infest wheat is relatively unknown. Although many anecdotal stories have circulated about insect activity associated with no-till small grain production, current research does not indicate that tillage is an important predictor of insect infestations. Certainly some secondary factors that may be related to tillage could be important, especially with the aphid-borne Barley Yellow Dwarf virus. For example, poor control of grassy weeds could provide a “green bridge” to sustain over-summering aphid hosts until the new wheat crop

emerges. Heavy residue might provide some protection to over-wintering insects or protection from frost in the short term for fall-infesting pests like aphids and fall armyworm. None of these possibilities is well enough defined to keep a producer from using reduced tillage if that system is appropriate for the site. Good insect management requires conscientious scouting, regardless of the wheat producer’s tillage system.

Weed Management

Weed control strategies in no-tillage wheat begin in the fall and continue through early spring, compared with corn and soybean where weed management is emphasized during the first few weeks after planting. The following time line for emergence of various problem weed species in wheat (Figure 2) illustrates why weed management is a continuous process.

Figure 2. Approximate Time of Emergence of Weeds in No-Till Wheat in Kentucky.



A major difference in weed control in no-tillage compared with conventional tillage wheat production is the emphasis on using herbicides and the amount of management needed before and soon after planting. Table 2 shows the benefit of using herbicides in no-tillage wheat, and that a slight yield increase was achieved by initiating weed control in the fall.

Table 2. No-Till Wheat Yields Following Fall- and/or Spring-Applied Herbicide Treatments (Princeton, Kentucky 1993 - 1998).

Herbicide Treatments	Method and Timing	Wheat Yield (bu/acre)
Gramoxone Extra (0.5 pt/A)	Preplant in Fall	
Harmony Extra (0.5 oz/A)	Postemergence in Spring	90
Harmony Extra (0.5 oz/A)	Postemergence in Fall	89
Harmony Extra (0.5 oz/A)	Postemergence in Spring	88
Untreated Check		75

Monitoring fields closely for the presence of weeds before seeding is critical for no-till wheat. Ideally, fields should be scouted before the crop is planted. A preplant “burndown” herbicide (Gramoxone Extra or Roundup Ultra) is normally recommended if weeds are present at the time of seeding (Table 3).

The majority of Italian ryegrass, *Bromus* species such as cheat and hairy chess, common chickweed, and

Table 3. Relative Response of Weeds to Preplant Burndown Herbicides for No-Tillage Wheat.

Preplant Herbicide	Italian Ryegrass	Brome species (cheat, hairy chess)	Common Chickweed	Henbit, Purple Deadnettle	Mustard species
Gramoxone Extra (1.5 to 2 pt/acre)	9	9	9	8	8
Roundup Ultra (2 to 3 pt/acre)	9	9	9	8	8

GOOD = 8-9 FAIR = 6-7 POOR = 5 or less

cornflower plants normally emerge by October or early November. Emergence of these weeds may be delayed if soil conditions are dry or cool. Scouting fields about one month after planting will determine if a selective postemergence herbicide is needed. It is especially important to scout fields that were not treated earlier with a preplant herbicide. Italian ryegrass and cornflower are examples of weeds that are difficult to manage when treatments are delayed until late fall or the following spring.

Wild garlic, henbit, purple deadnettle, and certain mustards start to emerge in the fall and continue through late winter. These weeds are suppressed or controlled effectively in conventional tillage wheat with a single spring treatment; however, in no-till wheat a fall spray program may be warranted to control those plants that have become well established in the fall. A follow-up spring treatment is usually needed to manage late emerging plants, particularly wild garlic.

Weeds that begin to appear in no-till plantings in late winter to early spring include Star-of-Bethlehem, marestalk, Pennsylvania smartweed, and giant ragweed. Spring treatments can suppress these species, but they rarely provide complete control. Star-of-Bethlehem does not compete with wheat long-term, since it is a short-season perennial that dies back as temperatures increase in late April and early May. Marestalk, Pennsylvania smartweed, and giant ragweed are annual weeds that emerge most frequently where wheat stands are poor and eventually become problems in the no-till soybean that follows wheat harvest. A preharvest treatment of 2,4-D or Roundup Ultra may occasionally be needed where these species inhibit the wheat harvesting process.

Guidelines for herbicides recommended in wheat are discussed in the most recent edition of the Extension publication AGR-6, *Chemical Control of Weeds in Kentucky Farm Crops*. Always consult the herbicide label for specific directions and restrictions.

Soil Factors That Impact Winter Survival

Freezing and thawing of soil in winter can force the plant's root system to the surface, exposing the crown to adverse environmental conditions. Research data have shown that crop residue on the surface insulates the soil, slowing the cooling of soil as the air temperature begins to decrease in the fall, but also slowing the warm-up of soil temperature in the spring. Further, this causes the air temperature just above the soil/residue surface to be colder in no-till small grain fields because radiant heat transfer from the warm soil is reduced.

The warmer soil temperatures in the fall may explain why the growth of no-till wheat in the fall is sometimes greater than growth of tilled wheat, while the cooler late winter and spring soil temperatures may explain slower overall crop development later, in early spring. The difference in temperature between the soil and the air just above the soil/residue surface is believed to be particularly stressful to seedlings shallowly established in the residue layer. This may contribute to the greater stand thinning and related damage sometimes observed in no-till small grain fields with a late winter or early spring freeze.

Field tillage research on clayey soils with barley, which is less winter-hardy than wheat, suggests that no-tillage reduces the potential for winter heaving. Heaving occurs after short warming periods, when ice turns to water at or near the soil surface. When soil conditions inhibit the drainage of water through the small grain root zone during a temporary thaw, subsequent refreezing can produce ice within the surface soil and cause heaving losses. The greater volume of large pores often found in no-till soils may aid root zone water drainage, allowing water percolation below the small grain root zone prior to refreezing. From late fall through winter and into early spring, crop residues in no-till plantings prevent quick increases in soil temperature during short warming periods. Consequently, there is less likelihood of snow melt, which reduces the potential for winter heaving injury.

Soil Compaction

Although some producers have expressed concern that a continuous no-tillage soil-crop management system might result in soil compaction, University of Kentucky research suggests that this concern is unfounded. The increased soil organic matter associated with long-term no-tillage systems can actually reduce the compaction potential of the soil. Values for soil bulk density and soil penetration resistance were similar for tilled and no-till soils planted to wheat in an otherwise complete no-till corn and soybean rotation. In general, wet soils should not be trafficked, regardless of tillage system.

Fertilization and Liming

Soil samples should be taken to a 4-inch depth when the soil management system is predominantly no-tillage. Phosphorus, potassium, and lime may be applied to the soil surface in the fall before planting. Yield losses in no-till small grains due to phosphorus or potassium deficiency have not been observed when these nutrients are applied on the soil surface according to soil test recommendations.

When double-cropping is specified on the soil testing form, adding together the fertilizer phosphorus and potassium recommendations for each of the two crops is not necessary or economical. Double-crop fertility research at the University of Kentucky has found that the most efficient and economical rates of phosphorus and potassium are based on the P or K needs of the more sensitive component of the double-crop system. Thus, recommended P_2O_5 rates are based on the needs of small grain while K_2O rates follow soybean or grain sorghum recommendations.

One of the most important yield-determining factors in winter cereal production is nitrogen availability. The residue remaining on the surface in no-till small grain fields influences nitrogen availability. In no-till situations, nitrogen fertilizer applied to the soil surface can be tied up while the residue is decomposing or can be lost via denitrification when the soil is water saturated. Thus, part of the nitrogen is either lost or unavailable for plant uptake, and nitrogen deficiencies may result.

No-till wheat may benefit from splitting the crop's spring N requirement and including slightly more N as compared with spring N management for tilled wheat. Splitting the spring N into two applications, one in February (Feeke's growth stage 2-3) and one in March (Feeke's growth stage 4-5), may help compensate for the greater potential for reduced N recovery by the crop. The amount of total spring N generally recommended for no-till wheat is 90 to 120 lb N/acre, which is about 30 lb N/acre more than recommended for tilled wheat. If spring N applications are split, the first application, in February, should be 40 to 60 lb N/acre. Research indicates little difference due to tillage from fall N fertilization. Fall N appears to benefit late-planted (after the first week in November) or thin stands (less than 25 plants/ft²) of wheat, regardless of tillage system, and should be limited to 20 to 40 lb N/acre. Research also indicates that little or no fall N is needed for timely planted wheat with adequate stands. In these situations, the fall N rate should not exceed 20 lb N/acre. For the latest information on soil testing and fertilizer recommendations, refer to the Cooperative Extension publication AGR-1, *Lime and Fertilizer Recommendations*, available from county Extension offices.

No-Till Wheat's Yield Potential

No-till small grain can yield as well as small grain established in a tilled seedbed when adjustments in planting practices, seeding rates, weed control, nitrogen, and residue management are made as specific conditions dictate.

No-till wheat following soybean generally results in yields equal to those from a tilled seedbed, primarily because there is less residue to interfere with establishment. However, no-till small grain establishment following corn is more difficult due to the greater amounts of residue to manage during the planting process.

Without proper management changes, no-till wheat can have reduced and uneven stands, slowed crop development, uneven seeding depth, and increased winter injury,

which can reduce yield potential. However, experience and management adjustments can minimize or eliminate most of these yield-reducing factors. Several experienced growers have made long-term comparisons of no-till and tilled wheat and found the yields to be equal.

Yield comparisons in Kentucky research trials between no-till and tilled wheat following corn have shown variable results. Some field experiments have shown no-till wheat yield to equal or exceed that of tilled wheat. In other comparisons, no-till wheat has yielded less. In these latter situations, winter or spring freeze injury and/or improper planting management could explain the yield reduction. Several research trials in the 1980s indicated equal yields between the two planting systems. Over a seven-year period, a current study has shown no-till wheat planted after corn to yield an average of 5 bushels/acre less than tilled wheat (Table 1). However, in four of those years, no-till wheat yields were equal or better than those for tilled wheat. In the other years, no-till wheat yielded considerably less (freezing and compaction problems). No-tillage should not be considered primarily as a tool to achieve a higher yield, unless that higher yield results from more timely planting. Rather, no-tillage is an alternative establishment method that can help conserve time, labor, and soil resources.

Long-Term Effects on Yields of Other Crops in the Rotation

Soil quality (organic matter, structure, etc.) improves as fields are continuously no-tilled for many years. This usually improves yields. Although many producers' rotations include no-till corn and soybean, small grains are still being tilled. Therefore, these are not continuous no-till rotations.

The results of a long-term trial at the University of Kentucky, which had no-till corn and double-crop soybean in rotation with either no-till or tilled wheat, indicate that a complete no-tillage system resulted in positive yield gains for corn and soybean (Table 4). Averages over the 6-year trial indicated a yield increase of 4 percent for soybean and 6.5 percent for corn in the total no-tillage system as compared with the system where only the wheat was planted in a tilled soil. In another 12-year trial, no-till wheat/double-crop soybean improved the yield of the following no-till corn crop by an annual average of 10 bushels/acre as compared with any other preceding crop (continuous corn, full-season soybean, and grass/clover hay).

Table 4. Effect of Wheat Tillage System on the Yield of Succeeding Crops, 1993-1998 (UKREC-Princeton, Kentucky).

Wheat Tillage System	Soybean Yield (bu/acre)	Corn Yield (bu/acre)
No-till	38.0	201
Conventional	36.6	189

No-Till Wheat Economics

Previous economics research has determined that, for Kentucky producers using typical crop rotations, no-tillage was the most profitable tillage system in almost all situations investigated. Only when all operating costs were substantially increased did no-tillage prove not to be the most profitable choice. Reduced tillage (chisel plow) was shown to be more profitable in this situation. Moldboard plowing was never the most profitable alternative.

When this research was completed 10 years ago, wheat was the one crop in the typical Kentucky corn, wheat, and double-crop soybean rotation that had made the least technological progress in no-tillage. Since then many technological advances have enhanced yield, as indicated in this publication as well as the wheat production handbook, ID-125, *A Comprehensive Guide to Wheat Management in Kentucky*. Current technology for no-tillage wheat production is far superior to what it was a decade ago. However, as pointed out elsewhere in this publication, the potential for no-tillage wheat production depends on site-specific agronomics and the producer's management capabilities.

An easy method of analyzing the potential for no-till wheat production on your own farm is to use a partial budget analysis. It will compare the economics of your current wheat tillage system to that of a new no-tillage wheat production system. Table 5 shows a general example of a partial budget analysis form. The primary elements of this partial budget analysis are simply the economic changes that result from changing wheat tillage systems. All of these economic changes can be categorized as either revenue increasing or decreasing and cost increasing or decreasing. The best source of information for estimating these changes is your own farm records concerning similar tillage practices used on other land or in a different crop. If this information is not available, you should consider getting estimates from other sources such as the *1996 Kentucky Custom Rates for Farm Machinery* and the *Kentucky Farm Machinery Economic Cost Estimates for 1996* or other similar estimates.

After all of the potential economic changes resulting from the new tillage system are identified and quantified, they can be entered into Table 5. Comparing the overall change in revenues and costs will result in a **net change** for the conversion to no-till wheat production for your specific farm situation. If the **net change** is positive, the change to no-till wheat production should be more profitable for your farm business. If the **net change** is negative, your current tillage system should prove to be more profitable than changing to a no-till wheat production system.

Table 5 includes categories for the most common economic changes that may result from a change to no-till wheat production. If your specific situation will result in other changes, they should be entered in the appropriate section of the table. Tables 6 and 7 show two examples of partial budgets for tillage system changes. Table 6 is an analysis with the following assumptions and expectations for producers switching to no-till wheat production:

Table 5. Partial Budget Analysis of Wheat Tillage System Choices.

Conventional Tillage System to No-Till System (Per Acre)			
<i>Description of Change:</i>			
Increased Revenues:		Decreased Revenues:	
<i>Wheat Yield</i>		<i>Wheat Yield</i>	
<i>Total:</i>		<i>Total:</i>	
Decreased Costs:		Increased Costs:	
<i>Machinery Cost</i>		<i>Seed Cost</i>	
<i>Labor Cost</i>		<i>Nitrogen Cost</i>	
		<i>Herbicide Cost</i>	
		<i>Machinery Cost</i>	
<i>Total:</i>		<i>Total:</i>	
Higher Profits		Lower Profits	
		Net Change:	

- they will be experienced with other no-till row crops.
- based on this experience, they do not expect yields to be different with the new system.
- they believe that the no-till system will eliminate stalk shredding, chisel plowing, and a double disking.
- based on prevailing custom machinery rates, including labor costs, they expect the no-till system to reduce machinery costs by \$22.94 per acre.
- they expect increased seed, nitrogen, and herbicide costs as shown in Table 6. The increased machinery costs are for custom application of a burn-down herbicide.

The analysis in Table 6 indicates that the producer should expect a **net change of \$8.76 per acre**. This suggests that it would be more profitable for the producer's wheat enterprise to change to a no-till production system.

Table 6. Partial Budget Analysis of Wheat Tillage System Choices.

Conventional Tillage System to No-Till System (Per Acre)			
<i>Description of Change: Experienced No-Tiller Using Custom Rate Machinery Costs</i>			
Increased Revenues:		Decreased Revenues:	
<i>Wheat Yield</i>		<i>Wheat Yield</i>	
<i>Total:</i>		<i>Total:</i>	
Decreased Costs:		Increased Costs:	
<i>Machinery Cost</i>	\$22.94	<i>Seed Cost</i>	\$1.50
		<i>Nitrogen Cost</i>	5.20
		<i>Herbicide Cost</i>	6.00
		<i>Machinery Cost</i>	1.48
<i>Total:</i>	\$22.94	<i>Total:</i>	\$14.18
Higher Profits	\$22.94	Lower Profits	\$14.18
		Net Change: \$8.76	

The sample analysis in Table 7 represents a producer who is considering the use of no-tillage in wheat production but in an agronomic situation that is less desirable. The producer expects the wheat yield to be 5 bushels fewer per acre than with a traditional tillage system. This lower yield, at an assumed price of \$3.00 per bushel, results in decreased revenues of \$15.00 per acre (shown in Table 7). The producer also expects to reduce cash machinery cost for fuel and lubrication by \$5.93 per acre. The reduced machinery operations will also reduce labor costs by \$3.48 per acre. The producer expects increased seed, nitrogen, and herbicide costs as indicated in Table 7. The increased machinery costs are for the fuel and lubricants associated with spray application of a burn-down herbicide. The increased labor costs are also associated with the burn-down herbicide application. This producer's situation should result in a **net change of -\$19.05 per acre**. This producer would expect lower profits in changing to no-till wheat production.

These examples demonstrate how a partial budget analysis can be useful in examining the economic consequences of changing to no-till wheat production. As mentioned earlier, each situation is different. The potential benefits from changing to no-till will depend on the producer's agronomic circumstances and ability to successfully manage the new system.

Table 7. Partial Budget Analysis of Wheat Tillage System Choices.

Conventional Tillage System to No-Till System (Per Acre)			
Description of Change: Beginning No-Tiller with Poor Agronomic Conditions			
Increased Revenues:		Decreased Revenues:	
Wheat Yield		Wheat Yield \$15.00	
Total:		Total: \$15.00	
Decreased Costs:		Increased Costs:	
Machinery Cost	\$5.93	Seed Cost	\$1.50
Labor Cost	3.48	Nitrogen Cost	5.20
		Herbicide Cost	6.00
		Machinery Cost	.30
		Labor Costs	.46
Total: \$9.41		Total: \$13.46	
Higher Profits \$9.41		Lower Profits \$28.46	
		Net Change: (\$19.05)	

Ten Steps to Successful No-Till Small Grain Production

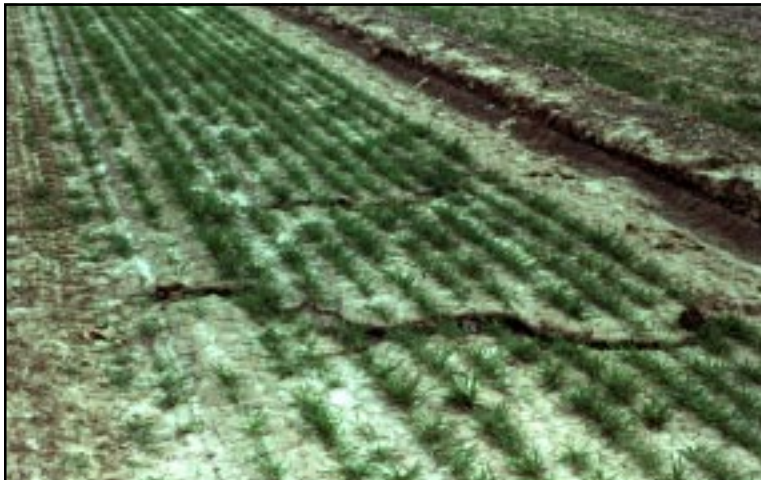
1. Spread residues from the previous corn or soybean crop evenly during harvest. Corn stalks can be left standing or shredded.
2. Choose well-adapted small grain varieties with good winterhardiness, good tillering capacity, and good resistance to the plant diseases most likely to occur in the area.
3. Plant at an angle across the rows of the previous crop (especially if corn stalks are not shredded) to reduce trash buildup during drill operation and improve stand establishment. Further, use a drill with a row spacing not less than 8 inches.
4. Planting depth should be 1 to 1.5 inches **below the soil surface** to reduce risk of winter injury. Plant at a slower speed and/or increase drill weight to ensure proper soil penetration and seed placement.
5. Increase seeding rates by 4 to 5 seeds/ft² if planting conditions are less than optimal.
6. A burn-down herbicide will be required if weeds are present at planting. For control of emerged weeds after planting, apply a fall and/or spring postemergence herbicide, according to species and size of weeds.
7. Apply lime, phosphorus, and potassium prior to or shortly after small grain establishment. Base amounts on a recent soil test. If double cropping is anticipated, base P₂O₅ rates on small grain needs, and K₂O rates on the needs of the double-crop component (usually grain sorghum or soybean).
8. Spring nitrogen rates should be 90 to 120 lb N/acre and split into two applications because of the greater potential for reduced N recovery under no-till conditions. Any fall N application should be limited to 20 to 40 lb N/acre on late-planted or thin stands of wheat.
9. Scout the crop regularly, noting weeds, insects, and diseases. Use control measures only when an economic response is expected.
10. Consult with the local county Extension agent when questions arise.

Other agronomic information is contained in Extension publication ID-125, *A Comprehensive Guide to Wheat Management in Kentucky*, which may be obtained at your county Extension office.

Mention or display of a trademark, proprietary product or firm in text or figures does not constitute an endorsement and does not imply approval to the exclusion of other suitable products or firms.



Erosion Control in No-Till Small Grain Production



Erosion in Tilled Small Grain Production

Note the contrast in apparent soil erosion between no-till (above) and tilled (below) small grain production fields.