Issue 556

K-STATE Research and Extension

## Extension Agronomy

# eUpdate

*03/21/2016*

These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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## 1. Potential for injury to wheat in Kansas from below-freezing temperatures

**How cold did it get?**

Minimum air temperatures reached very low levels on March 19th and 20th across Kansas. Most of the state was exposed to minimum temperatures below freezing (32°F), with the exception of small isolated pockets. While the western half of the state had minimum temperatures below 24°F (the threshold below which there can be damage to the wheat's growing point when at jointing), the western fifth of the state had minimum temperatures in the single digits (Figure 1).

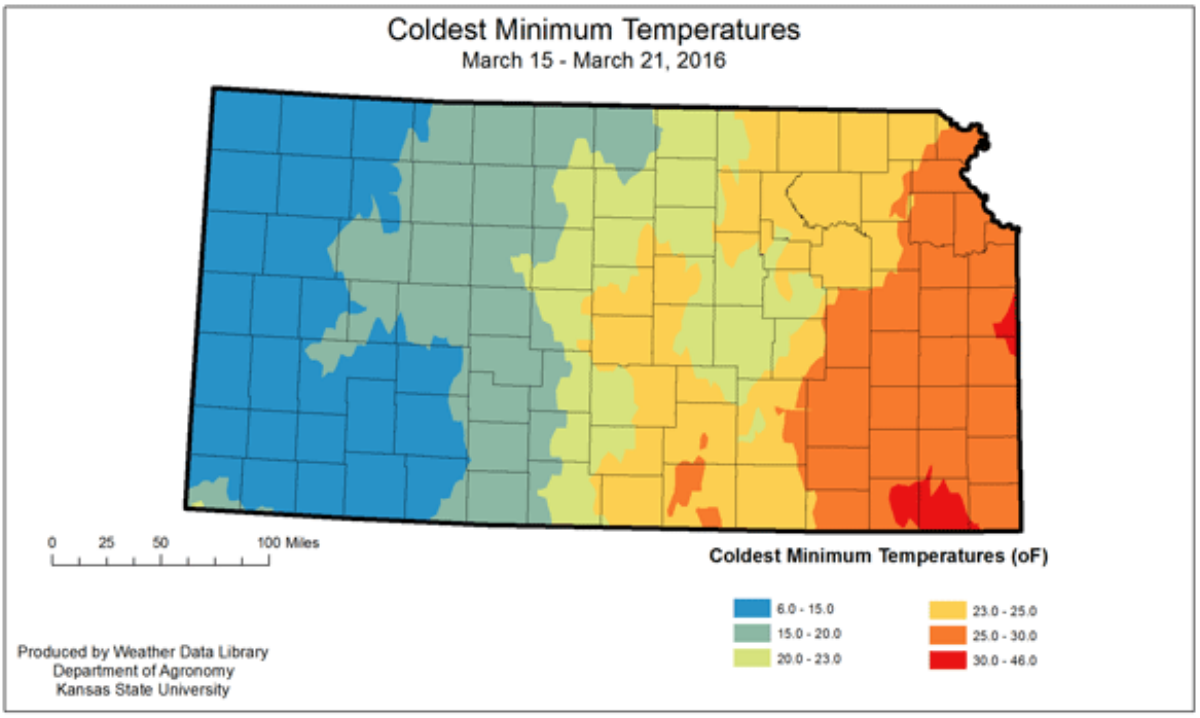


**Figure 1. Coldest minimum temperatures measured in the period March 15 – March 21.**

**How long were these cold temperatures sustained?**

The risk of damage to wheat is a function of the minimum temperature and duration of time spent a potentially damaging temperatures. In this case, the number of hours below 24°F between March 18th and March 21st varied according to geographical location within Kansas. Counties along the western border, neighboring Colorado, were exposed to as many as 27 hours below 24°F over the course of the last four nights (Figure 2). In general, the western half of the state had at least 11.4 hours of temperatures below 24°F. The number of hours sustained below 24°F decreased in the east, and many counties in the eastern fifth of the state did not have a single hour below 24°F.

The coldest night in the period was on March 19-20. Temperatures were below 24°F in that night for as much as 12.3 consecutive hours (Figure 3). The western third of the state, where about 40% of the wheat is grown, experienced colder temperatures for longer durations than other areas of the state.

While the temperatures this cold are not uncommon for this time of the year, the wheat crop is well advanced throughout the state this year due to a relatively warm winter, and producers who have jointed wheat might be concerned with possible damage to their crop.

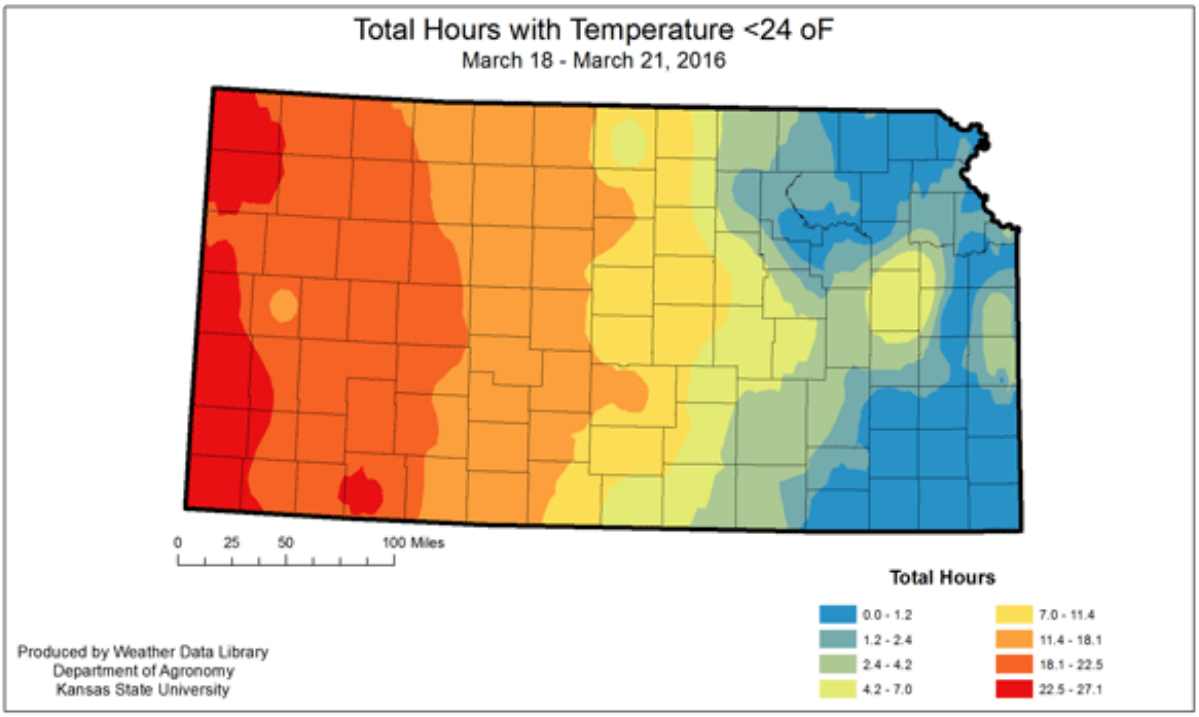


**Figure 2. Total hours with temperature below 24°F in the period March 18 – March 21.**

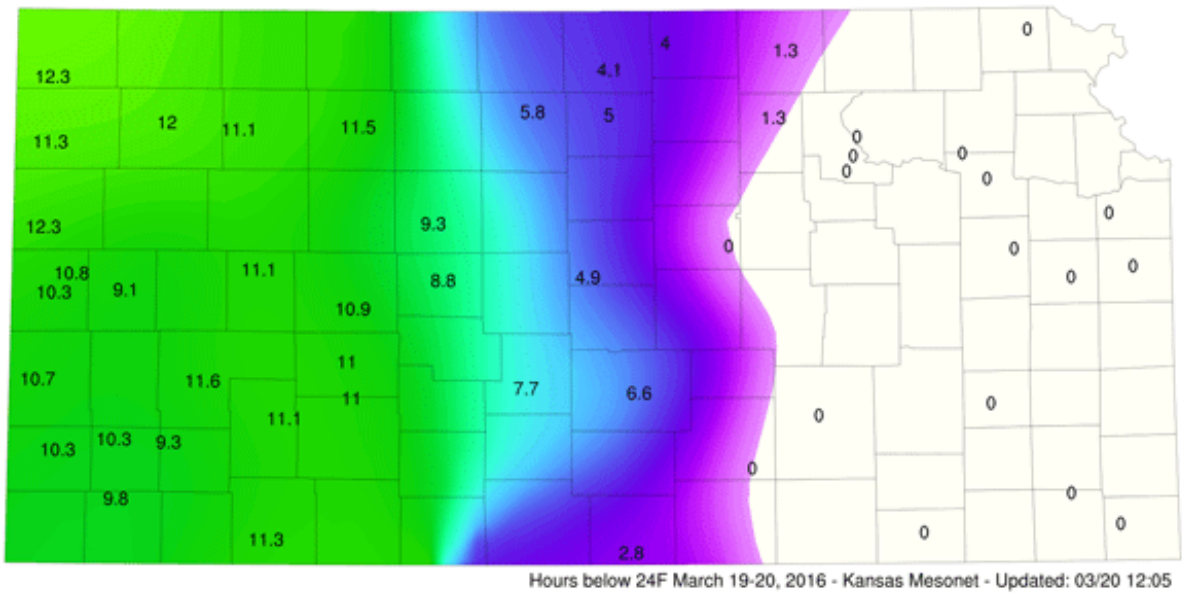


**Figure 3. Total hours with temperature below 24°F on the 24-hour period March 19 through 20.**

**Wheat growth stage**

Figure 4 shows the estimated average wheat developmental stage based on i) reports from producers, county extension agents, area agronomists, and crop specialists; and ii) accumulated growing degree days from January 1st to date. The actual wheat developmental stage is field-specific, varying within county by variety and planting date (among other management practices). Therefore, there may be differences between the growth stages estimated in Figure 4 (county estimate of wheat development) and actual wheat development in individual fields.

Different stages of wheat development vary in their sensitivity to cold temperatures. In stages in which the developing head is already above ground (jointing or later stages), cold temperatures can damage the developing wheat head. The threshold below which economic damage can occur when wheat is jointed is approximately 24°F. Additionally, temperatures need to be sustained at levels below 24°F for a minimum of two-to-three hours to be potentially damaging to the developing head.

The combined information from Figures 1, 2, and 3, suggests risk of freeze injury in south central Kansas, particularly in Harper, Barber, and Sumner counties, and possibly surrounding regions. These counties are far enough west to be exposed to temperatures below 24°F for a minimum of 4 hours while having a more advanced stage of wheat (beyond jointing in the majority of the county). Counties in southwest Kansas bordering Oklahoma might also see damage in the more advanced fields that have the growing point above ground due to the long exposure to temperatures below 24°F.

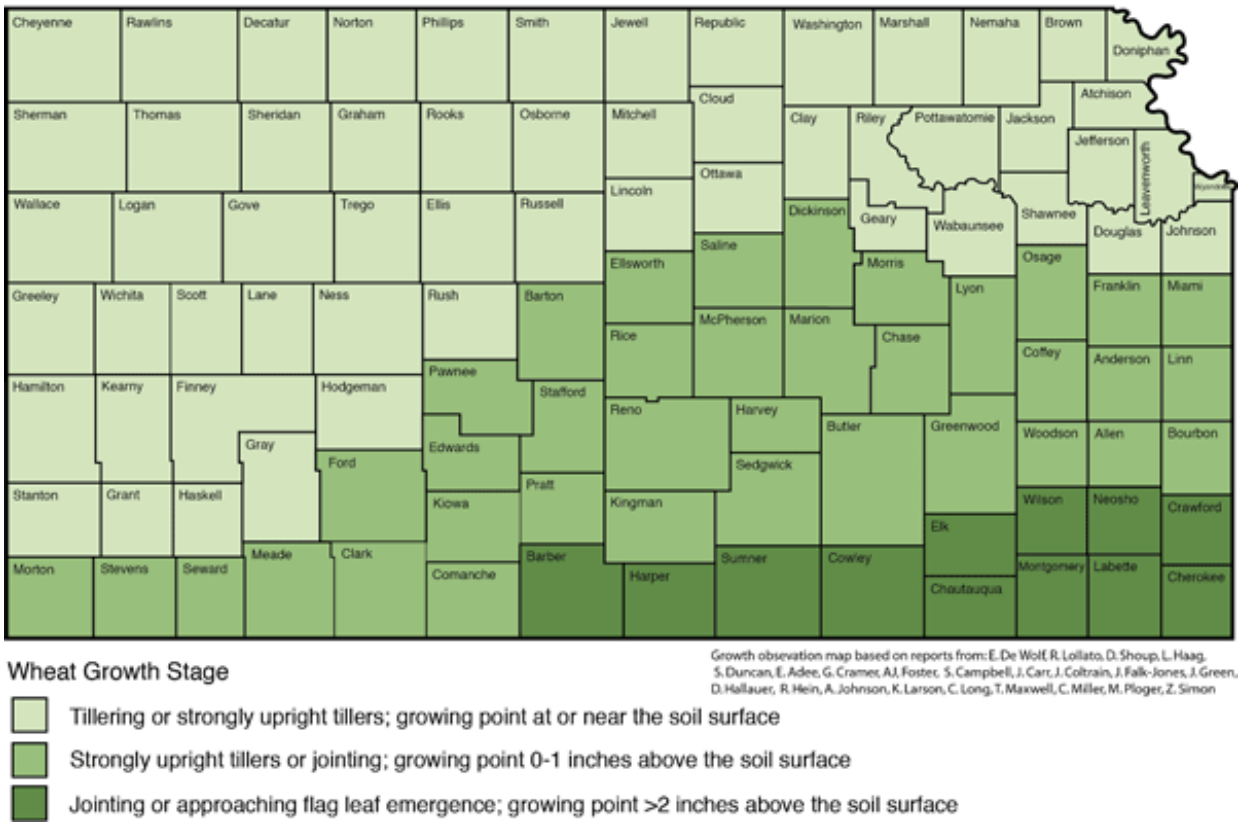


**Figure 4. Estimated wheat growth stage by county. Actual growth stage will vary within county and depend on variety and planting date.**

Although other scattered cases of freeze injury might be observed in more advanced fields throughout Kansas, the risk of severe freeze injury in other areas of the states appears to be low because either i) the crop is not as advanced as in the aforementioned regions; or ii) it did not get cold enough to sustain damage; or iii) a combination of both.

**Soil temperatures**

The extent of a possible freeze damage to the developing wheat crop will depend on several variables, including canopy density, soil moisture, crop residue, and wind speed (for more information, please refer to K-State eUpdate Issue 555 of March 18th, 2016, "Diagnosis of late winter/early spring freeze injury on wheat"). As a result of so many interacting variables, evaluating only air temperatures may not completely reflect the conditions experienced by the wheat crop. In this situation, soil temperatures can help determining the extent of the cold stress at crown and lower canopy levels, especially for crops in which the growing point is still below ground or just starting to elongate.

While air temperatures reached critical levels for damage to the developing wheat head, soil temperatures at 2" depth were above 32°F all across western Kansas, and in most cases above 40 °F in other regions of the state. Higher soil temperatures may have helped buffering the cold air temperatures experienced, minimizing possible injury to the wheat crop especially for crops still in

developmental stages where the developing head is below ground and therefore insulated (Feekes 3, 4, or 5). For wheat that has already jointed or more advanced, producers will be able to assess the damage in the next few days.

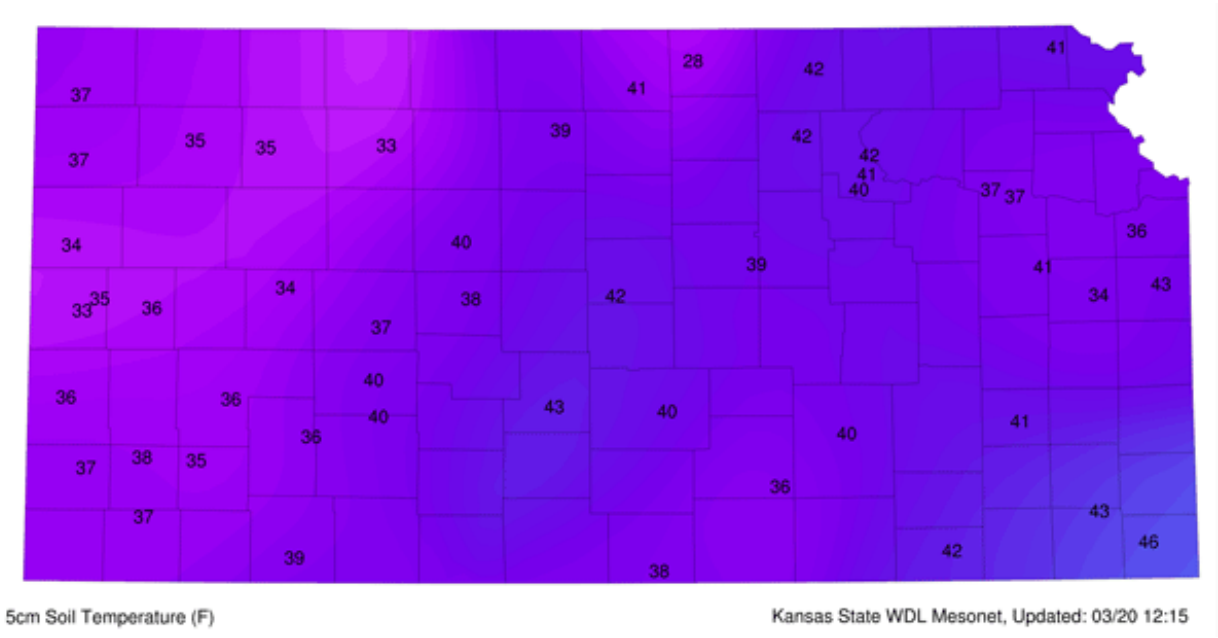


**Figure 5. Minimum 2" soil temperature as of midnight March 20, 2016.**

**What to look for?**

Leaf tissue. The extreme low temperatures measured over the weekend will give the crop a rough look for a few weeks. The first apparent sign of freeze injury will be leaf dieback and senescence (Figure 6), which should occur across most of the state regardless of damage to the actual growing point. Existing leaves will almost always turn bluish-black after a hard freeze, and give off a silage odor. Those leaves are burned back and dead, but that in itself is not a problem as long as newly emerging leaves are green. Provided that the growing point is not damaged, the wheat will recover from this damage with possibly little yield loss. If newly emerging leaves are nice and green, that probably indicates the tiller is alive. If newly emerging leaves are yellow, that probably indicates the tiller is dead.

**Figure 6. Leaf burn from freeze damage. By itself, this is cosmetic damage only. Photos by Jim Shroyer, K-State Research and Extension.**

Developing head. After a few warm days, the color of the developing head or growing point in wheat that has jointed will be the most important indicator of possible freeze damage. As long as heads are light green, crisp, and turgid, the head in that tiller is fine. If the head is whitish, flaccid, and mushy, it has died.

Stem integrity. If the wheat lodged immediately after the freeze, that indicates stem damage. Later tillers may eventually cover the damaged tillers. Even if there is no immediate lodging, look for lesions or crimps anywhere on the stems. If these symptoms are present, it usually means the wheat will lodge at some point during the season. If the stems look undamaged, that's a good sign.

New tillers. Where stems and/or growing points were killed by the freeze, new tiller growth (coming from the crown area) will occur. In many cases, new tiller growth can be observed even when the stems do not show any symptoms of freeze damage for some time. In those cases, the first sign that the tillers are dead is the sudden growth of new tillers at the base of the plant. If secondary tillers may begin growing normally and fill out the stand, the wheat may look ragged because the main tillers are absent. Enough tillers may survive to produce good yields if spring growing conditions are favorable. If both the main and secondary tillers are injured, the field may eventually have large areas that have a yellowish cast and reduced yield potential.

**Potential future problems?**

If the primary tillers have been affected and yield will rely on secondary tillers, current pest and disease problems may be of greater concern because the newly emerging tillers will be exposed to them from the start. Producers should scout for leaf and stripe rust, which have already been reported in the state, as well as for bird cherry oat aphids and other potential insect or disease problems on these late-developing tillers.

For more information on freeze damage to wheat, please see accompanying article here or publication "Spring Freeze Injury to Kansas Wheat", K-State Research and Extension publication C646, available at county and district Extension offices and on the Web at:
http://www.ksre.ksu.edu/bookstore/pubs/C646.pdf

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