

# KENTUCKY WHEAT VARIETY TESTING AND 2017 FREEZE DAMAGE

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Since 2013, Kentucky wheat yields have averaged 75.2 Bu/A across the state. In 2007 and 2012 however, Kentucky yields averaged 48 and 63 Bu/A, respectively. These lower yields were the result of a spring freeze event which damaged the crop. Reported yields would likely have been even lower had a portion of the damaged crop not been terminated in favor of planting corn or full season soybeans.

In 2017, Kentucky also experienced a spring freeze event, but the average state yield was 77 Bu/A. It is understood that the degree of freeze damage is associated with the stage of crop development at the time of freeze, how low temperatures were, the duration at which temperatures stayed low, and if the crop was protected by snow cover. In 2017, temperatures dropped to the mid-teens throughout Kentucky on March 15 and 16th, with no snow cover. Growth stage was advanced (approx. Feekes 6-8) following a period of warmer than average temperatures. Based on these conditions, the crop should have suffered severe freeze damage, as had been observed in other years, but much of the crop appeared to only have suffered minimal to moderate damage.

To better understand why the 2017 freeze did not destroy or severely damage the wheat crop, freeze damage ratings were taken at the UK wheat variety test near Trenton, KY. Most of the seven variety test locations showed minimal to moderate freeze damage among varieties. The Trenton test however, had moderate to severe visual damage among varieties. Some plots showed sporadic head damage, but in most cases the degree of premature lodging was widely indicative of freeze injury to the stem. Freeze damage ratings were taken on May 10th (Scale: 1=no damage; 9=severe damage). The

test was at growth stage Feekes 7-8 at the time of freeze.

103 wheat lines were planted under conventional tillage in 4 replicated small plots on October 17th, 2016 at the Trenton, KY test location. This test experienced similar temperatures as other areas in western Kentucky, but sustained much more freeze injury. Trenton test yields averaged 78.5 Bu/A, which was lower than the other 6 UK variety test locations (avg=86.4 Bu/A) and ranged from 40.9 – 101.2 Bu/A (Figure1). As expected, varieties with lower freeze damage ratings showed higher yields.

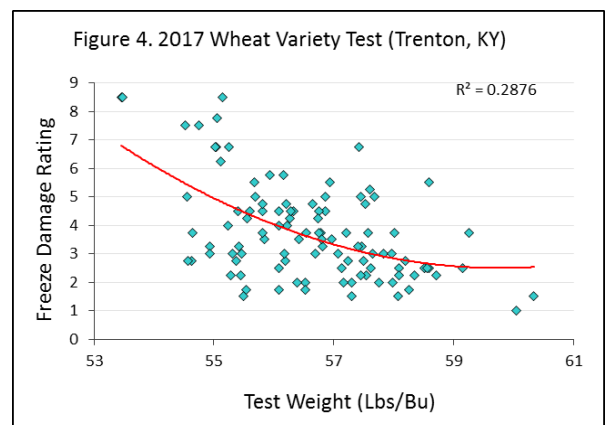
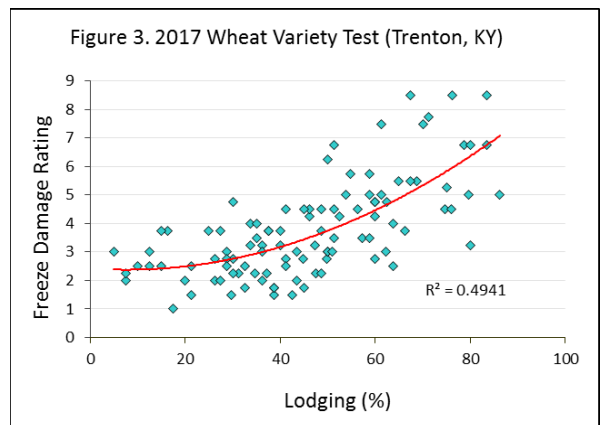
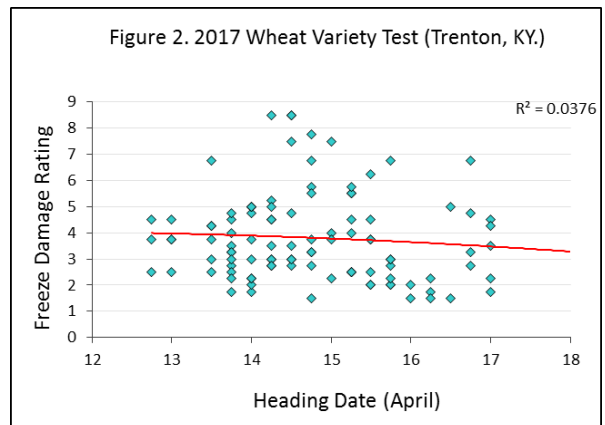
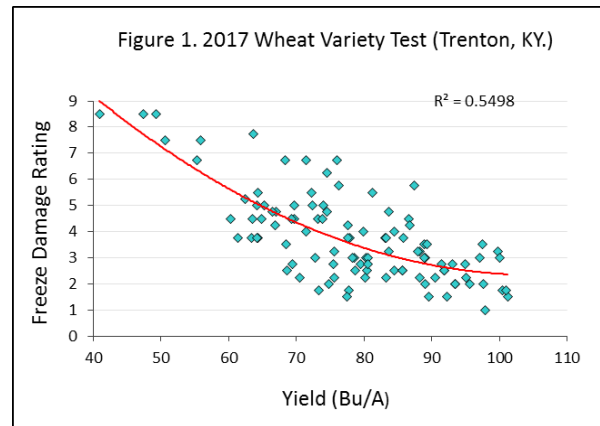
It is known that earlier heading (maturing) varieties are advanced in reproductive development and are potentially more susceptible to freeze damage. Likewise, earlier planted wheat may be more susceptible to spring freeze injury than late planted wheat. This was observed in the 2007 freeze, where varieties at advanced growth stages (i.e. Feekes 8-9 vs. 6-7) during the freeze event sustained much greater injury and yield losses. In 2017, it was surprising to see that heading date had no effect on the freeze damage rating within the test (Figure 2). Trenton test heading dates ranged from April 12th to April 17th, which was approximately 2 weeks earlier than the 5 year state average of variety test locations. Kentucky's wheat crop matured about one week earlier than normal and higher than expected yields (at this location and across the state) were in part, likely a result of this extended grain filling period.

Plant lodging at the Trenton site was high averaging 46% and ranged from 5-86%. As freeze damage increased, plant lodging also

increased (Figure 3). This was expected as damage ratings were primarily based on premature plant lodging visual estimates. Premature lodging associated with freeze damage this year was the result of a subtle type of freeze injury where the stem is damaged, but does not die. In this case, new tillering and regrowth are not forced and the head remains viable. It was reported that examination of plants in this region one week following the freeze, that the heads appeared to be viable, but the stem internodes were damaged though typically not killed. This unique type of stem damage is evident by its abnormal distorted shape from a typical round profile to a more oval or elliptical shape (Image 1). This type of damage allows the stem and head to develop normally, but weakens the stem and premature lodging (latent freeze lodging) can occur following wind, rain or just the weight of the developing head. In this case yield losses are more the result of premature lodging issues rather than head death or losses associated with regrowth following complete stem death.

Grain test weight tended to be reduced as freeze damage increased (Figure 4). Test weights averaged 56.6 Lb/Bu, which was lower than the average of the other 6 variety test locations (58.5 Lb/Bu). Reductions in test weights were likely the result of plant lodging and impacts of heads being near soil surface or buried under other plants.

According to the Wheat Freeze Injury Table in UK ID-125: A Comprehensive Guide to Wheat Management in Kentucky, the wheat crop should have experienced death of growing point, splitting and bending of lower stem and leaf burning at temperatures below 24°F at Feekes 6-7 (Table 1). With Kentucky's wheat crop being at stage Feekes 6-8 and overnight temperatures persisting near 15°F over 2 nights, it is difficult to explain why the crop did not suffer much greater injury. Variety test results from the Trenton location provide some insight as to how freeze injury is related to changes in test weight, lodging, yield, and heading date, but do not explain why the expected greater level of stem and head primordia destruction did not occur.



**Table 1. Freeze Injury in Wheat\*.**

<u>Growth Stage</u>	<u>Feekes</u>	<u>Approx. Injurious Temp. (2hrs)</u>	<u>Primary Symptoms</u>	<u>Yield Effect</u>
Tillering	1 - 5	12°F	Leaf chlorosis; burning of leaf tips; silage odor; blue cast to fields	Slight to moderate
Jointing	6 - 7	24°F	Death of growing point; leaf yellowing or burning; lesions, splitting, or bending of lower stem; odor	Moderate to severe
Boot	10	28°F	Floret sterility; spike trapped in boot; damage to lower stem; leaf discoloration; odor	Moderate to severe
Heading	10.1-10.5	30°F	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration; odor	Severe
Flowering	10.51-10.54	30°F	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration	Severe
Milk	11.1	28°F	White awns or white spikes; damage to lower stems; leaf discoloration; shrunken, roughened, or discolored kernels	Moderate to severe
Dough	11.2	28°F	Shriveled, discolored kernels; poor germination	Slight to moderate

\* Source: UK ID-125; A Comprehensive guide to wheat Management in Kentucky. [www.ca.uky.edu/agc/pubs/id/id125/id125.pdf](http://www.ca.uky.edu/agc/pubs/id/id125/id125.pdf)



**Photo courtesy of Barton Fogleman**