



K-STATE
Research and Extension

Extension Agronomy

eUpdate

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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. Special Edition: Freeze injury on wheat

The hard freeze, with temperatures well into the low- to mid-20's, or even lower, throughout Kansas overnight on April 14-15, could cause some damage to wheat in the jointing stage.

Freeze data from April 13 midnight to April 15 8 am (56 hours)

| County | Coldest reading | Hours less than 24 oF | County | Coldest reading | Hours less than 24 oF |
|-----------|-----------------|-----------------------|------------|-----------------|-----------------------|
| Brown | 23.8 | 1 | Miami | 28.1 | 0 |
| Butler | 23.8 | 1 | Mitchell | 21.2 | 3 |
| Cherokee | 24.8 | 0 | Osage | 19.3 | 6 |
| Cheyenne | 22.2 | 5 | Osborne | 17.9 | 6 |
| Clay | 21.0 | 3 | Reno | 22.9 | 1 |
| Dickinson | 23.0 | 3 | Republic | 18.8 | 7 |
| Elk | 29.9 | 0 | Riley | 25.6 | 0 |
| Ellis | 20.9 | 5 | Riley | 27.4 | 0 |
| Finney | 26.1 | 0 | Shawnee | 27.4 | 0 |
| Franklin | 27.0 | 0 | Shawnee | 27.6 | 0 |
| Grant | 23.1 | 3 | Sheridan | 24.4 | 0 |
| Gray | 21.0 | 6 | Sherman | 22.6 | 10 |
| Greeley | 19.3 | 9 | Stafford | 23.8 | 1 |
| Hamilton | 20.3 | 7 | Stanton | 24.9 | 0 |
| Harper | 26.3 | 0 | Stevens | 23.8 | 3 |
| Hodgeman | 22.7 | 3 | Thomas | 24.7 | 0 |
| Jewell | 27.3 | 0 | Wallace | 20.7 | 10 |
| Labette | 25.7 | 0 | Washington | 21.5 | 6 |
| Lane | 25.1 | 0 | Wichita | 24.8 | 0 |
| Meade | 23.5 | 1 | Woodson | 27.5 | 0 |

Source: Mary Knapp, Weather Data Library

The extent of this freeze event is not nearly as severe as the freeze about the same time last year.

| Last year's April freeze: Summary of temperatures potentially damaging to wheat in western Kansas, April 9-10, 2013 | | | | |
|--|------------------|------------------|------------------|------------------|
| | April 9, 2013 | | April 10, 2013 | |
| Location | Minimum temp (F) | Hours below 24 F | Minimum temp (F) | Hours below 24 F |
| Thomas Co. | 16.1 | 17 | 16.5 | 11 |
| Greeley Co. | 15.4 | 17 | 13.9 | 13 |
| Stevens Co. | 19.8 | 9 | 17.4 | 10 |

Source: Erick DeWolf, Plant Pathology Specialist

Important factors determining freeze damage

There are a number of key factors in determining freeze damage: the stage of development of the wheat, the density of the stand and condition of the plants, the amount of residue on the soil surface, the extent and duration of low temperatures, temperature gradients within the field, soil moisture, and the wind speed.

Stage of development.

-- Greenup. Wheat that hasn't started to joint yet might suffer damage to the existing foliage, but the growing points will be protected by the soil and should escape injury. This wheat will have cosmetic damage to the leaves that will show up almost immediately.

-- Jointing wheat can usually tolerate temperatures in the mid to upper 20's with no significant injury. But, if temperatures fall into the low 20's or even lower for several hours, the lower stems, leaves, or developing head can sustain injury.

Density of the stand and condition of the plants. If the stand is thick, that will tend to reduce the extent of freeze damage as the warmth of the soil will radiate up into the canopy. On the other hand, well-fertilized succulent wheat has often sustained more freeze injury than wheat that is not as well fertilized. Thin stands, which are common this year, are at higher risk of injury because the air can penetrate the stand more easily. If the plants were wet before the freeze, this can result in a coat of ice on the plants that may protect the growing point to some extent. If temperatures get too low, however, the cold will go through the ice.

Residue. Many times we see more freeze damage in no-till fields because the residue acts as a blanket and doesn't allow the heat from the soil to radiate up into the plant canopy.

Extent and duration of low temperatures. Significant injury becomes much more likely if the temperatures in the damaging range last for two hours or longer.

Soil moisture. There is often less freeze injury at a given temperature when soils are wet than when dry. Wetter soils tend to radiate a little more warmth than dry soils.

Wind speed. Windy conditions during the nighttime hours when temperatures reach their lows will reduce the amount of warmth radiating from the soil and increase the chance of injury.

Temperature gradients within the field. Low spots in the field are almost always the first to have freeze injury. The coldest air tends to settle in the low areas, especially under calm wind conditions.

Injury symptoms

There are many possible scenarios after a freeze, and things do not always go according to "the book." So just keep watching your fields closely over the next 7 to 10 days for the following:

- The color of newly emerging leaves. If they are nice and green, that probably indicates the tiller is alive. If newly emerging leaves are yellow, that probably indicates the tiller is dead. The

color of existing leaves is not terribly important, except for the flag leaf. 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.

- The color of the developing head or growing point in wheat that has jointed. As long as heads are light green and turgid, the head in that tiller is fine. If the head is whitish and flaccid, it has died.
- Ice in the stems. If there was ice in the stems below the first node the morning of the freeze, those tillers may be damaged (although not always) and may not produce grain. You may see split stems from ice accumulation.
- The integrity of the stem. 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 you see that, it usually means the wheat will lodge at some point during the season. If the stems look undamaged, that's a good sign.

The best thing producers can do for the first few days is simply walk the fields to observe lodging, crimped stems, and damaged leaves. Be patient. Do not take any immediate actions as a result of the freeze, such as destroying the field for recropping. It will take several days of warm weather to accurately evaluate the extent of damage. After several days, producers should split open some stems and check the developing head.

Where stems and/or growing points were killed by the freeze, start looking for new tiller growth coming from the crown area. In fact, look for new tiller growth even if you think the stems look okay. Sometimes tillers can be killed but will not show any symptoms for quite a while. 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. Watch out for bird cherry oat aphids and other potential insect or disease problems on these late-developing tillers. Enough tillers may survive to produce good yields (if spring growing conditions are good). 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.



Figure 1. Leaf burn from freeze damage. By itself, this is cosmetic damage only. Photos by Jim Shroyer, K-State Research and Extension.



Figure 2. A developing head still within the stem killed by freezing temperatures. The dead head is whitish and flaccid. If it were healthy, it would be light green and turgid.



Figure 3. A stem that was split open by having ice form within the stem. This stem has died and a new tiller has begun to grow at the base.

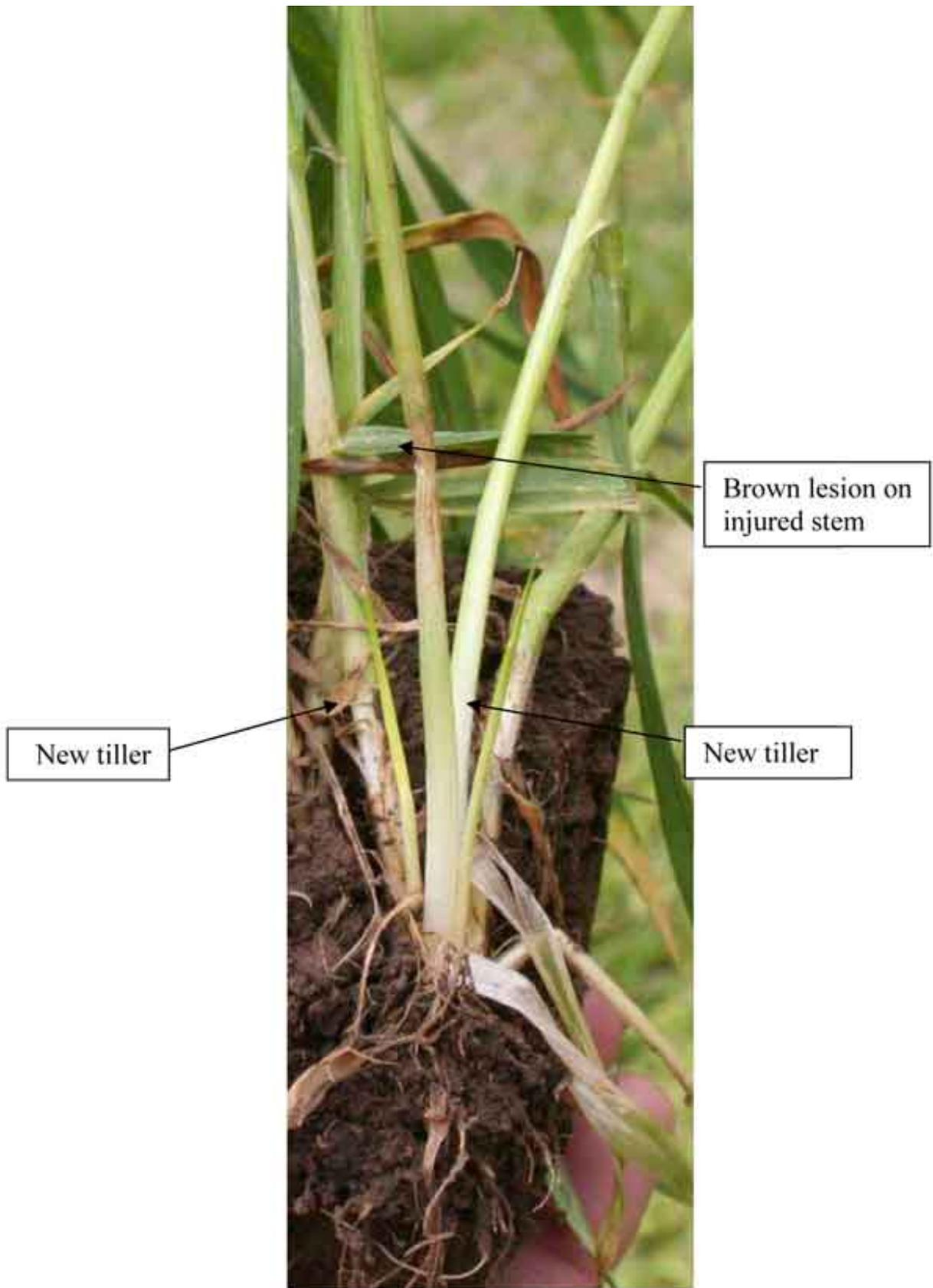


Figure 4. Some of the tillers on this plant had freeze damage to the lower stems. These stems are dying, but the symptoms may not be immediately evident. The growth of new tillers from the base of

the plant is a sure sign that the main tillers are dead or dying. Note the brown lesion on the stem with the two new tillers.

More information on freeze damage to wheat is available in *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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