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1. First hollow stem in wheat

The unusually warm weather we've had this year in February has wheat off to an early start in most areas of the state. This means producers should start examining their wheat a little earlier than usual for the "first hollow stem" (FHS) stage of growth. This stage occurs as the wheat switches from the vegetative stage to the reproductive stage of growth.

As leaf sheaths become strongly erect, the growing point soon begin to develop a tiny head. FHS is the point at which a half-inch or so of hollow stem can first be identified above the root system and below the developing head. FHS occurs when the developing head is still below the soil surface, which means that producers have to dig plants out of the ground to do the examination.

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 growth stage in order to affect 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). Prior to this stage the nodes are all formed but tightly packed together and hard to see. FHS occurs about 7-14 days before jointing, depending on the weather.

To look for FHS, start by digging up some plants from fields that have not been grazed. Select the largest tillers to examine. Cut the roots off at the base of the stem. Then slice the stem open from the bottom 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 base of the stem. If between 1/2 to 3/4" of hollow stem is present, the wheat plant is at FHS.

If the wheat has reached FHS, cattle should be removed to prevent grain yield loss. Yield losses from grazing after FHS may be up to 1.25 bushels per day according to OSU data, although losses may not be this great for the first few days of grazing after FHS. Still, 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.

Two things are observed when wheat is grazed too long: 1) fewer heads per acre because the primary tiller has been removed and 2) smaller 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 is not enough photosynthate, the plant begins aborting the lower spikelets (flowers where seed develops) 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.

First hollow stem. (Photo courtesy of Gene Krenzer, former Oklahoma State University Extension wheat specialist.)

For additional information, see:
"Wheat Hollow Stem Identification and Grazing Pull-Off," Texas Cooperative Extension Service, February 2003
http://lubbock.tamu.edu/othercrops/pdf/wheat/wheathollowstemid.pdf

"OSU Wheat Production Newsletter" Feb. 22, 2007
http://www.state.ok.us/~wheat/Web%20Site/News%20and%20Info/news%20and%20info/WPN%20by%20Dr.%20Carver/WPN%203-7%2002-22-07.pdf

Portions of both of these publications were used in this article, and provide good background information on this subject.

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2. Nitrogen use by wheat

Wheat requires approximately 1.25 pounds of nitrogen (N) per bushel of yield. This N can come from mineralized N in the soil, commercial fertilizer or manure applications, or other sources.

In the fall, wheat uses nitrogen to develop tiller potential and a secondary root system. Wheat needs about 20-40 pounds per acre of available N in the top 6 inches of soil in the fall to have optimum tillering and root development. If a soil test shows less than 10 parts per million (20 lbs per acre) of nitrate-N prior to planting, then at least 15-20 lbs of N per acre should be applied in the early fall. Producers should apply no more than 20 lbs N plus potash in direct contact with the seed to minimize the risk of germination injury.

If a soil test shows more than 30 ppm (60 lbs per acre) of available nitrate-N in the top 6 inches prior to planting, no additional fertilizer N is needed in the fall to achieve adequate tillering and root development.

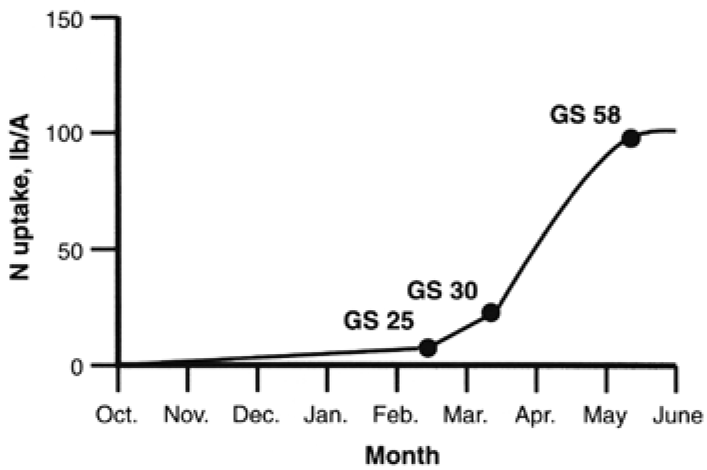
Those are guidelines for minimum, not maximum, levels of N in the fall. On medium- to fine-textured soils in Kansas, research has shown that wheat yields are usually about the same whether the N application is split between fall and early spring, or supplied entirely in the late summer or fall. On sandy or poorly drained soils, a split application is recommended for best N use efficiency.

Winter wheat uses about 30-40 percent of its total seasonal uptake of N by the start of stem elongation. The remainder of the seasonal uptake occurs after that time.

During the leaf sheath erection and stem elongation growth stage (Feekes stages 3 and 4), the number of kernels per head is being established and rapid N uptake begins. Ideally, the crop should be growing vigorously and have a deep green color at this stage. If the crop is showing signs of nitrogen deficiency at this time, an application of N will be critical to develop adequate head size. Ideally spring application of N should be completed by first hollow stem, usually a week or two before jointing.

After that time, adequate N is needed to produce enough leaf area for producing profitable yields.

Nitrogen uptake during the grain fill period is relatively low compared to uptake during stem elongation. The plant utilizes N already in the stems and leaves to the grain at this stage instead of taking N up from the soil. It would be rare to get any yield response to N applied at or after flowering.



This chart uses the Zadoks scale of growth stages for wheat. GS 25 is equivalent to Feekes stage 3 (early stem elongation). GS 30 is equivalent to Feekes stage 5 (jointing). GS 58 is grain fill.
Source: Mark Alley, Virginia Tech University, Nitrogen Management for Winter Wheat: Principles and Recommendations
http://www.ext.vt.edu/pubs/grains/424-026/424-026.html

The current recommendation for N application rate in Kansas is based on the following equation: N Rec = (Yield Goal × 2.4) – (% SOM × 10) – Profile N – Other N Adjustments + Previous Crop Adjustments + Tillage Adjustments + Grazing Adjustments

- N Rec= nitrogen recommendation in pounds per acre.
- Yield Goal= realistic yield goal in bushels per acre.
- % SOM= percent soil organic matter. Each one percent SOM provides 10 lb of N (%SOM x 10). Soil samples (0-6 inch depth) should be analyzed for SOM level.
- Profile N= profile nitrogen test (0-24 inch depth) in lb N/acre.
- Other N Adjustments= Additional N application such as manure.
- Previous Crop Adjustments=

Previous crop	Adjustment
Corn, Wheat	0 Lb N/A
Sorghum, Sunflowers	+ 30 Lb N/A
Soybeans	0 Lb N/A
Fallow:	
Without Profile N Test	- 20 Lb N/A
With Profile N Test	0 Lb N/A

- Tillage Adjustments= for no-till system an additional 20 lb N/acre. No adjustment for conventional tillage.
- Grazing Adjustments= 40 lb of N per 100 lb beef weight gain per acre.

Example:
Expected yield= 40 bu/acre
% SOM= 2%
Profile N= 40 lb/acre
Other N Adjustments= no manure or additional N source.
Previous Crop= sorghum
Tillage= conventional
Grazing= no grazing
N Rec (lb/acre) = (40 x 2.4)-(2 x 10) –(40) –(0) +(30)+(0)+(0)
N Recommendation (lb/acre) = 66 lb N/acre

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3. Eastern gamagrass production in Kansas

Eastern gamagrass is a native, perennial, warm-season bunchgrass adapted to moist sites, swales, and stream banks throughout most of the eastern U.S. This sod-forming grass can grow several feet tall and forms clumps 2 to 4 feet in diameter. Natural stands of eastern gamagrass are rarely found in native rangeland grazed season-long, but can be found on subirrigated sites throughout Kansas.

Once established, eastern gamagrass can be a high-quality, high-producing forage crop in Kansas that can be used as hay, for grazing, seed production, and for haylage. Under irrigation and high fertility, forage production has reached as high as 10 tons per acre. Production under dryland conditions varies, with yields normally in the range of 2 to 5 tons per acre. Eastern gamagrass harvested in the boot to early heading stage will contain 12-14% crude protein, 65-68% neutral detergent fiber, and 58-65% in vitro dry matter digestibility.

Eastern gamagrass germplasm adapted and sold commercially for use in Kansas includes the cultivars Pete, Iuka, and PMK-24. Problems with seed production and germination, seeding date, and grazing management have limited the widespread use and reestablishment of eastern gamagrass.

Stand establishment. Seed dormancy in eastern gamagrass can greatly limit seedling emergence. Dormancy can be overcome by three approaches.

* The first is to plant seed between December 1 and March 1 and let winter temperatures stratify the seed. Plant the seed ½ to 1 inch deep at 6 to 8 pounds per acre of pure live seed (PLS).

* A second approach is an artificial stratification that involves chilling the seed at 35-45 degrees F for at least five weeks under moist conditions. Treatment with a fungicide may be necessary to reduce abnormal amounts of fungal growth. Stratified seed cannot be allowed to dry before planting and must be kept chilled if not planted immediately after treatment or purchase. Do not plant moist, pre-chilled seed into dry soil.

* A third approach for successful establishment of eastern gamagrass involves a process called priming. Priming is an osmotic conditioning process where seed is hydrated to a level that pre-germination metabolic activity is initiated but emergence of the radicle does not occur. Primed seed usually emerges at a higher rate, and soil moisture may not be as critical. Stratified and primed seed should be planted ½ to 1 inch deep between March 15 and June 1 at the rate of 6 to 8 pound per acre PLS. Greenhouse studies indicated that prechilled eastern gamagrass seed could emerge from a depth of 2 inches if moisture was present.

Small fields of eastern gamagrass could be established by sprigging. The crowns of existing plants can be broken down into simple or compound shoots. These crowns with roots should be collected and transplanted during the late dormant period (February-March) and either irrigated or placed in moist soil.

Eastern gamagrass can be seeded in 30-inch rows using a corn planter or drilled at 10-inch row spacings or less. Wider rows are generally used in seed production fields, but this results in large clumps that are difficult to harvest and hard on equipment. Consequently, narrow rows may be more ideal for stands that will be hayed or grazed.

Broadleaf and grassy weed problems should be addressed in the crop prior to planting eastern gamagrass. Glyphosate could be used prior to planting, but there currently aren't any herbicides labeled for weed control in eastern gamagrass. Mowing and flash grazing can help control weed growth. Once established, a prescribed burn will enhance grass production and weed management. The burn should occur when new spring growth is about one inch tall, which is prior to the usual time to burn native rangeland.

Management. Fertilizer should be applied in late April according to soil test results. Eastern gamagrass can be cut for hay or grazed. A 2-cut system is appropriate in eastern Kansas. The first harvest should occur by the early heading stage (about June 15) and the second cutting 6-8 weeks later. A 6- to 8-inch stubble should be left at both cuttings.

About 50 pounds of actual nitrogen can be applied in mid-April and again after the first cutting. This will produce 3 to 4 tons of hay with 12 percent crude protein.

Minimal grazing studies have been done on eastern gamagrass. Repeated intense defoliation will reduce vigor of individual plants and could lead to stand loss. Under continuous grazing to maintain a stubble height of 8 inches in a North Carolina study, steers gained 1.8 pounds/day. In an Arkansas study, steers gained 2.5 pounds/day in May, but only 0.3 pounds/day in August under a continuous grazing system. A five-year research project in Oklahoma produced an average daily gain of 1.9 pounds in cattle grazing a 7-paddock system between May 9 and August 25. The gamagrass was grazed for 54 days at a stocking rate of 2 steers/acre. Each paddock was grazed for 2 days early in the season and 3 to 5 days later in the season.

Leaving 8 to 10 inches of stubble and allowing at least a 30-day rest period before restocking is important for maintaining the eastern gamagrass stand.

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4. Crop production problem diagnosis: Poor wheat greenup

The following is an actual case study of a crop production problem in Kansas. Some of the details have been changed to make the case more hypothetical. See if you can diagnose the problem correctly.

A producer notices that parts of his wheat field are not greening up in late winter (late February-early March). Generally, the damaged areas are on the tops and back sides of terraces. Except for a few more damaged spots, the rest of the field is greening up as it should. The farmer immediately thinks of winterkill damage, but rules out that option because the field was planted to a winterhardy cultivar and it hadn't been cold enough to cause winterkill. In fact, the previous fall had been warm and fall-like conditions extended well into December. Plus, the damage is on the south-facing slope of the field. A close examination by an Extension entomologist (see photo below) found no live insects.

The questions I would ask:

1. What are the symptoms? Described above.

2. What is the history of herbicide application? No herbicide was applied to the wheat. The previous crop was Roundup Ready soybeans, and only glyphosate was applied. There was no herbicide drift from nearby fields.

3. What was the rate of fertilizer application, the timing, and the method of application? About 50 lbs per acre of N, as anhydrous ammonia, was applied preplant.

4. What is the pH and nutrient level of the soil? The pH = 6.2. P and K levels were adequate, and there was nothing unusual about the areas of the field with the poor wheat. No other soil test information was available.

5. What has the weather been like in the area to this point? Extended warm weather in fall. Mild winter.

6. What variety is it? Jagalene.

7. Are there any insects or diseases present? None.

Answer: The problem was winterkill induced by a greenbug infestation in late fall and early winter. The greenbugs had died out by early spring, leaving dead "mummies" in the crown area, but the plants were weakened and the damage was done.

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These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu