Issue 980

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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. Considerations for fall applications of anhydrous ammonia

Soils across Kansas are still running above 50°F at the 4-inch depth (Figure 1). It is best to delay anhydrous ammonia applications until soil temperatures drop below this threshold. Applying anhydrous ammonia in the fall ahead of the following corn crop has some appeal to producers. For one thing, fall fertilizer application spreads out the workload, so there's more time to focus on corn planting in the spring. Secondly, wet conditions in the spring sometimes prevent producers from applying lower-cost anhydrous ammonia ahead of corn planting and force them to apply more expensive sources after planting. Equally important for many producers have been issues with anhydrous ammonia availability at times in the spring.

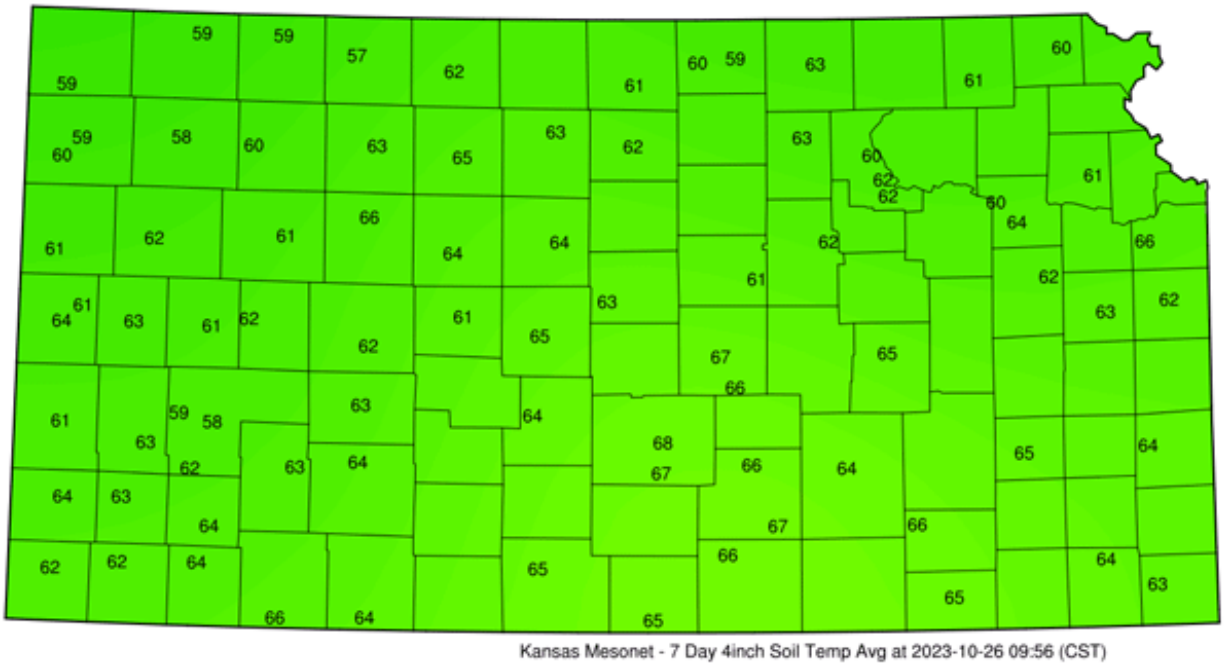

Figure 1. Average soil temperature (°F) at 4 inches for the 7-day period ending on October 26, 2023. Soil temperatures in individual fields in any given area will vary with differences in vegetative cover, soil texture, soil moisture, and other factors. (Kansas Mesonet)

Despite those advantages, producers should be aware that there is potential for higher nitrogen (N) loss in the spring following a fall application due to nitrification of the ammonium during late winter and very early spring and subsequent leaching or denitrification**.**

Reactions of anhydrous ammonia in the soil

Anhydrous ammonia has a strong affinity for water (hydrophilic) and readily reacts with water in its surrounding environment. This hydrophilic nature can be detrimental if the ammonia comes in direct contact with plants or exposed skin, but it can also be advantageous when applied correctly as a fertilizer.

When anhydrous ammonia is injected into the soil, the ammonia gas (NH_3) reacts rapidly with moisture in the soil and is converted to ammonium (NH_4^+). This ammonium is no longer in a gas form, and, being positively charged, it can be bound to clay and organic matter particles within the soil. This bound ammonium does not readily move in most soils, and leaching is not an issue except for some sandy soils with very low cation exchange capacity (CEC).

While this process does require moisture, the amount of water needed is quite low. The physical properties of dry soils cause the most common problems when applying anhydrous ammonia to dry soils. Poor closure of the injection furrow and voids and cracks in the dry soil can allow the ammonia to escape to the surface before converting it to ammonium. Using deeper injection depths and wing sealers in dry soils increases the amount of soil the gas comes into contact with and can significantly reduce ammonia losses back through the surface. Closing disks can also help seal the injection furrow and prevent losses at the injection site. More information on applying anhydrous to dry soils is available in this previous eUpdate article: https://eupdate.agronomy.ksu.edu/article_new/can-dry-soils-affect-anhydrous-ammonia-applications-510-4.

At soil temperatures above freezing, ammonium is converted by specific soil microbes into nitrate-N (NO_3^-) in a process called nitrification. Since this is a microbial reaction, soil temperatures strongly influence it. The higher the temperature, the quicker the conversion will occur. Depending on soil temperature, pH, and moisture content, converting all the ammonia applied in the fall can take 2-3 months or longer to nitrate.

By delaying application until cold weather, most of the applied N can enter the winter as ammonium, and over-winter losses of the applied N will be minimal. Producers should wait until soil temperatures are less than 50°F at a depth of 4 inches before applying ammonia in the fall or early winter. Nitrification does not cease below 50°F, but the soil will likely become cold enough to limit the nitrification process. In many areas of Kansas, soils may stay warmer than 50 degrees well into late fall and only freeze for short periods during the winter.

Using a nitrification inhibitor can help reduce N losses from fall N applications under specific conditions, particularly when soil temperatures warm back up for a period after application.

One should also consider soil physical properties when considering fall application. Fall applications of N for corn should not be made on sandy soils prone to leaching, particularly those over shallow, unprotected aquifers. Instead, fall N applications should focus on deep, medium- to heavy-textured soils where water movement through the profile is slower.

When is nitrogen lost?

When considering fall applications of N, remember that loss of N during the fall and winter is not usually a problem in Kansas. The conversion of "protected" ammonium to "loss-prone" nitrate during the fall and winter can be minimized by waiting to make applications until soils have cooled and using products such as nitrification inhibitors. The fact that essentially all the N may remain in the soil as ammonium all winter, coupled with our dry winters, means minimal N is likely to be lost over winter.

However, soils often warm up early in the spring, allowing nitrification to start well before planting corn. Generally, if the wheat is greening up, nitrification has begun! Thus, one of the potential downsides of fall application is that nitrification can begin in early March and essentially be complete

by late May and June.

Summary

If anhydrous ammonia is to be applied in the fall, several factors must be considered, including soil texture, temperature, and soil moisture. Consider the following guidelines:

- Do not apply anhydrous ammonia in the fall on sandy soils.
- On silt loam or heavier-textured soils, wait to apply anhydrous ammonia until soil temperatures at the 4-inch depth are below 50 °F. Grass-covered soil at the 2-inch depth typically reaches 50 degrees around November 20 in central Kansas (Figure 2). You can expect the 4-inch depth to lag behind that date depending on soil type and earlier if the ground is bare.
- Deeper injection depths (6 to 8 inches), wing sealers, and closing disks can help mitigate application problems when soils are dry.
- Use a nitrification inhibitor with anhydrous ammonia to help reduce fall nitrification.
- To check the soil temperature in your area, visit the K-State Research and Extension Weather Data Library at: http://mesonet.k-state.edu/agriculture/soiltemp/

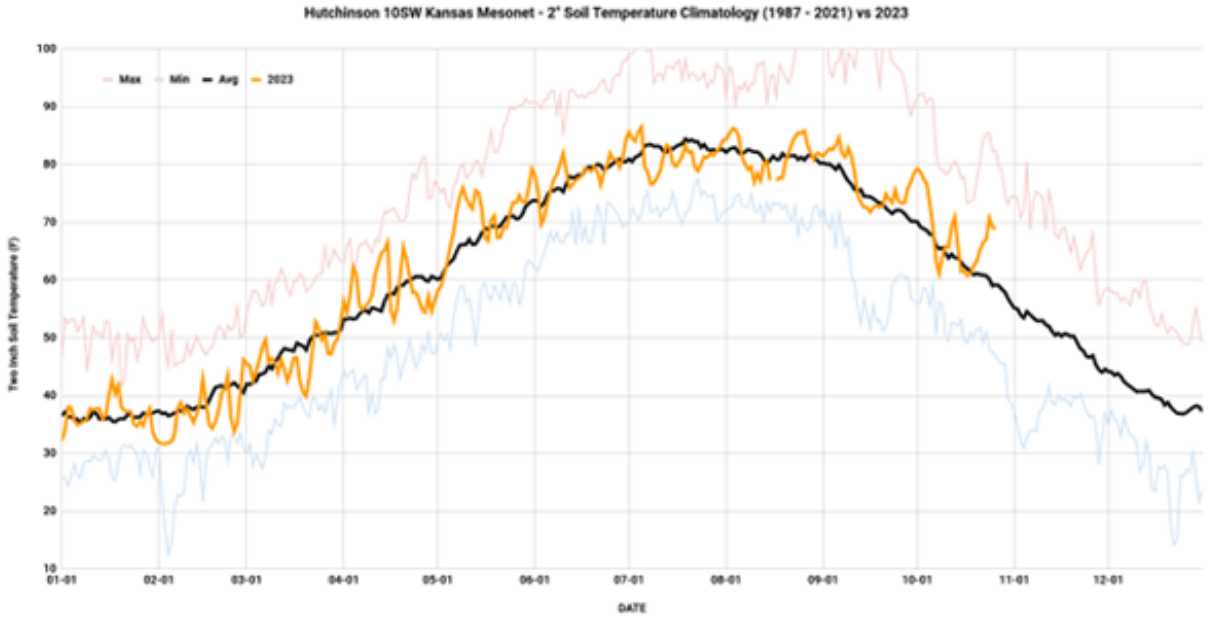

Figure 2. Hutchinson 10SW Mesonet station 2023 2-inch soil temperature compared to climatology under grass cover. Soil temperatures in individual fields in any given area will vary with differences in vegetative cover, soil texture, soil moisture, and other factors. (Kansas Mesonet)

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

Bryan Rutter, K-State Soil Testing Lab Manager
rutter@ksu.edu

Christopher “Chip” Redmond, Kansas Mesonet Manager
christopherredmond@ksu.edu

Peter Tomlinson, Environmental Quality Specialist
ptomlin@ksu.edu

2. Fall herbicide applications - Atrazine label updates

Fall or early spring herbicide applications are a great proactive weed management strategy to ensure fields "start clean" at planting, even though additional herbicide applications will be needed for fields to "stay clean" throughout the season. Other benefits include conserving water and removing hosts for pests.

Some weeds to target with these applications include kochia, marestail, and winter annual weeds such as henbit, weedy brome species, and volunteer wheat. Recommended herbicides for these scenarios include products with postemergence activity and residual herbicides. Atrazine has historically been an important part of these programs. However, recent changes in atrazine labels mean that atrazine cannot be used in some fall-applied scenarios.

Companies that label atrazine-containing herbicides have not renewed 24(c) labels in Kansas that allow for fall applications in row-crop stubble. Fall applications to wheat stubble in a chemical fallow system are still allowed.

Alternative herbicides to atrazine

Some herbicides with residual activity to consider in place of atrazine in these applications include Group 14 herbicides like sulfentrazone (Authority, others) or flumioxazion (Valor, Panther, others) and Group 15 herbicides like pyroxasulfone (Zidua, Anthem, and others), S-metolachlor (Dual, others), and acetochlor (Harness, Warrant, others).

Regardless of which herbicides you apply, the postemergence herbicides will work better when temperatures are warm enough for active weed growth. Daytime temperatures in the 40s would be a good minimum temperature for most applications. Another consideration is that herbicides should not be applied to frozen soil. Be sure to check your herbicide label(s) for application requirements specific to your fields.

Additional information about fall herbicide applications ahead of corn and sorghum can be found in this eUpdate article from September and in the 2023 Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland, K-State publication SRP-1176.

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.

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

3. Field equipment maintenance - Winterizing sprayers

Temperatures across the state are expected to drop much below normal this weekend, so now is the time to get your field sprayers winterized. As you put the sprayer in storage for the winter, this is also a good time to clean and inspect the exterior, tanks, hoses, and other components – including your tendering equipment. This article summarizes some of the key steps to winterizing sprayers. Be sure to check your owner's manual for detailed instructions for your particular sprayer so you don't void any manufacturer's warranty.

1. Clean the sprayer to remove herbicide residues, if not already done.
2. Check and service the pump.
3. Remove filters, nozzles, check valves, and screens from your sprayer and wash them by hand. You can store metal filters and screens in vegetable oil to prevent rusting.
4. Remove pressure gauges and store them at room temperature.
5. Remove as much water as possible. Consider using an air hose to blow out moisture.
6. Add RV antifreeze with a corrosion preventer. Solutions designed to winterize sprayers are also available. Liquid fertilizer is another option, but can cause corrosion.
7. Circulate the antifreeze through the entire system, including the boom (if applicable). For boom sprayers, turn on one section at a time until you see the antifreeze come out the nozzle openings, then cap the opening.
8. Refer to your owner's manual for other components, such as flow meters, rate controllers, and electronics.

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

4. Range Management Lectureship features speaker on non-traditional application of fire - Nov. 7

Dr. John Weir will present the 23rd annual Kling Anderson Range Science Lectureship on Tuesday, November 7, at 3:30 p.m. in 1018 Throckmorton Plant Sciences Center on K-State's Manhattan campus. The title of Weir's lecture is "Burning Outside the Box." This lecture is free and open to the public. Light refreshments will be served outside the lecture room starting at 3:00 p.m. Guest parking passes are available for $6.00 and can be purchased online at https://www.k-state.edu/parking/parking/visitor.html

Fire in tallgrass prairies has evolved to burning in the spring. Research has shown that burning at the time of emergence produces the greatest livestock performance and maintains dominant tall grasses. However, numerous trials have evaluated growing season burns. John Weir has been involved in much of that research in tallgrass prairie in Kansas and Oklahoma while serving as an Associate Extension Specialist at Oklahoma State University in Natural Resource Ecology and Management.

Weir has a BS from Cameron State and an MS in range science from Texas Tech. His fire experience is likely unmatched, with 1431 burns on 122,269 acres burned mostly as fire boss (1380 of 1431). Weir has taught five courses and conducted 44 fire schools and workshops. His fire expertise has been responsible for his inclusion in councils, committees, and advisory boards throughout North America, leading to his work setting fire policies throughout the US and Canada. He has shared his expertise through nearly 270 invited talks and tours nationwide. The Agronomy Department is excited for the Anderson Lecture to be presented by John Weir on the nontraditional application of fire.

The Kling Anderson Lectureship was established to enhance training in Range and Forage Management at Kansas State University by allowing students and faculty to benefit from interaction with outstanding scholars. The lectures and seminars provided through this program also perpetuate and honor Kling L. Anderson and commemorate his many years of outstanding service to Kansas State University, the people of the State of Kansas, and the range management profession worldwide. Donations by family, friends, and associates of Kling L. Anderson have endowed the Lectureship Fund in the Kansas State University Foundation. Tax-deductible donations are encouraged. Please send your gift, specifying that it is for the Kling L. Anderson Lecture Series, to the Kansas State University Foundation, 1800 Kimball Ave, Manhattan, KS 66502.

Clenton Owensby, Professor of Range Management
owensby@ksu.edu