Issue 1046

K-STATE Research and Extension

Extension Agronomy

eUpdate

03/27/2025

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. First hollow stem update - March 24, 2025

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

First hollow stem update

To screen for FHS during this important time in the growing season, the K-State Extension Wheat and Forage's crew measure FHS on a weekly basis in 16 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 40 stems monitored per variety. The average length of the hollow stem is reported for each variety in Table 1. **As of March 24, four varieties had reached first hollow stem (AP24 AX, AR Turret 25, Kivari AX, and Sheridan).** Moreover, all varieties had started to elongate their hollow stem with several past 1.0 cm, meaning they should reach first hollow stem shortly.

Figure 1. Ten main wheat stems were split open per replication per variety to estimate first hollow stem for this report, for a total of 40 stems split per variety. Photo by Romulo Lollato, K-State Research and Extension.

Table 1. Length of hollow stem measured between February 17 and March 24, 2025, of 16 wheat varieties sown mid-September 2024 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	**2/17/25**	**2/24/25**	**3/6/25**	**3/10/25**	**3/17/25**	**3/24/25**
AP Sunbird	0	0	0	0.00	0.41	0.89
AP24 AX	0	0	0	0.03	0.70	**1.58**
AR Iron Eagle AX	0	0	0	0.06	0.44	0.95
AR Turret 25	0	0	0	0.04	0.51	**1.50**
CLH10-153.022	0	0	0	0.00	0.37	1.18
CLH10-1853.014	0	0	0	0.03	0.37	1.08
CP7017AX	0	0	0	0.01	0.50	1.04
CP7869	0	0	0	0.03	0.29	1.10
Kivari AX	0	0	0	0.09	0.58	**1.74**
KS Ahearn	0	0	0	0.01	0.34	0.85
KS Bill Snyder	0	0	0	0.00	0.29	1.07
KS Mako	0	0	0	0.02	0.35	0.90
KS Providence	0	0	0	0.01	0.55	1.01
KS Territory	0	0	0	0.00	0.29	0.73
KS21H36	0	0	0	0.01	0.22	0.69
Sheridan	0	0	0	0.01	0.35	**1.75**

We expect all varieties to reach the first hollow stem stage within a week or two. We will report the progress of first hollow stem until all varieties are past this stage. It is important to consider that first hollow stem is generally achieved within a few days from when the stem starts to elongate – depending on temperature and moisture conditions. Therefore, we advise producers to monitor their wheat pastures closely.

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

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2. Mixing ammonium thiosulfate with herbicides: Considerations for spring applications

With spring burndown applications well underway, we've recently had some questions about mixing ammonium thiosulfate (ATS) with herbicides. As addressed in some previous eUpdate articles, sulfur fertility needs of wheat, corn, soybean, and canola may require sulfur fertilization. ATS is a popular liquid fertilizer used to meet these requirements. There are two main topics to address with regard to mixing ATS with herbicides: using ATS as a carrier for 'weed and feed' applications; and using ATS as an ammonium sulfate (AMS) replacement.

Ammonium thiosulfate as a carrier for herbicides. The volume of ATS typically needed for sulfur fertilization requirements is likely lower than the desired spray volume for a herbicide application. Hence, using ATS as the sole carrier for a herbicide application is an unlikely scenario. The needed rates of ATS could be included in the carrier volume needed; however, it is important to recognize that ATS is more prone to physical incompatibility than urea ammonium nitrate (UAN). One rule of thumb to reduce the risk of incompatibility is to keep the amount of ATS in the tank mix to less than 10% of the total solution. Another tip is to add ATS to the tank last. When in doubt about the physical compatibility of a tank mix, consider a jar test. Also, we'd be remiss if we didn't remind you to check your product label(s) for specific tank mixing instructions.

In addition to physical incompatibility, ATS can reduce the efficacy of burndown herbicide applications. Weed scientists at Purdue conducted a greenhouse study to evaluate wheat and velvetleaf control 14 days after treatment by glyphosate and 2,4-D applied with AMS and ATS. The data for glyphosate (Roundup PowerMax at 22 fl oz/A) applied with AMS (8.5 lbs/gal) and ATS (0, 1.5, and 7 gal/A) are summarized in Figure 1. Both wheat and velvetleaf control was reduced when ATS was included in the treatment. In addition, the spray solution pH increased from 4.6 to 5.4 when ATS was included at 1.5 gal/A and to 6.3 at 7 gal/A. This has implications for the use of ATS as an AMS substitute.

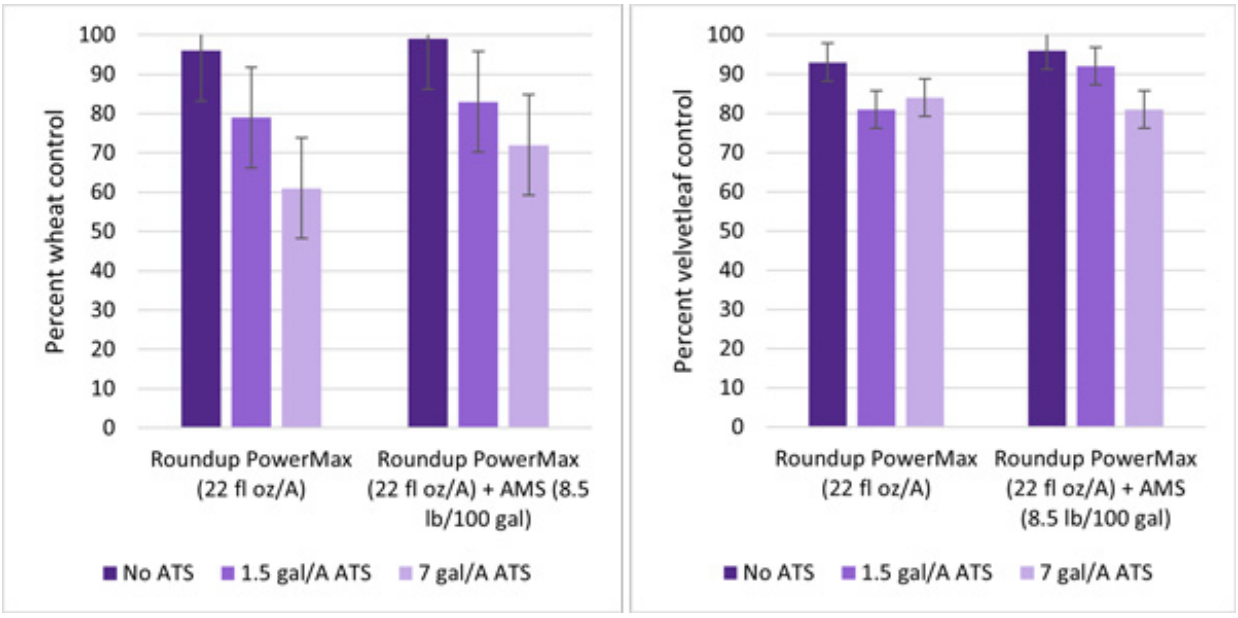

Figure 1. Wheat (left) and velvetleaf (right) control by Roundup PowerMax applied with and without AMS and ATS in a greenhouse study. Data from Johnson et al. 2019.

Ammonium thiosulfate as a replacement for ammonium sulfate. AMS is an important water conditioner and adjuvant that comes in both liquid and dry products. The price of dry AMS is attractive, but handling the bags is not. So, if a person wants to apply sulfur, they may wonder if they can apply ATS and forego adding AMS. Even though both products contain ammonium and sulfur, they do not behave similarly when used as a water conditioner. First, the fertilizer analysis is different, with AMS being 21-0-0-24 and ATS 12-0-0-26. Thus, when applied at the same rate of sulfur, ATS will apply less N (ammonium). Second, AMS contains sulfate (SO_4^{2-}), while ATS contains thiosulfate ($S_2O_3^{2-}$). These may seem like small changes, but they affect how the products react in hard water (see a companion article in this eUpdate issue on hard water and spray applications). When weak acid herbicides like glyphosate, glufosinate (Liberty, others), 2,4-D, and clethodim (Select, others) are mixed with hard water, dissolved minerals like calcium, magnesium, iron, and sodium, which are positively charged, bind to the negatively charged herbicide and prevent absorption. Both AMS and ATS will dissolve in water, making ammonium (NH_4^+) available to interact with herbicides. The ammonium salts of the herbicides are readily absorbed across the plant leaf surface. When AMS is dissolved in water, the minerals preferentially bind to sulfate, preventing them from binding to the herbicide. When ATS is dissolved in water, thiosulfate does not react with calcium, magnesium, or iron as readily as sulfate.

In addition, ATS influences solution pH differently than AMS. While AMS slightly decreases solution pH, ATS is likely to increase the spray solution pH, which may influence herbicide performance through enhanced degradation or other methods.

For more detailed information, see the "2025 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://bookstore.ksre.ksu.edu/pubs/SRP1190.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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3. The role of water quality on effective herbicide applications

Understanding spray water quality is a crucial first step for successful herbicide applications. Much of the water used for herbicide applications in Kansas is inherently "hard," and the quality of water from some wells is decreasing as water resources decrease. This article will focus on the effects of water quality on herbicide efficacy, particularly in postemergence applications. Three main factors affect water quality in Kansas - turbidity, pH, and hardness, and we'll look at each more closely.

Turbidity is defined as the clarity of water and is mostly affected by larger particles suspended in the water, such as algae, clay, minerals, or organic matter. Poor turbidity is more likely to exist where surface waters such as ponds, streams, or rivers are the source of spray water. These suspended particles interact with many of our herbicides and can influence uptake by the plants, chemical changes at the site-of-action (SOA), and decrease the performance of sprayer equipment. Its effect is severe on cationic (positively charged) herbicides (paraquat and diquat) and herbicides with low soil mobility (glyphosate). If turbidity is an issue, chelating agents may be available for use in holding ponds or tanks prior to mixing in the spray tank.

Spray water pH is a measure of acidity or the presence of hydrogen ions. Pure water is neutral, having a pH of 7.0, whereas values below 7 are considered acidic, and values above 7 are basic. Kansas surface and subsurface water pH typically ranges from 6.5 to 8.5. Generally, pH values of spray water in Kansas do not have a large effect on the herbicides commonly applied. The efficacy of weak-acid herbicides (glyphosate, glufosinate, clethodim, sethoxydim, bentazon, and 2,4-D) is generally improved with acidic water pH. In contrast, the efficacy of sulfonylurea herbicides (group 2) is negatively impacted by acidic pH. These sulfonylurea herbicides and HPPD herbicides (Table 1) tend to be more effective (more soluble) at a pH above 7, whereas flumioxazin degrades rapidly in spray water with a pH greater than 7.8. Additionally, very low pH values can cause salts of certain herbicides (glyphosate, 2,4-D, others) to precipitate out. Also, it is important to keep in mind that dicamba volatility increases in acidic solutions with a pH lower than 5.0. Unless a known water source is extremely acidic or basic, pH-modifying agents are not usually necessary.

Table 1. Common herbicides used in Kansas.

Herbicide group	Site-of-action	Examples	Brand names
Group 1	ACCase inhibitors	Quizalofop, sethoxydim	FirstAct, Select, others
Group 2	ALS inhibitors	Metsulfuron, imazamox	Ally, Beyond, Imiflex
Group 4	Synthetic auxins	Dicamba, 2,4-D, fluroxypyr	Banvel, Starane, others
Group 9	EPSP inhibitor	Glyphosate	Roundup, others
Group 10	Glutimine inhibitor	Glufosinate	Liberty, others
Group 14	PPO inhibitors	Flumioxazin, saflufenacil, sulfentrazone	Valor, Sharpen, Authority, others
Group 27	HPPD inhibitors	Mesotrione, tembotrione	Callisto, Laudis, others

Water hardness is one of the largest issues impacting herbicide applications in Kansas. Hardness is caused by the presence of positively charged minerals (cations) suspended in the water, particularly calcium (Ca), sodium (Na), magnesium (Mg), potassium (K), and iron (Fe). Because many of our

herbicides, notably glyphosate and glufosinate, form weak acids (negatively charged) when mixed in water, cations can bind to herbicide molecules, thus changing how the herbicide is absorbed by the plants and altering its ability to bind at the site of action.

Water hardness can be classified into the following groups based on the total number of cations present expressed in parts per million (ppm):

- Soft = less than 75 ppm
- Moderately hard = 75 to 150 ppm
- Hard = 150 to 300 ppm
- Very hard = greater than 300 ppm

Figure 1 shows the cation concentrations from four wells in Finney County, where all but one (Finnup) had total cation concentrations above the 300 ppm level. Furthermore, cation concentrations varied greatly even for these wells, which were within three miles of each other. To combat hard water antagonism, water conditioners such as ammonium sulfate (AMS) are recommended with many of our postemergence herbicides. When added to the water prior to the herbicide, AMS produces ammonium ions which bind to the herbicide and prevent other cations from interacting with it. Recommended rates of AMS range from 8.5 to 17 pounds per 100 gallons of spray water. North Dakota State University researchers developed a simple formula for calculating AMS needs based on the presence of cations in the water and their ability to interact with herbicides:

(0.002 x ppm K)+(0.005 x ppm Na)+(0.009 x ppm Ca)+(0.014 x ppm Mg)+(0.042 x ppm Fe) = lbs AMS/100 gallons

Plugging in the cation numbers from the domestic well in our graph, we get the following equation:

(0.002 X 9)+(0.005 X 190)+(0.009 X 230)+(0.014 X 120)+(0.042 X 0) = **4.7 lb AMS/100 gallons**.

So, approximately 5 pounds of AMS per 100 gallons of water is needed to counteract the cations in this example. A handy Excel-based version of this formula can be found at the website: https://sprayers101.com/wp-content/uploads/2022/02/AMS-Calculator-Sprayers101-1.xlsx

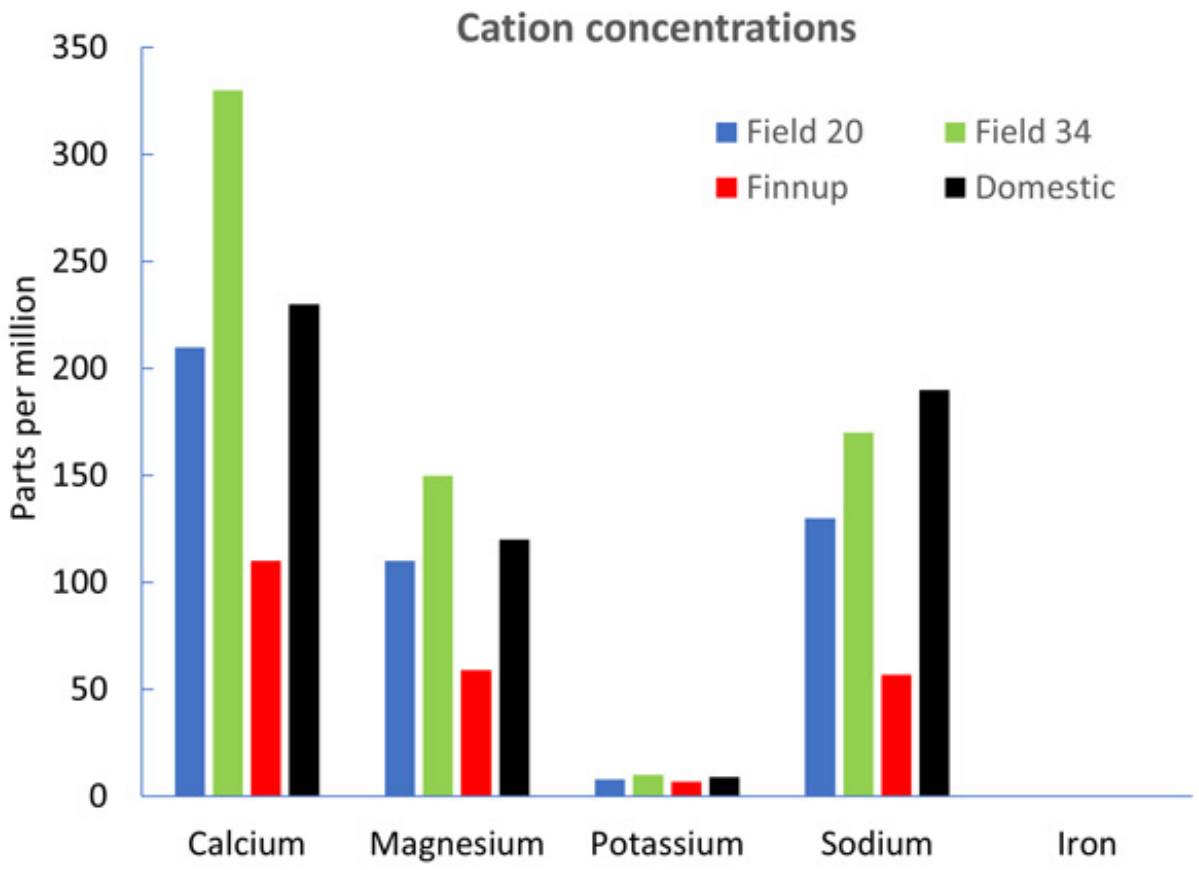

Figure 1. Cation concentrations in water samples from four wells at the Kansas State University Research & Extension Center in Garden City, KS.

There are also liquid AMS replacement products on the market. These products are very convenient and easy to use compared to dry AMS. However, be aware that these products vary greatly in their composition, and it is important to ensure that sufficient ammonium ions are being added to properly condition the hard water. Previous research at K-State indicated that many of the products can be equal to dry AMS, but most are more expensive, and some did not perform as well as dry AMS. Another important point to remember is that in addition to being a water conditioner, AMS is also an adjuvant that influences herbicide uptake by plant leaves. Interestingly, the weeds we are targeting can also affect our spray operations. Species such as velvetleaf, lambsquarters, and sunflower tend to have greater concentrations of cations on their leaf surfaces than other species, and this can lead to greater herbicide antagonism.

There are other ways to combat water quality issues for spraying. If practical, using treated water from a municipal source can limit the negative influences of turbidity, pH, and hardness. However, there may be additional costs associated with this, and travel distances may make it unfeasible. Some producers have opted to install commercial reverse osmosis (RO) systems to combat poor water quality. This can be an effective method, but it comes with costs as well. If thinking about investing in an RO system, consider the initial purchasing cost, cost of filter maintenance, cost of storage for the treated water, and disposal of the effluent water produced. In cases where water hardness is the primary issue, this can also be overcome by increasing the rates of the herbicide in question. As

herbicide concentration increases, a smaller percentage of the active ingredient is tied up by the cations in a given volume of water. Conversely, using a lower spray gallonage may be an option as well. Less water in the tank means fewer cations to interact with the herbicide. Always consult the herbicide label to ensure maximum herbicide rates are not exceeded and the minimum gallon-per-acre volumes are met.

Summary

Water quality has a large impact on herbicide efficacy. As water resources decline, water quality can and does change over time. A proper water test is the best way to understand what characteristics are influencing our spray applications and how to mitigate those effects. K-State, as well as several commercial providers, can conduct water tests for a nominal charge.

During the summer of 2025, researchers at K-State will be collecting spray water samples from around the state to test for quality. If you are interested in participating in this study, please contact one of the authors below, your local Extension agent, or your regional Extension Specialist.

For an in-depth discussion on spray water quality, check out the War Against Weeds podcast on the subject. It can be found at: https://waragainstweeds.libsyn.com/s9-e2-spray-solution-quality

More information can also be found at: https://bookstore.ksre.ksu.edu/pubs/2025-chemical-weed-control-for-field-crops-pastures-rangeland-and-noncropland_CHEMWEEDGUIDE.pdf

References:

War Against Weeds podcast Season 9, episode 2, https://waragainstweeds.libsyn.com/s9-e2-spray-solution-quality

2025 North Dakota Weed Control Guide, J. Ikley, et al. publication W253-25.

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

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4. Outlook for stripe rust in the 2025 Kansas wheat crop is optimistic

Over the last ten years, stripe rust has been one of the most damaging wheat diseases in Kansas. There are several factors that contribute to the development and severity of stripe rust in our region within a given year. The stripe rust pathogen typically does not survive in Kansas over the winter but can survive in Texas through the winter months and make its way back north as the weather warms in the spring. Because of this, weather conditions in Texas can be important indicators of how bad stripe rust will be in Kansas.

We have received reports that low levels of stripe and leaf rust were active in College Station, TX, and Waco, TX, in late February. As of today's publication, we have not received any reports of stripe rust in Oklahoma or Kansas. Historically, stripe rust detections in Kansas prior to April 15 have been associated with bad stripe rust years. Scouting efforts over the next few weeks will be very important.

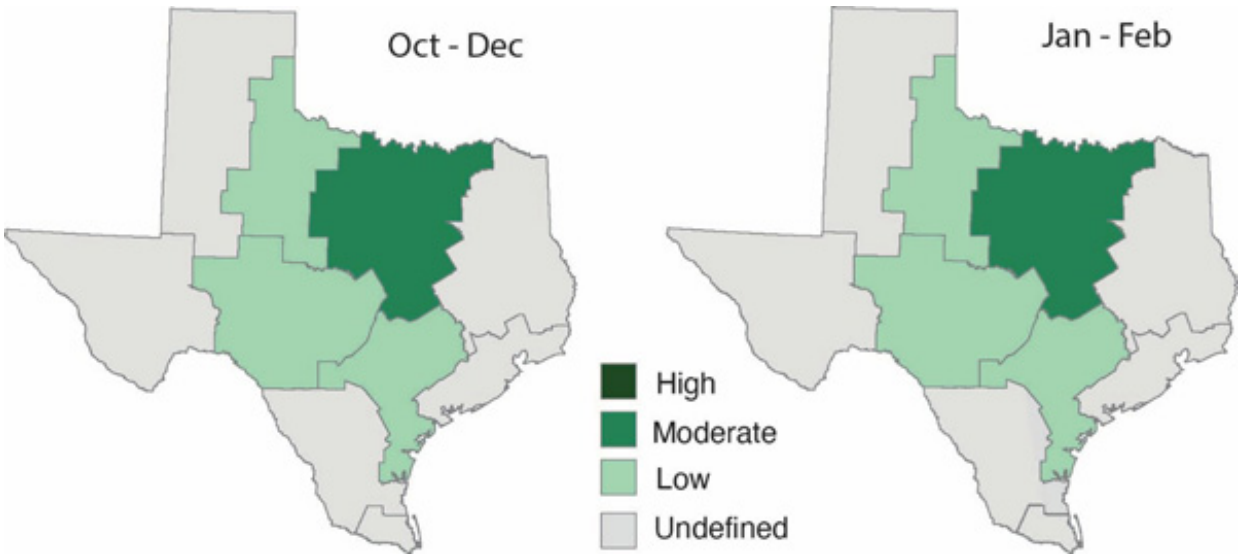

Figure 1. K-State research has shown that the annual severity of stripe rust outbreaks in Kansas can be predicted by soil moisture in key regions of Texas in both the fall and the early spring. In 2024, soil moisture in Texas was low to moderate (indicated by medium/dark green colors on the map). In the spring of 2025, moisture in key regions of Texas was also low. These maps show soil moisture levels based on the "Palmer Z-Index" provided by NOAA-National Centers for Environmental Information. Maps courtesy Erick DeWolf, K-State Research and Extension.

What is the outlook for Kansas wheat?

The maps above indicate that conditions this fall/winter were dry in parts of Texas that are important for stripe rust overwintering. At K-State, we combine this information with several weather-based

models to help forecast whether or not stripe rust will be widespread and yield limiting in Kansas. Right now, all models are indicating that **the stripe rust risk is generally low for this year**. Historically, years that begin like this have ended with lower-than-average yield losses in Kansas to this disease.

Of course, stripe rust severity in Kansas is still driven by weather conditions in the state in the late spring. Once stripe rust is detected in Kansas, cool evenings and extended periods of canopy moisture will be necessary for disease establishment at levels that would result in yield losses.

The disease situation can change rapidly, and it is important to continue to scout for signs of disease development as the season progresses. We will continue to provide updates on stripe rust occurrence and weather outlook as we move toward critical growth stages for fungicide applications in Kansas over the next several weeks.

Please contact me (andersenk@ksu.edu) if you detect stripe rust in Kansas so we can update regional maps.

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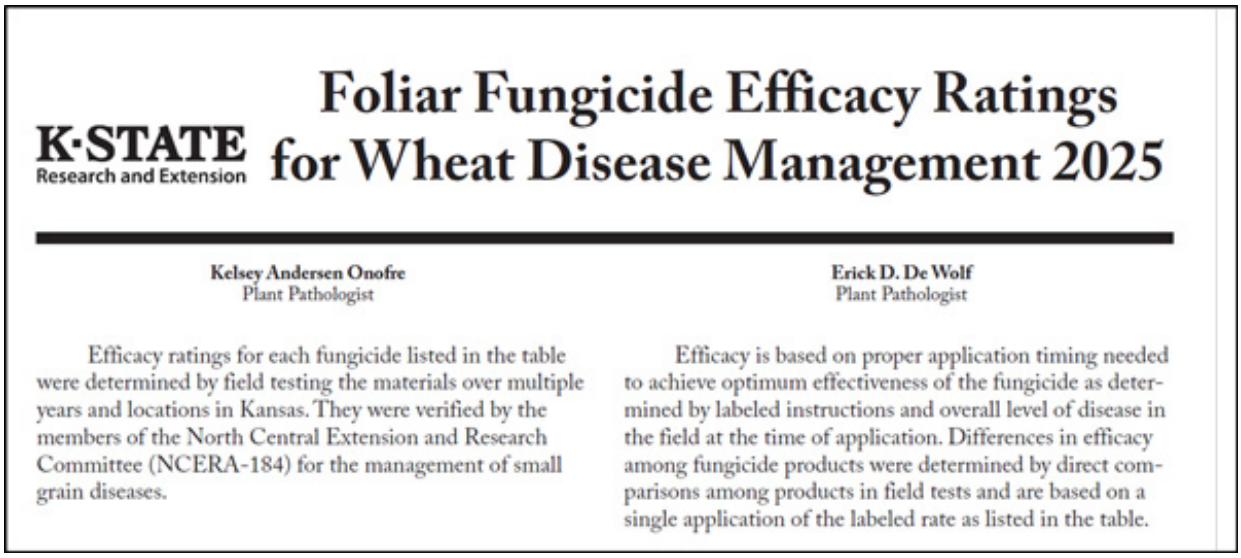
5. Foliar fungicide efficacy ratings for wheat disease management

The K-State Research and Extension publication *Foliar Fungicide Efficacy for Wheat Disease Management* has been updated for 2025. Check out the updated pub here: http://www.bookstore.ksre.ksu.edu/pubs/EP130.pdf.



K-STATE Research and Extension

Foliar Fungicide Efficacy Ratings for Wheat Disease Management 2025

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Erick D. De Wolf
Plant Pathologist

Efficacy ratings for each fungicide listed in the table were determined by field testing the materials over multiple years and locations in Kansas. They were verified by the members of the North Central Extension and Research Committee (NCERA-184) for the management of small grain diseases.

Efficacy is based on proper application timing needed to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table.

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

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

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6. Sunflower production: Matching hybrids to market needs

Have you considered growing sunflowers as part of your summer crop plans? Sunflower producers have a number of market types to choose from when deciding to raise a sunflower crop. Depending on which market a farm is producing for, specific hybrid types should be selected to meet a particular market.

Two types of sunflowers can be produced. They are oil sunflowers and confection sunflowers (Figure 1).

Figure 1. Characteristics of oil sunflower seeds and confection sunflower seeds. Photo by Jeanne Falk Jones, K-State Research and Extension.

The largest market category exists for sunflower oil. In general, sunflower oil is used in cooking, and you will likely find it on grocery store shelves. Sunflower oil is light in taste and appearance and supplies more Vitamin E than any other vegetable oil. It combines monounsaturated and polyunsaturated fats with low saturated fat levels. Oil-type sunflower varieties need to be planted when producing for an oil market.

The current most desirable oil market type is high oleic oil. This has changed over the years with sunflower breeding efforts and market demand targeting high oleic oil. Currently, when purchasing sunflower varieties for an oil market, the sunflower hybrids need to be high oleic oil types. While markets exist for other oil types, discounts may be applied for linoleic and NuSun type varieties. As a result, when ordering seed for oil markets, ask the seed dealer for a high Oleic type variety.

High oleic sunflower oil is very high in oleic (monounsaturated) acid. High oleic sunflower oil is usually defined as having a minimum of 80% oleic acid (a description of oil fat type). The oil has a very neutral taste and provides excellent stability without hydrogenation. High oleic sunflower oil offers a trans-fat-free oil solution for customers. The oil has many uses, including bakery applications, spray coating oils for cereal, crackers, and dried fruit; it is used in non-dairy creamers, many types of frying, and other uses. High oleic sunflower oil is low in saturated fat and has a longer shelf life making this oil type the predominant market type used in the industry today. Sunflower oil market

representatives can be asked which oil-type sunflower hybrids have high oleic traits. In addition, at delivery, there are quality characteristics that are also important, such as oil percentage and test weight. Premiums are paid for oil percentages over 40%, with discounts for oil percentages below 40%. Test weight is also an important factor, with higher test weights being important.

Another sunflower market class is birdseed. Most oil-type sunflower varieties work fine for the bird seed market, and oil percentage is less important for this market. However, test weight is important for this market. Low test weight can cause discounts to occur. Sunflowers grown for birdseed markets are grown with the same agronomic practices as the oil type.

Last, another sunflower market is the confection market. Confection sunflower is a separate classification from other markets and requires confection-type hybrids to be planted. As a result, when ordering seed, communicate which market type hybrid you will need. Confection seeds delivered to an oil market will be discounted heavily and may be rejected. The same marketing issue occurs if an oil-type hybrid is delivered to a confection buyer; the load will be rejected. Therefore, if producing for a confection market, a production contract is needed, and seed ordering needs to be directed to a confection sunflower hybrid only. Seed size is important when producing for a confection market, as large-sized seeds will generate a premium. The premium is paid for seed that flows over a 22/64 screen. Currently, confection markets in Kansas and the surrounding states are limited.

Delivery points in the High Plains exist at various locations. A current list of sunflower buyers and sellers can be found at the National Sunflower Association website at www.SunflowerNSA.com/buyers, and current prices are posted at www.sunflowernsa.com/growers/Marketing/daily-oilseed-sunflower-price/

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7. K-State Plant Disease Diagnostic Laboratory fee adjustments

On April 1, 2025, the K-State Plant Disease Diagnostic Lab will slightly increase service fees. This adjustment allows us to continue providing quality diagnostic services while continually upgrading our testing technologies.

Table 1. K-State Plant Disease Diagnostic Lab Services and Fees.

Diagnostic Service	Internal Charges (KSRE)	External Charges (non-extension)
Digital Diagnosis	$0	$0
Routine Diagnosis (per sample)	$12	$15
There is no routine diagnosis charge when running the specialized tests listed below.		
Fescue Endophyte	$30	$40
Nematode – Soybean Cyst Nematode	$30	$40
Nematode – Pine Wilt	$30	$40
ELISA (wheat virus screen-6 pathogens)	$55	$75
Molecular (first/single pathogen)	$55	$75
Molecular (each additional pathogen)	$20	$30

Wheat viruses (WSMV/TrMV) have been confirmed in western Kansas in the last month, so it is time to be on the lookout for this problem in wheat fields this spring.

The ELISA testing fee has increased to $55 for extension and $75 for non-extension.

The K-State Plant Disease Diagnostic Lab uses ELISA (a protein-based diagnostic test) to screen for wheat viruses. The wheat viruses that we screen for are Wheat Streak Mosaic Virus (WSMV), Triticum mosaic Virus (TriMV), High Plains Wheat Mosaic Virus (HPWMoV), Wheat Spindle Streak Mosaic Virus (WSSMV), Soil-borne Wheat Mosaic Virus (SBWMV), and Barley Yellow Dwarf Virus- PAV (BYDV-PAV).

Sample Submission – High-quality samples lead to high-quality diagnoses

- Collect and ship samples on or before Wednesday to avoid weekend storage.
    - Collect healthy **and** symptomatic plants (labeled).
    - Collect the entire plant.
        - Dig up the plant to keep the root system intact.
        - Bag roots separately to avoid soil contact with leaves.
        - Place bagged roots and above-ground materials in a larger plastic bag.
        - Label and use plastic bags instead of paper; do NOT add water. This maintains sample integrity.

- Once collected:
    - Fill out the submission form with as much information as possible. Include variety/hybrid info (especially for wheat). Attach it to the outside of the sample bag.
    - Ship plants ASAP overnight via UPS or FedEx when possible. USPS can take up to 14 days.

- Send plant sample photos to clinic@ksu.edu with the tracking number or date shipped.
    - 3 useful types of images (see Figure 1 for an example of a good versus bad sample submission)
        - Symptom/problem up close and in focus
        - Entire plant from ground level to the top of plant
        - Site – capture the pattern in the field, transition areas, terraces, etc.

Figure 1. The photo on the left is an example of a good sample submission. The picture on the right is a poor sample submission.

If you have any questions, comments, or concerns, please contact us via clinic@ksu.edu or 785-532-6716.

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