



K-STATE
Research and Extension

Extension Agronomy

eUpdate

04/16/2018

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, 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 Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Update on recent cold temperatures: Risk of freeze injury to Kansas wheat	3
2. Update: Soil temperature variations and cold injury for corn.....	7

1. Update on recent cold temperatures: Risk of freeze injury to Kansas wheat

The weekend of April 14-16 brought, once again, cold temperatures that have potential to cause freeze injury to the 2018 wheat crop. Factors that influence the potential for freeze injury to wheat at any point in time include primarily:

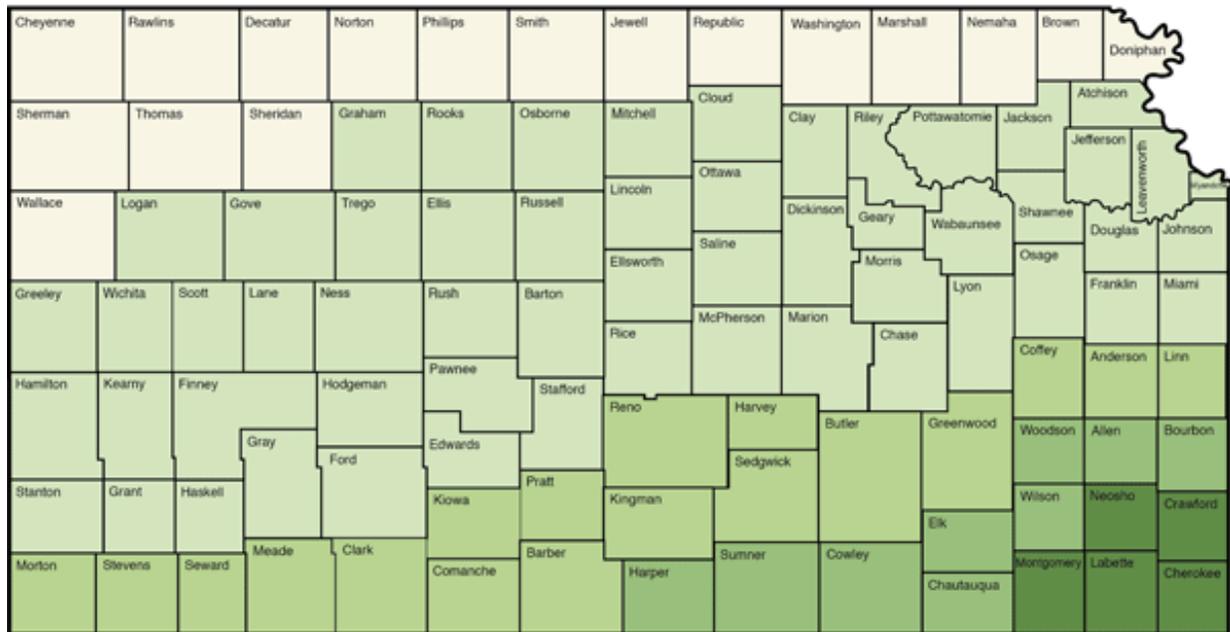
- Growth stage of the crop
- Air temperatures
- Duration of cold temperatures
- Soil temperatures
- Snow cover

Other factors, such as position on the landscape (low lying areas are at higher risk) and presence of residue covering the soil surface, might also impact the extent of freeze damage within a field. The challenge is to integrate all these factors into a reasonable estimate of freeze injury.

Based on simple wheat development models and observations from K-State Extension personnel, the wheat growth stage around Kansas ranges from tillering to Feekes 5 in the northwest part of the state, to flag leaf emergence in the southeast with a few reports of early-sown fields approaching boot in the southeast region (Figure 1). Most of the crop in south central Kansas is at the first or second node, and the crop is less developed as we move north and west in the state. For fields that have not jointed yet, the crop generally withstands temperatures lower than 20 degrees F fairly well, especially if the growing point is still below ground. This is the condition for most of northwest and northern Kansas. If the growing point is already above ground (first joint visible), wheat can sustain temperatures down to about 24 degrees F for a few hours. Temperatures below 24 degrees F for extended periods of time increase the risk of crop injury. Information from the [K-State Mesonet](#) indicates that air temperatures dipped below this 24-degree F threshold for at least a few hours in most areas of the state. Many areas of the state experienced more than five hours with air temperatures below 24 degrees F, which could cause damage to fields at the first node of development or more advanced stages. More advanced fields, such as second node to flag leaf emergence (many fields in southeast Kansas), are more sensitive to freeze injury and temperatures near 25 degree F can cause damage. Temperatures below this threshold were measured in southeast Kansas where the crop is most advanced.

Estimated Wheat Growth Stage

April 16, 2018



Growth observation map based on reports from R. Lollato, E. De Wolf, D. Shoup, L. Haag, S. Duncan, A. Foster, S. Blocker, M. Chamas, J. Coltrain, J. Coover, A. Esser, J. Falk-Jones, D. Hallauer, W. Hughes, T. Huta, A. Johnson, R. Ladd, C. Long, S. Lincoln, T. Maxwell, C. Miller, L. Russell, Z. Simon, K. VanSkike, S. Wick, M. Young

Wheat Growth Stage

- | | | |
|--|--|--|
| <input type="checkbox"/> Tillering or strongly upright tillers | <input type="checkbox"/> Flag leaf emergence or boot | <input type="checkbox"/> Dough or physiologically mature |
| <input type="checkbox"/> Strongly upright tillers or jointing (first node) | <input type="checkbox"/> Boot or flowering | |
| <input type="checkbox"/> Jointing (first node) or jointing (second node) | <input type="checkbox"/> Flowering or watering ripe | |
| <input type="checkbox"/> Jointing (second node) or approaching flag leaf emergence | <input type="checkbox"/> Watering ripe or milk | |
| <input type="checkbox"/> Approaching flag leaf emergence or at flag leaf emergence | <input type="checkbox"/> Milk or dough | |

Figure 1. Estimated wheat growth stage as of April 16, 2018, for the state of Kansas. Growth stage is estimated for each county based on temperatures accumulated in the season and adjusted by observations of crop stage by K-State personnel. Local growth stage may vary with planting date and variety. Map created by Erick DeWolf, K-State Research and Extension.

While soil temperatures can help buffer freezing air temperatures if the growing point is below ground or near the soil surface. The buffering capacity of warm soils decreases as the crop develops and the growing point moves further from the soil surface. Thus, we can expect positive effect of the soil temperatures in northern and northwest Kansas where soil temperatures were sustained above 34 degrees during the entire weekend and the crop is still at tillering through Feekes 5 stages of development. Soil temperatures can be viewed via the Kansas Mesonet here: <http://mesonet.ksu.edu/agriculture/soiltemp>. However, the more advanced crop in south central and southeast Kansas likely did not benefit as much from the buffering influence of warm soil temperatures. There was also minimal snow cover across the state to help insulate plants against the cold air temperatures.

Based on these factors, we estimate that the north and northwest portions of Kansas are at a low risk of freeze injury from the cold temperatures on April 14-16 (Figure 2). The risk of freeze injury increases as we move down a northwest – southeast transect. The greatest risk of freeze damage appears to be in the south central and southeast portions of the state where the crop is most advanced and temperatures were below the threshold for freeze damage.

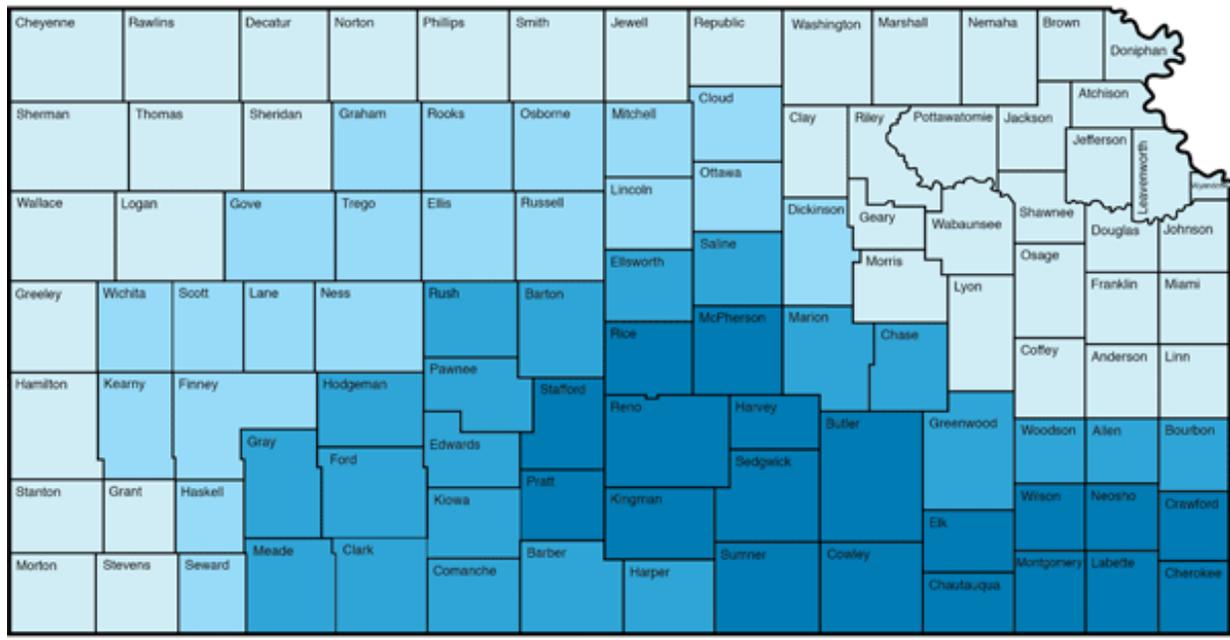
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Risk of Freeze Injury to Wheat

April 16, 2018



Risk map based on observations of wheat growth stage, snow cover, min. temperature and duration of temperature below 24 degrees. Kansas State University; E. De Wolf, R. Lofatto, M. Knapp, and C. Redman.

- Risk of Freeze Injury**
- Low risk
 - Moderate risk
 - Moderate/high risk
 - High risk

Figure 2. Estimated risk of freeze damage due to a combination of wheat growth stage sensitivity, lowest temperatures during April 14-16, 2018, number of hours below 24 degrees F during the same period, cumulative snowfall during the period, and soil temperatures at the 2-inch depth. Map created by Erick DeWolf, K-State Research and Extension.

Symptoms of freeze injury on foliage should occur over the next few days across the entire state. In most cases, however, this injury should not result in any long-term damage to the crop, especially if there is available moisture to help the crop recover the lost foliage. Freeze injury symptoms to the developing wheat head, such as a mushy, discolored/brown head, take slightly longer to be develop (10-14 days). Thus, growers with fields at advanced growth stages should check for potential injury to the developing head within this timeframe.

For detailed information on evaluating wheat for freeze damage, see the eUpdate article from Issue 683 on April 4, 2018, "[Diagnosing freeze damage to wheat](#)".

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2. Update: Soil temperature variations and cold injury for corn

Selection of the optimal planting date is one of the most critical factors in the decision-making process for producers. In making this decision, producers should consider soil temperatures rather than just calendar dates. After a very warm start to March, air temperatures across Kansas declined this past week.

For the week of April 10-16, the difference in maximum and minimum soil temperatures at 2- and 4-inch soil depths ranged from less than 10 to more than 40 degrees F (Figure 1). For example, in the northeast region, soil temperatures varied close to 30 degrees F; while in the southwest region, soil temperatures varied from 20 to more than 40 degrees F at the 2-inch soil depth (Figure 1; upper panel). Soil temperature variations for northwest and southeast areas of Kansas ranged from 20 to 30 degrees F (Figure 1; upper panel). Lower ranges of soil temperature fluctuations were experienced at the 4-inch soil depth, but were still from less than 10 to more than 30 degrees F (Figure 1; lower panel). The largest variation was observed in the south central part of the state (> 30 degrees F); while the lowest variation was recorded in small pockets within the northwest and southeast regions (<15 degrees F).

Daily soil temperature variation within the last week (7-day report) was recorded across Kansas for several locations (Figure 2), presenting variations around 20 degrees F. Soil temperatures were above 60 degrees F for Friday April 13 in several locations, suddenly dropping to at or less than 40 degrees F on Monday, April 16 (Figure 2).

As published in the eUpdate on April 13, 2018, cold temperatures can result in injury to the germinating seed as it is absorbing moisture – a problem called imbibitional chilling injury. When soil temperatures remain at or below 50 degrees F after planting, damage to germinating seed can occur.

Soil temperatures at the 4-inch depth during the first 24-72 hours after planting, when the kernels imbibe water and begin the germination process, are critical. Kernels naturally swell when hydrating (taking in water). If the cell tissues of the kernel are too cold, they become less elastic and may rupture during the swelling process, resulting in “leaky” cells. Injury symptoms may include swollen kernels that fail to germinate or aborted growth of the radicle and/or coleoptile after germination has begun.

Chilling injury can also occur following germination as the seedlings enter the emergence process, reducing plant metabolism and vigor, potentially causing stunting or death of the seminal roots, deformed elongation (“corkscrewing”) of the mesocotyl, leaf burn, and either delayed or complete failure of emergence, often leafing out underground. Chilled seedlings may also be more sensitive to herbicides and seedling blights.

Before making any decisions, fields should be scouted 4-7 days after the cold weather occurred since the extent of the damage and potential for new growth will be evident during this time.

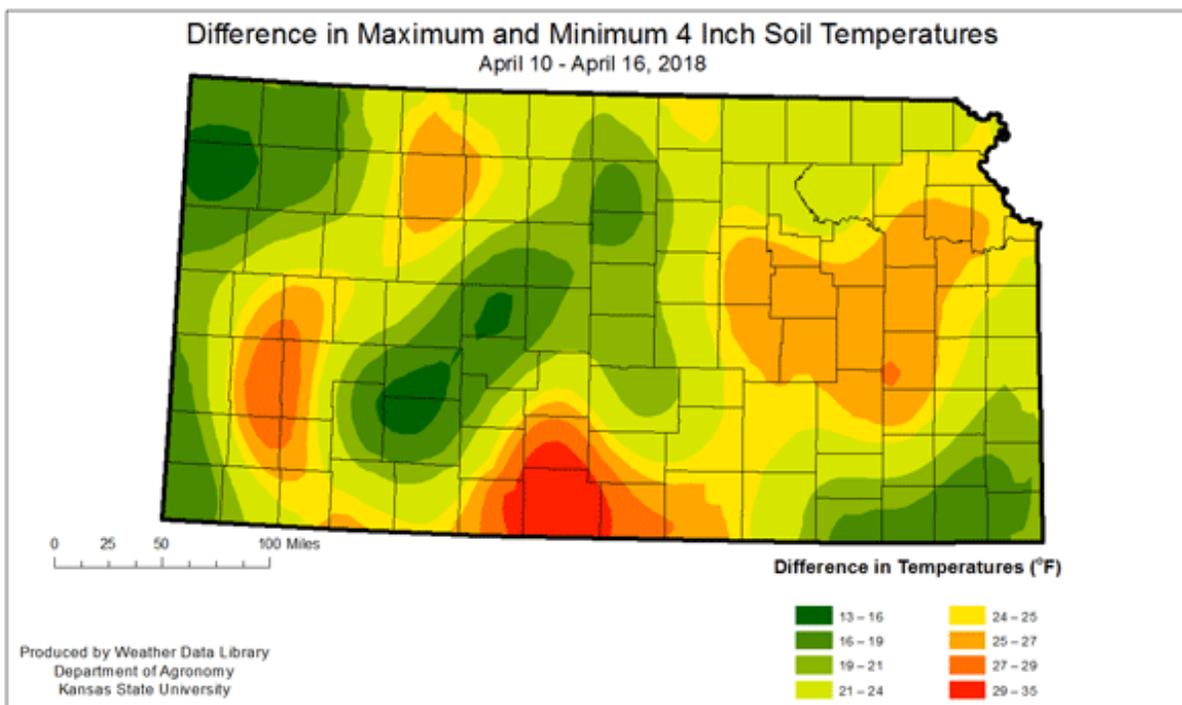
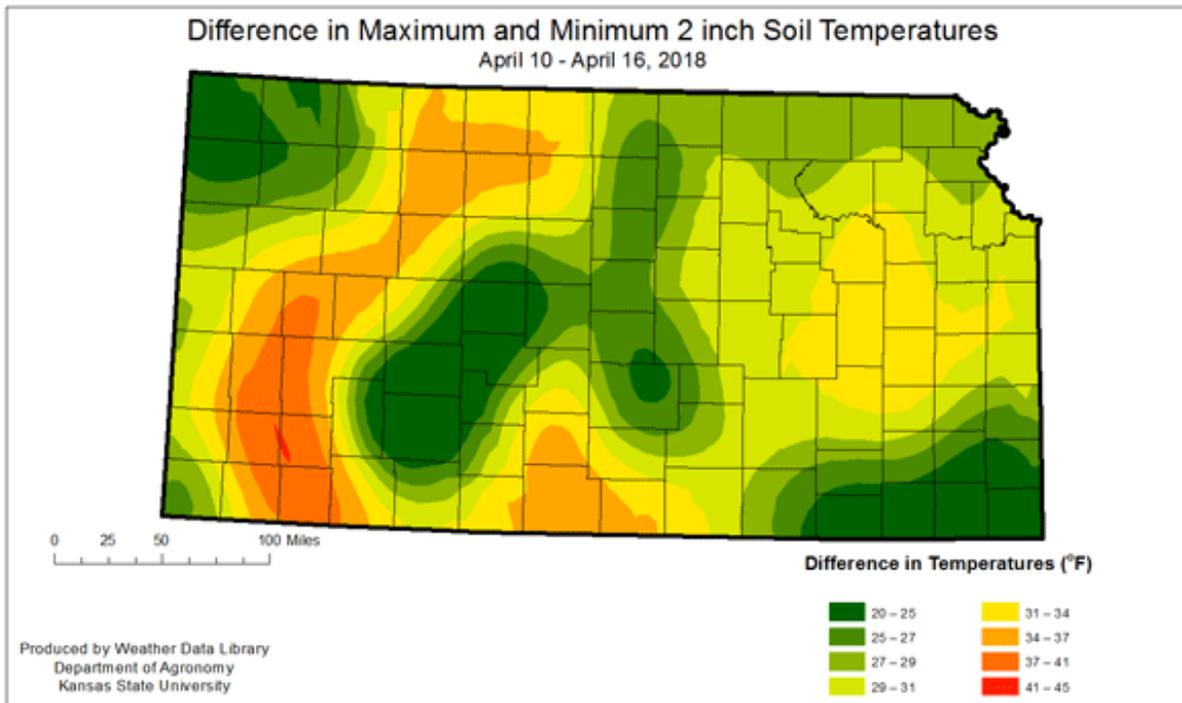


Figure 1. Average soil temperatures at 2-inch (upper panel) and 4-inch (lower panel) soil depth for the week of April 10-16, 2018.

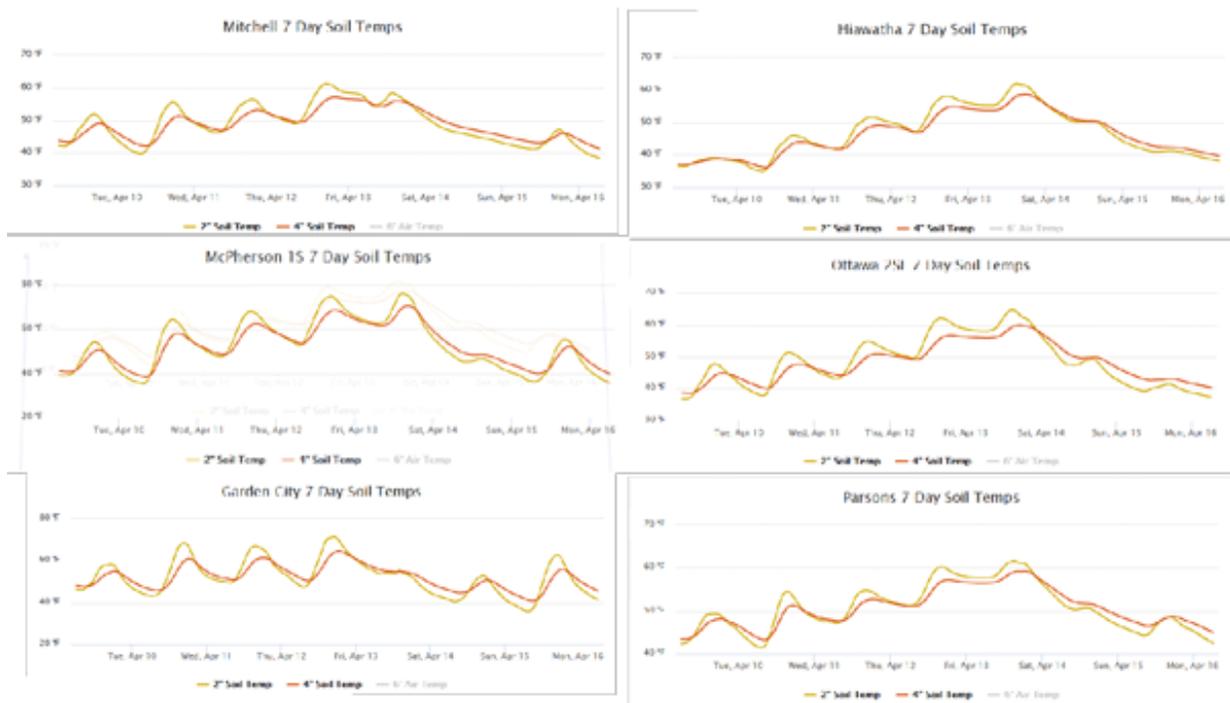


Figure 2. 7-day soil temperatures (2- and 4-inch soil depth) for Hiawatha, Ottawa, Parsons, Mitchell, McPherson, and Garden City.

Producers should consider all these factors when deciding on the planting time. More information about the planting status of summer row crops will be provided in upcoming issues of the Agronomy eUpdate. Stay tuned!

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