Issue 897

K-STATE Research and Extension

Extension Agronomy

eUpdate

03/18/2022

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. Army cutworm reaching treatment thresholds in winter canola

With the onset of warmer temperatures, winter canola is breaking dormancy and army cutworms are now present in fields across Kansas. Significant army cutworm pressure has been observed in fields northwest of Caldwell in Sumner County.

The economic threshold for chemical control is 1 to 2 cutworms per foot of row. Army cutworms behave nocturnally and typically spend the daylight hours belowground. When scouting, it is critical to dig in the soil around individual canola plants to find the larvae. However, it is not unusual to find army cutworm above ground when populations are high (Figure 1). The larvae are greenish-gray and often curl up into a C-shape.

Figure 1. Army cutworm found in winter canola variety trials in Sumner County. Photo courtesy of Greg Turek, producer.

Army cutworms feed aggressively and significant damage can occur in a short period of time. Smaller plants are most susceptible. The larvae feed on the leaf tissue, leaving the plants with a fed-on appearance (Figure 2). When minor feeding is observed, you may find leaves severed from the plant and laying on the soil surface. Where infestations are high, army cutworms will remove all leaf tissue, leaving only the base of the stem (Figure 3).

Figure 2. Army cutworm feeding in winter canola near Hutchinson in 2015. Photo by Mike Stamm, K-State Research and Extension.

Figure 3. Severe army cutworm damage to winter canola. Photo by Mike Stamm, K-State Research and Extension.

Use insecticides labeled for army cutworm control (Table 1). Carefully read the label for proper application and any restrictions.

Table 1. Insecticides with rates for control of army cutworms in winter canola. Source: Great Plains Canola Production Handbook.

Insecticide	Rate per acre
Brigade 2EC (bifenthrin)	2.1 to 2.6 fl oz
Warrior II with Zeon (lambda-cyhalothrin)	0.96 to 1.92 fl oz
Proaxis 0.5 CS (gamma-cyhalothrin)	1.92 to 3.84 fl oz
Mustang MAXX EC (zeta-cypermethrin)	4.0 fl oz

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2. Optimal time to remove cattle from wheat pastures: First hollow stem

The unique climate characteristics of the Southern Great Plains allow producers to use wheat as a forage and grain crop (dual-purpose), potentially increasing overall profitability compared to grain-only or forage-only systems. Date of grazing termination is an important factor in determining wheat's recovery potential and ability to produce grain. First hollow stem (FHS) is the optimal time to remove cattle from wheat pastures to protect grain yield potential.

What is the first hollow stem (FHS) stage of wheat development?

Before the wheat leaf sheaths become erect after spring green-up, the developing growing point, which is below the soil surface, will soon begin to form a tiny head. Although the head is quite small at this point, it has already established some important yield components. At this stage, the maximum potential number of spikelets is determined. Sufficient nitrogen (N) should already be available in the root zone at this growth stage to maximize the potential number of seeds per head.

Once the embryo head has developed, the first internode will begin to elongate, pushing the head up through the leaf sheaths. This first internode will be hollow. This will be visible before you can actually feel the first node (joint, located just above the first internode).

FHS is the point at which a 1.5 cm (about half-inch) length of hollow stem can first be identified below the developing head (Figure 1). This length is roughly equivalent to the diameter of a dime, which makes its identification in the field easier. FHS occurs when the developing head is still below the soil surface. This means that producers have to dig plants out of the ground to measure it.

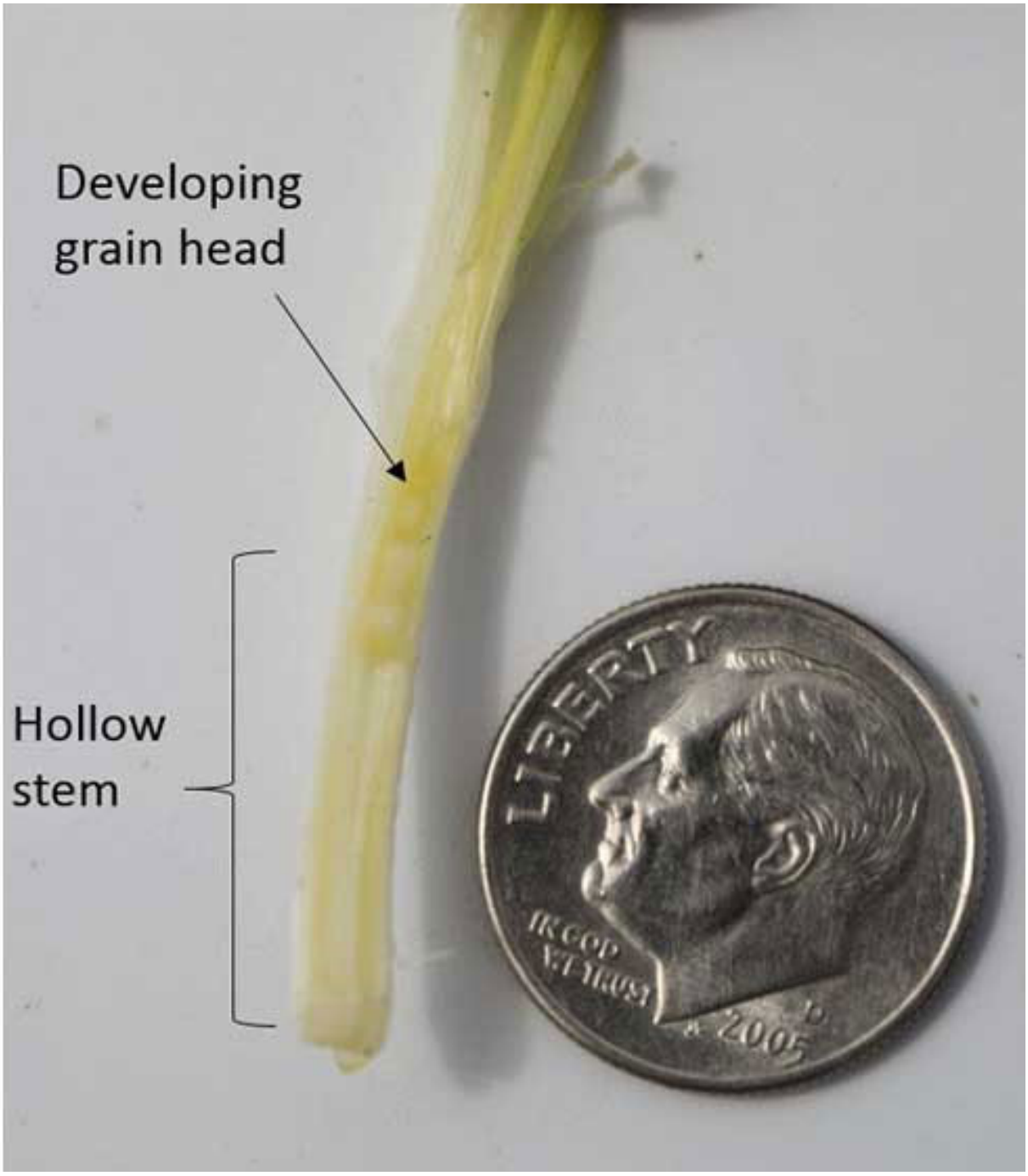

Figure 1. Wheat plant reaching the first hollow stem stage of growth, characterized by approximately 1.5 cm (or roughly the diameter of a dime) of hollow stem underneath the developing grain head. Photo by Romulo Lollato, K-State Research and Extension.

Assessing for first hollow stem

To look for FHS, start by digging up some plants from fields or areas that have not been grazed, such as field corners or just outside the fence. Date of FHS is variety- and field-specific, so it is important to sample each individual field. Select the largest tillers to examine, and slice the stem open from the crown area up. Look for the developing head, which will be very small. Next, see if you can find any

hollow stem between the developing head and the crown area. If there is any separation between the growing point and crown, the hollow stem is elongating. If that separation is 1.5 cm, the wheat plant is at FHS. FHS occurs between a few days to a week or more prior to jointing, depending on temperatures.

Yield losses from grazing past first hollow stem

If the wheat has reached FHS, cattle should be removed to prevent grain yield loss. Yield losses from grazing after FHS can range from 1 to 5% per day, depending on grazing intensity and the weather following cattle removal (Figure 2). If cattle removal is followed by cool, moist weather, yield losses will often average about 1% per day grazed after FHS; if weather is hot, dry, and harsh, yield losses of 5% per day or more can be expected. It is easy for producers to be late by a few days in removing livestock as they wait for obvious nodes and hollow stems to appear, and even the first few days can be significant.

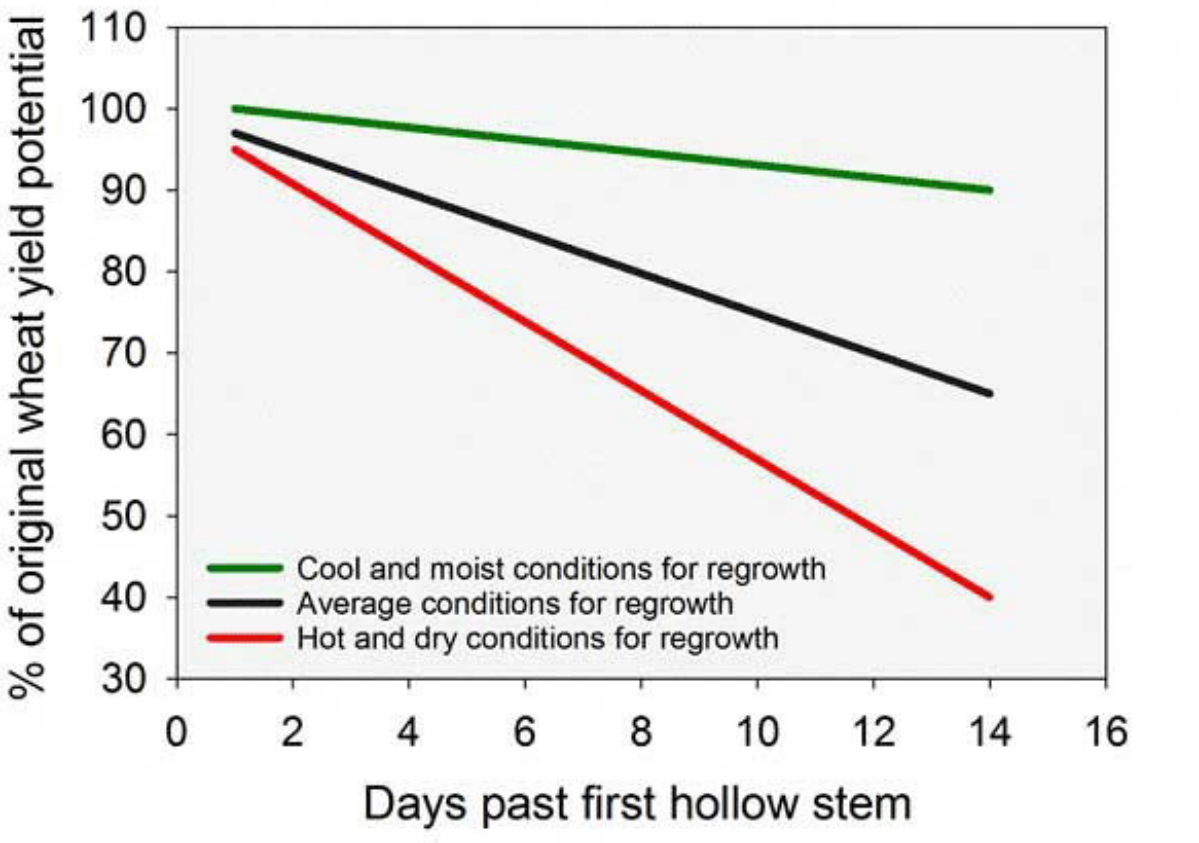

Figure 2. Percent of original wheat yield potential as affected by days of grazing past first hollow stem and weather conditions following grazing termination. Average yield losses by grazing for 14 days past first hollow stem ranged from 10% under favorable conditions to 60% under non-favorable conditions. Research conducted by Oklahoma State University (OSU) and published as K-State publication MF3375 and OSU publication PSS-2178.

Two things can occur when wheat is grazed too long: 1) fewer heads per acre because the primary tiller has been removed, and 2) smaller and lighter heads than expected because leaf area has been removed. As cattle continue grazing, the wheat plant is stressed and begins to lose some of the tillers

that would produce grain. A little later, if there are not enough photosynthates, the plant begins aborting the lower spikelets in the head or some of the florets on each head. Finally, if there is not enough photosynthate during grain filling, the seed size will be reduced and if the stress is severe enough, some seed will abort.

Air and soil temperatures during 2022

Crop development is mostly a function of available water, nutrients, and temperature. Nutrient availability is field-specific and thus will not be discussed in this article. Water has been limiting since the fall for the majority of the wheat growing region of the state which will likely slow down crop development. Likewise, average temperatures across most of Kansas were cooler-than-normal for the growing season this far, which has likely slowed down the progression toward first hollow stem compared to most years. As temperatures increase and wheat begins growing more rapidly in the spring, producers should start thinking about when to pull cattle off pasture to protect grain yields. Soil temperatures may be quick to warm as much of the state has dry soils. As the soils thaw, muddy conditions may also influence the decision to remove cattle in some areas.

For more information on managing wheat in dual-purpose systems, check the K-State Research and Extension publication MF3375 [PSS-2178 from Oklahoma State Extension], "Dual-purpose wheat: Management for forage and grain production" at https://www.bookstore.ksre.k-state.edu/pubs/MF3375.pdf.

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3. First hollow stem update - March 18, 2022

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 the eUpdate article in this issue "Optimal time to remove cattle from wheat pastures: First hollow stem").

First hollow stem update

In order to screen for FHS during this important time in the growing season, the K-State Extension Wheat and Forages crew measures FHS on a weekly basis in 19 different commonly grown wheat varieties in Kansas. The varieties are in a September-sown replicated trial at the South Central Experiment Field near Hutchinson.

Ten stems are split open per variety per replication (Figure 1), for a total of 30 stems monitored per variety. The average length of hollow stem is reported for each variety in Table 1. As of March 15, 2022, no variety had reached first hollow stem yet but most varieties had started to elongate their stems.

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 30 stems split per variety. Photo by Romulo Lollato, K-State Research and Extension.

Table 1. Length of hollow stem measured on March 9 and 15, 2022 of 19 wheat varieties sown mid-September 2021 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	**3/9/2022**	**3/15/2022**
AP Exp#1	0.2	0.3
AP Roadrunner	**0.7**	**1.0**
AP18AX	**0.6**	0.6
AM Cartwright	0.3	0.5
Crescent AX	0.4	0.8
KS Ahearn	0.3	0.3
KS Hatchett	0.1	0.5
KS13DH0041-25	0.2	0.5
LCS Atomic AX	0.5	0.6
LCS Chrome	0.2	0.5
LCS Helix AX	0.3	0.4
LCS Julep	0.2	0.3
LCS Photon AX	0.4	0.5
LCS Revere	0.2	0.2
LCS Runner	0.2	0.2
LCS Steel AX	0.3	0.3
LCS Valiant	0.2	0.3
Plains Gold Ray	0.3	0.4
Zenda	**0.5**	**1.2**
Average	0.3	0.5
Min.	0.1	0.2
Max	0.7	1.2

While no variety had reached first hollow stem as of March 15, 2022, all varieties had started to elongate the stem at different rates and there were statistical differences among the varieties evaluated. Zenda and AP Roadrunner are the ones with the most elongated stems to date. We will report first hollow stem during the next few weeks until all varieties are past this stage. Additionally, first hollow stem is generally achieved within a few days from when the stem starts to elongate, so we advise producers to closely monitor their wheat pastures at this time.

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

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4. New tool for estimating first hollow stem in wheat from Kansas Mesonet

Winter wheat is beginning to break dormancy, and the Kansas Mesonet has introduced a new tool to help track the crop 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.

Wheat First Hollow Stem

Wheat first hollow stem is the stage when there is about 1.5 cm of hollow stem growth underneath the developing wheat head (Figure 1). This is the beginning of stem elongation and, for winter wheat, it occurs in the spring after winter dormancy. This stage is important for dual-purpose wheat growers (grazing plus grain) because it is the optimal time for grazing termination to maximize forage yield while minimizing grain yield losses. The rationale is that up to this point, grazing cattle only remove foliage and consequently, yield losses due to grazing are modest. However, beyond this point, grazing can remove the developing wheat heads, increasing the potential for yield reductions due to grazing.

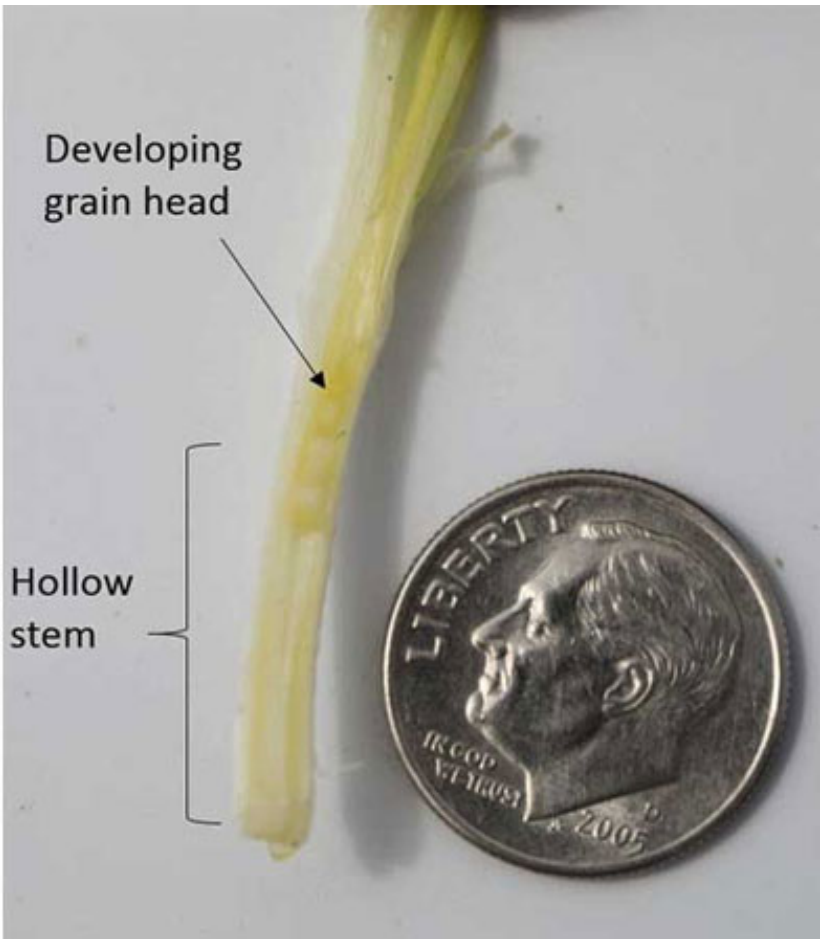


Figure 1. Wheat plant reaching the first hollow stem stage of growth, characterized by approximately 1.5 cm (or roughly the diameter of a dime) of hollow stem underneath the developing grain head. Photo by Romulo Lollato, K-State Research and Extension.

Calculation of Wheat GDD and Estimated Probability of First Hollow Stem

There are two different models currently in place at the Kansas Mesonet, one representing the probability of occurrence of first hollow stem for an early-maturing variety, and another for a late-maturing variety. The calculations employed in this tool are identical to those employed at the Oklahoma Mesonet, with the single difference that the model representing varieties of medium maturity in Oklahoma is used to represent varieties of late maturity in Kansas.

Both models calculate the probability of first hollow stem based on accumulated soil temperatures at the 4-inch depth, using a base temperature of 31°F and a start date of December 22 of the previous year. Soil temperature accumulation is calculated as daily soil temperature minus 31°F, and daily accumulated temperature values are summed from December 22 of the previous year until current date to estimate probability of first hollow stem. The accumulated temperatures are then contrasted with Table 1 below to determine the probability of first hollow stem at a given calendar date.

Table 1. Probability of first hollow stem for early and a late-maturing varieties based on accumulated soil temperatures at the 4-inch depth beyond 31°F. Table courtesy of Oklahoma Mesonet.

Probability of FHS occurrence	Accumulated soil temperature beyond 31°F	
	Early	Late (note that this model is for medium varieties in Oklahoma)
2.5%	543	702
5.0%	576	731
10.0%	612	763
25.0%	670	812
50.0%	734	864
75.0%	809	920
90.0%	879	980
95.0%	935	1022
97.5%	991	1065

We acknowledge that these models were developed in Oklahoma. To ensure their accuracy in Kansas, we tested their performance against six years of first hollow stem data collected near Hutchinson, Kansas. The model performance was excellent, with $r^2 = 0.92$ and root mean square error of 4.1 days (Figure 2).

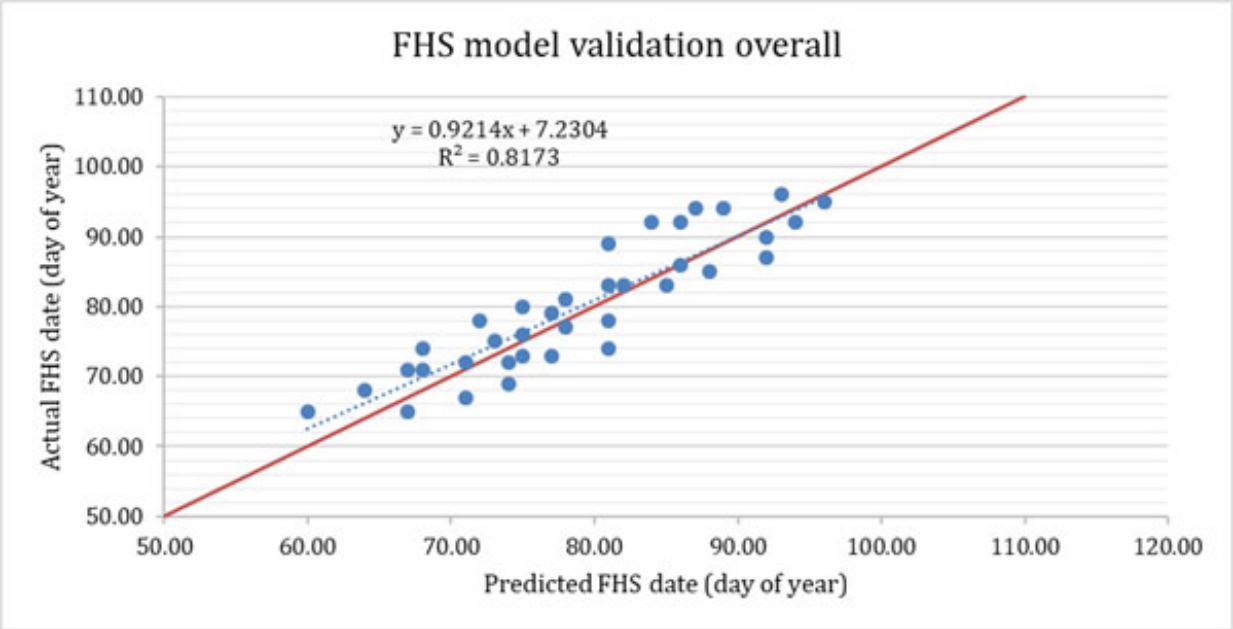
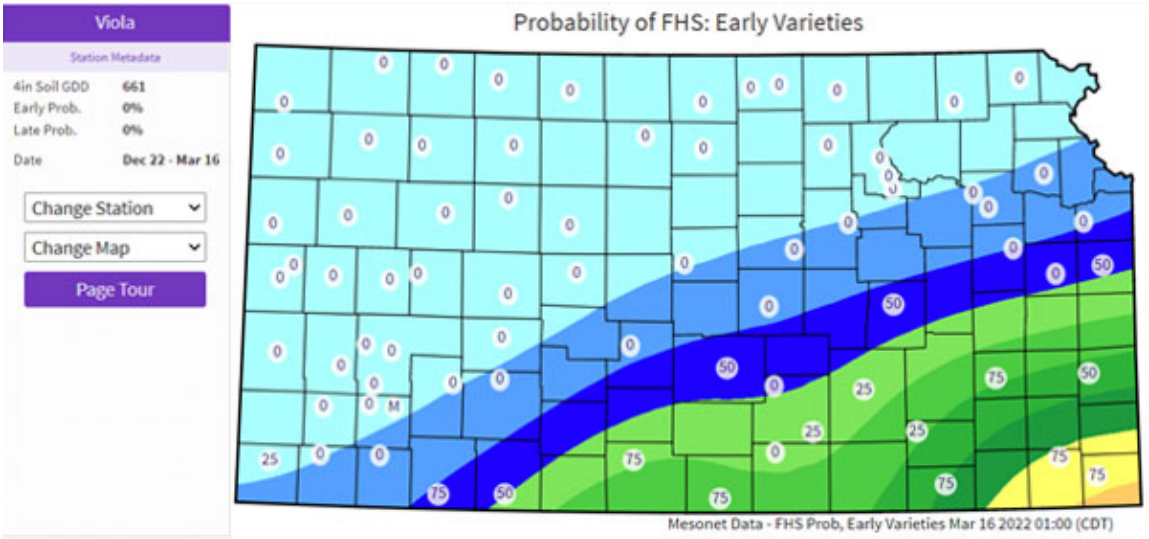


Figure 2. Predicted versus actual first hollow stem dates (day of year) for data collected near Hutchinson, KS, during 2016-2021. For each year, model performance was compared against 25, 50, and 75% probabilities for early- and late-maturing varieties. Note that the Oklahoma model for medium-maturing varieties is used for late-varieties in Kansas.

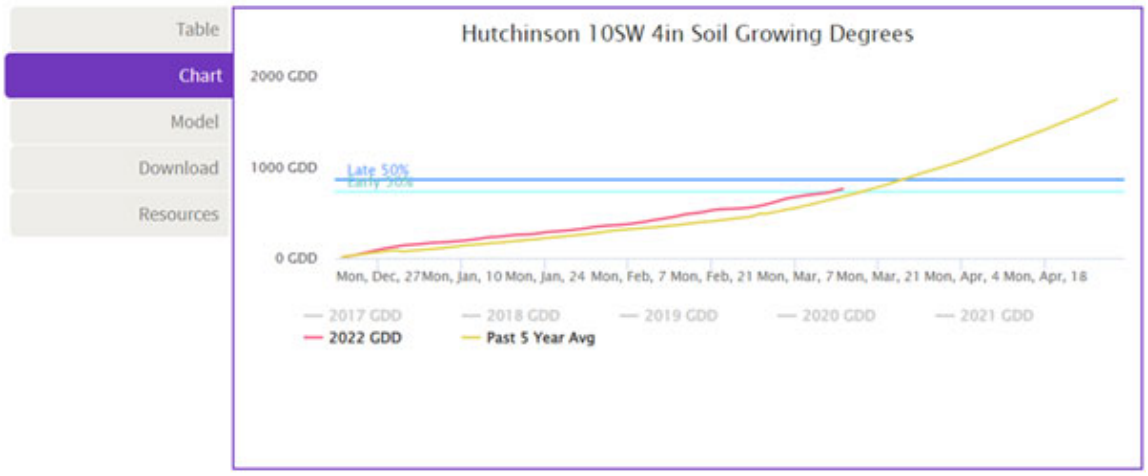
How might you benefit from the Kansas Mesonet Wheat First Hollow Stem page?

Here are a few examples:

1. **See an estimated probability of FHS across the state for varieties with contrasting maturities.** In "Change Map", select either "Early probability" or "Late probability" to see the probability of first hollow stem occurrence across the entire state. The example below illustrates the statewide probability of first hollow stem for early maturing varieties across the state, with greater changes in SE KS (75% probability) and SC KS (25-75% probability depending on station) chance as compared to the rest of the state (0% probability).



2. **Compare previous years with a chart**. Select chart tab within the wheat growth tools. By selecting specific years of interest, it is possible to compare the current year to other recent years and the 5-yr average for a given location. Current data supports comparisons between 2017-present year. The solid blue lines indicate when an early (light blue) or late (dark blue) varieties are expected to reach 50% probability of first hollow stem. The example below illustrates a comparison made for Hutchinson KS. Note how the current year (red line) is slightly earlier than the 5-yr average (yellow line).



3. **Statewide statistics:** The table lets you quickly view and sort data from across the state. You can also download data to perform your own analysis (see the Download tab).

4. **Graphics and social media:** Download any of the maps in .PNG format for easy sharing.

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5. World of Weeds: Mustard species

The mustard family includes vegetable crops like broccoli and cabbage, and several weed species commonly found in Kansas Mustard species can often be difficult to differentiate, especially when in the cotyledon or rosette stage. It is important to be able to identify these weeds as some of them vary in their sensitivity to common herbicides. These weeds can often be troublesome in winter crops, like winter wheat. Mustards germinate in the late summer and early fall, overwinter as a low-growing rosette, and flower, or bolt, in the spring. Flowers of mustard species all have 4 petals and are replaced by seed pods called siliques. Key features for identification are summarized in Table 1.

Ecology and identification of mustard species

Blue mustard (*Chorispora tenella*) is native to Asia and the middle east but was introduced to the U.S. from Siberia. Blue mustard seedlings have oval to oblong cotyledons, the first true leaves are alternate, and the leaves tend to have a rough surface. All green parts of the plant have white hairs and the plant emits a unique, unpleasant odor. Leaves in the rosette tend to be pinnately lobed or have large round teeth (Figure 1, left), while the leaves attached to the stem are slightly toothed or have smooth edges. Blue mustard tends to bolt sooner than other mustard species. Once bolted, blue mustard is 12 to 18" tall and will eventually bear purple or blue flowers at the top of the plant (Figure 1, right). Rectangular seeds that are flat on one side and round on the other are produced in siliques that are generally 1 to 2" long with a beak at the end. Seeds can be viable as soon as 10 days after the plant blooms.

Figure 1. Blue mustard seedling (left) and mature plant (right). Photos by Dallas Peterson.

Bushy wallflower (Erysimum repandum), also known as treacle mustard, is native to Eurasia. It emerges in the fall and overwinters as a rosette. Cotyledons are small and spoon shaped, tapered at the base, and slightly notched at the tip. The rosette has long, narrow leaves that are irregularly notched (Figure 2, left). Leaves are alternate in on the stem and the stem zig-zags at nodes. Bushy wallflower grows 12 to 18 inches in height and bears bright, yellow flowers at the top of the plant that have white sepals (Figure 2, right). Oblong, orange-brown seeds are formed in narrow siliques that are 2.25 to 4.75 inches long.

Figure 2. Bushy wallflower rosette (center) and mature plant (right). Photos Dallas Peterson.

Pinnate tansymustard (*Descurainia pinnata*), a native plant, and **flixweed** (*D. Sophia*), introduced from Eurasia, are very difficult to distinguish. Both emerge in the fall and overwinter as a rosette with finely-lobed, lace-like leaves, although pinnate tansymustard has reddish-green to purple stems (Figure 3, left). Mature plants of both species are covered in dense, fine hairs. After bolting, leaves of both species are alternate on the stem and become smaller higher up on the stem. Pinnate tansymustard leaves are smaller, ranging from 0.25 to 2.5 inches long, while flixweed leaves range from 1.25 to 4 inches long. Flowers of both species are usually yellow and occur in small clusters, but pinnate tansymustard flowers can range in color from yellow to yellow-green to white. Another difference is that flixweed sepals (the green structures just below the petals) are longer than the petals. One key difference in the two species is the siliques (Figure 3, right). Pinnate tansy mustard siliques are short (about 0.25 inch) and club-like silique with a prominent midrib which flixweed siliques are longer (0.5 to 1 inch) and narrower, and are attached to the stem at right angles. Both species spread by oblong seeds during the summer. Pinnate tansymustard seeds are dark red-brown and flixweed seeds are bright orange.

Figure 3. Pinnate tansymustard rosette (left) and flowering stems of pinnate tansymustard and flixweed(right). Photos Dallas Peterson.

Field pennycress (*Thlaspi arvense*) can emerge in the fall and overwinter as a seedling or a rosette, or it can emerge in the spring from seed. Cotyledons are oval to oblong and have a very long petiole, up to ¼". First true leaves are round to oval with a prominent midvein and occur on long petioles and do not have hairs. Leaves grow into a rosette and are oval in shape with wavy edges and do not have hairs (Figure 4, left). When field pennycress bolts, the leaves are lanceolate in shape, attach directly to the stem, have slightly toothed edges, and pointed lobes (Figure 3, right). The plant ranges from 4 to 24" in height. Stems do not have hairs and only branch on the upper portions of the plant. Flowers are white and occur in clusters at the end of the stems. The seeds can be found in circular, flat seed heads that are 1/2" in diameter with a distinctive wing along the edge. Field pennycress is a prolific seed producer and can produce up to 15,000 seeds per plant and seeds can remain viable for 10+ years in the soil. Persistent seed viability and prolific seed production have allowed field pennycress to be a troublesome weed in horticulture crops and winter wheat. This weed also has a strong odor that can cause cows to have bitter-flavored milk if they consume it.

Figure 4. Field pennycress rosette (left) and mature plant (right). Photos by Dallas Peterson.

Shepherd's-purse (*Capsella bursa-pastoris*) can germinate in the fall and overwinter as a rosette or it can germinate in the spring. Cotyledons are egg shaped or spatulate and have a slight notch at the tip. The hypocotyl is light green to purple. The first two to four leaves are somewhat round with smooth or toothed lead edges. The first set of leaves are opposite. When growing in a rosette, leaves are variable. Leaf edges can be smooth or be toothed to deeply lobed, which is the most common (Figure 5, left). There is a line of hairs on the midvein on the lower leaf and hairs on the upper leaf. Stems of bolted plants (Figure 5, right) are green to purple in color, range from 4 to 20 inches tall, and generally only have hairs on the lower portion. Leaves are only found on the lower part of the stem and are alternate and lanceolate and attach directly to the stem. Flowers are small and white to green and can be seen from spring to late fall. Very small (less than 0.1 inch), orangish-brown seeds are produced in a distinctive flat and triangular or heart shaped seed pod.

Figure 5. Shepard's-purse rosette (left) and mature plant (right). Photos by Dallas Peterson.

Control of mustard species

There are some non-chemical control measures for managing mustard species. These include purchasing weed-free seed and maintaining field edges so mustards cannot become established or produce seeds. Light tillage can be used to stimulate germination and increase herbicide effectiveness; however, mustard seeds tend to be long-lived in the soil, so frequent deep tillage is not an effective control method.

Regardless of the herbicide, mustard species are easier to control while still in the rosette stage. In addition, early control of mustards will reduce the impact on yield. 2,4-D is effective on mustard species; however, growth stage restrictions may reduce the effectiveness in winter wheat. Dicamba and fluroxypyr, two other Group 4 herbicides, are less effective on mustard species. Huskie (pyrasulfotole + bromoxynil), which combine herbicides from group 27 and 5 also controls mustard species. The Group 2 herbicides Ally and other metsulfuron-containing products, Amber and other triasulfuron-containing products, or Glean and other chlorsulfuron-containing products can also provide excellent control of mustard species. However, both blue mustard and flixweed resistant to Group 2 herbicides have been confirmed in Kansas.

Table 1. Some identifying features of selected mustard species.

Species	Emerges	Basal leaves	Flowers	Fruit
Blue mustard	Fall	Pinnately lobed	Blue/purple	Narrow
Bushy wallflower	Fall	Wavy margins	Bright yellow	Narrow
Pinnate tansy mustard	Fall	Finely lobed	Pale yellow/white	Club-like
Flixweed	Fall	Finely lobed	Pale yellow	Narrow
Field pennycress	Fall, spring	Wavy margins	White	Oval, flat
Shephard's-purse	Fall, spring	Deeply lobed	White	Heart-shaped, flat

For more detailed information, see the "2021 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://bookstore.ksre.ksu.edu/pubs/SRP1162.pdf or check with your local K-State Research and 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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6. Several K-State publications on insect pest management updated for 2022

Several K-State Research and Extension publications related to insect management in Kansas were recently updated and are available to the public.

These publications were prepared to help producers manage insect populations with the best available methods proven practical under Kansas conditions. They are revised annually and intended for use during the current calendar year. The user should know that pesticide label directions and restrictions are subject to change, and some may have changed since the date of publication.

Each fact sheet is available online using the links provided below.

MF742 - Sorghum Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF742.pdf

MF743 - Soybean Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF743.pdf

MF745 - Wheat Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF745.pdf

MF809 - Alfalfa Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF809.pdf

MF810 – Corn Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF810.pdf

MF814 – Sunflower Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF814.pdf

MF2674 – Cotton Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF2674.pdf

The economics of control should be considered in any pest management decision. Because costs vary greatly over time and are influenced by factors beyond the scope of this publication, product cost is not a consideration for including or omitting specific insecticide products in these recommendations. Growers should compare product price, safety, and availability when making treatment decisions. Growers also need to consider the impacts of insecticides on non-target organisms like pollinators and natural enemies. Rotating insecticide groups can help combat insecticide resistance issues by leveraging different modes of action. The user bears ultimate responsibility for correct pesticide use. For proper use, always read label directions carefully before applying pesticides. Remember, it is illegal to use a pesticide in a manner inconsistent with the label.

More information on pests covered in these publications is available at:

www.entomology.k-state.edu/extension/insect-information/crop-pests/

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