Issue 970

K-STATE Research and Extension

Extension Agronomy

eUpdate

08/17/2023

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. Planning your wheat fertility program: Start now by soil testing

Wheat planting is just a month or so away in parts of Kansas, so now is the time to get your soil sampling done to have good information on which to base your fertilizer inputs. This is particularly important after drought and lower-than-expected yields for the previous crops in parts of the state.

Which nutrients should be tested?

The most important tests and nutrients to focus on this year depend in part on where you are located, the choices you make when applying N, and your tillage system. The nutrients for which wheat is most likely to show responses statewide are nitrogen (N) and phosphorus (P). Wheat is the most P-responsive crop we grow in Kansas, and while P removal with wheat may be less than with corn or soybeans, the relative yield response is often the highest. Therefore, knowledge of P soil test levels and fertilizer needs will be valuable. In addition, low soil pH is becoming a problem, especially in fields with a history of high rates of N application and relatively low cation exchange capacity.

In addition to the "Big 3" (pH, N, and P), potassium (K) deficiency in wheat can also be found in some areas of southeast and south central Kansas. Wheat is generally less prone to K deficiency than many of the rotation crops commonly grown, such as corn, soybeans, or grain sorghum. Generally, the focus of a K fertilization program is on the rotation crops, and meeting the higher K needs of corn and soybeans minimizes the chance of a K deficiency in wheat.

The 0-6 inch soil sample: Non-mobile nutrients and pH

A standard 0-6 inch surface sample is normally used to test for pH and the non-mobile nutrients such as P and K. Phosphorus and K are buffered processes in our Kansas soils. This simply means that the soil contains significant quantities of these nutrients and the soil tests we commonly use provide an index value of the amounts available to the plant, not a true quantitative measure of the amounts present. In the case of P, most Kansas soils require about 18 pounds of P_2O_5 to increase 1 ppm in soil test P; for K is around 8 pounds of K_2O to increase 1 ppm K soil test.

The buffering value for both P and K varies based on soil cation exchange capacity (CEC) and the soil test levels. On high CEC soils, especially those soils with high clay content, the buffering capacity goes up, so the soil test levels will change more slowly. However, on low CEC soils, the buffering capacity can be much lower, and soil test levels can change rapidly. The same situation occurs with soil test levels. On soils with low soil test P or K levels, it will require more P or K to raise the soil test than at high soil test levels.

In addition to requesting the standard soil tests of pH, P, and K from the 0-6 inch surface sample, producers might also want to monitor soil organic matter levels and micronutrients such as zinc (Zn). Zinc is not a nutrient commonly found deficient in wheat production. However, it is important for corn and grain sorghum. Thus including it in your sample package would be helpful for planning for these rotation crops.

Soil organic matter (SOM) is an important source of nutrients such as N and sulfur (S). When calculating the fertilizer needs for both these nutrients, SOM is taken into consideration. For wheat production, 10 pounds of available N and 2.5 pounds of S are credited for every 1% SOM in the soil.

The 0-24 inch soil sample: Mobile nutrients

In addition to pH, SOM, P, K, and Zn -- all of which are non-mobile in soils and accumulate in the surface – the mobile nutrients N, S, and chloride can provide significant yield responses when deficient in soils. Since all three of these nutrients are mobile in soils and tend to accumulate in the subsoil, we strongly recommend the use of a 24-inch profile soil sample prior to growing wheat, corn, or grain sorghum.

Nitrogen is a nutrient likely to provide yield response statewide. One common misconception is that the accumulation of N in the soil profile only occurs in the drier, western half of the state. However, with our dry winters, N can accumulate in the soil statewide. Rainfall tends to peak in Kansas in June and July, with a rapid decrease in monthly precipitation in the fall. Rainfall totals are generally lowest in December and January. Wheat takes up the majority of its N prior to flowering. In southeast Kansas that is in April, and in north central Kansas it is in early May most years.

In some years, especially following this year following recent dry conditions, significant amounts of N can be present in soils at wheat planting. On the other hand, after good yields, the residual N levels may be lower than the commonly used "default" value, and N fertilizer rates would need to be adjusted accordingly. Don't miss the companion article in this issue on the correlation between the amount of nitrate in the soil profile and wheat yield.

Sulfur deficiency is increasing across the state in wheat production also. There are two primary causes: the reduction in sulfur deposition from the atmosphere seen over the past 2-3 decades, and the reduction in S content in many P fertilizers. While not as soluble as nitrate, S is also a relatively mobile nutrient that accumulates in the subsoil. The S profile soil test is a good way to determine S needs.

Chloride (Cl) is the third essential mobile element to be considered for wheat production with profile soil testing. Chloride deficiency is normally found in the eastern half of the state on soils that do not have a history of potash (KCl) application. In general, this includes many areas in eastern Kansas, north of the Kansas River, and the central corridor of wheat production. Chloride deficiency is associated with grass crops, wheat, corn, and grain sorghum, and is correlated with the plant's ability to resist plant disease. Again, the profile soil test for chloride is well-calibrated in Kansas and should be considered.

Summary

In summary, wheat producers in Kansas should consider soil testing to help in making accurate fertilizer decisions. Accurate decisions are especially important during years with low grain prices and tight budgets. Furthermore, after variable conditions and yield levels across the state, fertilizer needs may require adjustments based on soil tests. Wheat producers specifically, should use surface 0-6 inch samples to determine the need for lime on low pH soils, P, K, Zn, and soil organic matter. They also should be using 24-inch profile soil tests for N, S, and Cl. Now is the time to get those samples taken, to ensure there will be enough time to consider those test results when planning your fall fertilizer programs.

For more information on soil sampling and submitting samples to the **K-State Soil Testing Laboratory**, visit their website at http://www.agronomy.k-state.edu/services/soiltesting/.

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2. Soil fertility and wheat production: Profile nitrate levels and wheat yield

An article in this eUpdate issue gives a great summary of planning the best wheat fertility program through timely soil testing. This article addresses the correlation between the amount of nitrate in the soil profile and wheat yield.

Taking 24-inch soil profile-N samples in the fall has been a recommended practice for making an N recommendation for winter wheat for many years. However, due to the mobility of nitrate-N in the soil, soil test values observed in the fall may be different from values observed in the spring, particularly on soils prone to leaching. Because many producers wait until spring green-up to make their N application**, does soil sampling in the fall for nitrate-N really provide useful information for N management in wheat?** That is a legitimate question.

Analysis of yields taken from K-State research plots that received no N fertilizer shows a strong positive relationship with fall soil profile nitrate-N (Figure 1).

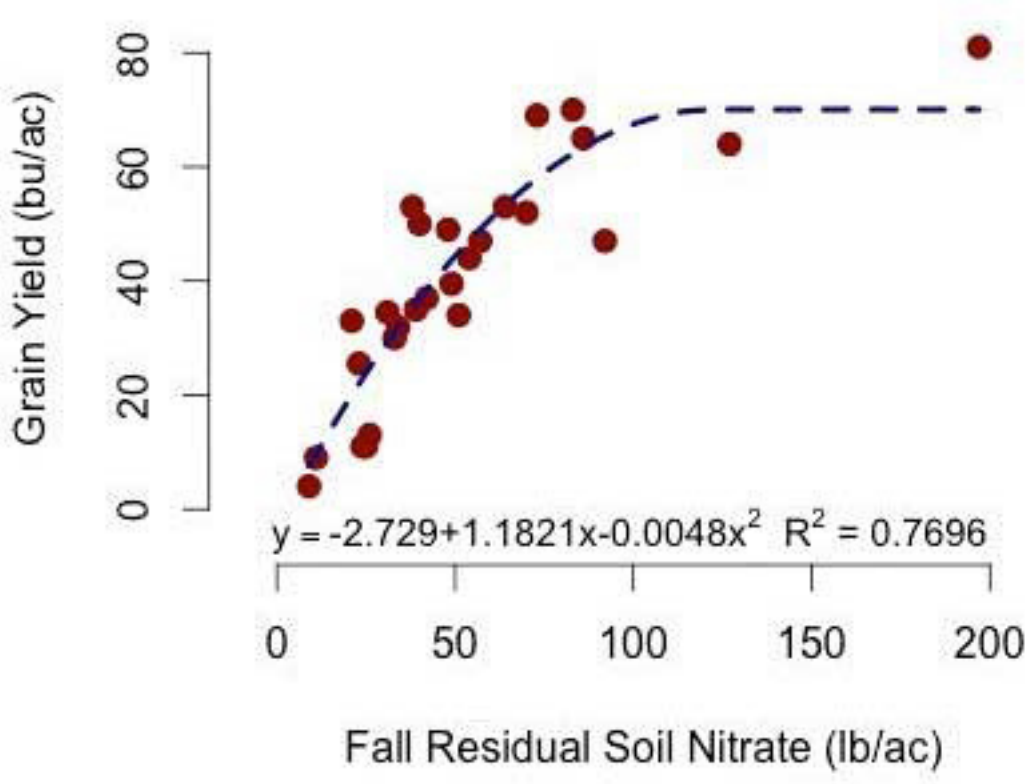

Figure 1. Relationship between fall soil profile nitrate-N level and wheat yield with no N fertilizer applied. Graph by Dorivar Ruiz Diaz, K-State Research and Extension.

We found that at low soil nitrate levels, wheat yields responded well to applied fertilizer. We also found that when fall soil profile nitrate-N levels are greater than 80 to 100 lb/acre, it is unlikely the site will respond to additional fertilizer N applied in the spring.

In short, a strong relationship was found between wheat yield and fall nitrate-N levels from 24-inch profile soil test analyses when no N fertilizer was applied. Although new practices have been

developed to improve N management in winter wheat, soil sampling in the fall for nitrate-N remains an important practice to manage N efficiently and can result in considerable savings for producers.

When soil sampling for N is not done, the K-State fertilizer recommendation formula defaults to a standard value of 30 lb/acre available N. In this particular dataset, the average profile N level was 39 lb N/acre. However, the N level at individual sites ranged from 11 to 197 lbs N/acre. Most recommendation systems default to a standardized set of N recommendations based on yield goal and/or the cost of N. Without sampling for N or using some alternative method of measuring the soil's ability to supply N to a crop, such as crop sensing, the recommendations made for N will be inaccurate, resulting in a reduction in yield or profit per acre and increased environmental impact.

Failure to account for the N present in the soil wastes a valuable resource and can result in excess foliage, increased plant disease, inefficient use of soil water, and reduced yield. Soil sampling in the fall for nitrate-N can have a significant impact on N recommendations for winter wheat in Kansas soils.

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3. Wheat streak mosaic virus: Early control of volunteer is crucial

Wheat streak mosaic virus could be problematic this coming season, with rainfall encouraging volunteer development in parts of Kansas. One of the best preventative measures for wheat streak is the control of volunteer wheat early and often after harvest. If volunteer wheat is allowed to stand, it creates a "green bridge", allowing wheat streak mosaic and wheat curl mites to survive locally. Volunteer wheat should be terminated at least two weeks prior to planting to allow sufficient time for mites to die off. Growers should be mindful of volunteer wheat that may "hide" in double-cropped soybeans or cover crops.

Figure 1. Volunteer wheat that has emerged in wheat residue. Photo by Sarah Lancaster, K-State Research and Extension.

Breaking the "green bridge"

Wheat curl mites will move off growing wheat as the green tissue dries down and dies. After moving off the existing wheat at or near harvest time, the mites need to find green tissue of a suitable host soon or they will die (death of the whole population will take approximately 2 weeks).

Producers often like to wait several weeks after harvest before making their first herbicide application to control volunteer wheat. This allows as much volunteer as possible to emerge before spraying it or tilling it the first time. Glyphosate and atrazine are two herbicides that are often used for this purpose. Additional information about controlling volunteer wheat can be found in a recent eUpdate article: "Controlling weeds after wheat harvest". Often, a second application or tillage operation will be needed later in the summer to eliminate the green bridge to fall-planted wheat by making sure all volunteer is dead within ½ mile of wheat being planted in the fall. Wet weather through late summer often favors multiple flushes of volunteer wheat (Figure 2) and also favors the growth of other grassy weeds that can also support moderate populations of the curl mites and virus.

Figure 2. A thick stand of volunteer wheat after wheat harvest (left panel) and detail of volunteer wheat development (right panel). Photos taken in Edwards County, KS by Romulo Lollato, K-State Research and Extension.

Management with genetic resistance: One tool in the toolbox

Other than timely control of volunteer wheat, genetic resistance is also an important tool for WSMV control. Genetic resistance to wheat streak mosaic can also reduce the risk of severe disease problems. There are currently several that have wheat streak mosaic resistance, including KS Dallas (red), KS Hamilton (red), Guardian (red), Oakley CL (red), Joe (white), and Clara CL (white). Some of these varieties have a gene named *WSM2*. These resistance genes help but have some serious limitations. For example, they are effective against wheat streak mosaic virus, but not against triticum mosaic (https://bookstore.ksre.ksu.edu/pubs/ep145.pdf) or wheat mosaic virus (high plains disease), two other viral diseases spread by wheat curl mites, sometimes simultaneously. The resistance conferred by WSM2 is also temperature sensitive and is much less effective at high temperatures, although resistance in KS Dallas and KS Hamilton seem to endure greater temperatures before breaking down (~ 70º F). If wheat is planted early for grazing or if high temperatures persist into October, the resistance is much less effective. KS Silverado (white) also has temperature-sensitive resistance to wheat streak mosaic, although from a different source than WSM2.

In addition, there are a handful of varieties with resistance to the wheat curl mite, including TAM 112, Byrd, Avery, Langin, Kivari AX, KS Western Star, Whistler, Canvas, Guardian, Crescent AX, Incline AX, Fortify SF, TAM 115, TAM 204, and T158. These varieties remain susceptible to viral diseases, but they generally slow the development of the mite populations in the fall. This resistance can help reduce the risk of severe disease but will not provide enough protection if wheat is planted in close

proximity to volunteer wheat or other hosts infested with large populations of the curl mites and virus.

Unfortunately, many of these varieties are adapted to Western Kansas and may not be the best options for production systems in the central corridor. There are some central Kansas-adapted varieties that tolerate WSMV infection better than others, including Rockstar, SY Wolverine, LCS Photon AX, LCS Helix AX, and LCS Julep. These varieties will still show symptoms of WSMV, but may yield better than other varieties that are more susceptible.

More information on variety selection can be found here: MF991 *Wheat Variety Disease and Insect Ratings* https://bookstore.ksre.ksu.edu/pubs/MF991.pdf

Figure 3. Close-up of wheat showing symptoms of a wheat streak mosaic virus infection in the fall. Photo by Kelsey Andersen Onofre, K-State Research and Extension.

Other hosts for the wheat curl mite

Volunteer wheat is not the only host of the wheat curl mite. Over the years, multiple research studies have evaluated the suitability of wild grasses as hosts for both the curl mite and the wheat streak

virus. There is a considerable range in the ability of a grassy weed species to host the mite and the virus. Barnyardgrass is among the more suitable hosts for both virus and mites, but fortunately, it is not that common in wheat fields. In contrast, various foxtails, although rather poor hosts, could be important disease reservoirs simply because of their abundance. These grasses may play an important role in allowing the mites and virus to survive during the summer months, particularly in the absence of volunteer wheat.

The K-State Research and Extension publication, MF3383 - *Wheat Streak Mosaic*, includes information about grassy weed hosts of the mite and virus, and the contribution of these hosts to the risk of severe wheat streak mosaic infections. Take note of significant stands of these grasses in marginal areas and control them as you would volunteer wheat.

If volunteer wheat and other hosts are not controlled throughout the summer and become infested with wheat curl mites, the mites will survive until fall and could infest newly planted wheat. Wheat curl mite infestations of wheat often lead to wheat streak mosaic infections (Figures 2 and 3).

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4. Update on sugarcane aphids in Kansas

Sugarcane (sorghum) aphids were first detected migrating into Kansas in mid-July this year. So far, they have been reported in a south-central to north-central corridor from the Oklahoma border to Ellis County on the west to Geary County on the east, and south of I-70. They are probably north of I-70, but we have not received any verification yet.

According to entomologist Dr. J.P. Michaud, the colonies are small and scattered but a few have gotten large (See Figure 1 provided by M. Pipe from south central Kansas). Fortunately, the beneficials are also plentiful (See Figure 2 which shows green lacewing eggs within 3 feet of aphid colonies). Therefore, please continue to monitor for these aphids because, if past history is any indication, they will continue to migrate into Kansas until late September/early October. The current status of the SCA (now called sorghum aphid) *can be found at:* https://www.myfields.info/pests/sugarcane-aphid.

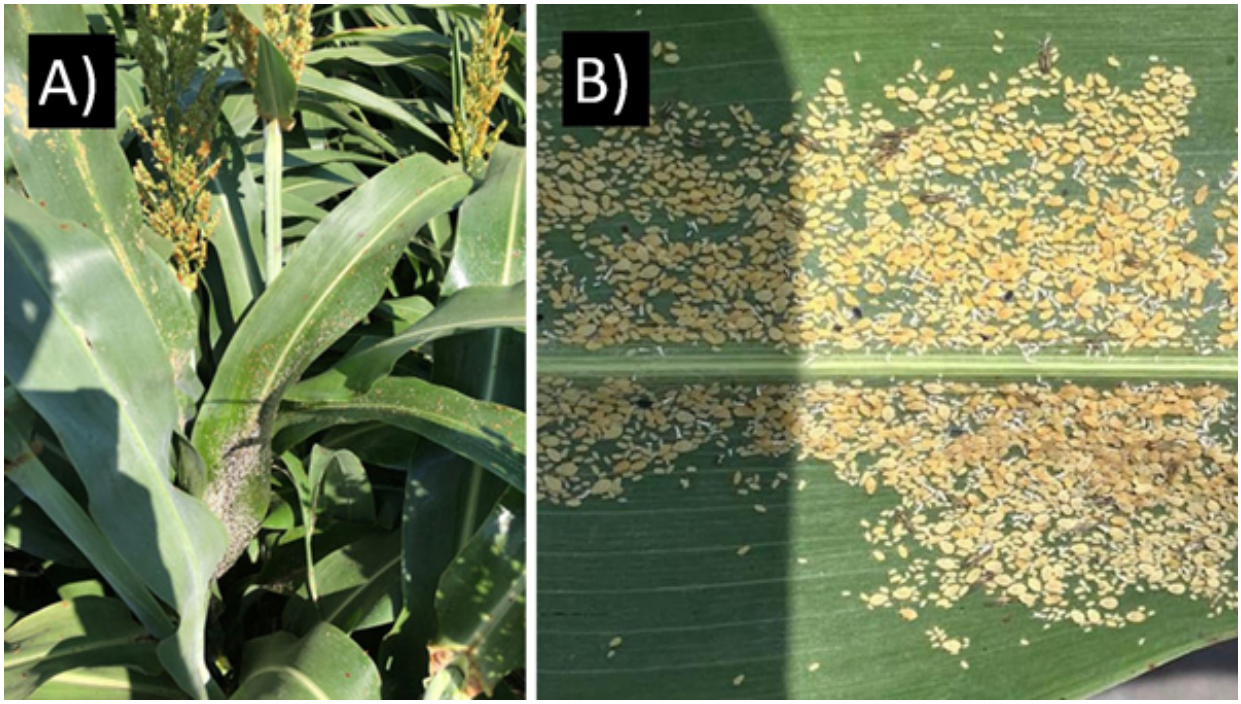


Figure 1. A) Sorghum aphids (formerly called sugarcane aphids) in a sorghum field in Ellsworth County, Kansas. Photo by Craig Dinkel, K-State Research and Extension and B) aphid colony found 5 miles north of Hwy 56 (south-central Kansas). Photo by M. Pipes.

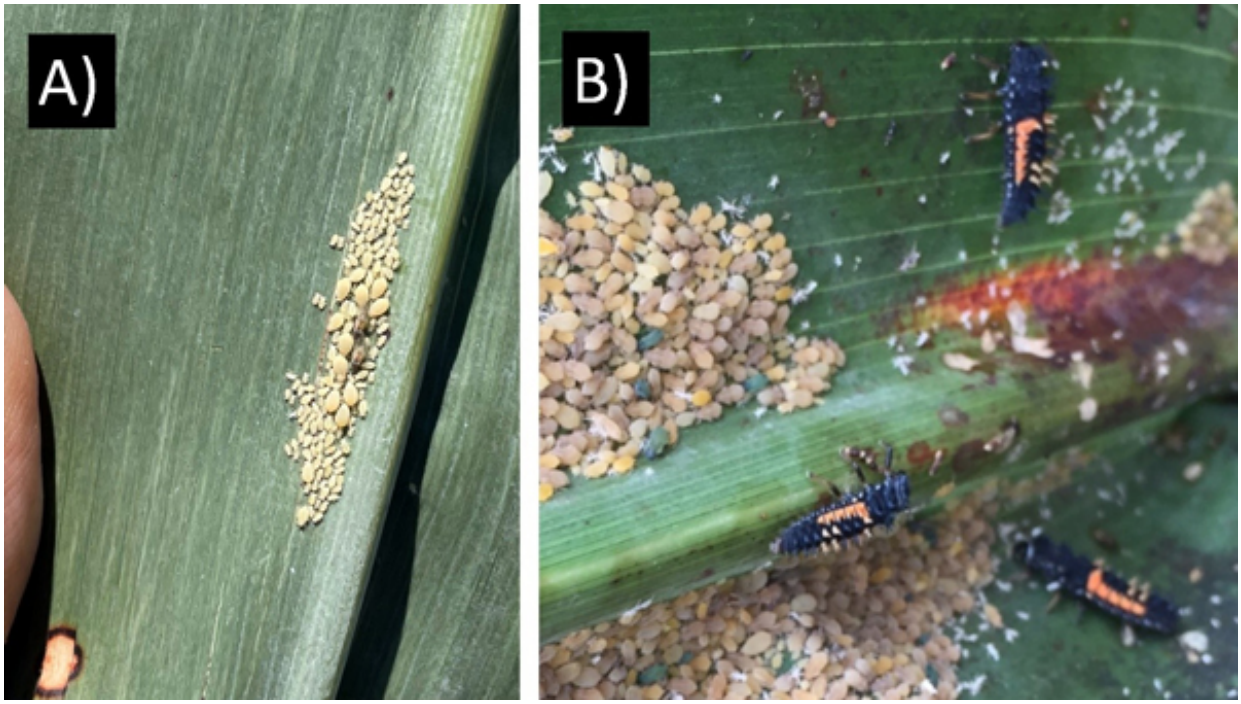
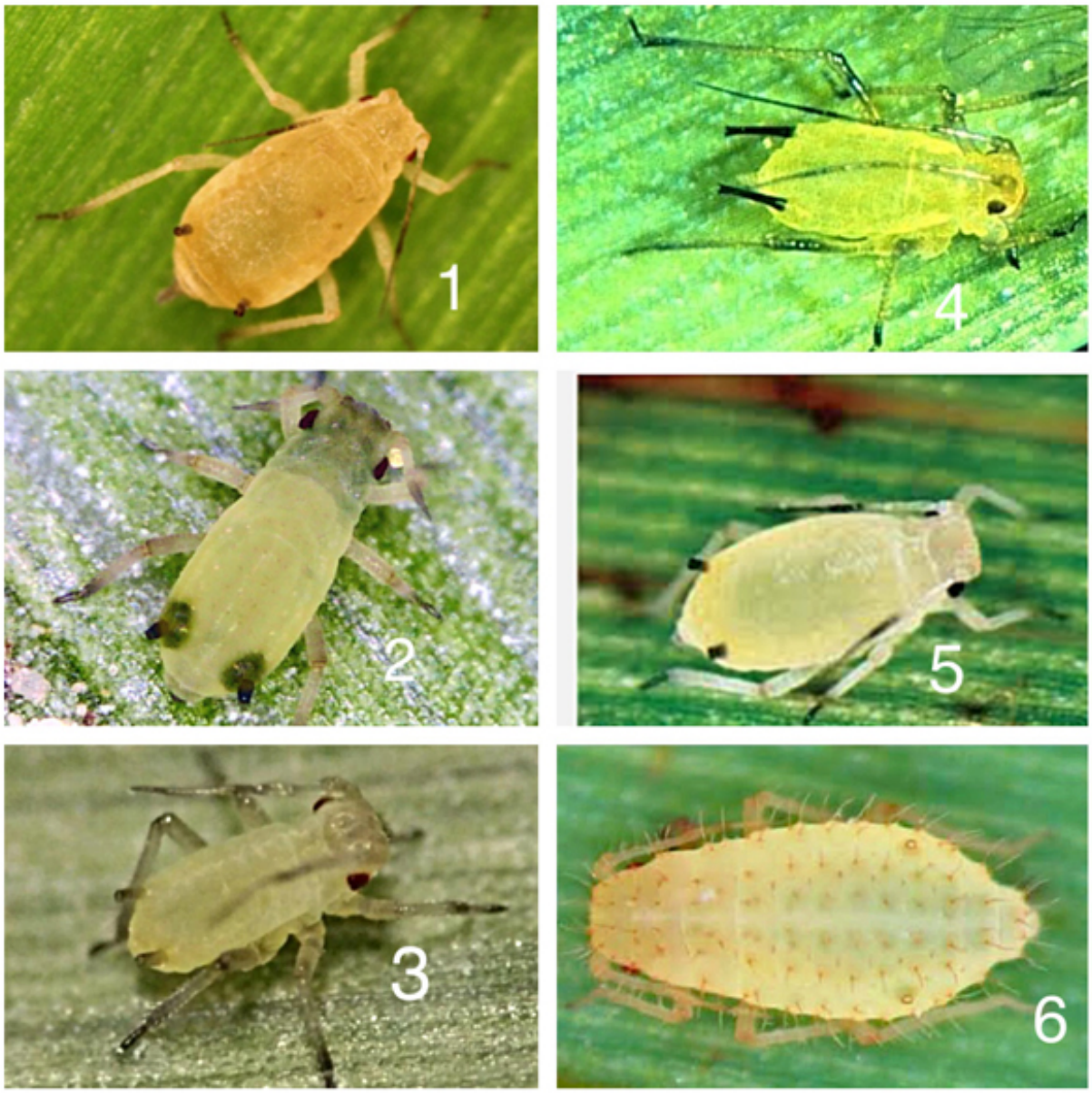


Figure 2. A) newly established aphid colonies representative of most fields sampled this past week (i.e., overall populations remain below treatable levels), and B) natural enemies (lady beetles, Harmonia axyridis**) feeding on aphid colonies.**

Identification of sorghum aphid

There are several similar aphid species on sorghum that could be confused with sorghum aphids especially when the aphids are young. The sorghum aphid has a smooth body with a light-colored head and light-colored legs with dark feet. They have dark-colored, short cornicles (tail pipes) with no shading at the base of them as on the corn leaf aphid, which are blue-green aphids that have purplish patches around their cornicles along with a rectangular body.



1. sugarcane (sorghum) aphid

2. corn leaf aphid nymph

3. corn leaf aphid nymph

4. english grain aphid

5. sugarcane (sorghum) aphid

6. yellow sugarcane aphid

Scouting time for sorghum aphid

Early detection is key to the management of this pest, but treatments should be based on established thresholds. One heavily infested plant does not equal a yield loss. Applying insecticides too soon can result in repeated applications.

Plants are vulnerable to infestation by SCA at any growth stage, but Kansas sorghum is most at risk from the boot stage onward. The ability of sugarcane aphids to overwinter on Johnsongrass and re-sprouting sorghum stubble represents challenges to the management of this pest in more southerly regions.

Issues arising from sorghum aphid in Kansas are likely to become increasingly uncommon with each passing year, especially with natural enemies like lady beetles (Figure 2B) and lacewings providing adequate control during early establishment of aphid colonies (Figure. 2A). It is best practice to scout late-planted fields, as these are more susceptible to yield loss and aphids and this a bigger window for aphids to build to damaging levels later in the season. Also, prioritize fields that were planted to susceptible varieties. Be sure to contact your seed dealer for information on hybrid tolerance to sorghum aphids.

Sampling method

- Once a week, walk 25 feet into the field and examine plants along 50 feet of row:
- If honeydew is present, look for SCA on the underside of a leaf above the honeydew.
- Inspect the underside of leaves from the upper and lower canopy from 15–20 plants per location.
- Sample each side of the field as well as sites near Johnsongrass and tall mutant plants.
- Check at least 4 locations per field for a total 4 locations per field for a total of 60-80 plants.

If no aphids are present, or only a few wingless/winged aphids are on upper leaves, repeat this sampling method once a week thereafter.

If sorghum aphids are found on lower or mid-canopy leaves, begin twice-a-week scouting. Use the same sampling method, but be sure to include % plants with honeydew. Estimate the % of infested plants with large amounts of sorghum aphid honeydew (shiny, sticky substance on leaf surface) to help time foliar insecticides for sorghum aphid control on sorghum (Table 1).

Table 1. SCA Thresholds

Growth Stage	Threshold
Pre-Boot	20% plants infested with localized areas of heavy honeydew and established aphid colonies
Boot	20% plants infested with localized areas of heavy honeydew and established aphid colonies
Soft dough	30% plants infested with localized areas of heavy honeydew and established aphid colonies
Dough	30% plants infested with localized areas of heavy honeydew and established aphid colonies
Black Layer	Heavy honeydew and established aphid colonies in head *only treat to prevent harvest problems

**observe pre-harvest intervals

You can download a free sorghum aphid scouting guide here:
https://www.myfields.info/sites/default/files/page/ScoutCard%20KSU%20v05312017.pdf

For ongoing current information on the sorghum aphid in Kansas, check out the myFields website often in the coming weeks and months: https://www.myfields.info/pests/sugarcane-aphid

Please email Brian McCornack (mccornac@ksu.edu) with any counties to add to the map!

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5. K-State Field Research Reports for 2023 are now available online

Kansas State University conducts research in nearly all areas of agricultural production. The Kansas Agricultural Experiment Station (KAES) Research Reports are the published preliminary results of individual research projects. These reports allow researchers to disseminate their work rapidly to Kansas producers, agricultural industries, and other researchers.

2023 Field Research

The KAES field reports include preliminary results of research conducted on production and management practices for crops in Kansas. These studies are conducted across the state, varying year-to-year. This report includes research project summaries on winter canola, corn, grain sorghum, tillage management, soybeans, weather station reports, weed management, and winter wheat.

To access the Field Research Report, you can scan the QR code below with a cell phone or tablet or by using this link: https://newprairiepress.org/kaesrr/vol9/iss4/

KANSAS STATE UNIVERSITY Agronomy

KANSAS FIELD RESEARCH 2023

K-STATE Research and Extension

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