Issue 896

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eUpdate

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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. Pay attention to growth stage for spring herbicide decisions on wheat

Producers should pay close attention to the growth stage of their wheat before making spring herbicide applications. Some herbicides must be applied after tillering, several must be applied before jointing, and others can be applied through boot stage. Remember that weeds are most susceptible at early growth stages and coverage becomes difficult as the wheat canopy develops, so the earliest practical and labelled applications generally result in the best weed control.

Applications permitted prior to jointing

Dicamba can be applied to wheat between the 2-leaf and jointing stages of wheat. Application of dicamba after wheat reaches the jointing stage of growth causes severe prostrate growth of wheat and significant risk of yield loss. Dicamba is effective for control of kochia, Russian thistle, and wild buckwheat, but is not good for control of mustard species. Kochia, Russian thistle, and wild buckwheat are summer annual weeds that may emerge before or after wheat starts to joint, so timing of dicamba for control of these weeds can sometimes be difficult. Fortunately, dicamba provides some residual control of these weeds following application.

Products labeled only for use on herbicide-resistant wheat must also be applied prior to jointing. Beyond should be applied to 1 gene ClearField wheats after tiller initiation and prior to jointing, but can be applied to 2-gene ClearField wheats until the second node is detected at the soil surface. Aggressor should be applied to CoAXium wheat varieties after 4-leaf growth stage and before jointing. Beyond should only be applied to ClearField wheat varieties and Aggressor should only be applied to CoAXium wheat varieties.

Other herbicides that must be applied prior to jointing include Agility SG, Olympus, Outrider, PowerFlex HL, Pulsar, and Rave.

Applications permitted through boot

Herbicides that can be applied later in the spring – prior to boot stage – include Ally + 2,4-D, Amber, Finesse, Glean, Starane Flex, and Starane NXT. Starane is a better choice than dicamba products for control of kochia after wheat moves into the jointing stage of growth

2,4-D is labeled for application to wheat from the full-tiller stage until prior to the boot stage of growth. Application of 2,4-D prior hinders the tillering process and can result in significant yield loss if applied too early. Wheat will sometimes exhibit prostrate growth when 2,4-D is applied in the jointing stage of growth, but yields generally are not significantly affected if applied before the boot stage of growth.

In general, MCPA is safer on wheat than 2,4-D, especially when applied prior to tillering. MCPA can be applied after the wheat is in the three-leaf stage (may vary by product label) until it reaches the boot stage of growth. Neither herbicide should be applied once the wheat is near or reaches the boot stage of growth, as application at that time can result in malformed heads, sterility, and significant yield loss (Figure 2).

Both 2,4-D and MCPA are available in ester or amine formulations. Ester formulations generally provide a little better weed control than amine formulations at the same application rates, but also

are more susceptible to vapor drift. However, the potential for vapor drift damage in early spring is minimal. Ester formulations generally are compatible for use with fertilizer carriers, while amine formulations often have physical compatibility problems when mixed with liquid fertilizer.

Applications permitted through flag leaf

Many herbicides used in the spring on wheat can be applied up to the time the flag leaf is visible, or later. One newer product that can be applied from 2-leaf and flag leaf is called Pixxaro EC. It is labeled for control of flixweed, horseweed, kochia, wild buckwheat, and other troublesome weeds.

Other herbicides that can be applied through flag leaf include Affinity BroadSpec, Affinity TankMix, Ally Extra SG, Express, Harmony, Harmony Extra, Huskie, Quelex, Sentrallas, Supremacy, Talinor Weld, and WideMatch must be applied before the flag leaf is visible.

Figure 1. Stunting from an application of 2,4-D to wheat prior to tillering. Photo by Dallas Peterson, K-State Research and Extension.

Figure 2. Malformed heads from an application of 2,4-D at boot stage. Photo by Dallas Peterson, K-State Research and Extension.

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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2. Understanding the chemical reactions of urea in the soil

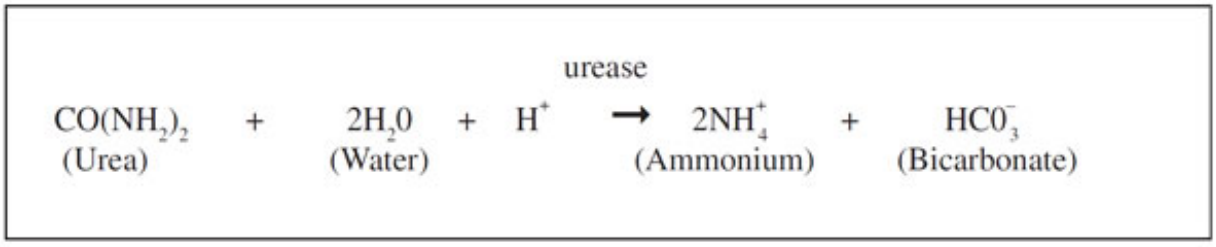
With the current high prices of commercial fertilizers, it is even more important to implement management practices that minimize nutrient loss and maximize crop uptake. Some common nitrogen (N) containing fertilizers used in Kansas are composed of urea. This article explains some of the science behind what happens to urea when it is applied to soil. The information is taken from a new KSRE publication, MF894 *Management Practices Affecting Nitrogen Loss from Urea*. The full article can be viewed at: https://bookstore.ksre.ksu.edu/pubs/MF894.pdf.

Urea fertilizers range in composition from pure, dry, granular urea (46-0-0) to products that are mixtures of urea and other sources of N and/ or phosphate and potash. The most common mixture of urea with other N fertilizers is the liquid urea-ammonium nitrate solution (UAN), which in Kansas is most often sold as a solution containing 28% N. It also may be sold as a 32% N solution. Approximately half of the N in UAN is urea.

While cost advantages favor increased use of urea, questions are often raised about its availability to crops compared to other N sources and its potential for loss when applied to the soil surface and not incorporated by tillage or irrigation. Chemical reactions of urea and ammoniacal N (ammonia and ammonium) in soil, and soil, climate, and management factors that affect the performance of urea need to be understood for proper use.

Reactions of Urea in Soil

Urea applied to the soil reacts with water and the soil enzyme urease and is rapidly converted to ammonium. This conversion, shown with the chemical reaction below, is called urea hydrolysis. In this reaction, hydrogen ions (H+) are consumed, causing the soil pH near the fertilizer to rise. If the pH rises above 7, a significant amount of gaseous ammonia can form in soil for a few days following urea application. When urea is surface applied, the formation of ammonia at the soil surface from urea hydrolysis may allow some ammonia to be lost, and if urea is banded with the seed, some plant damage may occur because of ammonia toxicity. The severity of both processes depends largely on the concentration of ammonia formed in the soil.



The concentration of ammonia in the soil from urea hydrolysis depends on a number of factors. The most important are:

1) **The rate of urea applied**. Larger urea applications generally result in more hydrolysis and higher ammonia concentrations in soil. Band applications also concentrate the urea in smaller volumes of soil, which can result in more ammonia formation at the site of fertilizer placement; however, this does not mean that ammonia loss will be greater from surface banded urea, since the hydrolysis

rate may be reduced (see number 3).

2) **The pH at the soil surface for the first three to five days following urea application**. The higher the pH during this time, the more ammonia will be formed. Soils vary in their ability to resist the increase in pH due to the amount of hydrogen ions they contain. Soils with relatively large amounts of clay and organic matter, and low pH before urea is applied have relatively large amounts of hydrogen ions. Less ammonia will be formed on these soils. At the other extreme, soils that are sandy and low in organic matter, especially those with a high pH, allow more ammonia to be formed from urea hydrolysis.

3) **The speed (rate) of urea hydrolysis in soils**. Fast urea hydrolysis reduces the time available for urea and ammonium (and any gaseous ammonia) to diffuse deeper into the soil when surface-applied (or away from the seed in case of seed-placed urea). When the time for diffusion into the soil is reduced, the ammonium will be more concentrated at the surface, the pH will be higher, and more ammonia will form. The factors affecting the rate of hydrolysis that are most likely to change from field to field include the amount of urease enzyme in the soil, soil temperature, and soil moisture. Since band application reduces the contact between fertilizer and soil urease, this method slows the rate of urea hydrolysis.

Weather Conditions at and Shortly after Application

Two weather-related factors, temperature and moisture, greatly affect urea hydrolysis rates and ammonia loss from surface-applied urea fertilizers. If a choice is possible, apply urea fertilizers when temperatures are cool. Wheat and cool-season grasses can be fertilized in late winter to good advantage, rather than late spring when temperatures begin to rise. Even though losses are usually not large with later application, the early application is preferred. Although application under cool or cold conditions is preferred, there is potential for loss of fertilizer in storm runoff should an unusual winter rainstorm or quick snowmelt occur when soils are frozen. Poor fertilizer performance has been observed in a few instances when these somewhat rare weather events occurred. It is best to avoid application of fertilizer to frozen soils, if there is a high probability of rapid warming conditions with rainstorms and runoff. If the surface soil is partially thawed at fertilizer application time or if it thaws soon after application, the fertilizer will dissolve and diffuse into the soil within a day or two. If storms and runoff then follow, losses will be small.

Application is also better under dry surface soil conditions than under wet conditions to avoid ammonia loss. Usually, the surface of a well-drained soil dries quickly in Kansas weather. Soils with high water tables, however, may stay moist near the surface for longer periods of time. Lower parts of a field that stay wet for long periods of time may also experience some problems with ammonia loss, whereas well-drained areas of a field may not. Somewhat higher rates of application on these wetter areas could increase production by offsetting some N loss.

Reference: Perin, V., Santos, E.A., Lollato, R., Ruiz Diaz, D.A., Kluitenberg, G.J. 2020. Impacts of ammonia volatilization from broadcast urea on winter wheat production. Agronomy Journal. 2020; 112: 3758– 3772. https://doi.org/10.1002/agj2.20371

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3. Management practices affecting nitrogen loss from urea

When urea fertilizers are top-dressed to winter wheat in late winter or broadcast and incorporated for production of any crop, studies have shown good crop performance and little or no loss of ammonia. Low losses from urea top-dressed to wheat are due largely to the low soil temperatures typical at the time when top-dressing is usually done. For other crops, incorporation of urea by tillage or by 1/2 inch or more of rain or irrigation water the day of application (ideally in rainfall withing 2-3 days) will generally eliminate ammonia loss. Even when conditions are considered ideal for ammonia loss (lots of urease, warm temperatures, and moist soil), losses are unlikely to exceed 20% of the surface-applied urea. Injection of urea-containing fertilizer solutions into irrigation water also results in little ammonia loss. The effectiveness of this method of fertilizer application depends on how uniformly the water (and therefore the urea) can be applied across the field. The following describes some cases in which ammonia loss from urea fertilizers may be a problem and suggests practices to reduce losses.

Ammonia loss from surface-applied urea is likely to be greater for no-tillage than for conventional tillage systems. Continued no-till crop production results in a layer of crop residue on the soil surface that can enhance ammonia loss from surface-applied urea or UAN solution. A layer of partially decomposed or undecomposed crop residue can increase loss because:

1. The urease activity of this residue layer is higher than in underlying soil;
2. Undecomposed crop residue may reduce diffusion of fertilizer into the soil;
3. Crop residue at the surface often increases the water content of the surface soil layer, which can increase ammonia loss as discussed earlier. The layer of partially decomposed crop residue can tie up N temporarily, making it less available to the crop as discussed below.

Cumulative N loss by volatilization can be significant even under low temperatures for top-dressed urea on wheat, as shown in a 2020 study in Kansas. These types of losses occur in smaller increments but extended over time if there is lack of precipitation to incorporate the nitrogen. The effect of tillage and the presence of heavy residue can have a significant effect on ammonia volatilization, with typically higher volatilization potential under no-till. Also, urease inhibitors (NBPT) reduce urease activity and minimize volatilization. Urease inhibitors can delay the process of urea hydrolysis, providing an opportunity for precipitation to incorporate the nitrogen into the soil.

In many cases, UAN solution may be mixed with herbicides and applied together preplant. The loss of ammonia from this mixture after application will not be affected by the herbicide and will still be determined by the factors discussed here for urea-containing fertilizers applied alone.

No-till row crops fertilized with surface-applied urea or UAN solution have sometimes yielded less than crops fertilized with other N sources, which do not lose ammonia when applied to neutral pH or acid soils. However, sufficient evidence has been collected to show that the differences in crop response to the various N sources are not always due to differences in ammonia loss from the various fertilizers. Decomposing crop residue can tie up surface-applied N (making it unavailable to crops), whereas N placed below the decomposing crop residue is not as susceptible to this problem. Therefore, N fertilizer banded below the soil surface will often be more available than surface-applied

N, even with non-urea fertilizer sources.

An alternative method of applying liquid N sources with little or no tillage is to apply the fertilizer in surface bands (such as strimmer bars). When differences occur, this method of placement provides better N availability to row crops or small grains than surface broadcast applications, but not as good as fertilizer injected below the soil surface.

Take-home Message

Ammonia can form in soils following the application of urea fertilizers. If urea is surface-applied and not incorporated by tillage or does not receive 1/2 inch of rainfall or irrigation within 24 hours, there is some potential for ammonia loss. In Kansas, this potential is generally small for many surface-applied urea fertilizers.

Urea may be safely applied for the following conditions when tillage is not possible:

- Wheat top-dressed in winter when soil temperatures are cool or cold;
- Cool-season grasses fertilized during cool weather from November through March on well-drained soils;
- Early spring application for summer crops on clean-tilled fields.

Enough ammonia loss to reduce crop yields can sometimes occur under the following conditions:

- No-till crop production when urea is applied to a warm and moist soil surface heavily covered with crop residue.
- Soils kept wet by water tables near the soil surface. These are most likely to be lower-lying areas of fields following very wet weather.

This article has some key excerpts taken from a new KSRE publication, MF894 *Management Practices Affecting Nitrogen Loss from Urea*. The full article can be viewed at: https://bookstore.ksre.ksu.edu/pubs/MF894.pdf.

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4. Kansas Ag-Climate Update for February 2022

The Kansas Ag-Climate Update is a joint effort between our climate and extension specialists. Every month the update includes a brief summary of that month, agronomic impacts, relevant maps and graphs, 1-month temperature and precipitation outlooks, monthly extremes, and notable highlights.

February 2022: Cooler in the south and less rainfall in the northeast

Statewide average temperature in Feburary dropped below the normal after a consective four-month warming from October to January. The statewide averaged temperature was -0.7°F cooler, which was stratifiedly distributed across the state's latitutes. While the state was cooler than normal, the southern regions were slightly cooler compared to the rest of state (Figure 1). The temperature ranked as the 50th coldest and 79th warmest month during the past 128 years. However, considering the 4-month window for winter wheat, the average four-month (Nov. through Feb.) temperature was still the warmest since 2017.

Climatologically, Kansas January precipitation is about 1 inch. This month was slightly drier on average across the state (-0.5" departure from the normal). It ranked as the 26th driest month during the past 128 years. Similarly, considering the four-month accumulated precipitation for winter wheat, it was almost 2.5 inches drier than the four-month normal. This 4-month precipitation was the driest since 2018.

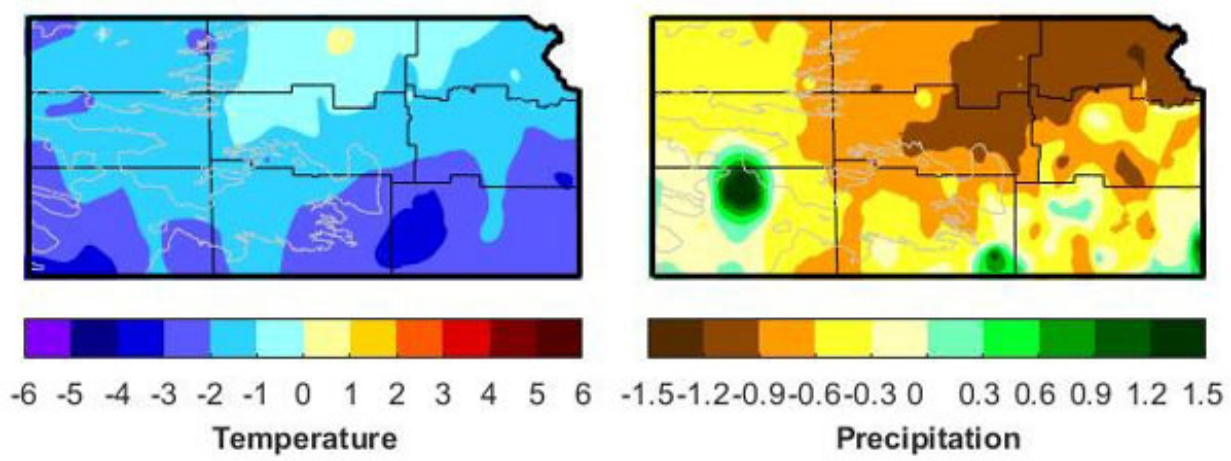

Figure 1. Departures from normal temperature (°F) and precipitation (inches) for February 2022.

View the entire February 2022 Ag-Climate Update, including the accompanying maps and graphics (not shown in this short summary), at http://climate.k-state.edu/ag/updates/.

5. Certified Crop Advisor exam review course is now available in a self-paced online format

In a collaborative effort from several faculty from K-State Research and Extension, individuals preparing for the certified crop advisor exam now have access to an online training course. This course is divided into multiple modules and includes several practice quizzes comprised of randomly selected questions from a pool of more than 500.

Course modules are divided based on the certified crop advisor objectives and include more than 11 hours of recorded presentations. Each presentation was developed and delivered by faculty from Kansas State University. The Certified Crop Advisor Exam Review course is a self-paced program that remains available for 10 months (304 days) from the date of enrollment. The cost for the entire course is $120.

The course is offered through K-State's Global Campus. To enroll, use this link: https://bit.ly/CCAexamprep or scan the QR code below with your smart phone.

For more information, please contact:

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6. Farmer input requested about the myFields online pest management tool

myFields is an online tool that provides crop producers with pest management information, such as pest diagnostics, pesticide application information, and real-time notification of pest issues. By creating an account on myFields, users can curate the information that is relevant to them based on their location and which kinds of crops they grow.

As a member of the agricultural community, we ask that you participate in our survey and provide input on how to improve the user experience of myFields. Participation is voluntary, and the survey can be completed in approximately 5 minutes. Responses from this survey will impact development decisions for myFields, including potential features and other updates to the website. The deadline to participate in this survey is April 1, 2022. Simply click the link below to access the survey.

https://kstate.qualtrics.com/jfe/form/SV_4SgDlxJrhTIvQaO

We thank you for your time, and we hope that you will complete this survey.

Max Dunlap, myFields Team
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7. One more session for K-State CropTalk webinar series - March 14

In 2021, a new series of hour-long webinars was launched with great success. For 2022, the K-State CropTalk webinar series is back and will be focused on agronomic topics targeted for northwest and north central Kansas. Topics range from soil fertility, weed management, cover crops, and weather resources. Continuing education credits have been applied for and will vary based on the subject area of each webinar.

Each webinar will begin at 12:00 pm (CST) and last until 1:00 pm. Upon registration, participants will receive an email with instructions to attend via Zoom or YouTube. These webinars are open to all and there is no cost.

Visit the K-State Northwest Research and Extension Center's website to register: **https://www.northwest.k-state.edu/events/.**

Please contact any local KSRE extension office in north central or northwest Kansas for any questions.

UPDATED: List of the remaining webinars, with dates, topics, and speakers is detailed below.

March 14 – **2022 Grain Market Outlook and Strategies**
Dan O'Brien, Northwest Area Agricultural Economist