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WHEAT YIELDS 2007: What Happened?

Chad Lee & Jim Herbek - Extension Grain Crop Specialists
Lloyd Murdock & Greg Schwab - Extension Soils Specialists

Winter wheat was much more resilient following the spring freeze than anyone predicted. Average yields for Kentucky are estimated to be near 51 bushels/acre, not the best yields, but far better than we predicted. Some fields that we thought would not be suited to harvest yielded 30 to 50 bushels/acre. So, why did we miss it so badly?

This was the most freeze damage on wheat any of us had witnessed. We have seen wheat freeze before, but the wheat was not as mature when the freeze hit. Many wheat fields had dead growing points on the primary tillers. Surviving tillers produced about 30 heads per square foot, well below the ideal 50 heads per square foot. The low number of heads can provide good yields if all growing conditions are right. If there is any disease, lodging or bad weather the yields will drop.

In some fields as much as 80% of the surviving tillers had damaged stems near the soil surface, often between the first and second joint. Usually, damaged stems will fall over once the wheat head adds weight. Also, diseases often occur in the stems at the site of freeze damage. Previous experience tells us to assume that these heads on damaged stems will not produce adequate seed. If all damaged stems do not make a head, then final stands are close to 6 heads per square, well below what is needed for adequate yield.

The death of the primary tillers normally means a delay in growth and development and harvest. This harvest

delay would delay double-crop soybean planting, which would reduce their yield.

This was the picture we all saw during April. What happened next...or what did not happen... changed that picture entirely.

Kentucky experienced about six weeks of dry weather following the freeze event. The dry weather prevented wheat from falling over. It discouraged disease development that normally occurs on damaged stems. No heavy rains occurred to knock down the wheat. The dry weather encouraged faster development and most wheat matured within a few days of normal. This was absolutely the best possible weather conditions for wheat recovering from freeze damage. None of us expected perfect weather conditions.

To contrast our experience in Kentucky, Arkansas had wheat freeze damage at similar growth stages this year. Arkansas experienced several rainfall events while Kentucky experienced none. Arkansas wheat yields were very low (about 40 bu/acre) and grain quality was low. Kansas was similar to Arkansas in that final yields were less than what was expected (32 bu/acre).

Some Kentucky wheat fields looked much better than others following the freeze. Part of the reason may be due to nitrogen application timing. We noticed that wheat treated with fertilizer nitrogen about two weeks before the freeze did better than wheat treated at other

timings with fertilizer nitrogen. We assume that this timing, this year, allowed wheat to have good uptake of fertilizer nitrogen. Concentration of nitrogen in the leaves was at a high level and acted as anti-freeze to the cold temperatures. Wheat with nitrogen applied either before or after this two-week timing did not have high enough nitrogen concentrations to serve as anti-freeze. The timing of fertilizer nitrogen application depended on temperatures, soil moisture and wheat growth, so it would be extremely difficult to predict whether such timings would have similar results in future events.

In unusual weather events (such as a week of temperatures in the 80 s in March, followed by three to five days of freezing temperatures the first of April in Kentucky) unusual things happen. The science behind our predictions on wheat freeze damage was sound. One thing we all have learned, and continue to do so, is that it is extremely hard to outguess Mother Nature.

SELECTING WHEAT VARIETIES

Dave Van Sanford - Wheat Breeder
Bill Bruening - Variety Testing Specialist

Choosing a wheat variety is one of the most important management decisions Kentucky wheat producers will make. Yield potential is clearly important, but the decision is complicated by such factors as the need for disease resistance, the extreme year to year climatic variation that we face in Kentucky, and the need to spread out the harvest maturity date so that every variety is not ready to combine at once. This fall some growers are still reeling from the late spring freeze that resulted in the destruction of many acres of wheat. It is important though, to put this event in perspective and then apply this perspective to the issue of selecting wheat varieties. One of the first questions to ask is how frequently can we expect a freeze of this magnitude? According to weather data from the Princeton weather station, there is only a 5% probability of temperatures as low as 30 degrees in April; the low temperature actually recorded was 19 degrees. Add to this the fact that the low temperatures were sustained for 3-4 nights and had been preceded by unseasonably warm weather, and you are talking about an extremely rare event. Having said that, it is still important to take steps to minimize the impact of a spring freeze.

It is **always** a good idea to minimize your risks by planting several varieties with good yield potential & test weight that complement one another in terms of disease resistance, maturity, and susceptibility to spring freeze damage. If your choice for an early maturing variety is also one that reaches jointing very early in the spring, then you will **not** want to plant this variety early because you will be setting yourself up for potentially major losses from spring freeze damage. Instead, the first variety you plant in the fall should be the one that breaks dormancy latest in the spring, and the variety that breaks dormancy earliest

should be the last to be planted. This information is not presented in the variety performance report and may be difficult to find. If you are new to the variety, however, it pays to ask around and check with dealers, reps, and other growers so that you do not set yourself up for severe freeze injury.

Although conditions that led to the freeze damage of 2007 were extremely rare as noted above, in KY we often experience erratic fluctuations in weather, resulting in spring freeze injury, or other environmental related problems. So how does a grower use UK's variety performance data in choosing wheat varieties? While the decision will never be simple, it can be made easier by following several principles which we often cite in these newsletter articles, at meetings and field days.

Multi-year / Multi-location Data

While many growers ask about the variety that looked best in this year's test it is more useful to know which varieties have performed well over a range of conditions. When interpreting the results in the variety performance report, it is important to note that the yield of a variety is relative and should only be compared with yields of other varieties in the same test or within the same analysis across locations. The overall state summary provides performance data across test locations / years. It provides the best estimate of varietal performance, particularly the 2 and 3 year averages. When selecting varieties, growers should utilize data from the overall state summary, as well as their regional test and determine which varieties performed well both in their regional test, as well as across all test locations/years. After identifying a group of varieties with high yield potential, varietal selection can be based on secondary characteristics such as test weight, straw yield potential, maturity, height, or disease reaction.

To emphasize the importance of environmental variability and the use of multi year data across different agroclimatic regions of KY, the grower should recall the following: 2007 – wet fall delayed planting, record high temperatures in March followed by record lows in April resulted in severe freeze damage, hot dry weather during grain fill; 2006 - drought-like conditions throughout planting period affected emergence, hard freeze in late February caused some lodging due to freeze-weakened stems, ideal conditions during grain fill, record yields; 2005- late planting, spotty stands, ideal conditions during May led to excellent yields; 2004 - good planting conditions, mild winter, severe pressure from BYDV and head scab. Wheat varieties that performed well under these conditions are more likely to perform well again. For growers who want to try a new variety, do not use a variety that has not been evaluated and if it has been tested for one year only, use the overall state summary table; we do not recommend using single year data from a single (regional) test. Additional variety performance data may be available from other (bordering) state variety testing programs. The UK Small Grain Variety Testing Pro-

gram website has links to other state variety testing programs at www.uky.edu/ag/WheatVarietyTest.

Sources of Information

In addition to the UK Variety Performance Report, growers should investigate other sources of information. It is very difficult to adequately sample all of the micro-environments in our state in the variety testing program. If your neighbor, who has similar soil types and a similar management style to yours, has had good success in growing a certain variety, you may want to give it a try on a small part of your acreage. Seed companies, consultants and agribusiness dealers have trials around the state; see if you can get a copy of their data. Likewise, it may be useful to access data from other state variety testing programs to determine how broadly adaptive a variety is. The ultimate decision is yours, and you must evaluate the information, testing conditions, and the source of the data.

Economic Analysis

Farmers are always interested in high yields, but the highest yielding variety may not always be the most profitable. One needs to consider other economic factors such as disease susceptibility (may require fungicides), lodging (costs more to harvest), late maturity (delays soybean planting), potential straw yield as a secondary commodity and low test weight (discounts at the elevator). All of these factors require study to determine the most profitable varieties for your operation. The potential for maximum productivity and profitability begin with variety selection.

most Kentucky soils is denitrification which is simply microbiological conversion of nitrate nitrogen back to atmospheric nitrogen. This conversion happens only when the soil is saturated, so a wet winter will likely mean that very little of the residual nitrogen will remain for wheat or other spring crops. If on the other hand, we continue to have dry conditions then we may need less than the recommended rate of nitrogen for wheat in the spring.

If you would like analytical confirmation of adequate nitrogen levels, most private soil testing laboratories offer nitrate analysis. Because nitrate is mobile in the soil profile the core should be collected at least to 12 inches deep. The results can be converted to pounds per acre by multiplying the parts per million nitrate nitrogen (NO₃-N) by 0.3 and then the depth the sample was collected in inches. For example, a sample collected to a depth of 12 inches had 10 ppm NO₃-N. The calculation is $10 \times 0.3 \times 12 = 36$ lbs of NO₃-N per acre. Nitrogen in the organic form or in the ammonium form is not included in the analysis. The same analysis can be repeated in the spring to calculate the amount of residual nitrogen remaining. Levels of NO₃-N below 10 ppm, for a 12 inch sample depth collected in the spring, is considered to be at background or natural levels, so nitrogen fertilizer would be added at recommended levels in this range.

Given the high price of nitrogen, farmers should be striving to get the most out of their fertilizer investment. Fall nitrogen applications on wheat, especially after drought conditions, is no place to invest.

FALL NITROGEN NOT NEEDED FOR WHEAT

Greg Schwab and Lloyd Murdock
Extension Soils Specialists

Under normal conditions, the University of Kentucky does not recommend fall nitrogen fertilization of wheat. While the plant visually responds to fall nitrogen, research data shows that this response is not reflected in a higher grain yield. In a drought year, N applications on wheat make even less sense. Because of the severe water limitations, the corn plant was unable to produce up to genetic yield potential over much of Kentucky. Nitrogen that would have been taken up in the plant under normal growing conditions was left in the soil. This residual nitrogen will be immediately available to wheat planted this fall. In addition to the residual nitrogen available, there will also be less corn residue to decompose further reducing the need for fall nitrogen.

Any of the residual nitrogen that is not taken up by the wheat plant this fall will be subject to losses through the winter months. The primary nitrogen loss mechanism in

YIELD OF NO-TILLAGE WINTER WHEAT AFTER SURFACE AERATION/HARROW TILLAGE OF THE PREVIOUS CORN CROP'S RESIDUES

John Grove, Research Soil Fertility Specialist

There has been considerable interest in reducing the negative impact of heavy corn residues in the establishment of no-till wheat. Producers have chopped, disked and plowed corn residues in previous attempts at corn residue management. The latest tools being used for this are rolling aerators, used mostly in pasture and turf areas and rolling tine harrows (Phoenix or Phillips harrows). Our objective was to determine the impact of surface aeration or aeration/harrow tillage on the yield of otherwise no-tillage wheat.

We conducted two field experiments, for three years (2005, 2006 and 2007), at the Spindletop research farm in Fayette County, Kentucky. The soils (Loradale and Maury) were both well drained silt loams and the previous crop was always corn. The residues were evenly distributed with a hay tedder prior to the aeration treatments. A Genesis Tillage II unit equipped with helical tines and

a Phoenix harrow was used to make the aeration treatments. The helical aerator was only gently angled, giving a "passive" pass over the corn residues, but clearly pushed a portion of the residue into the soil. On the Loradale soil there was one aeration tillage treatment with the Phoenix harrow engaged and another with the harrow disengaged. On the Maury soil both aerator and harrow were engaged in the tillage treatment. There was an undisturbed no-tillage treatment at both locations. Either Southern States 560 or 8302 wheat was planted at 40 seed/ft² using a Lilliston 9680 no-till drill in middle to late October of each year.

No-till wheat yields were good in 2005, excellent in 2006 and fair in 2007 (Table 1). Frost damage was evident in 2007, on both soils. Each year, yields were generally better on the Loradale soil. Aeration plus harrowing resulted in small but significant yield differences in only two of the six site-years (Loradale – 2005 and Maury – 2006). There was no relationship between the yield response, or lack thereof, and a site-year's average yield level (not shown). The low probability of a yield benefit to this practice suggests that improved no-till wheat establishment is more likely with greater attention to: a) uniform corn residue distribution during corn harvest; and b) no-till drill performance during wheat planting.

PREEMERGENCE RYEGRASS CONTROL IN WHEAT

James R. Martin, Extension Weeds Control Specialist

Finesse, Hoelon, and Prowl H2O are herbicides labeled for preemergence control of Italian ryegrass in wheat in Kentucky. As a general rule they are not as effective compared with most postmergence herbicides used in wheat. However, when used as a part of a planned program in conjunction with a postmergence herbicide, they increase the likelihood of achieving season-long control of ryegrass. This strategy also allows growers the opportunity to involve multiple modes of action as a means of limiting the development of herbicide-resistant biotype of ryegrass.

The success of a soil-residual herbicide is dependant on rainfall within 7 to 10 days following application. Finesse and Prowl H2O need to be applied before ryegrass emerges; whereas, the high rate of Hoelon is capable of providing preemergence and postmergence control of ryegrass.

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Information on using preemergence herbicides in wheat in Kentucky is summarized in the following table on the next page.

Table 1. No-Till Wheat Yield Response to Surface Aeration/Harrow Tillage of the Previous Corn Crop Residues

Year	Aeration? Harrow?	No No	Yes No	Yes Yes	Yearly Average:
Grain Yield (bu/acre)					
Loradale Silt Loam					
2005		69.0b	77.7a	72.9ab	73.2
2006		90.8a	92.8a	91.0a	91.5
2007		56.0a	56.0a	56.9a	56.3
Aeration/Harrow Average		71.9a	75.5a	73.6a	
Maury Silt Loam					
2005		66.4a		61.8a	64.1
2006		70.2b		74.0a	72.1
2007		46.4a		47.5a	46.9
Aeration/Harrow Average		61.0a	61.1a		

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PREEMERGENCE RYEGRASS CONTROL IN WHEAT

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HERBICIDE	RATE	COST/A ¹	REMARKS
<p>FINESSE (chlorsulfuron + metsulfuron)</p>	<p>0.5 oz/A</p>	<p>\$7.50/A</p>	<ul style="list-style-type: none"> • Apply after planting but before wheat and ryegrass emerges. Crop injury may occur if wheat is planted less than 1" deep. • Provides 70-80% control when applied alone. • Will not control ALS resistant biotypes of ryegrass. • Allow a minimum rotation interval of 6 months for STS soybeans and 18 months for non-STs soybeans when soil pH is ≤ 7.9.
<p>PROWL H2O (pendimethalin)</p>	<p>1.5 pt/A to 2.5 pt/A</p>	<p>\$ 5.75/A to \$ 9.50/A</p>	<ul style="list-style-type: none"> • Apply after wheat emergence from 1- leaf stage but before flag leaf is visible. Plant wheat seeds 0.5 to 1.0 inch deep to limit risk of crop injury. Prowl H2O will not control emerged ryegrass. • Provides 50% ryegrass control when applied alone and up to 97% control when Prowl H2O is applied preemergence followed by a labeled postemergence herbicide. Tank mix with a postemergence ryegrass herbicide if ryegrass is emerged at time of Prowl H2O application. • Harvest restrictions: <ul style="list-style-type: none"> - Do not apply within 60 days of harvest of grain or straw. - Do not apply within 28 days of harvest of wheat hay. - Do not apply within 11 days of harvest of wheat forage. • Soybeans may be planted following wheat.
<p>HOELON (doclofop)</p>	<p>2.67 pt/A</p>	<p>\$25.00/A</p>	<ul style="list-style-type: none"> • Apply before or after wheat emergence but before first node (jointing). Hoelon will control ryegrass before plant emergence or emerged plants up to 2 tillers. • Provides approximately 80-100% control when applied preemergence to ryegrass. • Will not control ACCase-resistant biotypes of ryegrass. • Harvest restrictions: <ul style="list-style-type: none"> - Do not graze within 28 days after application. - Do not harvest forage, hay, or straw before grain harvest. - Do not apply within 77 days of harvest. • Soybeans may be planted following wheat. • Do not make more than one application per season. • Classified as a Restricted Use Pesticide.

¹ Cost does not include expenses associated with application.

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