Issue 1100

K-STATE Research and Extension

Extension Agronomy

eUpdate

04/23/2026

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: Advanced Crop Development and Freeze Injury

The recent overnight cold temperatures on April 17-19 were enough to cause freeze damage to winter wheat in parts of Kansas, especially in the western and north-central regions. 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 each region, field-specific factors, such as crop density and residue level, also contributed. 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 western Kansas ranged from 24°F in the larger valleys to the freezing mark in higher and more open regions. These cold temperatures spanned the overnight hours of Friday into Sunday morning (April 17-19). The following map (Figure 1) shows cold temperatures and the duration of time during which temperatures were below freezing. According to the K-State Spring Freeze Injury to Kansas Wheat publication, the approximate injurious temperatures for boot and heading wheat are two hours at 28 and 30°F, respectively. These are not hard numbers, as many factors influence freeze injury.

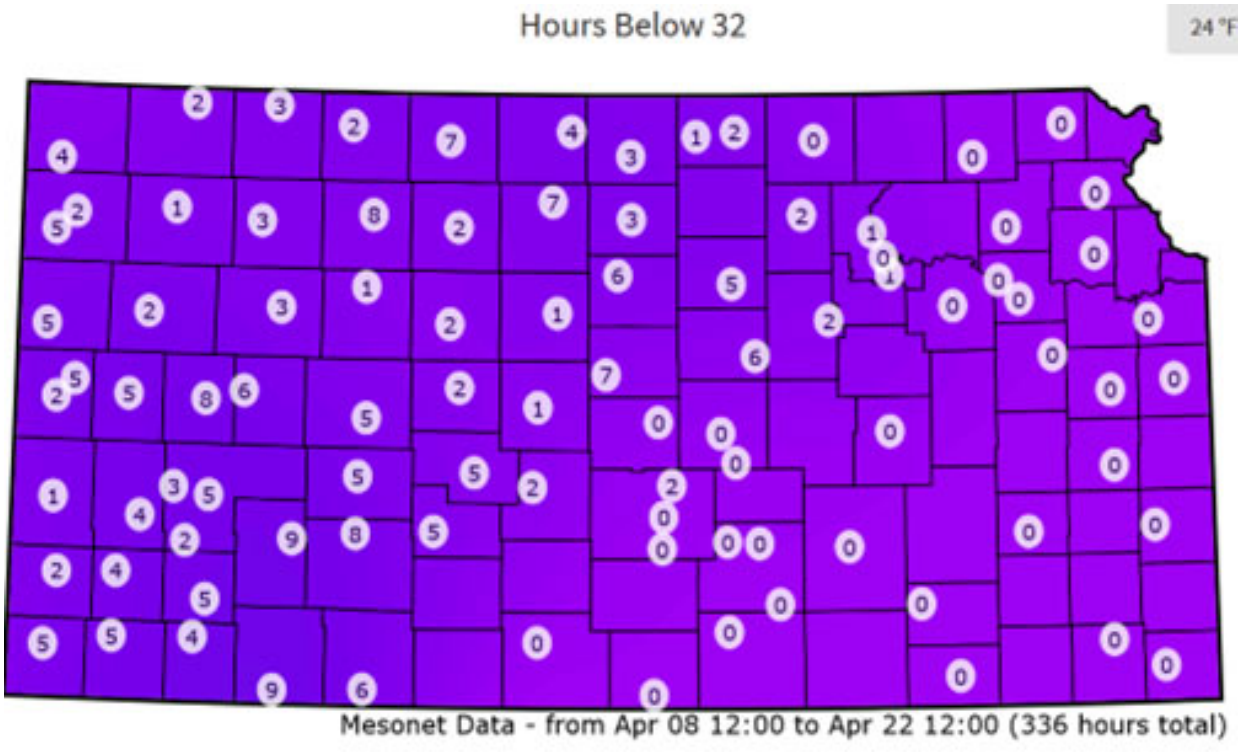


Figure 1. Duration in hours of below freezing temperatures, 32°F, for April 8 through April 22, 2026. Maps generated by Kansas Mesonet.

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.

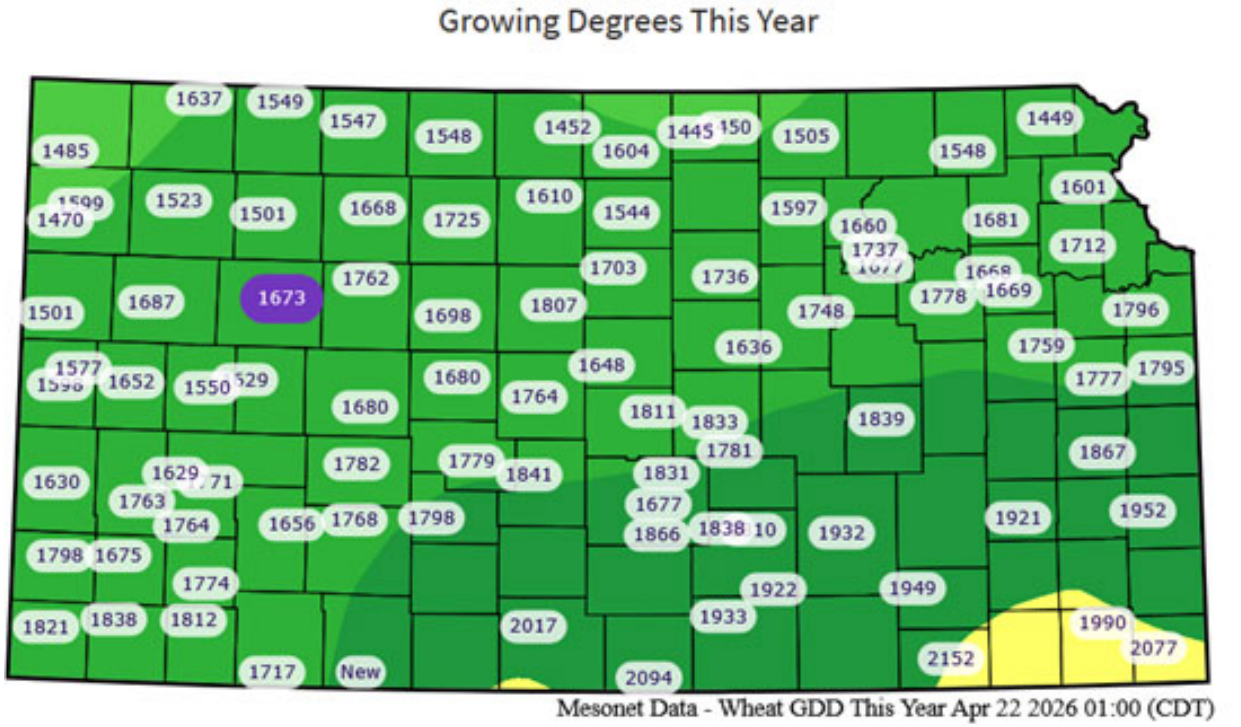
Soil moisture. There is often less freeze injury at a given temperature when soils are wet than when they are dry. Wetter soils tend to radiate a little more warmth than dry soils. On the other hand, drought-stressed plants tend to be more tolerant of cold injury, and their lower leaf water content tends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

Wind speed. Windy conditions during the nighttime hours, when temperatures are at their lowest, will reduce 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.

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, which will depend strongly on the crop stage (Figure 2).



Color	GDD °F	Estimated Wheat Growth Stage
	0 to 600	Seedling growth or tillering
	600 to 800	Tillering or strongly upright tillers
	800 to 1000	Strongly upright tillers or jointing (first node)
	1000 to 1200	Jointing (first node) or approaching flag leaf emergence
	1200 to 1400	Flag leaf emergence or boot
	1400 to 1600	Boot or heading
	1600 to 1800	Heading to flowering
	1800 to 2000	Heading or flowering
	2000 to 2200	Flowering or watery ripe

Figure 2. Estimated wheat growth stage on April 22 based on growing degree day accumulation in Kansas. Map generated by Kansas Mesonet.

Crop Stage: After Jointing, but Prior to Boot Stage

After the growing point has emerged above the soil surface and before the head enters the boot stage, the growing point and developing wheat head are wrapped in leaves, and the stem is forming below the growing point. During this time, the damaging temperatures are in the mid to upper 20s. Freeze damage may be seen on the leaves, on stems, on the growing point, and on the developing wheat head.

The stem should be split to look for damage to the growing point or the developing wheat head. A healthy growing point and wheat head should appear light yellow-green and turgid. A damaged

growing point may appear mushy or dark yellow to brown colored (Figure 3). A damaged wheat head can appear underdeveloped, mushy, and off-colored.

If the growing point is damaged, that tiller will slow or stop growing. The leaf that is emerging from the whorl will start to turn yellow and then brown (Figure 3). The wheat head may not emerge at all, or it may emerge and be white, or portions of the head may be white.

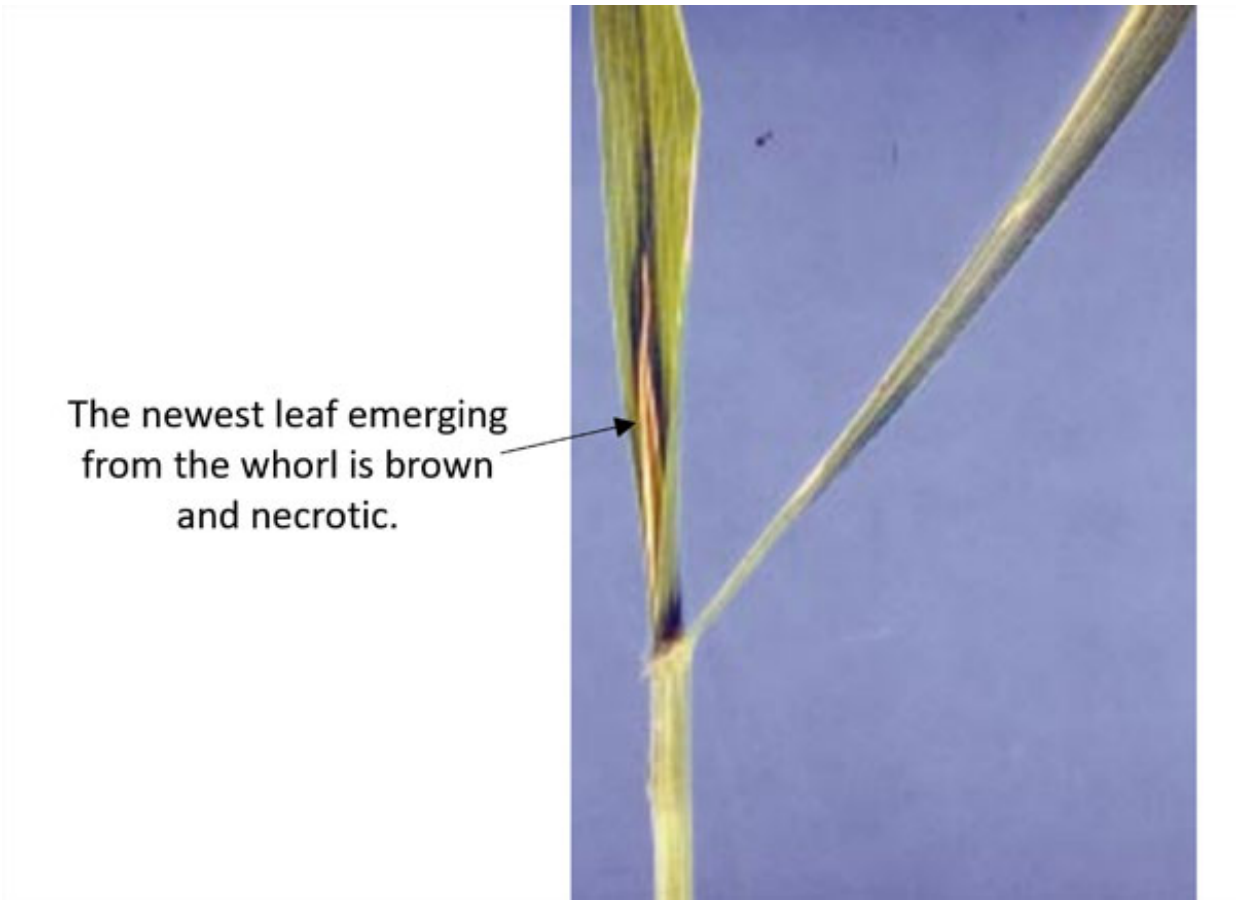


Figure 3. A yellow or necrotic leaf emerging from the whorl indicates the growing point is damaged. Photo from K-State Spring Freeze Injury to Kansas Wheat publication.

While you may see freeze-damage to the leaves, stems should also be examined for damage. This can appear as the stem's sides splitting open from ice freezing inside. Damage to the stem can result in lodging and decreased ability to carry water and nutrients to the growing point.

Crop Stage: Boot

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 (Figure 4). Frequently, only the male parts (anthers) of the flowers die because they are more sensitive to low temperatures than the female parts (Figure 5). Since wheat is self-pollinated, sterility caused by freeze injury results in poor kernel set and low grain yield.

Figure 4. The twisted spike on the right was trapped in the boot and split out the side of the sheath. The awns of the middle spike were damaged while it was still in the boot stage. The spike on the left had partially emerged when freezing occurred, so only its upper portion was damaged. Photo from K-State Spring Freeze Injury to Kansas Wheat publication.

Some of the spikelets may be alive and healthy, dark green. At the same time, other spikelets on the same head are damaged (Figure 4). 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).

Figure 5. Each wheat floret contains three anthers. Healthy wheat anthers are trilobed, light green, and turgid before pollen is shed (a). Anthers become twisted and shriveled, yet remain their normal color within 24 to 48 hours after a freeze (b). If damaged, anthers become white after 3 to 5 days and eventually turn whitish-brown (c). The anthers will not shed pollen or extrude from the florets. Images from K-State Spring Freeze Injury to Kansas Wheat publication.

Crop Stage: Heading and Flowering

Wheat spikes typically emerge from the boots during the first three weeks of May; however, the Kansas wheat crop is about one month ahead of schedule in 2025. At these stages, most symptoms of freeze injury—such as sterility, leaf desiccation, and lesions on the lower stems—are similar to those seen in earlier growth stages. The most noticeable symptom, however, is usually chlorosis, or bleaching, of the awns (the beards of the wheat), resulting in a white color instead of the normal green (Figure 4).

Several days after exposure to freezing temperatures, a light green or white "frost ring" may appear encircling the stems one to two inches below the spikes. This yellowed, chlorotic tissue marks the point where the stem and the flag leaf meet at the time of the freeze. The frost ring may be present on both injured plants and those that show no other symptoms of injury. It typically does not interfere with nutrient transport from the plant to the developing grain. However, as the plants mature, the spikes may break at the frost ring, particularly in well-filled spikes and during windy conditions.

Symptoms of freeze injury during the flowering and heading stages of wheat are quite similar. However, the flowering stage is the most sensitive to freezing temperatures. Even small differences in temperature, duration of exposure, or other conditions can lead to significant variations in the level of injury. When wheat is exposed to freezing temperatures during the flowering stage, the male parts of the flowers are killed. After freezing, the anthers turn white and become desiccated or shriveled, losing their normal light green or yellow color (Figure 5).

Freeze injury at this stage can result in either complete or partial sterility, leading to void or poorly

filled spikes due to the extreme sensitivity of the flowers. Flowering in wheat occurs from the florets near the center of the spikes to those at the top and bottom over a period of 2 to 4 days. If freezing occurs when florets at the center or at one or both ends of the spikes are still in a sensitive stage, those areas may end up void of grain. Conversely, grain may develop in other areas of the spikes, as flowering may not have started or could have already completed in those florets by the time of the freeze.

Take Home Message

- Freeze damage depends on crop stage, temperatures, and field conditions.
- Do not make immediate decisions. Allow 10-14 days for symptoms to appear.
- Check stems and developing heads to confirm injury.
- Focus scouting on higher-risk fields first.

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 Disease Update: Scab Risk and Rust Outlook

The wheat crop is ahead of schedule across the state and battling drought stress. Because of this, diseases have been slow to develop. In this article, we recap the current Fusarium head blight risk and provide updated reports of wheat rust in the state.

Fusarium head blight (scab risk) is elevated in the southeast

The weather is currently favorable for scab development in southeast Kansas, and risk is elevated moving into central Kansas according to wheatscab.psu.edu (Figure 1). This model considers weather conditions favorable for scab development over a 14-day window. Flowering (Feekes 10.5.1 - https://bookstore.ksre.ksu.edu/pubs/wheat-growth-and-development-poster-20x30_MF3300.pdf) is the critical window for a fungicide application to control Fusarium head blight (scab). It will be important to carefully watch risk in fields that are approaching the critical application window for a fungicide application (flowering- Feekes 10.5.1). The highest risk will be in fields planted with scab-susceptible varieties and planted back into corn residue. Continued wet weather around flowering will increase our risk of scab in Kansas. For a reminder about the scab ratings for individual varieties, please refer to the Kansas Wheat Variety Guide: https://bookstore.ksre.ksu.edu/pubs/mf991.pdf.

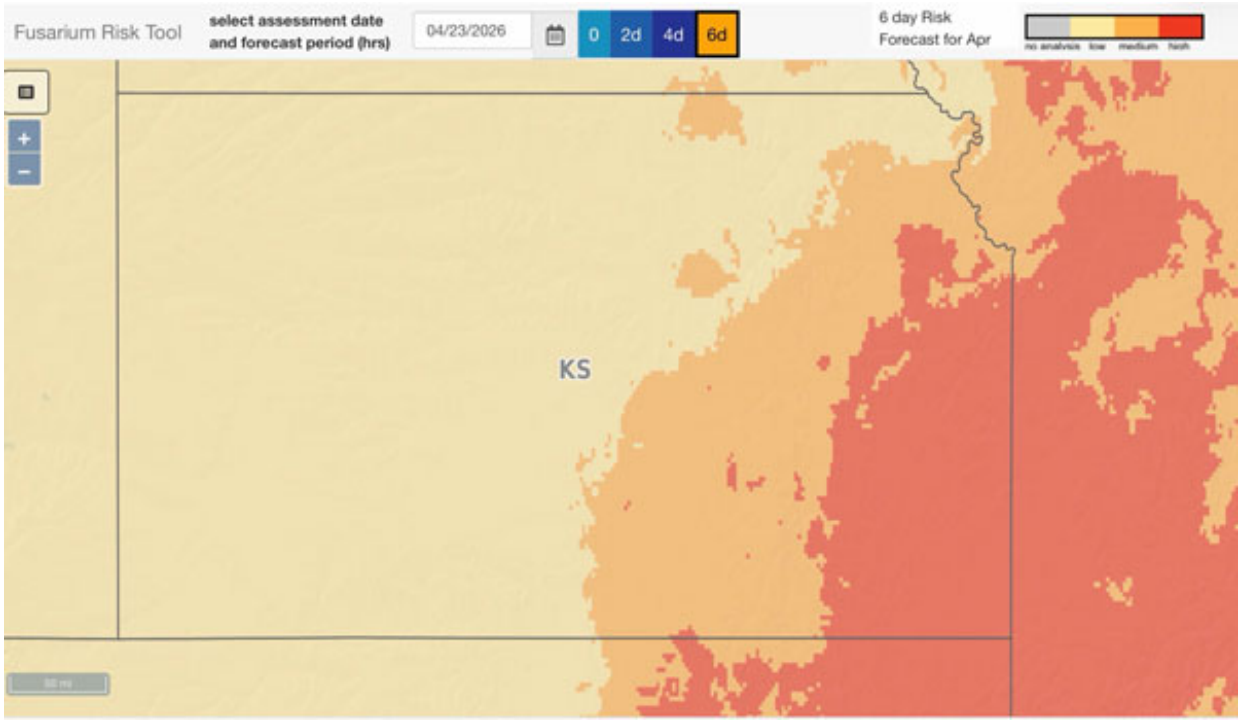

Figure 1. Fusarium head blight (scab) risk for April 23rd, 2026. Red areas are regions with the most favorable weather for scab over the last two weeks, and yellow indicates less favorable weather. This model is calibrated for susceptible varieties of winter wheat. This interactive map can be accessed at www.wheatscab.psu.edu.

As a reminder, scab infection occurs at flowering, but symptoms are not visible for 14-21 days after infection (Figure 2). Because of this, we cannot scout for scab the same way we do for stripe rust or

other foliar diseases. Fungicide decisions need to be made based on weather-related risk and the field's yield potential. Not only can scab lower yield and test weight, but it also produces a mycotoxin (vomitoxin, DON) and can produce grain that is "scabby," which can sometimes lead to discounts.

Figure 2. Fusarium head blight (scab) infection often begins with bleaching of infected spikelets and will progress throughout the head. When humidity is high, orange fungal structures are visible on the outside of the spikelet. The grain from infected heads may appear lightweight, white, or pink. Photos by K-State Extension.

Reminders for scab fungicide applications

Fungicide products - Fungicides such as Miravis Ace, Prosaro, Sphearex, Prosaro Pro, and generic equivalents are known to suppress scab (head blight). Specific fungicide performance for scab and other diseases can be found here: https://bookstore.ksre.ksu.edu/pubs/EP130.pdf. Other fungicides are not labeled or not recommended for scab control, particularly products containing strobilurin (FRAC group 11 – azoxystrobin, pyraclostrobin, etc.). As a reminder, all products that control scab will also control stripe rust and other foliar fungal diseases.

Timing – Because the wheat crop is ahead of schedule, we are getting questions about applying after the flowering period. Fungicides are most effective against scab when applied at early flowering (Feekes 10.5.1), and can provide disease protection even when applied later in the flowering window (7-10 days after flowering begins). It is important to pay attention to pre-harvest intervals at this point in the season and to follow the guidelines provided on product labels. The products listed above either have a 30-day pre-harvest interval (cannot be applied within 30 days of harvest) or

cannot be applied after Feekes 10.5.4 (end of flowering, watery ripe growth stage).

It is important to remember that flag-leaf fungicide applications will have little to no effect on scab control.

Rainfastness - With the current wet weather, we are getting many questions about fungicide rainfastness. Rainfast time is the period of time between the application of a fungicide and a rainfall event during which the fungicide will not lose efficacy. This information is often not included on the product label or is ambiguous. Rainfast time will vary with temperature and canopy moisture, but most products recommended for wheat in Kansas will be rainfast within 2 hours and likely within 1 hour under most conditions. Rainfastness is improved when a product is applied with a non-ionic surfactant.

Residual life - The residual life of the fungicide application is influenced by the product used, the environment, and the application rate. In general, products in the triazole and strobilurin classes of fungicides will run out of gas (you may start to see symptoms) after 21 days (about 3 weeks). Small differences in residual life among products typically do not result in large differences in grain yield. Some newer products are promoted as having much longer residual lives, but we don't have university research that supports those claims.

Seed treatments - Seed treatments do not have any influence on disease protection during the growing season, as the fungicides in these seed treatments wear off within 30-45 days of emergence. Seed treatments can improve the emergence of seed from infected fields, as this pathogen can cause seedling diseases when infected seed is planted back.

Stripe rust update and outlook

We received our first observations of low/trace levels of stripe and leaf rust in Kansas this week from Sumner County (Figure 3). We are continuing to scout and monitor the situation and will update the regional map with new observations: https://wheat.agpestmonitor.org/stripe-rust/ (Figure 4).

Figure 3. Stripe and leaf rust were observed at low/trace levels in Sumner County, Kansas, on April 22, 2026. Photo: Jeff Seiler, K-State Extension Sedgwick County.

Overall, the risk of widespread loss in Kansas remains low. Three factors are driving this low risk at this point in the season: 1) rust is arriving late in the season compared with previous years; 2) the wheat crop is ahead of schedule in most areas; and 3) conditions have been very dry through most of the state. Because of this, leaf and stripe rust will have a difficult time getting established at high enough levels to cause yield loss.

Scouting efforts should continue over the next few weeks as we move through critical growth stages across the state. Scouting efforts will be particularly critical in the portions of the state where the wheat growth stages are much less advanced. As a reminder, the probability of a positive return on a fungicide application greatly diminishes when disease pressure is absent.

If you detect stripe rust, please contact me at andersenk@ksu.edu so we can verify and update regional maps.

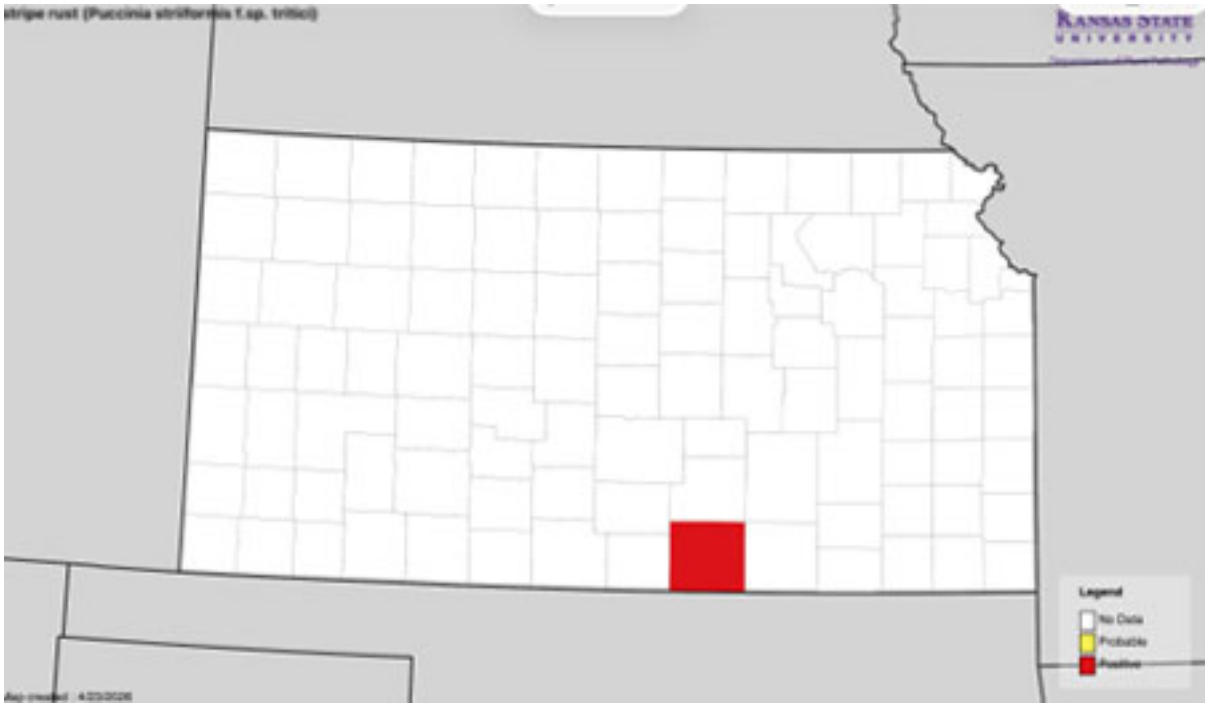

Figure 4. Counties where wheat stripe rust has been confirmed as of April 23, 2026. Real-time updates can be monitored at https://wheat.agpestmonitor.org/stripe-rust/.

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3. High Surfactant Oil Concentrate Adjuvants in Herbicides

Adjuvants are commonly used to increase the efficacy of postemergence herbicide applications.

There are a few key types of adjuvants, including:

- nonionic surfactants (NIS)
- crop oil concentrates (COC)
- methylated seed oils (MSO)
- nitrogen fertilizers such as ammonium sulfate (AMS) or urea ammonium nitrate (UAN).

The success of many herbicide applications depends on selecting the correct adjuvant, which is always described on the herbicide label. For example, COC is often recommended with clethodim (Select), MSO with tembotrione (Laudis), MSO plus AMS with saflufenacil (Sharpen), and NIS with mesotrione (Callisto). In some cases, using the wrong adjuvant may reduce herbicide efficacy or increase crop injury. One important example of this is glyphosate (Roundup) when mixed with COC or MSO.

High Surfactant Oil Concentrate (HSOC) adjuvants were developed for use in tank mixes that include herbicides that require an oil adjuvant and glyphosate. HSOC adjuvants are oil-based, containing 20% to 50% surfactant and a minimum of 50% of oil. An HSOC can use either COC (HSPOC) or MSO (HSMOC). The surfactant component of HSOC improves droplet spread and disperses oil-soluble compounds in water while the oil component increases absorption across the leaf cuticle. The overall effectiveness of an HSOC on hydrophilic (water-soluble) and lipophilic (oil-loving) herbicides depends on the properties of the oil and surfactant, and the oil-to-surfactant ratio. Research conducted in North Dakota showed that glyphosate plus dicamba or tembotrione provided greater control of several indicator species, on average, with HSMOC compared to HSPOCs evaluated (Figure 1).

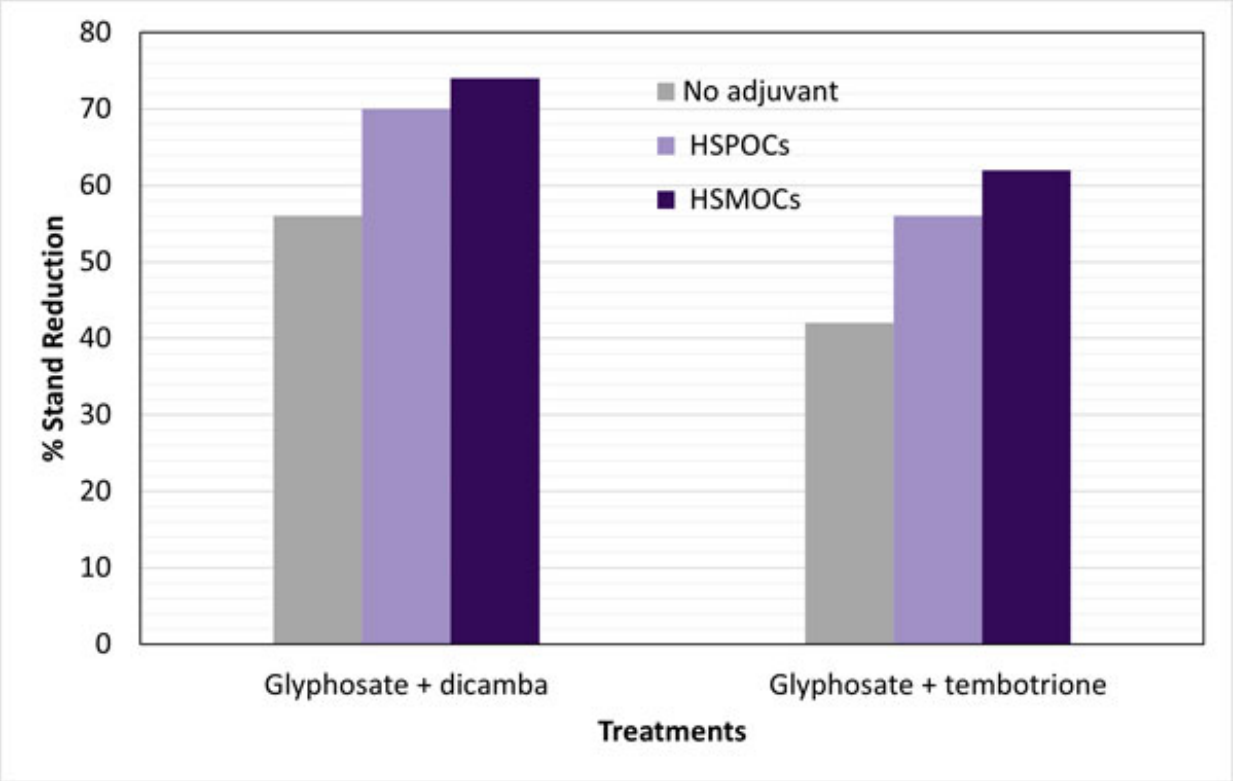

Figure 1. Average species control expressed as stand reduction (%) for glyphosate + dicamba and glyphosate + tembotrione applied without adjuvant or with average HSPOC and HSMOC treatments. Adapted from Wirth and Zollinger (2018), who reported few differences among individual products within HSPOC and HSMOC groups; therefore, group averages are presented here for clarity.

Always follow label requirements and recommendations for adjuvant use. If the herbicide label does not specify HSOC use directions, HSOC adjuvants should generally be applied at half the labeled rate of COC or MSO, typically around 0.5 % v/v, to minimize the risk of crop injury.

For additional information about adjuvants, see Adjuvants with Herbicides. When and Why They Are Needed. For more detailed information about herbicides, see the "2026 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide online 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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4. Webinar to Help Western Kansas Cattle Producers Make Grass Turnout Decisions

Dry conditions across western Kansas have many cattle producers questioning when to turn cattle out on pasture this spring. Kansas State Research and Extension will host a free webinar on **Wednesday, April 29, from noon to 1 p.m**. Central to help producers make informed grass turnout decisions.

Spring green-up has been slow or limited in some areas of Kansas this year. While weather patterns may shift, both the timing and amount of precipitation remain uncertain.

Maintaining adequate pasture cover is important for capturing available rainfall, improving infiltration, and reducing runoff. Management decisions such as stocking rate and turnout timing can play a key role in preserving grass cover, particularly during dry conditions.

The webinar will feature Keith Harmoney, range scientist at K-State's Agricultural Research Center in Hays, who will discuss planning and decision-making strategies based on historical range research. His work includes analysis of drought periods from the 1930s and 1950s, as well as more recent dry conditions.

Also participating will be Chip Redmond with the K-State Mesonet, who will provide a short-term weather outlook and highlight online climate and decision-support tools available to producers.

The webinar is hosted by the K-State Research and Extension Western Kansas Centers. The program is free, but registration is required at **https://tinyurl.com/kstate-grazing**.

The session will be recorded and made available afterward on the K-State Department of Animal Sciences beef website, **KSUBeef.org**.

For more information, please contact Sandy Johnson at 785-443-1332 or **sandyj@ksu.edu.**

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5. 2026 Kansas Wheat Plot Tours: May 11-May 15

The Department of Agronomy and K-State Research and Extension will host several winter wheat variety plot tours in different regions of the state starting May 11, 2025. Please make plans to attend a plot tour near you to see and learn about the newest available and upcoming wheat varieties, their agronomics, and their disease reactions. Below is a list of plot tour dates for May 11 through May 15, times, and locations with directions. This list will be continually updated in the coming weeks.

May 11 – Monday

Time	County	Location/Town	Agent	Directions
8:30 AM	Harper	Harper	Jenni Carr	South of Harper. 1½ mile west of K2 on US 160.
6:00 PM	Pratt	Pratt	Jenna Fitzsimmons	2 miles west and ½ mile south of BTI-Pratt.

May 12 – Tuesday

Time	County	Location	Agent	Directions
11:00 AM	Barber	Isabel	Justin Goodno	North of Isabel on the intersection between Main Street and SE 120th St.
5:00 PM	Barber	Kiowa	Justin Goodno	May Precision Ag: 126 S 7th, Kiowa, KS 67070

May 13 – Wednesday

Time	County	Location	Agent	Directions
11:00 AM	Kingman	Spivey	Grace Schneider	Bock Seeds Test Plot: 7681 SW 80 Ave, Kingman, KS 67068
8:30 AM	Barton	Great Bend	Stacy Campbell	West Barton Co Rd & NW 50 Ave
5:00 PM	Edwards	Kinsley	Baley Doggett	Head 2 miles west out of Kinsley on L Road then north 1.75 miles on 70th Ave.
6:00 PM	Ellis	Hays	Stacy Campbell	Hays Ag Research (Ct. So 1232 240th Ave. From office, go south on the east side of blacktop road)

May 14 – Thursday

Time	County	Location	Agent	Directions
10:00 AM	Kiowa/Comanche	County line	Madi Ary and Levi Miller	1 mile south of the Kiowa/Comanche County Line on the west side of HWY 183.
11:00 AM	Ellsworth	Lorraine	Craig Dinkel	2 miles west of Lorraine on Ave W west of 8th rd on the north side of the road GPS coordinates 38.55120 N - 98.35416 W

11:30 AM	Harvey	Newton	Alex Acheson	435-471 E Dutch Ave, Newton, KS 67114
3:30 PM	Reno	Buhler	Patrick Bergkamp	½ mile south of the corner of Rayl Rd. and East 69th Av. Meal at 5:30
6:00 PM	Pawnee	Larned	Kyle Grant	From Larned, go north on Toles Ave. 5 miles north, ½ mile east, and ¼ mile north. Plot is on the east side of the road.

May 15 – Friday

Time	County	Location	Agent	Directions
8:30 AM	Dickinson	Abilene	Bret Toews	Take 15 Hwy straight south of Abilene, the plot is just north of 1100th Ave.
11:30 AM	McPherson	Moundridge	Shad Marston	23rd Ave and Cheyenne Rd, just north
3:30 PM	McPherson	Inman	Shad Marston	1/4 mile east of 4th Ave and Cheyenne Rd.

Plots tours scheduled after May 15 are being finalized, and details will be updated soon. Stay tuned to the eUpdate for any changes to this schedule.

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