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These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy eUpdate 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 Dalas Peterson, Extension Agronomy State Leader and Weed Management Specialist 785-532-0405 dpeterso@ksu.edu.

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1. Wheat Status: Injury Symptoms from Freeze Damage

The recent cold temperatures experienced on March 15-16 were enough to cause freeze damage to winter wheat in parts of Kansas. The actual freeze damage will be region-specific, depending on crop growth stage and minimum temperatures (some regions had the worst combination of temperatures and crop growth stage), and, within a region, field-specific, owing to many individual aspects such as crop density, residue level, etc. While there is nothing we can do immediately, growers can prioritize the fields they sample for freeze-damage symptoms based on conditions more likely to result in freeze damage. In this article, we discuss the low temperatures across the state and the individual conditions that might help growers prioritize which fields to sample and which injury symptoms to look for.

How cold did it get?

Cold temperatures across Kansas ranged from -1 degree F in northwest Kansas to 17 degrees in south central Kansas. These cold temperatures spanned the overnight hours of Sunday into Monday morning. The following maps (Figure 1) show the cold temperatures and the duration of time that temperatures were below 12 and 24 degrees. According to the K-State Spring Freeze Injury to Kansas Wheat publication, the approximate injurious temperatures for tillering and jointing wheat are two hours at 12 and 24°F, respectively. These are not hard numbers, as many factors influence freeze injury.

Figure 1. Duration in hours of below freezing temperatures, 12°F (top map) and 24°F (lower map), for March 2 through March 16, 2026. Maps generated by Kansas Mesonet.

Field conditions that can affect the potential for freeze damage

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 greater risk of injury because air can penetrate them more easily. If the plants were wet before the freeze, a coating of ice may form, protecting the growing point to some extent. However, if temperatures drop too low, the cold will penetrate the ice.

Residue. No-till fields can often sustain more freeze damage because the residue acts as a blanket, preventing the soil's heat from radiating up into the plant canopy.

Soil moisture. There is often less freeze injury at a given temperature when soils are wet than when they are dry. Wetter soils tend to radiate a little more warmth than dry soils. On the other hand, drought-stressed plants tend to be more tolerant of cold injury, and their lower leaf water content tends to reduce the severity of freeze injury.

Wind speed. Windy conditions during the nighttime hours, when temperatures are at their lowest, will reduce the amount of heat radiating from the soil and increase the risk 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 freezing temperatures at a given growth stage is very similar across all varieties, Kansas wheat varieties can differ in their release from winter dormancy by up to 3 weeks. Because of differences in winter-dormancy release, late-release varieties may escape freeze injury due to delayed development.

Injury symptoms to look for in the coming days

There are many possible scenarios after a freeze, and producers should not make any immediate decisions. 10 to 14 days of warm temperatures are needed to allow the wheat to resume growth and to properly assess freeze damage to the wheat crop, which will depend strongly on the crop stage (Figure 2).

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Figure 2. Estimated wheat growth stage on March 16 based on growing degree day accumulation in Kansas. Map generated by Kansas Mesonet.

Greenup

Wheat that hasn't started to joint yet (Feekes 3: completion of tillering through 5: Leaf sheaths strongly erect) will likely show damage to the existing foliage. This wheat will have damage that causes the leaves to appear dark green to blackish, and it will turn brown and crispy (Figure 3).

Figure 3. Leaf damage from cold temperatures. Dark green to black coloration of leaves following exposure to temperatures below 10 degrees F (left). Leaf burn from freeze damage (Right). By itself, this is cosmetic damage only. Photos by Jeanne Falk Jones and Romulo Lollato, K-State Extension.

Splitting the wheat stem to identify the growing point and determine whether it is above or below the soil surface can help assess the risk of freeze injury. It is also important to note that the growing point location differs between the primary tiller and later-developing tillers.

Jointing

Where wheat was at the jointing stage, producers should evaluate their fields 10-14 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 likely indicates the tiller is damaged from the freezing temperatures. 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, giving 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 the head is whitish, flaccid, and mushy, it has died (Figure 4).
- **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 dark 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 4. Following an early freeze, crops at jointing might still develop healthy heads (left panel). However, depending on minimum temperatures and duration of the freeze event, the developing head might be killed even if still within the stem (right panel). The dead head is whitish and flaccid, while the healthy head is light green and turgid. Photos by Romulo Lollato, K-State Extension.

For the first few days, producers should walk the fields to observe lodging, crimped stems, and damaged leaves. They should not take any immediate action in response to the freeze, such as destroying the field for re-cropping. It will take several days of warm weather to assess the extent of the damage accurately. After several days, producers should split open some stems and check the developing head.

Where the freeze killed stems and/or growing points, new tiller growth (coming from the crown area) will occur (Figure 5). 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. Producers should scout for bird cherry oat aphids and other potential insect or disease problems on these late-developing tillers. 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 5. Left: 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. Right: 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. Photos by Jim Shroyer, professor emeritus, K-State Extension.

Boot

As we look ahead to potential future freezes the Kansas wheat crop could experience, at the boot stage, wheat can be injured if temperatures drop into the mid- to upper 20s for several hours. Injury is more likely when it occurs repeatedly and when it is windy at night. To detect injury, producers should wait several days, split open some stems, and look at the developing head. If the head is green or light greenish in color and seems firm, it will most likely be fine. If the head is yellowish and mushy, that's a sign of freeze injury.

Freeze injury at the boot stage causes several symptoms when the heads are enclosed within the flag-leaf sheaths. Freezing may trap the spikes inside the boots, preventing them from emerging normally. When this happens, the spikes will remain in the boots, split out the sides of the boots, or emerge base-first from the boots.

Sometimes heads emerge normally from the boots after freezing but remain yellow or even white instead of their usual green color. When this happens, all or part of the heads have been killed. Frequently, only the male parts (anthers) of the flowers die because they are more sensitive to low temperatures than the female parts. Since wheat is self-pollinated, sterility caused by freeze injury results in poor kernel set and low grain yield.

It's possible for some of the spikelets to be alive and a healthy dark green while other spikelets on the same head are damaged. If a spikelet flowers normally and the kernels on that spikelet develop normally, then the head is at least partially viable and will produce grain (unless it freezes again, of course).

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

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2. Wheat Progress: First Hollow Stem Update - March 16, 2026

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 this recent eUpdate article, "Optimal time to remove cattle from wheat pastures: First hollow stem."

First hollow stem update

To screen for FHS during this important time in the growing season, the K-State Extension Wheat and Forage crew measures FHS on a weekly basis in 12 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 main stems are split open per variety per replication (Figure 1), for a total of 40 stems monitored per variety. The average length of the hollow stem is reported for each variety in Table 1. **As of March 16, all varieties evaluated in this trial had 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 (10 per repetition) split per variety. Photo by Luiz Pradella, K-State PhD student.

Table 1. Length of hollow stem measured between February 17 and March 16, 2026, of 12 wheat varieties sown in late September 2025 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). Value(s) in bold indicate the highest FHS group.

	First Hollow Stem (cm)				
Variety	**02/17**	**2/23**	**3/2**	**3/9**	**3/16**
AP Tango (CP17CU3493#009)	0	0.01	0.63	**1.59**	–
AP Sunbird	0	0.02	0.29	**1.57**	–
AP24 AX	0	0.01	0.59	**2.32**	–
CP7017AX	0	0.03	0.35	**1.84**	**5.30**
CP7599CLP	0	0.00	0.55	1.24	**7.60**
Gallagher	0	0.03	0.76	1.38	**2.78**
KS Bill Snyder	0	0.00	0.11	0.34	**6.03**

KS Providence	0	0.00	0.33	1.04	**2.45**
KS20HD134	0	0.00	0.08	0.25	**1.88**
KS211130	0	0.00	0.03	0.13	**2.70**
PlainsGold Sheridan	0	0.00	0.17	0.49	**5.30**
Zenda	0	0.17	1.48	**2.59**	**–**
Mean	0	0.02	0.45	1.23	**4.26**

* For reference: 1 inch = 2.54 cm, or 1 cm ≈ 0.3937 inches

Since all varieties have already reached the first hollow stem stage, this will be the last report for the 2025-26 growing season. We note that some fields in north-central or northeast Kansas may not yet have reached first hollow stem (Figure 2). Therefore, we advise producers in those areas to closely monitor their fields to make the decision on when to remove cattle from wheat pastures.

First Hollow Stem Tracking Tool on the Kansas Mesonet

The Kansas Mesonet has a tool to help track wheat development: Wheat First Hollow Stem (https://mesonet.k-state.edu/agriculture/wheat/hollowstem/). This page tracks soil temperature to calculate wheat growing degree days (GDD) associated with first hollow stem occurrence. This tool employs a wheat growth model developed by Oklahoma State University and the Oklahoma Mesonet, which was validated for wheat growing conditions experienced in south-central Kansas during the 2016-2021 growing seasons. The output of the model provides the probability of first hollow stem occurrence (current and historical) both for early- and late-maturing wheat varieties. A detailed description of this tool is available at https://eupdate.agronomy.ksu.edu/article/wheat-growth-and-development-tool-for-estimating-first-hollow-stem-534-2.

Figure 2. Values represent the percent probability of first hollow stem occurrence for early

maturing varieties. Source: Kansas Mesonet.

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

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3. Wheat Fungicide Efficacy Publication Updated for 2026

The K-State Extension publication *"Foliar Fungicide Efficacy for Wheat Disease Management "* has been updated for 2026 and is now available. Check out the updated resource here: http://www.bookstore.ksre.ksu.edu/pubs/EP130.pdf.

The recommendations in this publication reflect several years of head-to-head comparisons of products in Kansas and many other wheat-producing states. These ratings have been verified by members of the North Central Extension and Research Committee (NCERA-184) for managing small grain diseases, which is composed of extension plant pathologists from universities throughout the U.S.

It is important to remember that all efficacy ratings listed here are based on proper application timing. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table. This publication includes fungicides widely marketed in Kansas and is not intended to be a list of all labeled products. Many products have specific use restrictions, which can include the amount of active ingredient that can be applied within a period of time or the number of sequential applications that can be made. Read and follow all use restrictions described on individual product labels prior to use.

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4. Marestail in soybeans: Strategies for the best control

Controlling marestail in soybeans can be a challenge for Kansas no-till producers. Application timing and weed size are critical factors for successfully controlling this weed germinating in the fall or early spring. Research has shown that up to 80% of marestail can die over the winter as a result of cold temperatures and/or lack of adequate moisture. In addition, a well-established cover crop in the fall can reduce marestail establishment and survival. However, marestail that does survive is often robust and can be difficult to control with herbicides, especially later in the spring. Herbicide options are also limited by widespread resistance to glyphosate and/or ALS-inhibiting (Group 2) herbicides in marestail.

Figure 1. Glyphosate-resistant marestail in soybeans. Photo by Dallas Peterson, K-State Extension.

Early spring options

In the early spring, using a growth regulator (Group 4) herbicide such as 2,4-D and/or dicamba is an inexpensive and effective option to control rosette marestail (Figure 2, left). Dicamba provides better marestail control than 2,4-D and will also provide some residual control, especially at higher use rates. Halauxifen (Elevore) is a newer Group 4 herbicide that can provide similar marestail control to dicamba. Making these applications in March generally allows adequate time ahead of planting soybeans to meet required pre-plant intervals, but more importantly, spraying weeds before they bolt (Figure 2, right) will result in greater control. In general, marestail in Kansas will bolt in April, so now is the time for these applications.

Using herbicides with a longer residual helps control weeds that germinate between early spring applications and soybean planting. Products that include chlorimuron (Classic, Canopy), cloransulam (FirstRate), flumioxazin (Valor, others), saflufenacil (Sharpen, Optill, Verdict), or metribuzin (Sencor, others), can help provide residual control against several broadleaf species, including marestail. However, it is very important to consult and follow the herbicide label guidelines for the required pre-plant intervals prior to planting soybeans, as well as the proper rate for your soil. Also, keep in mind that resistance may reduce the effectiveness of ALS-inhibiting herbicides such as chlorimuron and cloransulam.

Figure 2. Marestail in the rosette growth stage (left photo) versus bolted (right photo). Photos by Sarah Lancaster, K-State Extension.

Pre-plant options

As soybean planting nears, existing marestail plants can become difficult to control because plants will have bolted and be considerably larger. Herbicides to apply as a burndown prior to planting include tank mixes of glyphosate with dicamba or 2,4-D and the residual products listed above.

Be very careful to follow label directions regarding plant-back restriction when applying dicamba ahead of soybeans that are not resistant to dicamba and 2,4-D ahead of soybean varieties that are not resistant to 2,4-D. Xtend or XtendFlex varieties have no plant-back restriction for Stryax, Engenia, or Tavium and Enlist soybean varieties have no plant-back restriction for Enlist One or Enlist Duo. However, non-resistant varieties have plant-back restrictions ranging from 0 to 30 days, depending on herbicide rate and formulation, soybean variety, precipitation, and geography.

One additional herbicide to consider as a rescue burndown application to control bolting marestail prior to soybean planting is glufosinate (Liberty and others). Although it would be better to control marestail at an earlier growth stage, glufosinate has been one of the most effective herbicides for controlling bolting marestail. Glufosinate is a non-selective herbicide that has activity on other broadleaf and grass species. Glufosinate is a contact herbicide, so a spray volume of 15 gallons per acre or greater generally provides the most consistent weed control. Glufosinate tends to work best under higher humidity and warm, sunny conditions at application. Including saflufenacil (Sharpen) with glufosinate may increase control.

Post-emergence options

Controlling marestail in the growing soybean crop can be the biggest challenge for producers, especially in soybeans that are not resistant to 2,4-D. Enlist One or Enlist Duo will be effective control options in Enlist E3 soybeans. One final post-emergence option to consider is glufosinate. Glufosinate resistance is in Liberty Link, XtendFlex, and Enlist E3varieties.

For more detailed information, see the "2026 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://bookstore.ksre.ksu.edu/pubs/SRP1194.pdf or check with your local K-State Extension office for a paper copy.

The use of trade names is for clarity to readers and does not imply endorsement of a particular product, nor does exclusion imply non-approval. Always consult the herbicide label for the most current use requirements.

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