Issue 683

K-STATE Research and Extension

Extension Agronomy

eUpdate

04/04/2018

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. First hollow stem update: April 3, 2018

Cattle should be removed from wheat pastures when the crop reaches first hollow stem (FHS). Grazing past this stage can severely affect wheat yields (for a full explanation, please refer to eUpdate article "Optimal time to remove cattle from wheat pastures: First hollow stem" in the Feb. 23, 2018 issue).

First hollow stem update

In order to screen for FHS during this important time in the growing season, the K-State Extension Wheat and Forages crew measures FHS on a weekly basis in 28 different commonly grown wheat varieties in Kansas. The varieties are in a September-sown replicated trial at the South Central Experiment Field near Hutchinson.

Ten stems are split open per variety per replication (Figure 1), for a total of 40 stems monitored per variety. The average length of hollow stem is reported for each varieties in Table 1. **As of April 3rd, all except one variety had already reached first hollow stem.**

Figure 1. Ten main wheat stems were split open per replication per variety to estimate first hollow stem for this report, for a total of 40 stems split per variety. Photo by Romulo Lollato, K-State Research and Extension.

Table 1. Length of hollow stem measured Feb. 21, Feb. 28, March 6, March 14, March 21, March 23, March 28, and April 3 2018, of 28 wheat varieties sown mid-September 2017 at the South Central Experiment Field near Hutchinson. The critical FHS length is 1.5 cm (about a half-inch or the diameter of a dime). Least significant difference (LSD) between varieties for statistical significance is also shown.

Variety	2/21	2/28	3/6	3/14	3/21	**3/23**	**3/28**	**4/3**
AM Eastwood	0.19	0.28	0.30	0.52	0.79	**2.35**	--	--
NE10478-1	0.15	0.25	0.24	0.44	0.71	1.11	**1.66**	--
LCH13-22	0.16	0.21	0.24	0.40	0.65	1.39	**1.99**	--
LCH14-55*	0.17	0.19	0.25	0.42	0.51	1.12	**2.06**	--
LCH14-89	0.15	0.22	0.24	0.39	0.58	1.16	**1.72**	--
LCS Chrome	0.16	0.20	0.25	0.30	0.42	0.81	1.15	**1.58**
LCS Pistol	0.17	0.22	0.27	0.41	0.63	**1.55**	--	--
Bentley	0.12	0.22	0.23	0.35	0.58	1.20	1.46	**1.66**
Doublestop CL Plus	0.15	0.21	0.26	0.32	0.48	1.17	1.39	**1.82**
Gallagher	0.18	0.26	0.30	0.50	0.69	**1.64**	--	--
Iba	0.16	0.20	0.26	0.41	0.53	1.31	**1.63**	--
Lonerider	0.15	0.21	0.26	0.41	0.74	**1.78**	--	--
OK12716	0.15	0.21	0.28	0.35	0.61	1.36	**1.51**	--
Ruby Lee	0.13	0.19	0.25	0.46	0.57	1.46	**2.28**	--
Smith's Gold	0.18	0.27	0.24	0.48	0.89	1.29	**2.42**	--
Spirit Rider	0.19	0.24	0.31	0.47	0.55	**1.65**	--	--
Stardust	0.18	0.23	0.25	0.43	0.73	**1.68**	--	--
Paradise	0.19	0.23	0.32	0.43	0.78	1.24	**2.37**	--
Bob Dole	0.19	0.25	0.28	0.35	0.75	1.35	**1.78**	--
SY Achieve CL2	0.18	0.26	0.25	0.54	1.33	**2.52**	--	--
SY Benefit	0.18	0.26	0.30	0.52	1.02	**2.43**	--	--
SY Rugged	0.13	0.23	0.23	0.39	0.73	1.05	**1.75**	--
1863	0.21	0.24	0.30	0.63	1.27	**1.57**	--	--
Joe	0.16	0.21	0.27	0.37	0.59	1.18	**1.62**	--
Larry	0.15	0.22	0.25	0.39	0.58	1.31	**1.52**	--
Oakley CL	0.14	0.21	0.28	0.37	0.43	0.57	1.34	1.48
Tatanka	0.12	0.22	0.24	0.38	0.66	1.20	**1.70**	--
Zenda	0.19	0.23	0.28	0.41	0.54	1.08	**1.72**	--
Variety differences	No	Yes	No	Yes	Yes	Yes	Yes	Yes
LSD	-	0.04	-	0.33	0.90	0.79	0.39	0.47

The varieties that reached FHS between March 28 and April 3 were LCS Chrome, Bentley, and DoupleStop CL Plus. The only variety which had not reached FHS on April 3 was Oakley CL, but it was extremely close. At this time, cattle should already have been removed from wheat pastures if the intent is to harvest for grain, irrespective of wheat variety.

The intention of this report is to provide producers an update on the progress of FHS development in different wheat varieties. Producers should use this information as a guide, but it is extremely important to monitor FHS from an ungrazed portion of each individual wheat pasture to take the decision of removing cattle from wheat pastures.

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2. Cold snap on April 3-4: Can this damage the 2018 Kansas wheat crop?

Minimum air temperatures across Kansas reached very low levels during April 3-4. Cold temperatures occurred from the very southwest border of Kansas all the way east to Columbus and north to Cheyenne County. The minimum temperature observed across the state was 11 degrees F reported at both the K-State Mesonet station in Scandia and the station in Meade County.

Different stages of wheat development vary in their sensitivity to cold temperatures. This year, wheat development is delayed relative to the past two years in Kansas. For the southern portion of the state, the wheat has passed first hollow stem and therefore the developing head is above ground. Where 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 degrees F. Additionally, temperatures need to be sustained at levels below 24 degrees F for a minimum of 2-3 hours to be potentially damaging to the developing head.

Figure 1 shows the number of hours minimum temperatures were below 24 degrees F across Kansas. The number of hours below 24 degrees F ranged from 0 hours in extreme south central and southeast Kansas to as much as 10.3 hours near St. Francis, in northwest Kansas. In southwest Kansas, the number of hours below 24 degrees F averaged 5.8 hours. While it is late in the year for these observed temperatures, in most of the state the wheat crop is less advanced than normal due to a relatively cool winter. Producers who have jointed wheat might be concerned with possible damage to their crop.

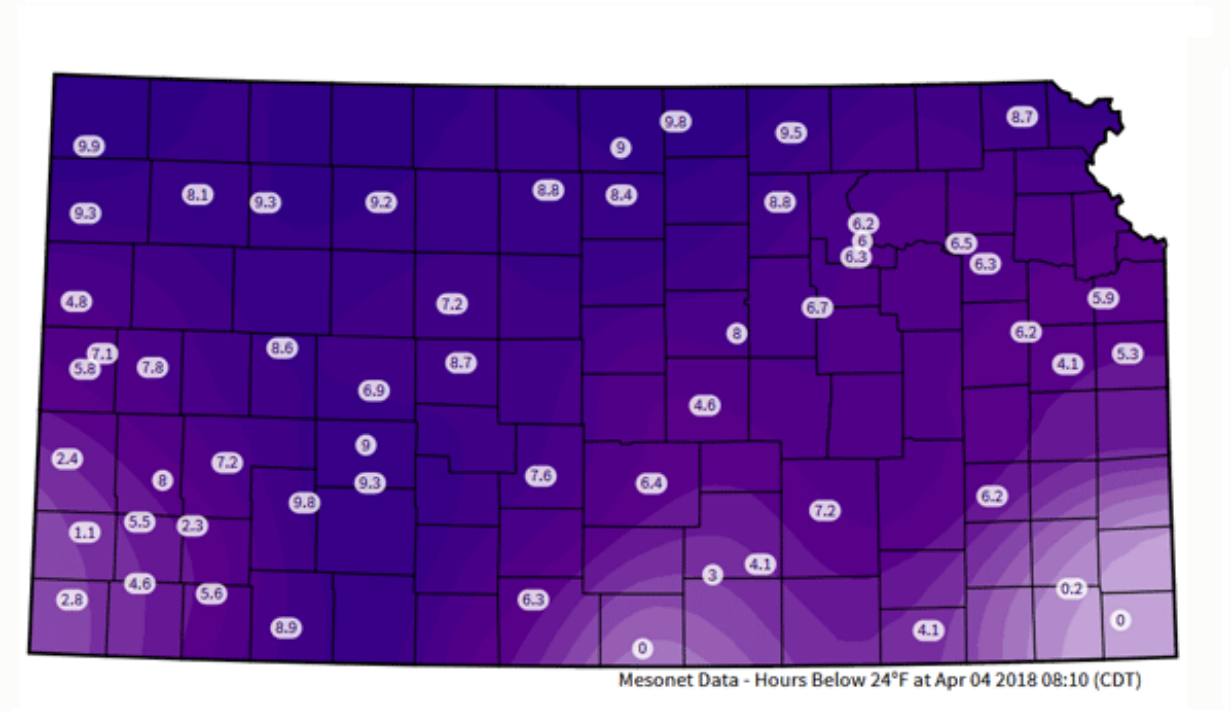

Figure 1. Number degrees F hours below 24 degrees F experienced during April 3 – 4, 2018.

While this is a tangible concern for jointed wheat in southwest Kansas, it is important to consider that air temperatures reported by meteorological monitoring stations are often measured 5 feet aboveground, and do not fully reflect the microclimate to which the wheat canopy is actually exposed. For instance, a lush wheat canopy will tend to reduce the extent of freeze damage as the warmth of the soil will radiate up into the canopy. In addition, moist soil buffers temperature changes better than dry soils and therefore there is often less freeze injury at a given temperature when soils are wet. Crop residue (or lack thereof) will influence how much heat will radiate out of the soil up into the plant canopy. Windy conditions will also increase the chance of injury.

As a result of so many interacting variables, evaluating solely air temperatures may not completely reflect the conditions experienced by the wheat crop. In this situation, soil temperatures can help determining the extent of cold stress at the crown and lower canopy levels.

Figure 2 shows the 2-inch depth soil temperatures measured on April 4 at 8:36 a.m. While air temperatures reached critical levels for damage to the developing wheat head (if the head is above ground), soil temperatures at the 2-inch depth were above 30 degrees F across western Kansas, and well above 40 degrees F in southwest Kansas. Higher soil temperatures may have helped buffer the cold air temperatures experienced, minimizing possible injury to the wheat crop.

Where the developing head is still below ground and therefore insulated from cold air temperatures (Feekes 3, 4, or early 5), little to no substantive damage should be expected from the cold temperatures on April 3-4. For wheat that has already jointed, it is still too early to define what possible yield losses the wheat crop may have experienced, if any.

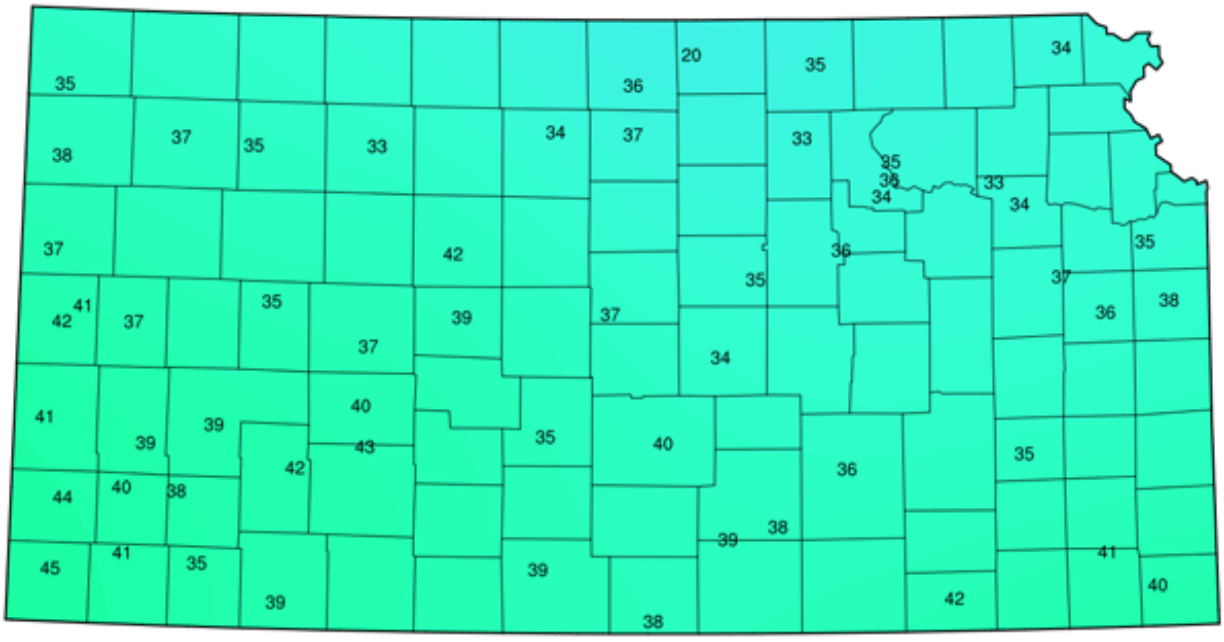

Figure 2. Current 2-inch soil temperature reported as degrees F at 8:36 (CDT) on April 4, 2018.

You can monitor temperatures throughout the weekend on the K-State Freeze Monitor page, part of

the Kansas Mesonet web site, at: http://mesonet.k-state.edu/weather/freeze/. There is a column for temperatures below 24 degrees and a link at the bottom for a map showing the number of hours below 24 degrees. Soil temperatures can be found at http://mesonet.k-state.edu/agriculture/soiltemp/.

For more information on freeze damage to wheat, please see the accompanying article in this special mid-week issue of the eUpdate or the publication, "Spring Freeze Injury to Kansas Wheat", K-State Research and Extension publication C646, at: http://www.ksre.ksu.edu/bookstore/pubs/C646.pdf

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3. Diagnosing freeze damage to wheat

Temperatures dropped below freezing in many areas of Kansas during April 3-4, with as many as 10 hours or more of temperatures below 24 degrees F. While the majority of the Kansas crop is delayed in development this growing season due to late planting in the fall and a cooler-than-normal winter and spring, some fields in south central Kansas are approaching jointing and some injuries might be sustained. This article addresses some factors affecting the likelihood of freeze damage, potential consequences of the recent freeze to the wheat crop, and guidelines for producers to check for freeze damage.

Important factors determining freeze damage

A number of key factors determine the potential for 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 (position on the landscape), soil moisture, and wind speed.

Stage of development

- Greenup. Wheat that hasn't started to joint yet (Feekes 3 through 5) 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 as leaf tip burn (Figure 1).
- Jointing. Wheat that is jointed or past is more sensitive to freeze damage than wheat at greenup because the growing point is above ground. It can still tolerate temperatures in the mid 20's with no significant injury, but if temperatures fall into the low 20's or lower for several hours, the lower stems, leaves, or developing head can sustain injury.

Figure 1. Leaf burn from freeze damage. By itself, this is cosmetic damage only. Photos by Romulo Lollato, K-State Extension Wheat and Forages Specialist.

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 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.

Amount of residue on the soil surface

No-till fields can often sustain more freeze damage 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 (below 24 degrees F for jointed wheat) last for two hours or longer, which is the case for parts of Kansas. For more detailed information on how cold parts of Kansas got and the duration of temperatures below the above threshold, please see accompanying eUpdate article "Cold snap on April 3-4: Can this

damage the 2018 Kansas wheat crop?"

Soil moisture

There is often less freeze injury at a given temperature when soils have more moisture present. Wetter soils tend to radiate a little more warmth than dry soils. On the other hand, drought-stressed plants tend to be more hardened against cold injury and their lower leaf water content tends to decrease the severity of the freeze injury.

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 (position on the landscape)

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.

Wheat variety

Although the sensitivity to cold temperatures at a given growth stage is very similar across all varieties, varieties can differ in their release from winter dormancy as much as three weeks. Because of differences in winter dormancy release, late-release varieties may escape a freeze injury for being delayed in their development. For instance, a late-release variety at Feekes 4 or 5 is less sensitive to freeze damage than an early-release variety planted at the same date which might have reached Feekes 6. For more detailed information of different varieties release from dormancy during the current growing season, please see the accompanying eUpdate on first hollow stem.

Injury symptoms

There are many possible scenarios after a freeze and producers should not take any immediate action following a freeze event. Several days of warm temperatures are needed to properly assess freeze damage to the wheat crop. Thus, producers should watch their fields closely over the next 7 to 10 days after the freeze event 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, which should not have emerged at this point yet. 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, crisp, and turgid, the head in that tiller is fine. If it is whitish, flaccid, and mushy, it has died (Figure 2).
- 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.
- 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.

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. Photo by Jim Shroyer, professor emeritus, K-State Research and Extension.

The best thing producers can do for the first few days is simply walk the fields to observe lodging, crimped stems, and damaged leaves. Producers should 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, new tiller growth (coming from the crown area) will occur (Figures 3 and 4). 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 begin growing normally and fill out the stand, the wheat may look ragged because the main tillers are absent. Producers should scout 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 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.

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. Photo by Jim Shroyer, professor emeritus, K-State Research and Extension.

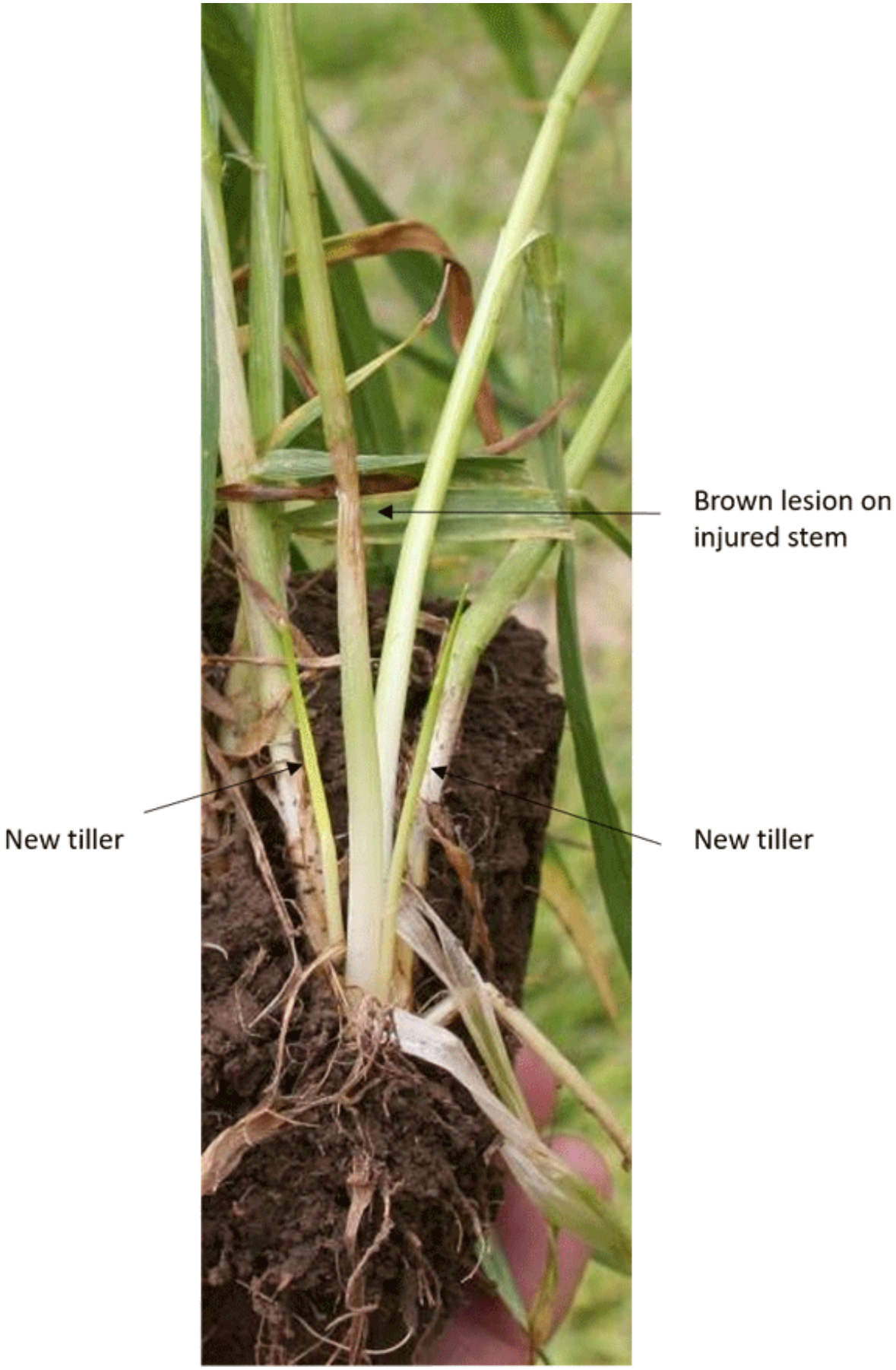

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Figure 4. Some of the tillers on this plant had freeze damage to the lower stems. These stems are dying, but the symptoms may not be immediately evident. The growth of new tillers from the base of the plant is a sure sign that the main tillers are dead or dying. Note the brown lesion on the stem with the two new tillers. Photo by Jim Shroyer, professor emeritus, K-State Research and Extension.

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 online at: http://www.ksre.ksu.edu/bookstore/pubs/C646.pdf

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