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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. Possible causes for white heads in wheat

White heads have been appearing in many wheat fields around Kansas. Sometimes, the white heads are just single tillers scattered throughout part or all of a field, and sometimes, they occur in small-to-large patches. Heads might be completely white starting from the stem or have just partial bleaching, showing a few spikelets with discoloration.

There are many causes of white heads. Here are some of the most common causes and their diagnosis.

Freeze injury to stem or crown. Depending on the growth stage at the time of a late spring freeze, parts of the head or all of the heads may die and turn white (Figure 1).

In years when the freeze occurs about the boot stage or a little earlier, there can be injury to the lower stem, which then cuts off water and nutrients to the developing head, and that stem simply does not develop. In years when the wheat is in the early heading stage at the time of the freeze, the freeze can damage the heads directly. This year, a hard freeze with temperatures down to 11 degrees F occurred on March 26-27. Symptoms of freeze damage are occurring across fields for most of the state.

Often, wheat on north-facing slopes, ridge tops, or low-lying areas will be most affected by freeze injury. However, freeze injury can also be so severe that it occurs throughout the fields in no particular pattern. Crown rot is another potential problem that can be traced back to freeze injury.

When the crown is damaged by cold temperatures or a freeze, part or all of the tillers can die. If the tiller from a damaged crown forms a head, this head will almost always be white. The crown will have internal browning, and stands will usually be thinner than normal.

Figure 1. Freeze-damaged wheat heads. Photos by Romulo Lollato, K-State Research and Extension.

Hail. Hail can cause a white head to appear when it breaks the connection between the stem and the head (Figure 2). Occasionally, hail can also damage just a portion of a head, and cause that damaged portion to turn white. The hail impact on the heads may also remove spikelets and expose the rachis (Figure 3).

Figure 2. Wheat field in Sumner County showing a high incidence of white heads due to hail damage. Photo taken May 22, 2019, by Romulo Lollato, K-State Research and Extension.

Figure 3. The heads in this photo have had a few spikelets removed due to hail impact and have their rachis exposed. Photo by Romulo Lollato, K-State Research and Extension.

Heat stress can scorch wheat heads and turn them white, usually starting from the top and moving downwards (Figure 4). Depending on the level of heat stress, entire tillers may be scorched in a given plant. This growing season, we have not had severe heat stress to this point, but if we happen to have it in the near future, look for partial discoloration of the top third of wheat heads.

Figure 4. White wheat heads caused by heat stress. Notice the scorched appearance starting from the top of the head and moving downwards. Photo by Romulo Lollato, K-State Research and Extension.

Dryland root rot (also known as dryland foot rot). This disease, caused by the *Fusarium* fungus, causes white heads and often turns the base of the plants pinkish (Figure 5). As with take-all, dryland root rot causes all the tillers on an infected plant to have white heads. This disease is usually most common under drought stress conditions and is often mistaken for either drought stress or take-all. This growing season, many fields in south central Kansas are impacted by this dryland root rot.

Figure 5. White wheat head caused by Fusarium root rot. Detail on the right shows pink discoloration inside the stem typical of the Fusarium pathogen. Photo by Romulo Lollato, K-State Research and Extension.

Head scab. During rainy periods while the wheat is flowering, heads may become infected with Fusarium head blight and turn white. The heads of some red-chaffed varieties turn a darker red when infected with scab, but the heads of most varieties turn white. Symptoms can be restricted to one or few head spikelets, but oftentimes the upper half or the entire head might be affected (Figure 6). Head scab is most common when wheat is grown after corn or after a wheat crop that had head scab the previous year. Head scab can be identified by looking for pink spores of the Fusarium fungi and a darker discoloration to the rachis of the wheat head. During the current growing season, head scab has been observed at low levels in south-central and southeast Kansas, but it is probably still early to see symptoms in north-central and northwest Kansas as it takes approximately three weeks from flowering for the first symptoms to appear.

Figure 6. Wheat heads affected by head scab or Fusarium head blight. Symptoms range from one or few spikelets that turned white, to the upper half or entirety of the head. Photo by Romulo Lollato, K-State Research and Extension.

Take-all. This disease often causes patches of white heads scattered throughout the field. It occurs most frequently in continuous wheat, and where there is a moderate to high level of surface residue. Take-all is also favored by high pH soils, so a recently limed field might also show symptoms. To diagnose take-all, pull up a plant and scrape back the leaf sheaths at the base of a tiller. If the base of the tiller is shiny and either black or dark brown, it is take-all. All tillers on a plant infected with take-all will have white heads. Plants will pull up easily.

Sharp eyespot. This disease is common in Kansas but rarely causes significant yield loss. Sharp eyespot causes lesions with light tan centers and dark brown margins on the lower stems. The ends of the lesions are typically pointed. If the stems are girdled by the fungus, the tiller may be stunted with a white head. Each tiller on a plant may be affected differently.

Wheat stem maggot. Wheat stem maggot damage is common every year in Kansas, but rarely results in significant yield loss. It usually causes a single white head on a tiller, scattered more or less randomly through part or all of a field. One typical symptom of white heads caused by wheat stem maggot is that the flag leaf and lower stem are often green, and only the last internode (peduncle) and head are white. If you can grab the head and pull the stem up easily just above the uppermost node, the tiller has probably been infested with wheat stem maggot. Scout for symptoms of chewing close to the base of the plants, which could indicate that the head has died as function of wheat stem maggot (Figure 7).

Figure 7. White wheat head due to wheat stem maggot, characterized by a white head and peduncle but with a healthy and green lower stem. Detail on the right shows chewing of the base of the peduncle by the maggot. Photo by Romulo Lollato, K-State Research and Extension.

Premature death. As wheat begins to mature, plants in some areas of the field may have an off-white color similar to take-all (Figure 8). This premature death could be due to drowning, hot dry winds, or other stress. The pattern of discolored heads will often follow soil types or topography and may occur in large patches. The grain will be shriveled and have a low test weight.

Figure 8. Large patches of drowned wheat in central Kansas (upper photo) and south central Kansas (lower photo). Photos were taken May 16 and 17, 2017, by Romulo Lollato, K-State Research and Extension.

Romulo Lollato, Wheat and Forages Specialist
lollato@ksu.edu

Erick DeWolf, Wheat Pathologist
dewolf1@ksu.edu

Kelsey Andersen, Extension Wheat Pathologist
andersenk@ksu.edu

2. Considerations when harvesting short wheat

In many areas of Kansas, prolonged drought has resulted in short wheat and thin stands (Figure 1). Harvesting wheat in these situations can be a challenge. Special attention needs to be given to cutting height, machine adjustments, and operator control. In short wheat, getting the heads into the combine with less straw will be challenging. In some cases, the reel may not be able to effectively convey the wheat back from the cutter bar to the auger nor hold it in place during cutting. Short cutting will also mean more contact potential with the ground and reduced levels of surface residue which will likely negatively impact moisture storage.

Figure 1. Typical wheat height and stand density in drought-affected areas of Kansas during the 2022-23 winter wheat growing season. Photo by Romulo Lollato, K-State Research and Extension.

In the case of material conveyance, stripper headers, air reels, and draper headers may be a great help.

Stripper headers

Stripper headers allow the grain to be harvested efficiently while leaving the maximum amount of standing residue in the field. Research has shown that this preservation of wheat residue can reduce evaporative losses of water after harvest, aid in the moisture retention of snow, and improve the yields of the next year's crop.

To properly use a stripper header, note the following:

- Operators need to be aware of the stripping rotor height and the relative position of the hood to the rotor. This position needs to be set correctly so that heads approach the rotor at the proper angle for stripping.
- Keep the nose of the hood orientated so that the top of the wheat heads are even with, or slightly below, the forward point of the nose. This may require operating the header with the nose in a slightly lower-than-normal position relative to the rotor. However, it's important to note that running a stripper header lower than necessary will result in increased power consumption and accelerated finger wear.
- Combine ground speeds should be kept high (above 4 mph) to maintain collection efficiency and minimize header losses.
- Several people have reported that adjusting header height with a stripper header is not as critical as it is with a conventional header and that a stripper header could easily be run by inexperienced people (see step 1).
- Continue to adjust stripping rotor speed throughout the day as conditions change. If rotor speeds are too high, that will result in detachment of the entire head and unnecessary increases in power requirements. Rotor speeds that are too slow will result in unstripped grain remaining in the head. In general, rotor speeds will be less in thin, short wheat than in better stands.

Air reels

Air reels will also aid in the material conveyance from the cutter bar to the auger in reel-type units when crops are light or thin. These units are made in several different types, including finger air reels, non-reel, and units that fit over existing reels. Examples of manufacturers are Crary (West Fargo, ND) and AWS (Mitchell, Ontario, Canada). Non-reeled units have the advantage of less eye strain from the continuously rotating header reel, but all units have collection efficiencies compared to conventional reels, even in sparse or short crops. These units do not control the amount of wheat stubble left in the field, and the operator still has to control the cutting height. In short wheat this may mean little to no field stubble will be left for next season's moisture collection, and for these reasons stripper headers may be a better choice for certain areas of Kansas.

Draper headers and flex heads

Draper headers may help with the conveyance of material since they have a very short distance between the cutterbar and the conveyance belt. The ability to tip the cutterbar completely back will aid in keeping harvested crop material moving across the cutter bar and onto the belt as well as ensuring some stubble remains standing on the soil surface. Cleats on the belt need to be in good to new condition to maximize the conveyance of crop material away from the cutterbar. Set gauge wheels properly to maximize cutting height and leave standing residue.

Flex heads will also help deal with the lower cutting heights and potential ground strikes. In thin wheat stands, it is even more important that sickles and guards are in good condition as there is less crop material pushing into the cutting area, which would normally help ensure cutting by worn sickles and guards. On headers with finger reels, it is quite likely that the short cut wheat will pass in between the fingers rather than being swept backward. Producers may consider adding material over or behind the fingers to act more as a bat to sweep the cutterbar clean. Plastic/vinyl materials or repurposed round baler belting has been successfully used for this purpose.

If harvesting with a draper or flex header, maintain the cutting height as high as possible to preserve standing stubble. Typically, cutting wheat at two-thirds of its full height will result in losses of less than 0.5 percent, as any missed heads contain lightweight grain that will be lost as tailings during harvesting.

Conventional headers

For many farmers, new equipment may not be an economical choice, and you may have to work with a conventional head on your combine. In this case, adjust the reel to get the best movement of the heads from the cutter bar to the auger. Combining in slightly damp conditions may help prevent shatter and decrease losses. If wheat heads have flipped out of the header from the top of the auger, an extra “auger stripper bar” may be necessary. A small strip of angle iron can be bolted slightly behind and below the auger to help with material conveyance. In thin wheat stands it is even more important that sickles and guards are in good condition as there is not as much crop material to push into the cutting area and ensure cutting by worn sickles and guards.

If harvesting with a conventional header, maintain the cutting height as high as possible to preserve standing stubble. Typically, cutting wheat at two-thirds of its full height will result in losses of less than 0.5 percent, as any missed heads contain lightweight grain that will be lost as tailings during the harvesting process.

Combine adjustments

In addition to material conveyance and cutting height, lower yields and uneven crop flow may also require performing combine adjustments to the concave/rotor cage clearance, cylinder/rotor speed, and fan speed. Follow the manufacturer’s recommendations. The leading cause of grain damage under almost any harvesting condition is an overly fast cylinder or rotor speed. This will especially be evident in harvesting short wheat as there will be less material in the concave or rotor cage to thresh against, increasing the likelihood of grain damage if cylinder/rotor speed is too high.

On conventional machines, it may be necessary to reduce concave clearance to attain good separation. On rotary combines it may be advantageous to maintain a typical clearance to provide a more normal threshing condition while using less threshing area. The use of blanking plates on the rotor cage may improve separation. Fan speeds may need to be reduced slightly in order to minimize grain losses. Once adjusted properly, try to keep material crop flow as constant as possible, as most threshing and cleaning units work best under these constant flow conditions. As the amount of material passing through the combine decreases, the response to various settings such as cylinder/rotor speed, concave/rotor cage clearance, and fan speed will be more sensitive than under more normal operating conditions.

Performing kill-stops during harvest will be especially critical in evaluating grain losses and identifying which stage of the harvesting process is the source. After performing a kill-stop the operator should look at shattered grain losses before the header, losses after the header and before the spread pattern of the combine, and losses in the tailings behind the combine. Losses can be quickly checked by looking at the number of seeds in the tailings and elsewhere around the combine.

Typically, 20 seeds per square foot equals 1 bushel per acre for a sampling area equal to the cutting width of the combine. For the tailings area, where the material is concentrated, multiply the 20 seeds per square foot by the header-to-tailings width ratio. For example, a combine with a 7-foot spreader width and 28-foot header would have a factor of 4 (28 divided by 7), and 80 seeds per square foot (20 x 4) would be the correct number for a bushel-per-acre loss. Also, a normal shoe length is typically one foot, so estimated measurements can be done with your foot. Individual field and header losses are determined by looking at areas before and under the combine. Actual combine threshing losses are determined by subtracting these numbers from the tailing loss.

Summary

Although this will be a rough wheat harvest for many farmers, some changes can be made to help maximize harvest efficiencies. If you have ever wanted to try an alternate header (stripper, flex-draper, etc.), this may be the year for you. For those not wanting to buy, renting may also be a viable option.

Producers in dryland production systems need to remember that in very low-yielding wheat years, anything that can be done to preserve the little crop residue present will have a large impact on evaporative losses and the productivity of the next crop.

Lucas Haag, Northwest Area Crops and Soils Specialist
lhaag@ksu.edu

Ajay Sharda, Extension Biological and Agricultural Engineer
asharda@ksu.edu

Romulo Lollato, Wheat and Forage Specialist
lollato@ksu.edu

John Holman, Cropping Systems Agronomist – Southwest Research and Extension Center
jholman@ksu.edu

3. Soybean response to standing water and saturated soils

Soybean planting is well underway in Kansas (43% planted), based on the USDA-NASS Crop Progress and Condition Report from May 19, 2024. However, heavy rainfall has occurred in many locations across the eastern half of Kansas, with some fields underwater and others with completely saturated soil.

Figure 1. Soybean plants slowly emerging and showing lack of uniformity. Photo by Ignacio Ciampitti, K-State Research and Extension.

Wet soil conditions will slow emergence, make the soil more susceptible to compaction (limiting root growth), and cause poor plant-to-plant uniformity after emergence. Sidewall compaction occurs when soybeans are planted when the soil is too wet, immediately followed by dry weather. Soil surface crusting is another potential challenge for soybean emergence.

After emergence, how will soybeans respond to standing water and saturated soil conditions?

If soybean plants are submerged for less than 48 hours, there is a good chance they will survive. Plants can survive underwater longer under cool than warm temperatures. Submerged soybean plants can survive for up to 7 days when temperatures are less than 80 degrees F.

Figure 2. Soybean seedlings under water. Photo by D. Shoup, K-State Research and Extension.

To determine whether the soybeans are damaged after the water recedes, split the stem at the tip and examine the growing point. A healthy growing point will be firm and white or cream-colored. A soft, dark growing point indicates injury. In some cases, the silt coating the plant after short-term flooding can cause more injury and plant death than the water itself.

Even if the fields do not have standing water and plants are not totally submerged, waterlogged soils can cause problems if the waterlogging lasts too long. When soils are saturated for a prolonged period of time, a lack of oxygen in the roots can lead to the accumulation of lactic acid and other products of anaerobic respiration. This is the underlying cause of damage to plants in waterlogged soils where only the roots are flooded.

Injury can depend on variety, growth stage, duration of waterlogging, soil texture, fertility levels, and diseases present. Interactions of these factors make it hard to predict how a given soybean field will react to waterlogged soils.

Figure 3. Soybean seedlings under full submersion. Photo by Ignacio Ciampitti, K-State Research and Extension.

Variety differences have been reported, and researchers have identified possible genes associated with tolerance to waterlogged conditions. Scientists in Missouri have screened a number of soybean varieties, subjecting them to two periods of flooding, each two weeks in duration. The average yield reduction for all varieties was 61%. Yields were reduced by 39% for the most tolerant varieties and 77% for the least tolerant. Producers should check with their seed supplier regarding information about a particular variety.

Growth stage factors

Research examining the influence of the growth stage on the degree of injury from waterlogged soils has provided mixed results.

- **Germination**. Saturated conditions during germination can reduce successful germination by up to 40% and can inhibit seedling growth. Seeds that are further along in the germination process at the time of saturation sustain more injury.
- **Vegetative growth stages**. Excess water during vegetative stages usually causes less injury than waterlogging during the reproductive and grain filling stages. Short-term waterlogging

(2 to 3 days) at V2 to V4 can cause yield reductions of 0% to 50%, depending on soil texture, variety, and subsequent weather. Yield reductions from waterlogging during the early vegetative stages have been attributed to reduced plant population and shorter plants with reduced branching and fewer pods per plant.

- We are far from the **reproductive stages** at the moment, but for the record, waterlogging for 2 to 3 days at R2 usually causes greater yield reductions than if it occurs during the vegetative stages. Waterlogging at R1 reduced the number of pods per node. At R5, yield reductions have been attributed to reduced seed size.

Duration of soil saturation

The longer the soil is saturated, the greater the injury, mortality, and consequent yield reductions. During germination, saturated conditions for 48 hours can decrease germination by 30% to 70% depending on the timing of the saturation, nearly twice the yield decrease resulting from durations of 24 hours or less. For plants that have emerged, a waterlogged condition that lasts for less than two days often causes little or no noticeable yield reduction. Intolerant varieties begin to show yield reductions after 2 days of saturation, but tolerant varieties can withstand up to 4 days of waterlogging with little reduction in yield. As the duration of soil saturation increases, researchers have documented greater reductions in population, height, pods per plant, yield, and leaf tissue nitrogen.

Other factors

Soil conditions also play a role in the severity of injury from waterlogging. Coarser-textured soils drain more quickly, minimizing the duration of oxygen deprivation to the roots. Fine-textured soils maintain saturation longer, increasing the chances of injury.

Fields that are flooded or are at or above the soil's water-holding capacity will be more likely to develop root rot problems. Flooding accompanied by cooler temperatures would favor Pythium root rot, whereas warmer temperatures would favor *Phytophthora* and *Rhizoctonia* root rots. Whether *Phytophthora* root rot develops often depends on the tolerance or resistance of the variety used. If the flooding occurs beyond the first week or two after emergence, any seed treatment fungicides that may have been used will no longer be effective.

Figure 4. Stand loss in a wet area due to Phytophthora root rot. Photo by Doug Jardine, K-State Research and Extension.

Need help with a seedling problem?

Contact your local K-State Extension Office. They will work with you to send photos of the problem (close-up, seedling, field shot) and plant samples to the K-State Plant Disease Diagnostic Lab. Here are guidelines that can help get a good sample to the lab:

Use this link for the sample submission form:

https://www.plantpath.k-state.edu/extension/diagnostic-lab/documents/DiseaseLabChecksheet.pdf

- Fill out the accompanying Plant Diagnostic Lab Form (PDF) as completely as possible.
- Send a sample characteristic of the problem that exhibits a range of symptoms.
- Dig (do not pull) up the seedling so the roots remain intact.
- Send a plentiful amount (~10 seedlings) of fresh plant material (including roots). Shake off most of the soil.
- Seal the plant material in an appropriately sized plastic bag and pack it in a crush-proof container.
- **Do not add water or wet paper towels to the sample!**
- Put the accompanying information sheet in a separate plastic bag to keep it dry.
- Bring your sample to the local K-State Extension Office for overnight shipping early in the week.

Shipping address:

K-State Plant Disease Diagnostic Lab
4032 Throckmorton PSC
1712 Claflin Road
Manhattan, KS 66506

Phone Number: 785-532-6716
Email: clinic@ksu.edu

Ignacio Ciampitti, Farming Systems
ciampitti@ksu.edu

Rodrigo Onofre, Plant Pathology
onofre@ksu.edu

Chandler Day, Diagnostician Plant Pathology
chandlerday@ksu.edu

4. Effect of standing water and saturated soils on corn growth

Standing water or saturated soil conditions in areas of a field can impact corn now or later. Periods of early-season water saturation can cause immediate problems for small corn plants and can have season-long implications as well. Hopefully, the affected areas are small and confined to low-lying or poorly drained spots.

Saturated soils after corn emergence

After corn emerges, saturated soils inhibit root growth, leaf area expansion, and photosynthesis because of the lack of oxygen and cooler soil temperatures. Yellow leaves indicate a slowing of photosynthesis and plant growth. If photosynthesis continues but growth is slowed, leaves and sheaths may turn purple from the accumulation of sugars. Corn plants can recover with minimal impact on yield if they stay alive and conditions return to normal fairly quickly.

Figure 1. Young corn plants affected by water standing and soil erosion. Photo by Ignacio

Ciampitti, K-State Research and Extension.

Although root growth can compensate to some extent later in the season, a saturated profile early in the season can confine the root system to the top several inches of soil, setting up problems later in the season if the root system remains shallow. Corn plants in this situation tend to be prone to late-season root rot if wetness continues throughout the summer, and stalk rots if the plants undergo mid- to late-season drought stress. Plants with shallow root systems also become more susceptible to standability problems during periods of high winds.

Tolerance of young corn plants to full submersion

Young corn plants can tolerate only a few days of full submersion. In some cases, symptoms and stand problems seen late in the season may be traced back to flooding when the plants were young. Before V6, when the growing point is at or below the soil surface, corn can survive only 2-4 days of flooding. Chances of plant survival increase dramatically if the growing point is not completely submerged or if it is submerged for less than 48 hours. After 48 hours of soil saturation, soil oxygen is depleted, and critical plant functions (photosynthesis, water, and nutrient uptake) are impaired.

Thus, young corn plants are more susceptible than corn beyond the V6 stage, when the plants are taller, and the growing point is above the surface. Research has demonstrated yield reductions from early-season flooding ranging from 5% to 32% depending on soil nitrogen status and duration of flooding.

Complicating factors

Temperatures can influence the extent of damage from flooding or saturated soils. Cool, cloudy weather limits damage from flooding because growth is slowed and because cool water contains more oxygen than warm water. Luckily, much of the flooded areas in the last couple of weeks have stayed relatively cool. Warm temperatures, on the other hand, can increase the chances of long-term damage.

Silt deposition in the whorls of vegetative corn plants can inhibit the recovery of flooded corn plants. Enough soil can be deposited in the whorl to inhibit the emergence of later leaves. A heavy layer of silt on leaf surfaces can potentially inhibit photosynthesis or damage the waxy surface layer of the leaf (cuticle), making the leaves subject to drying out. New leaves should not be affected if they can emerge normally. Ironically, what is often best for the silt-covered plants is to receive a small shower to help wash off the leaves.

In some instances, the soil in the whorl may contain certain soft-rotting bacteria. These bacteria can cause the top of the plant to rot. The whorl can easily be pulled out of a plant infected with these soft-rotting bacteria. In addition, a rather putrid odor will be present. These plants will not recover.

Disease considerations

Flooding can increase the incidence of moisture-loving diseases like crazy top downy mildew. Saturation for 24 to 48 hours allows the crazy top fungus spores found in the soil to germinate and infect flooded plants. The fungus grows systemically in the plant, often not causing visual symptoms for some time. Symptom expression depends on the timing of infection and amount of fungal growth in the plant. Symptoms include excessive tillering, rolling, and twisting of upper leaves, and proliferation of the tassel. Eventually, both the tassel and ear can resemble a disorganized mass of small leaves, hence the name “crazy top.”

Figure 2. Crazy top in corn. Photo by Doug Jardine, K-State Research and Extension.

Other concerns: Denitrification, cold weather crown stress, green snap, and root lodging

Saturated soils can also cause loss of N fertilizer by either denitrification (loss of N to the atmosphere, mainly as nitrous oxide gas) or leaching (movement of N beyond the rooting zone). For any of these losses to occur, N should be present in the mobile nitrate (NO_3^-) form. Depending on the fertilizer application time and source, most of the N may still be in the less mobile ammonium (NH_4^+) form. However, the conversion to nitrate happens quickly as soil temperature increases. Under wet spring planting conditions, corn may respond to in-season N applications if a large portion of early-applied N is lost to these processes. If corn remains N deficient later in the season, expect considerably higher levels of stalk rot.

Another condition associated with extended periods of cool, wet soils is commonly referred to as *cold weather crown stress*. Internal stalk cells in the crown nodes can become “leaky” when cell membranes become chilled, and oxygen is limited because of the saturated soils. Hybrids with “southern” genetics are more susceptible to this problem than are northern types. Plants may recover from this damage but will be much more susceptible to stalk rot later in the season if hot, dry temperatures occur since water and nutrients cannot be efficiently moved through the damaged crown.

Figure 3. Corn plant showing symptoms of cold weather crown stress. Photo by Doug Jardine, K-State Research and Extension.

The best advice is to scout your corn after water drains from the fields. Check the appearance of new leaves and the standability of the corn.

Ignacio Ciampitti, Farming Systems
ciampitti@ksu.edu

Dorivar Ruiz Diaz, Nutrient Management Specialist
ruizdiaz@ksu.edu

5. Corn rootworm egg hatch has begun in Kansas

To date, corn rootworm degree day accumulation for the northern half of Kansas is ahead of the same time last year, and egg hatching should begin in one to two weeks in most locations. In the southern portion of the state, degree day accumulation is slightly behind last year, but egg hatching is underway, and peak hatch is likely two to three weeks (Table 1).

Table 1. 2024 corn rootworm degree day accumulation compared to 2023 during the same time period. Calculated using 10 cm max/min ground temperatures provided by KSU Mesonet.

CRW Degree Day Accumulation as of May 19			
Location	**2023**	**2024**	**Difference**
Colby	189	255	+66
Hays	298	332	+34
Manhattan	306	356	+50
Garden City	451	428	-23
Meade	575	560	-15
Parsons	433	373	-60

Calculating Corn Rootworm Degree Days

As with all degree-day models, the base temperature, or developmental threshold, will be important for predicting rootworm hatch and emergence. Western Corn Rootworm eggs are laid in summer and overwinter in the soil. The following spring, a threshold soil temperature of 52°F or higher will trigger eggs to develop. This base temperature and the daily 10-cm high and low soil temperatures are used to monitor egg hatch using the formula below. It is important to note that degree day calculations for egg hatch should begin starting January 1 of the current year.

Calculating growing degree days for western corn rootworm egg hatch:

$$\left(\frac{\text{(Max. Daily 10cm Soil Temp. + Min. Daily 10cm Soil Temp)}}{2}\right) - 52^\circ\text{F}$$

For example:

$$\frac{(58^\circ\text{F} + 54^\circ\text{F})}{2} = \frac{112}{2} = 56 - 52 = 4 \text{ degree days accumulated that day}$$

Eggs should begin hatching after approximately 380 degree days have accumulated. Peak egg hatch occurs between 684 and 767 accumulated degree days. Examining corn roots for damage 10 to 14 days following peak hatch is recommended since feeding damage will be fresh and easier to detect.

Why is it important to scout for root damage?

Western corn rootworm resistance to Bt corn continues to be an issue in continuous corn in the United States. Field-evolved resistance was first detected in 2009, and, to date, resistance to every commercially available Bt trait package has been detected in corn-producing areas of the country. However, resistance is not uniform across all corn-growing regions, so be sure to check local conditions when making planting decisions. Given this, evaluating corn roots for rootworm damage during the growing season is highly recommended. Doing so lets you know how well your rootworm management practices are working and provides a way to detect the presence of potential resistance to the Bt hybrid planted.

Details for the process of evaluating corn root damage can be found in the KSRE publication MF845 *Corn Rootworm Management in Kansas Field Corn*. In short, several plants should be dug up throughout the field, and their roots should be washed well for subsequent evaluation using the Iowa State University 1-3 Node Injury Scale. Digging roots will need to be timed after peak damage from rootworm larvae occurs but before roots begin to regrow, typically late June to early July. Corn rootworm resistance to a Bt protein should be considered if the node injury rating is 1.0 in a field with at least 2 consecutive years use of the same single corn rootworm Bt toxin or if the node injury rating is greater than 0.5 in a field with at least 2 consecutive years use of the same pyramided corn rootworm Bt toxins.

It is important to remember that the best management tool for western corn rootworm is rotation. In continuous corn production, this includes rotating Bt traits annually to help slow the evolution of resistance. Rotation to a non-Bt hybrid combined with soil applied insecticides would be another option for continuous corn. Both practices will be useful for prolonging the efficacy of currently available Bt traits.

Anthony Zukoff, Extension Entomology Associate – Garden City
azukoff@ksu.edu

Field bindweed (*Convolvulus arvensis L*), a perennial vine in the morningglory family, infests millions of acres in the Great Plains. This weed significantly reduces crop yield and quality, reduces land value, interferes with harvest by entangling crop plants, and increases production costs associated with control practices. Earlier research in Hays, KS, over the span of 12 years, indicated that dense stands of field bindweed induced 20% to 50% cereal crop yield loss and 50% to 80% row crop yield reduction.

In North America, field bindweed was first reported in Virginia in 1739. It was possibly brought to Kansas in infested wheat seed from the Ukrainian region of Russia between 1870 and 1875. In 1877 and 1888, it was reported near Topeka (Kansas) and Nebraska, respectively (Figure 1).

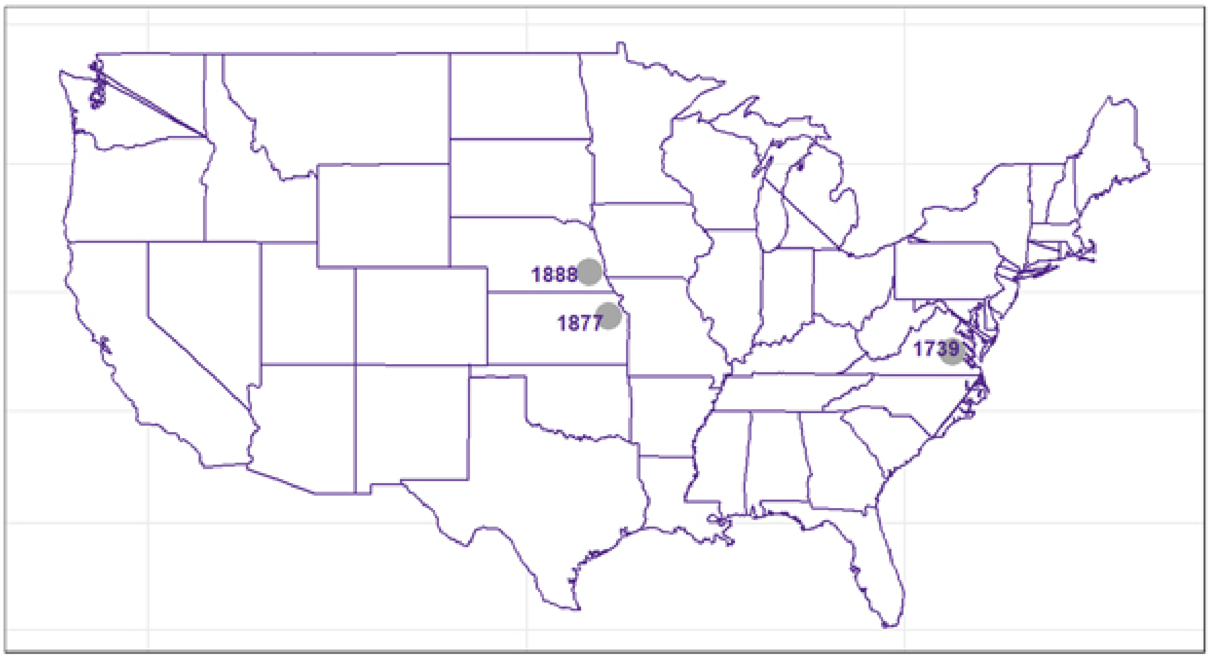

Figure 1. Field bindweed was first reported in Virginia in 1739, near Topeka (Kansas) in 1877, and in Nebraska in 1888.

Ecology of field bindweed

Growth and development. Seeds near the soil surface will germinate throughout the growing season following rainfall. Seedling emergence primarily occurs in the spring, usually in early to mid-April in Kansas, and continues growing until November or until temperatures drop to 20°F or lower; at these temperatures, its growth may be retarded, but the vines do not die. Seedlings quickly develop a deep taproot and numerous lateral roots about six weeks after emergence. Once lateral roots grow, the plant has a perennial growth habit (Figure 2). Growth ceases during severe drought, but new top growth appears after adequate rainfall. May 15 to June 15 is the heaviest bloom period in west-central Kansas, with the seed usually maturing from June 15 to July 15. However, field bindweed can continue to bloom under favorable conditions and produce seed during July and

August.

Figure 2. Field bindweed infestation. Photo by Jeremie Kouame, K-State Research and Extension.

Roots and food reserves. Field bindweed stores a large quantity of carbohydrates deep into its root system, which provides energy for below- and above-ground growth. Roots can have a lateral spread of approximately 10 feet in one season and may penetrate 18 to 20 feet (Figure 3). In two or three growing seasons, roots may extend to a diameter of 17 to 18 feet. In areas with average annual precipitations of 30 inches or more, field bindweed roots have been found 30 feet below the surface. However, on upland soils near Hays, where annual precipitation averages 23 inches, few roots were found below 6 feet. Also, more than 60% of the total weight of roots is reported to be in the top two feet of soil. Buds formed along lateral roots can develop into shoots, which become new plants when they surface.

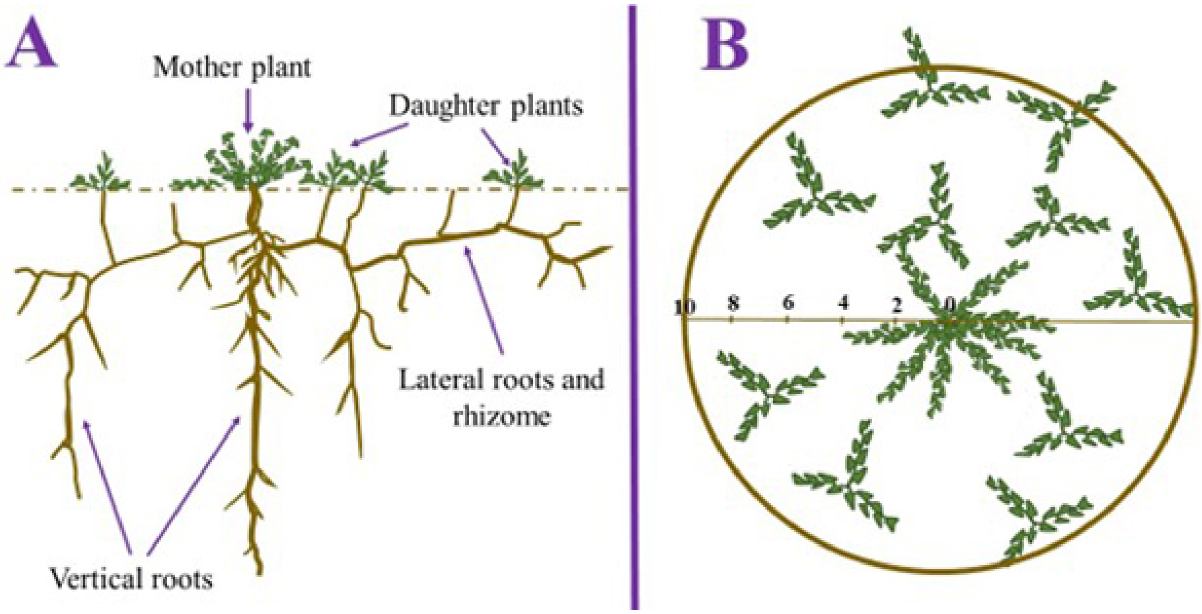

Figure 3. Field bindweed (A) mother plant with vertical and lateral roots and daughter plants (B) lateral spread with the mother plant in the center and daughter plants up to 10 feet away in all directions. Redrawn from Hillary Broad.

Dispersal mode. Field bindweed spreads by root segments and seeds, both of which can be spread by road maintenance equipment. Root segments with buds are dispersed by tillage implements and are capable of starting new plants when the soil has adequate moisture.

Spreading by seed occurs when:

- Vines, wrapped around tools and those that pass through harvesting equipment, drop field bindweed seeds.
- Seeds are collected with harvested grain and often planted with crop seed.
- Seeds in grain or hay fed to livestock pass through animals undigested and spread with manure.
- Seed is transported by drainage water, birds, animals, machinery, and vehicles.

Identification of field bindweed

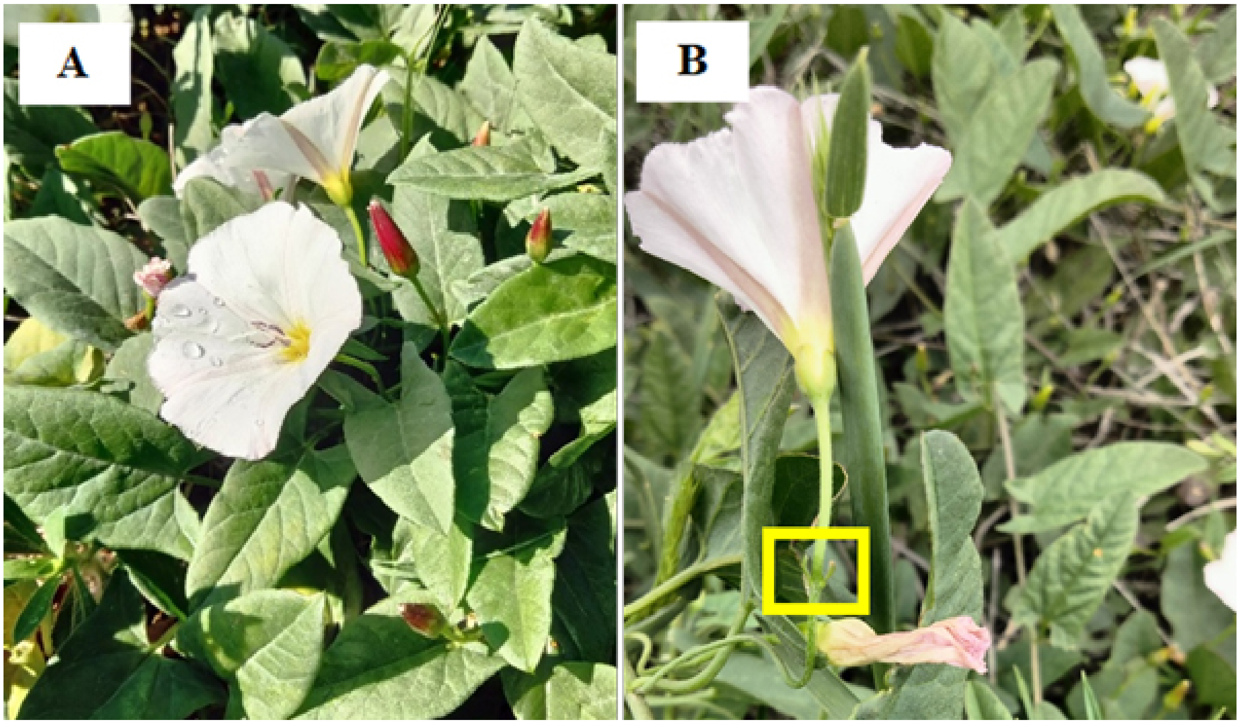

Figure 4. (A) A flowering field bindweed plant. (B) A field bindweed flower with two small bracts is present about 1 inch below the flower (yellow rectangle). Photo by Jeremie Kouame, K-State Research and Extension.

- Two **cotyledons**, present on plants emerging from seedlings and absent from those emerging from perennial rhizomes, are smooth and square to kidney-shaped.
- **Leaves** are alternate, smooth to hairy, and triangular to arrow-shaped with entire margins and rounded apical tips.
- **Stems** are twisting, prostrate unless climbing, smooth to hairy.
- The corolla of **flowers** is funnel-shaped (Figure 4A-B), 1 to 2 inches long, and varies from white to pink. Two small bracts are present about 1 inch below the flowers (Figure 4B).
- Each flower produces a nearly round seedpod containing 1 to 4 dark brown or black 3-sided **seeds**. Seeds are viable 10 to 15 days after pollination when seed moisture is down to 80%.

Management

Because field bindweed has long seed viability and tremendous food reserves stored in roots, a long-term management program is required for its successful control. A single application of a herbicide will not eradicate established stands.

A companion article in next week's eUpdate will discuss the best options for effectively managing bindweed.

Jeremie Kouame, Weed Scientist, Agricultural Research Center – Hays
jkouame@ksu.edu

Randall Currie, Weed Scientist, Southwest Research Extension Center - Garden City
rscurrie@ksu.edu

Sarah Lancaster, Extension Weed Management Specialist
slancaster@ksu.edu

7. 2024 Kansas Wheat Plot Tours - Updated Schedule

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 14, 2024. 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 preliminary list of plot tour dates, times, and plot locations/directions. This list will be continuously added to and updated in the coming weeks.

Romulo Lollato, Extension Wheat Specialist
lollato@ksu.edu

Date	Time	County	Location	Directions	Agent/ Contact	Speakers
5/28	5:00 PM	Finney	Garden City	Southwest Research and Extension Center in Garden City	Logan Simon	Logan
5/28	6:00 PM	Kiowa	Mullinville	Junction of State Hwy 54 and 11th Ave (east edge of Mullinville), south 2 miles, intersection of 11th Ave and M street.	Gary Jorgensen (Alliance Ag & Grain) / Mandy Hensen	Romulo
5/29	9:30 AM	Rush	LaCrosse	8 ½ miles straight west of the Casey's located in LaCrosse on Hwy 4. Do not curve north to Hargrave. At 7 miles, continue straight west off of the curve. The plot is south side of the road.	Lacey Noterman	Romulo/ Kelsey
5/29	2:00 PM	Ness	Ness City	17282 T Road. From Ness City, go North on Hwy 283 for 4 miles, then turn east on Rd. 170 for 1 mile, and then turn north on Rd. T. Plot is located north of the scale house on the Nichephor farm.	Lacey Noterman	Romulo/ Kelsey
5/29	6:00 PM	Lane	Dighton	7 miles west of Dighton to Eagle Rd, 2 miles south to West Rd 130, then 200 yards west toward Ehmke farmstead, east of the scale.	Lacey Noterman	Romulo/ Kelsey
6/5	7:30 AM	Republic	Belleville	Plot to focus on wheat strea mosaic virus. 2 miles	Luke Byers	

				west of Belleville in the North Central Experiment Field			

6/5	10:00 AM	Republic	Polansky	1 mile east of Belleville on U.S. 36	Luke Byers	
6/5	3:00 PM	Clay	Morganville	2 miles east of Morganville on KS-80, 0.5 miles south on Limestone Rd	Luke Byers	
6/5	5:00 PM	Washington	Palmer	3 miles east of Palmer on 4th Rd	Luke Byers	

8. K-State TAPS Technology Field Day - June 20 in Colby

The K-State Testing Ag Performance Solutions (TAPS) program invites TAPS contestants, agricultural industry partners, and anyone interested in sustainable and efficient irrigation technology to attend the TAPS Technology Field Day on June 20, 2024, at the Northwest Research-Extension Center, 105 Experiment Farm Drive, Colby, KS 67701.

The technology program and a tour of the TAPS plots will begin at 10:00 a.m. Afterward, a meal will be provided at the NWREC. Attendees are also invited to join the TAPS program team and technology partners for a golf scramble at Meadow Lake Golf Course.

Attendees can engage with technology partners and demonstrations, view the TAPS Sprinkler Irrigated Corn competition plots planted in May, connect with K-State Research and Extension Specialists, and build their network.

Schedule for the 2024 TAPS Technology Field Day

- 10:00 a.m. to 12:30 p.m. Technology Program and Tour of the TAPS Plots
- 12:30-1:30 p.m. Lunch
- 2:00 p.m. Tee Time at the Meadow Lake Golf Course

"TAPS unites industry, farmers, research, and education, building a collaborative network to support sustainable and profitable irrigation management," said Daran Rudnick, K-State director of sustainable irrigation and TAPS. "This technology field day is an opportunity for anyone interested to see what TAPS is all about and join the conversation."

The public is encouraged to attend the TAPS Technology Field Day to witness this exciting real-world farming competition and learn about the technology used in sustainable agricultural water management. Attendees will meet the farmers, industry professionals, and researchers working to conserve the Ogallala Aquifer and sustain a strong agricultural economy in western Kansas.

You can still participate in the TAPS competition by following @KSUTAPS on Twitter, Facebook, and Instagram and engaging with the TAPS social media team. The public is invited to vote and help make decisions for the TAPS Social Media Team plots, experiencing the same competition challenges farmers face in western Kansas.

To RSVP for the 2024 TAPS Technology Field Day and catered meal, visit the TAPS website at www.K-State.edu/TAPS or contact Renee Tuttle, TAPS and irrigation extension associate, at rstuttle@ksu.edu.


KSUTAPS
TESTING AG PERFORMANCE SOLUTIONS
REGISTER TODAY
TAPS TECHNOLOGY FIELD DAY & GOLF SCRAMBLE
Thursday, June 20, 2024
Northwest Research-Extension Center
105 Experiment Farm Drive
Colby, KS 67701