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Possible Wheat Damage from Cold Temperatures April 11 and 12, 2012

**Jim Herbek — Extension Grain Crops Specialist
Lloyd Murdock — Extension Soils Specialist**

TEMPERATURE MEASUREMENTS

Minimum temperatures were taken inside of wheat canopies for the morning hours of April 11 and 12. The temperatures were taken at 4 inches above the ground and at 18 inches above the ground (head height). The official minimum reported air temperature taken 5 feet above the ground is also shown in the following table. The temperatures were taken in tilled and no-tilled wheat plantings and there was no difference in the measurements.

The temperatures were coldest at 18 inches above the ground. These temperatures were below 30 degrees that would be expected to cause moderate to severe damage at the heading (Feekes 10) and flowering (Feekes 10.5) stages of growth. These temperatures could result in severe damage to the developing heads to wheat if the temperatures stayed this low over 2 hours.

Temperatures varied across the state and will also vary even within short distances. It would probably be a safe bet to expect the temperatures in your wheat field close to the ground to be at least 3 degrees colder than the temperature reported at the weather station in your area. Temperatures will also vary within a field with low areas having the lowest temperatures. Any damage would be most prevalent in these low areas.

Temperatures in Wheat Fields at Different Heights and Locations at Princeton, Ky on April 11 and 12, 2012

<u>Measurement Location</u>	<u>Temperature (F°)</u>	
	<u>April 11</u>	<u>April 12</u>
4 inches above ground	29	28
18 inches above ground	27	26
Official air temp	32	30

OBSERVATIONS MADE ON APRIL 16

The recent freezing temperatures that occurred on April 11-12, 2012 (and possibly on April 7 in portions of the state) have caused much concern regarding the extent of the damage to the wheat crop. Three basic conditions must be present for freeze damage to occur to the wheat crop. These are: 1) The wheat plant must be at a sensitive stage of growth; 2) Temperatures must drop to a certain critical level at each stage of growth; and 3) The temperature must remain at the critical level for at least 2-3 hours. The first two criteria needed for freeze damage did occur during the period of April 11-12th. The majority of the wheat crop in West Kentucky was headed or flowering (i.e. these stages are most sensitive to freeze damage). Temperatures of below 30°F were recorded in the wheat canopy in fields at the UKREC (See Table). The third criteria needed (i.e. temperature remaining at the critical level for 2-3 hours) was difficult to discern whether the critical temperature level remained for more or less than 2-3 hours.

We inspected wheat at the UKREC in Princeton, KY on the morning of April 16 (4 days after the freeze event of April 12) to determine if an early assessment of freeze damage could be made. Observations were made on plants taken from wheat fields as well as on plants that were dug up after the freeze event of April 12 and placed in the greenhouse under favorable growing conditions. All of the wheat was completely headed at the time of the freeze. Some of the wheat was in the pollination/flowering stages, whereas other wheat had not yet begun to flower during the freeze events of April 11-12.

Assessments were first made on the wheat plant itself. No obvious freeze damage symptoms were noted on the leaves (discoloration) nor was any damage observed on the stems (discoloration, splitting of internodes, node enlargement), at least at the present time. However, this does not infer that some low-lying fields or portions of fields in the state did not incur some minor stem damage. For the most, it is likely that major, extensive stem damage did not occur.

The major concern was floret sterility (i.e. pollen had been killed and no kernel development would occur). We examined the wheat heads closely for damage. No obvious, visible freeze damage symptoms (white awns or spikes) were observed on the heads. For those heads that were flowering, yellow anthers (pollen producing structures) were protruding from the florets. Yellow anthers indicate viable pollen has recently been shed inside the floret. After 1 or 2 days, these anthers will desiccate and turn white. Further close inspection of individual florets indicated a small kernel was starting to develop. This is a definitive indication that pollination occurred and the pollen and anthers were not killed by freezing temperatures.

Florets of wheat heads that had not yet flowered were also examined. We found these florets to contain healthy, green anthers which are an indication they were not damaged and will produce pollen before they emerge from the florets as viable, yellow anthers.

Overall, based on our assessment of wheat at the UKREC, there was little, if any, freeze damage that occurred to the wheat. The main concern was floret sterility (i.e. pollen killed resulting in no kernel development). However, our assessment of viable anthers and beginning kernel development indicate no extensive freeze damage occurred. Why possibly did we escape extensive freeze damage when the wheat was at very sensitive growth stages (heading and flowering) and critical temperatures of 30°F or below occurred? The most plausible explanation is that the temperatures did not remain at the critical levels for damage very long. Generally, the critical freezing temperature must remain for at least 2-3 hours duration for extensive damage. This apparently did not occur at this location.

It is also noted that temperatures will vary between locations and within the same field. So there may be small areas within some fields in this area that may have received some freeze damage.

OTHER LOCATIONS ACROSS THE STATE

The official temperatures from the Mesonet stations across the state indicate that the low temperature on the morning of April 12 at a few locations were 2 to 3 degrees colder than those at Caldwell County. Most of Western Kentucky was similar to Caldwell County and based on this we feel that the freeze damage was minimal in most of the fields in Western Kentucky.

In some other locations in the Southeastern part of the state, colder temperatures were recorded (25°F in Cumberland County and 27°F in Clinton County). There are also reports from this area that some damage is beginning to be seen. The table below gives visual symptoms at different stages of growth which may help in diagnosing any damage. A better assessment can be made 7 to 10 days after the freeze. At that time, kernel development or any damage will be more obvious.

Freeze Injury in Wheat			
<u>Growth Stage</u>	<u>Approximate Injurious Temp (two hours)</u>	<u>Primary Symptoms</u>	<u>Yield Effect</u>
Tillering (1-5) ^a	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—.5)	30°F	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration	Severe
Flowering (10.51-.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

^a Numbers in parentheses refer to the Feekes scale