K·STATE
Research and Extension

No-Till Series

Rotations and Cultural Practices

No-till farming has gained widespread acceptance with the development of improved equipment and broad-spectrum herbicides. The benefits of no-till include:

- Reduced soil erosion
- Improved soil quality
- Greater yields where inadequate soil moisture is a limiting factor
- Time savings
- Less labor requirement
- Possibility for increased cropping intensity
- Possibility for reduced equipment costs

A crop rotation system with optimal intensity and diversity is important for success with no-till. Without a sufficiently intense cropping system, no-till may not be profitable. Likewise, cropping systems that are too intensive can fail without no-till or some other high-residue production system in regions such as central and western Kansas that are prone to moisture stress.

What is cropping intensity? It is the amount of production per acre farmed over an extended period. Examples include:

1. Wheat, summer crop, fallow rotation (two crops in 3 years)
2. Wheat fallow rotation (one crop in 2 years)
3. Double cropping a row crop following winter wheat (two crops in 1 year)

Increased cropping intensity can be accomplished by double cropping or increasing the use of summer crops in rotation with wheat or other small grains by eliminating or shortening fallow periods. Intensified cultural practices (e.g. higher populations, narrower row spacings, and higher fertility rates) or intensified management of other inputs (e.g. micronutrients, herbicides, insecticides, and fungicides) can be coupled with increasing cropping intensity or applied to an existing cropping intensity to increase overall production.

No-till often increases the amount of available soil moisture throughout the growing season. If crops do not use the extra water, it can cause problems, such as increased weed growth, delayed planting, poor germination conditions, sidewall compaction, an increase in disease potential, or saline seep formation.

With an appropriately intense and diverse crop rotation system on soils with adequate surface or internal drainage, most producers should see improved weed control, soil health, and nutrition; fewer soilborne insect and soilborne disease problems; and more production per acre per year. Some advantages of no-till are apparent immediately, but changes in soil structure and organic matter take time. The full advantage of no-till may not be realized for several years. Long-term comparisons of conventional and no-tillage systems in a wheat/sorghum/fallow rotation at Tribune, Kansas showed greater yields in no-till after several years of consecutive no-till production than during the first few years after transitioning from a conventional to a no-tillage system (Table 1).

Producers will need to tailor their crop rotation to soil types and productivity potentials. No-till may involve more advanced planning than other tillage systems in order to reap the full benefits.

Table 1. Sorghum and wheat yields over time in conventional-till, reduced-till, and no-till.

Wheat/Sorghum/Fallow Rotation: Western Kansas Southwest Research-Extension Center, Tribune				
	Grain Sorghum Yield (bushels/acre)			
Tillage System	1991-1995	1996-2000	2001-2006	Average
Conventional-till	33	58	15	34
Reduced-till	51	88	26	53
No-till	50	103	52	67
	Wheat Yield (bushels/acre)			
Tillage System	1991-1995	1996-2000	2001-2006	Average
Conventional-till	36	40	12	28
Reduced-till	36	49	15	32
No-till	39	54	20	36

Source: Schlegel, A.J., L. Stone, T.J. Dumler, and C.R. Thompson. 2007. K-State Report of Progress 980

Important Factors When Planning Crop Rotations

Potential profitability and availability of markets

It is difficult to predict market prices 2 to 3 years in advance, but experience can be used as a guide to the potential profitability of various crop options in a given area. If new crops are being considered, factors such as market availability, the need for on-farm storage, and transportation cost must be considered.

Cropping intensity

Cropping intensity refers to the amount of production per acre farmed per year. Double cropping and shortening or eliminating fallow periods are two of the primary means of intensifying rotations.

In western Kansas, no-till might allow rotations to be intensified considerably compared to tillage-based, wheat/fallow systems. In many years, it may be possible to shorten or eliminate fallow periods with a no-till system because of improved moisture conditions. High residue, no-till cropping systems that include proper weed control, planting rates, and planting methods have facilitated the resurgence of dryland corn production in western Kansas, providing another warm-season crop option. In regions prone to moisture stress, including a forage crop or short season grain crop in the rotation might provide the correct balance for increasing cropping intensity yet maintaining a fallow period to replenish soil moisture capture.

In central Kansas, greater soil moisture will allow more double cropping of row crops following wheat and wheat planted behind row crops.

In eastern Kansas, rotation systems for no-till, minimum-till, and conventional-till may be similar, but cultural practices might need to be modified in no-till. For example, producers might need to use higher seeding rates or narrower row spacing to effectively use the higher soil moisture levels in no-till. On soils with poor surface and internal drainage in high-rainfall areas, it may be necessary to cultivate during the growing season to dry out the soil and improve water infiltration rates where wet soils may otherwise seal over. Winter cover crops may remove excess soil moisture to allow timely planting.

Keeping the soil surface covered with a crop as often as possible in a no-till cropping system will help use soil moisture for income-producing plants rather than weeds. Soil residue cover reduces soil water evaporation and can increase the amount of moisture available near the soil surface. Under dry conditions and high winds, the upper soil surface of no-till fields can dry out and reduce germination and stand establishment of crops, a problem that can occur in western Kansas. Under very dry soil conditions, planting with a hoe opener or using a coulter can improve seedling establishment. Occasionally conventionally tilled soil will have greater stand establishment than no-till because seed can be placed deeper.

Crop types, rotations, and sequences

Several long-term studies in Kansas have demonstrated the importance of crop rotation for successful no-till. More than 30 years of yield results from a rotation and tillage study at Manhattan showed consistently greater yields for soybeans, sorghum, and wheat in rotation compared to growing the same crop every year in no-till (Figure 1). A 10-year study at Hesston revealed the importance of crop sequence and rotation for no-till wheat. Wheat rotated with corn or soybeans yielded more than continuous wheat, but rotating with sorghum was no better than continuous wheat (Figure 2).

Figure 1. Crop yield response to rotation in no-till, 31-year averages, Manhattan, Kansas.

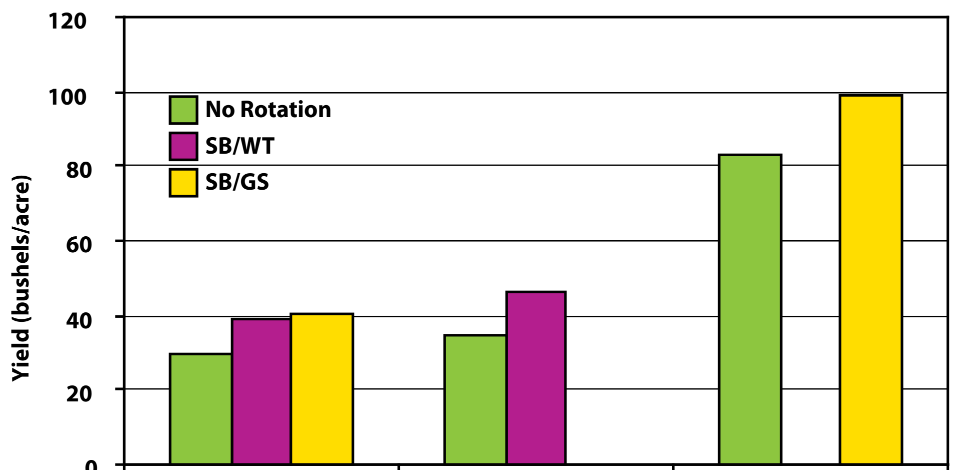
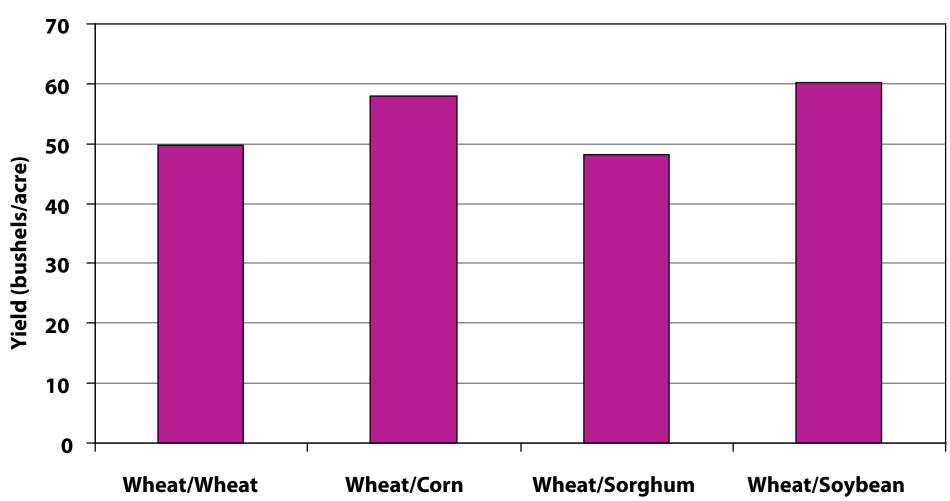


Figure 2. Wheat yield in no-till, 10-year averages, Hesston, Kansas.



Another study at Hesston that examined a greater number of crops and crop sequences in no-till indicated that sorghum following wheat or soybeans was superior to following sorghum. Corn following wheat or double-crop soybeans was better than following soybeans or sorghum. Wheat planted immediately after soybean harvest yielded more than wheat after corn, which was better than after sunflowers (Figure 3). Soybean yields were relatively insensitive to the previous crop in this study. Similar trends were observed for western Kansas with wheat and sorghum in a 10-year study at Tribune (Figure 4). Cover crops planted during the fallow period following wheat harvest or over the winter following summer-crop harvest may help increase diversity as well as provide additional residue, capture nutrients for cycling to a following crop, and accumulate nitrogen for a following crop if a legume is used.

Although the no-till system might more readily allow for the establishment of perennial weeds compared to conventional-tillage, increasing the diversity of crop types and length of rotations will help with weed control. Rotating between winter annual and summer annual crops and between grass and broadleaf crops will disrupt seed production and survival of both annual and perennial weeds.

Research has shown that a 2-year rotation consisting of a warm-season followed by a cool-season crop decreases weed density compared to planting the same crop every year. However, a 4-year rotation involving two different cool-season crops followed by two different warm-season crops had a 13-fold greater decline in weed density over time compared to the 2-year rotation in no-till.

Diversity within a crop type provides additional opportunities to disrupt weed life cycles. For example, both corn and grain sorghum are summer annual grass crops, but the later planting date for sorghum provides an additional opportunity for controlling late-emerging weeds before planting. Canola is being used successfully in wheat-dominated cropping systems for better control of cheat, downy brome, and other winter annual grass weeds because of additional herbicide options. Using crop diversity along with other cultural practices designed to minimize weed production has allowed some producers to reduce herbicide usage by 50 percent compared to their initial no-till rotations.

Figure 3. Crop yield response to previous crop in no-till, 3-year averages, Hesston, Kansas.

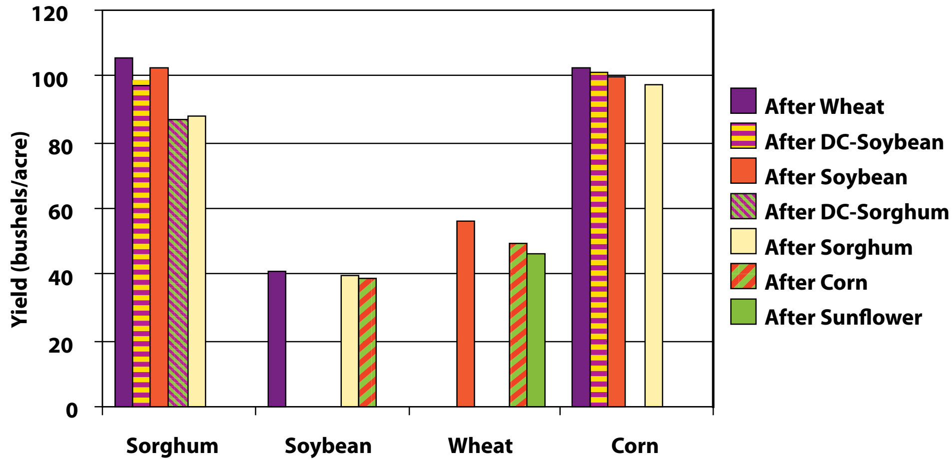
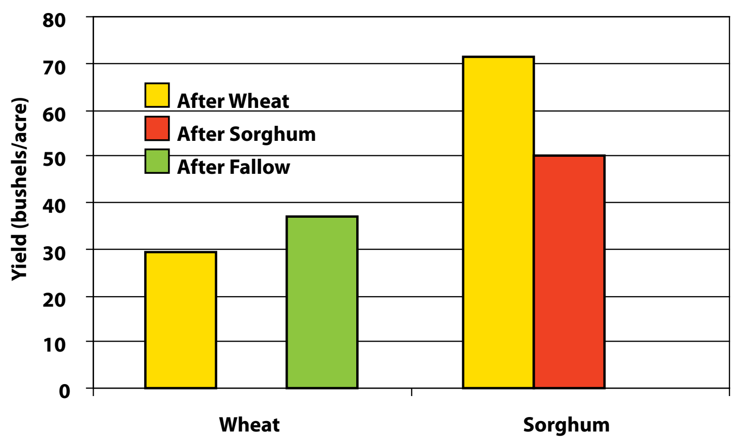


Figure 4. Crop yield response to previous crop in no-till, 3-year averages, Hesston, Kansas.



Herbicide requirements, modes of action, and potential carryover considerations

Crop rotations provide an excellent opportunity to rotate herbicides with different modes of action. As rotations become more complex, however, producers will have to pay closer attention to herbicide carryover restrictions. Environmental factors that affect herbicide carryover include soil moisture, soil type, pH, organic matter, and tillage system. For more information on herbicides and carryover concerns, see the most current edition of the K-State Research and Extension publication *Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland* and K-State Research and Extension publication MF-2339, *Weed Control in Dryland Cropping Systems.*

Water use requirements

Some crops require much more water than others. Use a crop rotation that matches crop water use with available soil moisture. It is best to use crops with a high water requirement where it is anticipated that soil water will be adequate or excessive much of the time. Corn is an example of a high water use crop and barley is an example of a low water use crop (Table 2).

Residue characteristics and management

Certain crops, such as corn and winter wheat, typically produce abundant residue that persists for long periods. Other crops, such as soybeans, offer relatively little long-lasting residue. Rotate low-residue and high-residue crops to maintain moderate soil cover. The greater the residue level, the cooler the surface soil temperatures will be in spring.

In areas with significant snowfall, it is best to leave residue standing to catch snow. Standing residue is also important for control of wind erosion. Stripper headers are designed to maximize the amount of standing stubble and stubble height. Both of these factors increase snow catch and the effectiveness of stubble for controlling wind erosion. Studies at Tribune, Kansas have shown greater row crop yields following wheat cut with a stripper header compared to following wheat cut with a conventional header. However, no yield advantage for row crops following wheat cut with a stripper header was detected in similar studies at Garden City, Kansas.

Uniform distribution of crop residue is critical for no-till success. Uneven swaths of chaff or straw can interfere with planter and herbicide performance. Variable residue distribution will cause non-uniform germination and emergence, leading to variability in plant size and development, a greater contributor to yield reductions than nonuniform plant spacing.

Uniform field operations

Conduct all field operations (planting, spraying, harvesting, manure applications, etc.) so that each pass is as uniform as possible. With no-till, the "leveling" effect that tillage provides is not present. Some producers control traffic paths so that each field operation follows the same wheel track, minimizing the area subject to possible compaction. This is especially important if field operations must take place when soil moisture content is greater than desired, for example to assure a timely herbicide application or to apply a fungicide within a narrow window of crop development.

Equipment needs

When planning a crop rotation system, producers should determine if specialized equipment will be needed. As tillage is reduced or eliminated, there is greater reliance on herbicides and crop rotation for weed control. Because of the need for timeliness and flexibility in herbicide application, many producers find it advantageous to own spraying equipment.

Some weeds such as tumble windmill grass or red threeawn are not susceptible to glyphosate or ALS herbicides, and no-till producers often require an under cutter to manage small patches of these weeds. An under cutter causes minimal soil disturbance and is an effective tool against these grass weeds since they are shallow rooted.

Disease and insect problems

In most cases, disease and insect problems are less severe where crops are rotated than in continuous monoculture cropping systems. Rotations often decrease the incidence of gray leaf spot and corn rootworms in corn; sooty stripe in grain sorghum; Phytophthora root rot in soybeans; and take-all, tan spot, and Stagonospora and Septoria leaf blotch in wheat. There are some cases, though, where problems can occur in a no-till rotation. For example, wheat following corn may have an increased risk for head scab since the source of inoculum comes from corn residue on the soil surface.

Table 2. Crop types and characteristics.

Crop	Type	Season	Water requirement	Residue levels/ Snow catch potential
Alfalfa	Broadleaf	Warm-season	High	Variable (depends on stubble height)
Barley	Grass	Cool-season	Low	Intermediate
Canola	Broadleaf	Cool-season	Intermediate	Intermediate
Corn	Grass	Warm-season	High	High
Cotton	Broadleaf	Warm-season	High	Low
Grain sorghum	Grass	Warm-season	Intermediate	High
Hairy vetch	Broadleaf	Cool-season	Intermediate	High
Oats	Grass	Cool-season	Low	Intermediate
Pearl millet	Grass	Warm-season	Intermediate	High
Proso millet	Grass	Warm-season	Low	Intermediate
Smooth brome	Grass	Cool-season	Intermediate	High
Soybean	Broadleaf	Warm-season	High	Low
Sunflower	Broadleaf	Warm-season	Intermediate	Intermediate
Wheat	Grass	Cool-season	Intermediate	High

Western Kansas

In western Kansas, the standard dryland cropping system for many years has been wheat/fallow, using sweep tillage to maintain the fallow. Wheat/fallow is neither intensive enough nor diverse enough for no-till, for the following reasons:

- There are few inexpensive, long-residual herbicides available to replace tillage and keep weeds controlled during the 14-month fallow period between wheat crops.
- Producing a crop every other year often cannot generate enough income to support the repeated use of nonresidual herbicides during the fallow period. Wheat often does not respond as much as summer row crops to increased soil moisture because of other limitations, such as hot weather in spring and a relatively short period between flowering and grain fill. However, long-term research at Tribune has found no-till wheat to yield more on average than conventional-till wheat.

- The 14-month fallow period inefficiently stores soil moisture. In a no-till system, soil moisture in wheat stubble is often replenished within 6 months, provided the weeds have been controlled and rainfall is average.

Over the past 15 years, there has been an increase in ecofallow systems such as wheat/sorghum/fallow or wheat/corn/fallow. This allows the use of long-residual, atrazine-based herbicides during the fallow period ahead of sorghum or corn. This rotation system has several advantages over a wheat/fallow system:

- Better moisture storage
- More surface residue to protect against wind and water erosion
- Better overall water use efficiency by decreasing evaporation and increasing plant transpiration
- Improved profit potential
- Improved winter annual weed control

With no-till, rotations that are even more intensive are possible for western Kansas (O'Brien, 1998). Examples include:

- Wheat/Corn/Sorghum/Fallow
- Wheat/Sorghum/Sunflower/Fallow
- Wheat/Wheat/Corn/Sorghum/Fallow

In western Kansas, dryland soybean yields are erratic, even under no-till conditions. Long-term research in Garden City, Hays, and western Nebraska show that soybean yields typically range from 20 to 25 bushels per acre (Wicks, 1991). Late August rains have a major influence on soybean yields. Regardless of the observed erratic yields, some farmers have incorporated soybeans into their crop rotation due to the rotational benefits for the next crop and the ease of planting into soybean residue.

Sunflowers are a good option for many in western Kansas. They extract water from greater depths in the soil profile than other crops. If sunflower populations are high enough and the stalks remain standing over the winter, sunflower stalks can effectively catch snow. Crops that follow sunflowers may suffer more drought stress than following other crops, especially in dry years.

No-till generally shows a significant yield advantage for corn in a wheat/corn/fallow rotation (Norwood and Currie, 1998). A similar response has been seen in sorghum (Figure 4). No-till improves water use efficiency by 23 percent for corn and 8 percent for grain sorghum (Table 3). Tillage systems generally have shown little or no effect on wheat yields in wheat/row crop/fallow, but a modest increase in wheat yields has been observed in a wheat/row crop/fallow rotation after the initial 5 to 6 years of using no-till in a long-term rotation study at Tribune.

Central Kansas

Continuous wheat, using various tillage-based systems, has been practiced for many years throughout central Kansas. Tillage is not free — it costs time and fuel and loses moisture to evaporation. With no-till, it is essential to increase rotation intensity compared to tillage-based systems to utilize the additional stored moisture. Continuous no-till wheat has generally been less successful due to problems with winter annual grass weeds (rye, bromes, cheat) and diseases. The increased soil moisture associated with no-till production does not provide enough benefit to wheat to overcome the problems associated with continuous wheat in a no-till system.

It may be necessary to have both winter and summer crops in a rotation. In many cases, double cropping sorghum, various summer annual forages, soybeans, or sunflowers after wheat can be successful if done under no-till conditions and there is enough plant-available moisture at planting with favorable growing season conditions. Standing wheat stubble that is not double cropped often produces a good crop of weeds that must be controlled. If there is enough moisture for weeds, there is enough to produce a crop that could be sold or used as animal feed. Producing a short-season forage crop can take advantage of extra soil water in the system with less risk of the crop having moisture stress compared to producing a grain crop.

Planting wheat directly after a row crop is also possible. Normally, most of the rainfall in central Kansas occurs in early summer. In a conventional- or minimum-till system, more of this rainfall is lost as runoff compared to a no-till system. Reducing soil water runoff increases the amount of moisture stored for establishing wheat. No-till saves time and moisture when planting wheat soon after the harvest of a row crop. There are seldom any important weeds in row crop stubble that would be a problem for wheat, so there is little reason to till for weed control purposes. Sometimes soybean stubble contains henbit or mustards, which should be controlled with appropriate herbicides.

Producers should be cautioned, however, that planting wheat soon after a row

Table 3. Soil water content and water use efficiency in conventional-till and no-till.

Wheat/Row Crop/Fallow Rotations: Western Kansas Southwest Research-Extension Center, Garden City 1991-1995				
	Soil water content (inches in 6-ft. profile) at:			
Tillage System	Corn planting	Sorghum planting	Corn harvest	Sorghum harvest
Conventional-till	7.9	9.1	3.4	2.6
No-till	9.2	10.5	3.8	2.9
	Water use efficiency (bu/inch)			
Tillage System	Corn	Grain sorghum		
Conventional-till	4.0	4.0		
No-till	4.9	4.3		

Source: Norwood, C.A. and R..S. Currie, J. Prod. Agric. 10: 152-157 (1997) crop carries a risk of crop failure. Soil types and capability classes are important considerations. In an unusually dry fall, it may be better to leave the field fallow over winter and plant a row crop the following spring.

Some rotations for use in no-till systems in central Kansas include:

- Corn/Soybeans
- Sorghum/Soybeans
- Sorghum/Cotton
- Wheat/Double-cropped Sorghum/Soybeans/Sorghum/Soybeans/Wheat
- Wheat/Double-cropped Soybeans/Corn/Wheat
- Wheat/Corn/Soybeans/Wheat
- Wheat/Sorghum/Soybeans/Wheat
- Wheat/Double-cropped Sorghum/Corn/Soybeans-Wheat
- Wheat/Double-cropped Soybeans/Sorghum/Wheat
- Wheat/Double-cropped Sunflower/Corn/Soybeans/Wheat
- Wheat/Sorghum/Fallow
- Wheat/Canola/Sorghum
- Wheat/Wheat/Canola/Corn
- Wheat/Wheat/Corn/Corn (or other stacked combinations); are being used, but would be more effective with greater crop diversity, e.g. Wheat/Canola/Corn/Sorghum

How often should wheat be included in a nonirrigated, no-till rotation in central Kansas? Under normal moisture conditions, it may be more profitable to remain in a corn/soybean or sorghum/soybean rotation as long as possible, using fuller-season varieties and managing for maximum row-crop yields. Under good moisture conditions, however, producers may want to plant a wheat crop between row crops. Planting a mixture of fall and summer crops also will help control weeds, diseases, and insects, and provides crops to sell during different times of the year, reducing marketing risk. Wheat has been shown to perform better following soybeans or corn than following grain sorghum (Claassen, 2006).

Long-term research at the Harvey County Experiment Field in Hesston, on silty clay loam soils, has compared several different tillage systems on yields in a wheat/grain sorghum rotation (Claassen, 1996). Sorghum and wheat yields were similar in all tillage systems.

Eastern Kansas

On well-drained soils in eastern Kansas, yields are usually about the same for all tillage systems with good management practices and appropriate rotations.

On soils with poor internal and surface drainage, yields have been about the same or lower with no-till. Research at the East Central Experiment Field in Ottawa, on somewhat poorly drained clay loam soils, has compared yields of corn and soybeans under no-till and chisel-till conditions. Corn yields were slightly lower with no-till. Soybean yields were not affected by tillage.

Rotations improve yields compared to continuous cropping. Grain sorghum in a sorghum/soybean rotation has had higher yields than continuous sorghum (Gordon, 1996; Kelley, 1998). There is about a 10 percent yield advantage to corn in a corn/soybean rotation as opposed to continuous corn.

Southeast Kansas

Long-term research at the Southeast Agricultural Research Center in Parsons on a thin claypan soil has shown that yield response to tillage system depends on crop and crop sequence. No-till results in lower grain sorghum yields (Sweeney, 1998). However, full-season soybean and wheat yields have not been affected by tillage system (Sweeney, 1999; Kelley and Sweeney, 2007). No-till double-crop soybean yields have been equal to or greater than with disking. Double-crop soybean yields have been greater when corn or sorghum was planted before the preceding wheat crop rather than soybeans (Kelley and Sweeney, 2007).

Upland soils in the area south of the Kansas River and east of the Flint Hills are primarily claypan, with poor internal drainage. Being located in the highest annual rainfall region of Kansas, these soils stay wet and remain cool longer in the spring than soils in most other regions of Kansas. Where both internal and surface drainage are poor, an occasional tillage operation allows moisture to evaporate from the claypan soils and promote soil warming.

In full-season row crops, a single cultivation 3 to 4 weeks after planting on these problem soils will generally improve yields by breaking the surface and allowing air to get into the soil and stimulate root development. Cultivation also can increase water infiltration and reduce runoff during the growing season on soils that have sealed over from earlier rainfall events. Cultivation, however, can reduce the effectiveness of surface-applied residual herbicide.

Soils in this region typically have low pH and are often low in phosphorus and occasionally potassium. Correct soil pH by incorporating lime before the initiation of no-till. For best results, knife all fertilizer into the soil under no-till conditions. Place phosphorus in the root zone to maximize plant uptake. Applying phosphorus with the planter to the side and below the seed is an efficient way to accomplish this. Liquid nitrogen (UAN) broadcast on no-till fields in southeastern Kansas has resulted in lower yields than other nitrogen sources or placement methods.

Cultural Practices

Seeding rates

In general, there is no need to increase seeding rates beyond the normal recommended range with no-till. At times, germination and emergence can be greater in no-till due to the greater amount of moisture near the soil surface compared to tilled seedbeds. However, an exception may be warranted when farmers are using a new drill in no-till. Farmers may want to use slightly higher seeding rates the first couple of years until they are sure the new drill is providing adequate seed-soil contact for optimum stand establishment. Regardless of equipment, it is a good idea to use the high end of the range of recommended seeding rates in no-till.

Planting dates

There is no need to change planting dates because of the tillage system used. However, adequate canola growth and development is critical for successful over wintering, so planting at the early end of the recommended range is advised for no-till. For spring crops, soils may remain wetter and cooler later in the spring, which can delay planting and seedling emergence. It is critical not to plant in no-till when soils are too wet to avoid sidewall compaction, poor stands, and poor root development.

Row spacing

There may be some weed control advantages to be gained from narrower row spacings later in the season. Otherwise, tillage systems should have no effect on row spacing decisions.

Fertilization

Additional nitrogen will likely be required for about the first few years of transitioning from conventional till to no-till or until enough residue is broken down and the nitrogen in the residue is mineralized or made available to succeeding crops. Placing starter fertilizer near the seed can improve yields in no-till and reduce the nutrients available for weed growth. However, if farmers wish to increase the organic matter in the soil over time, higher rates of nitrogen will need to be used.

Hybrid/variety selection

With no-till, "emergence" and "early season vigor" ratings become increasingly important traits in hybrid/variety selection. Some hybrids are more efficient in using starter fertilizers than others and may have an advantage in no-till systems. Herbicide resistance traits provide cost-effective, post-emergence weed control options for no-till production systems, but do not use herbicides as a replacement for crop rotation. These traits and their associated herbicides must be managed carefully to slow or avoid development of herbicide-resistant weed populations. Relying too heavily on one herbicide or class of herbicides usually results in development of herbicide resistance. Diversified weed management and herbicide programs will result in better weed control and less risk of developing herbicide-resistant weed populations.

Cultivation

On well-drained soils, inter-row cultivation is not generally recommended for no-till. On soils with poor surface and internal drainage (i.e. high clay content), a single cultivation 3 to 4 weeks after planting will generally improve yields. In these cases, cultivation breaks the surface and allows better infiltration and it allows air into the soil for root development. Cultivation also may be necessary when perennial weeds such as windmill grass invade no-till fields. Current herbicides are typically ineffective in controlling this weed once established.

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Summary

- Benefits of no-till include:
  - Reduced soil erosion
  - Greater yields where soil moisture is limiting
  - Time savings
  - Possibilities for increased cropping intensity, resulting in more production per year
- In general, producers using no-till should be able to use a crop rotation system at least as intensive as those used on similar soil types in conventional-till systems that receive 1 to 2 inches of additional precipitation.
- Appropriate crop rotations and sequences tailored to fit precipitation and soil resources are critical for the success of no-till.
- In K-State research from western Kansas, no-till has often increased yields of row crops. In some studies, wheat yields have been greater with no-till and in others wheat yields have been unaffected by tillage. The benefit of no-till on wheat yields required 5 years of consecutive no-till production before no-till out yielded conventional till. No-till requires a transition period before soil health and yield improvements are seen, and if no-till wheat is not managed properly, it will likely not yield greater than conventional-till wheat. No-till increases the success of increasing cropping intensity from a wheat/fallow rotation to a wheat/row crop/fallow rotation.
- In K-State research from central Kansas, tillage has not affected yields of any crop. If cropping intensity increases with no-till, the result would be an increase in production per acre farmed.
- In K-State research from southeast Kansas on claypan soils, no-till has resulted in lower yields for grain sorghum. Tillage has not affected full-season soybean or wheat yields.
- Cultural practices, such as fertility rates, seeding rates, planting dates, and variety selection, may need to be adjusted in a no-till system. Fertilization may need to be increased in the first few years after converting from conventional tillage. Canola is particularly sensitive to the interaction of planting date and tillage. Wheat varieties and corn hybrids with superior disease resistance should be used in high-residue situations.

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