Kansas State University

Managing No-till Wheat Following a Summer Crop in Eastern Kansas

Department of Agronomy **MF-2641** **Cropping Systems**

The adoption of more intensive cropping systems minimizes transition periods between summer and winter crops and requires more intensive management. An example of this is winter wheat planted immediately after a summer crop is harvested. For this situation, wheat is often no-till planted into heavy summer-crop residue, and is typically planted later than continuously cropped wheat. Consequently, several production practices may need to be adjusted to produce a successful wheat crop.

Variety Selection

One of the first and most important decisions to be made for late-planted wheat in high residue is wheat variety selection. A wheat variety that has excellent winter hardiness is important because late-planted wheat often does not have adequate time for root and crown development, two factors that can influence the ability of wheat to survive a harsh winter. Increased winter hardiness under these conditions improves the probability that an adequate number of plants will be present in the spring.

Above average tillering ability is another trait that is important when selecting wheat varieties. Tillers produced in the fall often account for more than 65 percent of the viable tillers at harvest. When planting is delayed in the fall, tiller production is reduced. Selecting a wheat variety that produces multiple tillers, either in late fall or early spring, will likely result in higher yields by increasing final head numbers.

Because of later planting, wheat planted after a summer crop is less likely to be exposed to diseases that are spread by insects in the fall such as wheat streak mosaic virus and barley yellow dwarf or insect infestations such as the Hessian fly.

Head scab is a disease that must be considered when selecting a wheat variety to plant immediately after a summer crop. Head scab is caused by *Fusarium*, the same fungus that causes ear molds and stalk rots in corn. It occurs if extended wet weather occurs during wheat heading and flowering. The risk of head scab in wheat is much greater if wheat is planted in corn stubble than if planted in grain sorghum or soybean residue. Currently, the best way to reduce the risk of head scab with wheat planted in corn stubble is by selecting a wheat variety that is tolerant to head scab. If a scab-susceptible variety has been chosen for planting after-summer crops, it would be better to plant that variety after grain sorghum or soybeans than after corn. Current wheat variety resistance/susceptibility to diseases is listed in *Wheat Variety Disease and Insect Ratings*, MF-991 a K-State Research and Extension publication that is updated every year.

Planting Date

Wheat planted after row crops should be planted promptly after harvest to reduce yield losses associated with late plantings (Figure 1a). Yields decline as planting dates are delayed due to fewer productive tillers at harvest (Figure 1b). Data from Hutchinson suggest that this decline in productive tillers at harvest is the result of fewer fall tillers being produced, as planting date had no impact on spring tiller production (Figure 1b).

Seeding Rate

Tiller development declines as planting dates are delayed. Thus, seeding rates should be increased as planting dates are delayed to compensate for the reduction in tiller numbers. A seeding rate of 120 pounds per acre was needed to maximize yields when planting

Figure 1. *Wheat yields and tillers per plant as planting was delayed*

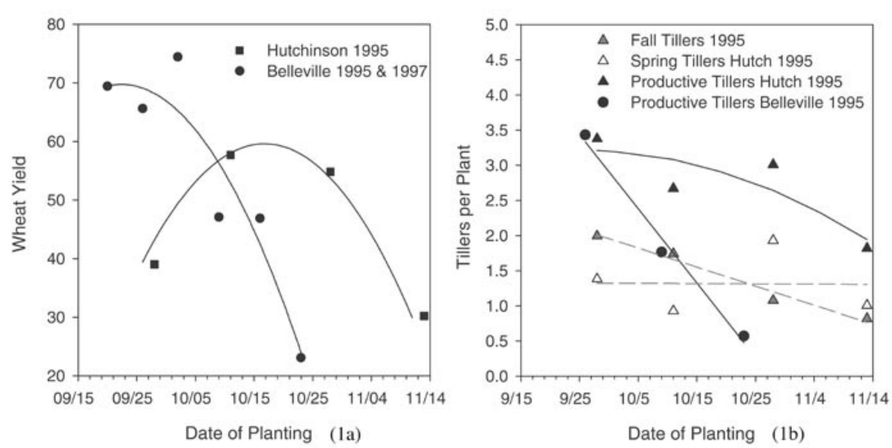
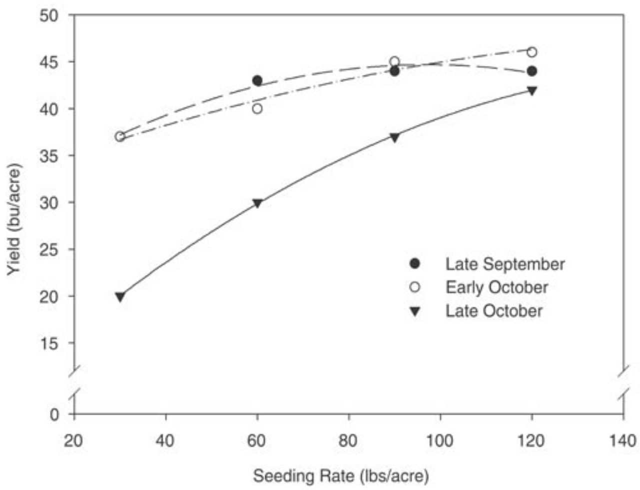


Figure 2. *Wheat yield response to seeding rates as planting is delayed (Belleville, 1996 and 1998)*



was delayed into October in research conducted at the North Central Experiment Field near Belleville, Kansas (Figure 2). However, seeding rates of 90 pounds per acre were sufficient for the late September plantings.

Previous Crop Influence on Other Management Considerations

The summer crop that is grown before wheat can affect wheat yields (Table 1). Obviously, the reasons summer crops affect wheat yields depends on the individual crops themselves. The differences are likely the result of how each summer crop influences stored soil water, soil nitrogen, residue amounts, and allelopathic chemicals that negatively influence the following wheat crop. Depending on the previous summer crop, management practices need to be adjusted to compensate for its influence.

Residue Management

Since summer crops such as grain sorghum and corn can produce high amounts of residue, decisions should be made to minimize the impact of this residue. Evenly spreading summer crop chaff and residue is important so uniform seeding depths can be achieved. High residue levels can cause shallow seeding to occur if the grain drill is not set properly for conditions. If residue is spread unevenly, seed depths need to be checked in the areas of high residue and down pressure increased if the drill cannot penetrate the residue in these areas. Shallow-planted wheat seed can result in poor root system development and plant death if water stress occurs immediately after planting. Uneven residue also may cause uneven nitrogen availability across the field. Areas with high residue levels may have greater immobilization of the nitrogen fertilizer applied. If this occurs, nitrogen deficiencies may be observed and yields reduced.

Herbicides

If a producer intends to plant wheat immediately following a summer crop, then herbicide selection for the spring and summer crop should be carefully considered to minimize carryover concerns. Consult current herbicide labels for crop rotation guidelines. Many broadleaf herbicides applied to corn, grain sorghum, cotton, or soybeans have plant-back restrictions that allow wheat to be planted as soon as 4 months after application.

Nitrogen Management

Nitrogen management for no-till wheat following summer crops will require some adjustments compared to wheat nitrogen decisions in continuous wheat. Many of the issues to be considered are reflected in the cur-

Table 1. *Nitrogen (N) recommendations for wheat following grain sorghum, soybeans, corn, or sunflowers for tilled and no-tillage systems*

	Tillage System, Previous Crop			
Variables affecting N rates	**Tilled Sunflowers or Grain Sorghum**	**Tilled Soybeans, Wheat, or Corn**	**No-Till Soybeans, Wheat, or Corn**	**No-Till Sunflowers or Grain Sorghum**
Yield Goal (bu/a)	40	40	40	40
	- - - - - - Pounds Nitrogen per acre - - - - - -			
Base N requirement†	96	96	96	96
Adjustments ‡				
Organic Matter	-20	-20	-20	-20
Profile N	-30	-30	-30	-30
Previous Crop	+30	0	0	+30
Tillage	0	0	+20	+20
Grazing	0	0	0	0
Total N recommendation	76	46	66	96

Nrec=(Yield Goal x 2.4) – (%SOM x 10) – Profile N – Other N Adjustments + Previous Crop Adjustments + Tillage Adjustments + Grazing Adjustments

† Base N requirement is calculated by multiplying Yield Goal x 2.4 lb N/bu

‡ Adjustments to base N requirement for this example are based on the following: Organic Matter = 2%; Profile N test = 30 lbs N/a (default) is used for this example, Grazing = 0 since the fields will not be grazed

Table 2. *Wheat yields for no-till and tillage systems following corn, grain sorghum, soybeans, and continuous wheat.*

Previous Crop						Manhattan	
		Hesston[1]	Columbus[2]	Parsons[3]	Hutchinson[4]	A[5]	B[6]
		- - - - - - - - - - - - - - - - Yield (Bushels per acre) - - - - - - - - - - - - - - - -					
Corn	No-Till	54.9	51.2	--	--	--	--
	Tilled	54.9	51.8	--	--	--	--
Grain Sorghum	No-Till	38.9	48.7	46.6	--	40.3	34.2
	Tilled	40.1	51.4	50.6	--	--	41.6
Soybeans	No-Till	60.4	53.2	50.3	--	47.5	--
	Tilled	54.6	53.2	53.8	--	--	--
Wheat	No-Till	42.6	--	--	36.1	--	--
	Tilled	42.9	--	--	47.6	--	--

1. Previous Crop-Tillage Study: 5-year average and tillage included V-Blade, sweep-treader and mulch treader passes.
2. Previous Crop Study: 6-year average and tillage included a disk pass
3. Nitrogen-Previous Crop Study: 5-year average 120 lb N/acre reported – tillage included a disk pass
4. Tillage-Nitrogen Study: 14 year average
5. Previous Crop-Nitrogen Study: 3-year average, 120 lb N/acre reported
6. Previous Crop Study: 2-year average

rent nitrogen recommendations as described in *Soil Test Interpretations and Fertilizer Recommendations,* MF-2586 from K-State Research and Extension. Table 1 illustrates examples of nitrogen recommendations for four different wheat-planting scenarios: tilled wheat following wheat, soybeans, or corn; tilled wheat following grain sorghum or sunflowers; no-till wheat following wheat, soybeans, or corn; and no-till wheat following grain sorghum or sunflowers. The nitrogen rate differences are largely the result of the amount and type of residue present and accounting for tillage system effects on nitrogen mineralization and immobilization.

One noticeable difference is the nitrogen credit for wheat following soybeans when compared to summer row crops following soybeans. Nitrogen rates for summer crops, such as corn and grain sorghum, are normally reduced by 40 pounds of nitrogen per acre if they follow soybeans, but this is not true for wheat. Microbial mineralization (release) of organic nitrogen from the soybean crop residues occurs when soils warm in the spring of the next year. This benefits summer row crops, but is too late to benefit wheat planted immediately after soybean harvest. Thus, there is no soybean nitrogen credit for wheat planted in the fall immediately following soybean harvest, as reflected in the recommendations for wheat following soybeans in Table 1.

Another adjustment made to nitrogen recommendations for wheat occurs when it is planted after grain sorghum or sunflowers. Table 1 reflects an additional 30 pounds nitrogen per acre for wheat planted immediately after grain sorghum or corn compared to other crops. Additional nitrogen is required to compensate for potential problems that may occur as a result of heavy residues (grain sorghum) and very efficient scavenging for soil nitrogen by sunflowers and grain sorghum compared to corn. Additionally, grain sorghum residue contains relatively low amounts of nitrogen compared to corn residue, which results in greater amounts of soil nitrogen being immobilized by soil microbes decomposing the crop residues.

Allelopathy

Research at Kansas State University and the University of Missouri has suggested that grain sorghum residue may have an allelopathic effect on no-till planted wheat. Allelopathic effects can occur, but are difficult to predict. Higher rainfall and temperatures may decrease the negative impacts of the residue. Research at other universities suggests that increased nitrogen rates also may alleviate the negative effects of grain sorghum residue. Tilling grain sorghum residue before planting wheat appeared to reduce the negative effects of sorghum residue and increase wheat yields. It is possible that these tillage operations reduced the nitrogen and water competition of the grain sorghum on the following wheat crop. Concerns over allelopathy should not discourage producers from no-till planting wheat after grain sorghum. No-till planting benefits, such as lower costs and enhanced soil and water conservation, may offset any negatives associated with planting into undisturbed grain sorghum residue.

Summary

Fallow periods between summer crop harvest and winter wheat planting have been replaced with no-till wheat planting immediately after summer crop harvest.

Intensifying rotations in this manner requires changes in management of the winter wheat crop due to later plantings than continuous wheat and the heavy residue from the previous summer crop. As a result, wheat producers should consider the following when planting winter wheat after a summer crop:

- Select wheat varieties that have excellent winter hardiness and tillering abilities.
- When following corn, select a wheat variety that is tolerant to head scab to reduce the risk of this disease in years with rainfall during heading and flowering.
- Increase wheat seeding rates to 120 pounds per acre or above if planting is delayed 2 weeks past the normal optimum planting date. Increased seeding rates compensate for reduced tillering that typically occurs with later planting dates.
- Nitrogen application rates should be increased 20 pounds of nitrogen per acre for no-till wheat production as compared to a conventional minimum-till system.
- Additionally, fertilizer nitrogen rates should be increased about 30 pounds of nitrogen per acre if the wheat will immediately follow grain sorghum or sunflowers.
- Do not reduce nitrogen fertilizer rates for wheat following soybeans compared to continuous wheat, since the organic nitrogen release from the soybean crop is likely to occur too late the next spring to benefit the wheat crop.
- Fertility management of other nutrients is similar to conventional tillage/rotation systems.
- Wheat following grain sorghum may yield less than following other crops as a result of allelopathic chemicals in the residue or competition for water and nitrogen. Tilling the sorghum residue can reduce the impact on the wheat crop that follows.

Other Publications Related to this Topic:

Planting Date Effects on Tiller Development and Productivity of Wheat. Keeping Up With Research No. 133, SRL 133, K-State Research and Extension, Manhattan, Kan.

Relationship Between Tiller and Grain Yield of Kansas Wheat Varieties. Keeping Up With Research No. 134, SRL 134, K-State Research and Extension, Manhattan, Kan.

Inhibition of Wheat by Sorghum Residue under Several Tillage Systems. Keeping Up With Research No. 123, SRL 123, K-State Research and Extension, Manhattan, Kan.

Wheat Production Handbook. C-529. K-State Research and Extension, Manhattan, Kan.

Wheat Disease and Insect Rating 2002. MF-991. K-State Research and Extension, Manhattan, Kan.

Soil Test Interpretations and Fertilizer Recommendations. MF-2586. K-State Research and Extension, Manhattan, Kan.

Scott A. Staggenborg
Crops and Soils Specialist
N.E. Area Office

James P. Shroyer
Crop Production Specialist
Department of Agronomy

Dale Leikam
Nutrient Management Specialist
Department of Agronomy

Dale Fjell
Crop Production Specialist
Department of Agronomy

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2641 February 2004

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