Issue 1048

K·STATE
Research and Extension

Extension Agronomy

eUpdate

04/10/2025

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. Starter fertilizer for corn - Nitrogen placement and rate

Starter fertilizer is typically considered to be the placement of a small rate of fertilizer, usually nitrogen (N) and phosphorus (P), near the seed at planting time. This fertilizer is intended to "jump start" growth in the spring, and it is not unusual for a producer to see an early-season growth response to starter fertilizer application. However, some producers might also consider using this opportunity to apply higher rates of fertilizer that can supply most of the N and P needs for the corn crop.

Producers should be very cautious about applying starter fertilizer that includes high rates of N (and/or K). It is best to have some soil separation between the starter fertilizer and the seed. The safest placement methods for starter fertilizer are either as a deep-band application 2 to 3 inches to the side and 2 to 3 inches below the soil surface (2x2) or as a surface-band application to the side of the seed row at planting time (2x0), especially in conventional tillage or where farmers are using row cleaners or trash movers in no-till (Figure 1).

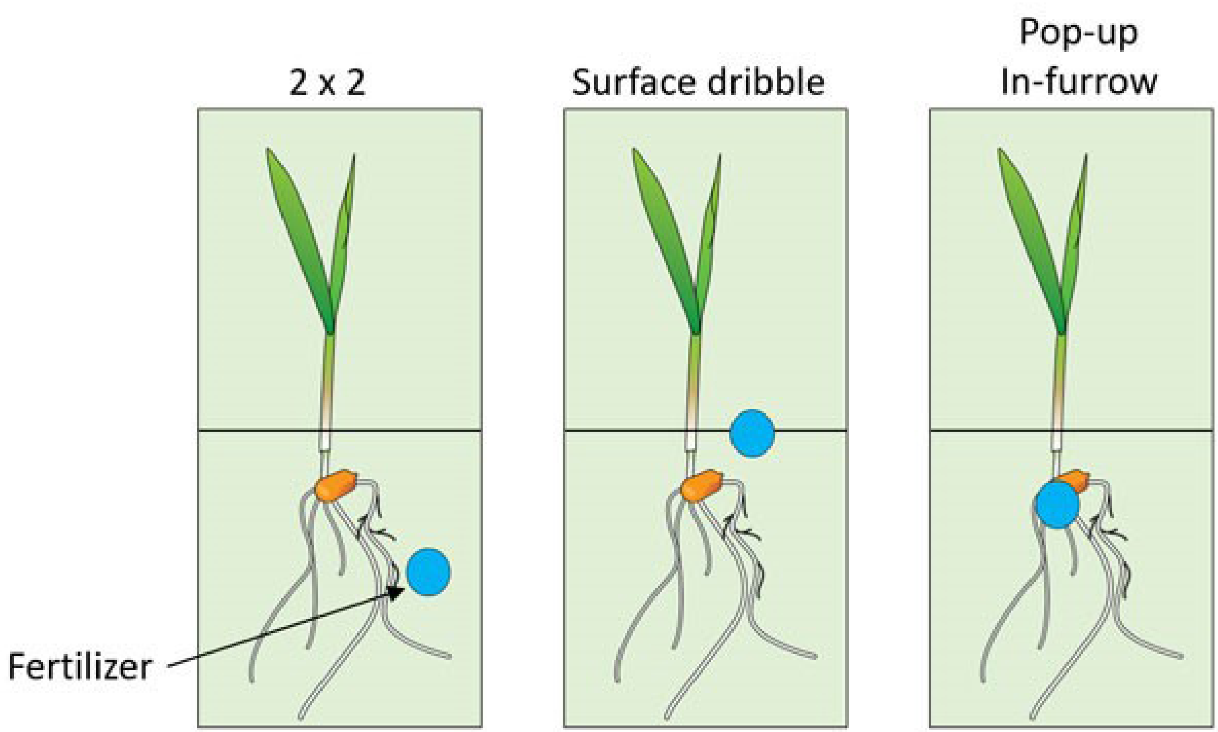

Figure 1. Example illustrations of starter fertilizer placement with respect to the corn plant. Graphic by Dorivar Ruiz Diaz, K-State Research and Extension.

What are the risks with "pop-up" placement?

If producers apply starter fertilizer with the corn seed ("pop-up" in-furrow), they run an increased risk of seed injury when applying more than 6 to 8 pounds per acre of N and K_2O combined in direct seed contact on a 30-inch row spacing (Table 1). Nitrogen fertilizer can result in salt injury. Urea-containing fertilizers can also result in ammonia toxicity. Urea converts to ammonia, which is very toxic to seedlings and can significantly reduce final stands (Figure 2).

What is a "salt"?

"Salts" are ionic compounds that result from the neutralization reaction of an acid and base. Most fertilizers are soluble salts (e.g., KCl from K+ and Cl- ions). Salt injury can occur when fertilizer addition increases the osmotic pressure in the soil solution (due to an increase in salt concentration) around the germinating seed and roots. This can cause *plasmolysis*, which is when water moves out of the plant cell, shrinking cell membranes and collapsing the cell. Symptoms of salt damage are short, discolored roots and a reduced corn population.

Figure 2. Symptoms of ammonia toxicity from urea-containing fertilizers placed too close to the seed. Photos by Dorivar Ruiz Diaz, K-State Research and Extension.

Table 1. Suggested maximum rates of fertilizer to be applied directly with corn seed for "pop-up" fertilizer.

	Pounds N + K_2O (No urea or UAN)	
Row Spacing (inches)	**Medium-to-fine textured soil**	**Sandy soil**
40	6	4
30	8	6
20	12	8

N rates with 2x2 placement or "surface dribble"

Starter fertilizer placements, such as 2x2 or surface dribble (2x0), provide enough soil between the fertilizer and the seed and are considered safe alternatives for higher rates of N application. Recent studies in Kansas suggest that the full rate of N can be applied safely using these placement options. One concern from some producers is related to the additional time demands for the application of high rates of fertilizer during planting. However, from an agronomic perspective, this can be an excellent time for N application, minimizing potential N "tie-up" and providing available N to the corn, particularly under no-till systems with heavy residue.

Take-home message

Producers can apply most of the corn needs at planting as long as the fertilizer placement provides enough soil separation between the fertilizer and the seed. The best options are the 2x2 placement or surface-dribble, with similar results in terms of crop response. Nitrogen applications with these starter fertilizer options can provide an excellent alternative for producers who might not have the opportunity for anhydrous ammonia applications this spring or are planning to apply additional N as a side-dress application.

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2. Pre-emergence herbicides for soybeans

Preemergence herbicides are the foundation of any excellent weed control program in soybeans. Using multiple effective residual herbicides is important to broaden the spectrum of controlled weeds, ensure herbicide activation in various environments, and guard against herbicide resistance. The basic "recipe" to control key weeds in soybeans is a Group 15 herbicide + a Group 14 herbicide + metribuzin or a Group 2 herbicide. Herbicides in each of these groups will be discussed below. Additional information can be found in the *2025 Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland* (SRP 1190) at: https://bookstore.ksre.ksu.edu/pubs/SRP1190.pdf

Group 15 herbicides. Seedlings absorb these herbicides as they germinate and prevent the production of fatty acids needed for plant growth. The herbicides commonly used in soybeans are acetochlor (Warrant, others), dimethenamid-P (Outlook, others), pyroxasulfone (Zidua, others), and S-metolachlor (Dual, others). They control most annual grasses and small-seeded broadleaf weeds. These herbicides are very important across our crop rotations, and resistance has been reported in Palmer amaranth in Arkansas and waterhemp in Illinois. Therefore, it is very important to manage resistance by applying them in combination with other effective herbicides.

Group 14 herbicides. These herbicides inhibit an enzyme needed to make chlorophyll. The key residual herbicides in this group are flumioxazin (Valor, others) and sulfentrazone (Spartan, others). These herbicides contribute very little grass control to the mix but provide excellent control of pigweeds and morningglories. Group 14 herbicides can cause crop injury if seedlings are exposed to the herbicide due to poor furrow closure or rain splash.

Metribuzin. Metribuzin (Dimetric, others) is a Group 5 herbicide that inhibits photosynthesis. It provides good to excellent control of pigweeds and some large-seeded broadleaf weeds. It can cause crop injury, specifically if soybeans emerge slowly. However, soybean tolerance to metribuzin has generally increased across the industry. Recent research conducted in Kansas and 14 other states suggests that metribuzin rates up to 16 fl oz/A (0.75 lb a.i./A) can be safely used on soybeans.

Group 2 herbicides. Widespread resistance to ALS-inhibiting herbicides has reduced the usefulness of these products for pigweed control. However, products such as cloransulam (FirstRate) are still useful for controlling large-seeded broadleaf weeds like cocklebur, sunflower, and velvetleaf.

Another topic sometimes mentioned when discussing residual herbicide applications in soybeans is the interaction with row spacing. Generally speaking, residual herbicides must remain effective until the soybean canopy closes, so planting in row spacings less than 30 inches has advantages for weed control later in the season. However, narrow row spacing results in more soil disturbance, which can reduce the effectiveness of residual herbicides applied ahead of planting. Sometimes, logistics dictate that fields must be sprayed before being seeded. This means the herbicide layer will be disrupted, and an effective herbicide concentration may not be present in the zone where weed seeds germinate. In these situations, a general recommendation is to plant as soon as possible after spraying.

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. Inoculating soybeans is a good insurance policy

When planting soybeans in Kansas, it may be a good insurance policy to inoculate the seed. The *Bradyrhizobium* bacteria form nodules on soybean roots that fix nitrogen from the atmosphere, and supply it to the plants. Neither soybeans nor *Bradyrhizobium japonicum* are native to the United States, so there will be no *Bradyrhizobium japonicum* in the soil unless it was introduced in the past by inoculated soybean seed.

Why do we need to inoculate soybeans?

1. To promote good nodulation
2. To improve nitrogen (N) fixation
3. To help ensure a stable yield

Soybeans are big users of nitrogen. For example, a soybean yield of 60 bushels per acre requires 300 lbs N per acre in the plants, requiring about 3-4 lbs of N per bushel of seed. Most of the N required by a soybean plant is supplied via biological nitrogen fixation that takes place in the soybean root nodules. When well established, the N fixation process can provide 40-80 percent of the plant's N needs for the season. The actual contribution of N fixation to the N requirement can be influenced dramatically by the amount of residual or mineralized N available in the soil profile or by stress conditions affecting the plant, such as drought and heat, inhibiting N fixation due to the cost of maintaining the N fixation process.

Yield responses to inoculation have been quite variable in Kansas and other surrounding states. However, the cost of buying pre-inoculated seed or inoculating the seed or soil yourself is low, and the potential yield loss from poor inoculation can be significant unless available soil N levels are high. Soybeans that are poorly nodulated will have to take up most of the N they need from the soil, just like corn, sorghum, wheat, or any non-legume crop. Because N fertilizer is generally not applied for soybeans, a poorly nodulated crop will quickly use up the available N in the soil and become chlorotic (yellow) from N deficiency. For poorly nodulated soybeans, N deficiency is usually evident later in the growing season as the nutrient demand increases (Figures 1 and 2).

Figure 1. The soybeans in the part of the field at left in this photo had good nodulation. The area of the field on the right had poor nodulation and exhibited nitrogen deficiency symptoms. Photo by Tom Maxwell, K-State Research and Extension.

Figure 2. Well-nodulated soybean plants (left) compared to plants without nodulation. Photo by Kraig Roozeboom, K-State Research and Extension.

Why is the yield response to inoculation so variable?

There are several reasons for the variability in yield response to inoculation. If soybeans have been grown on the field in previous years, then there may be enough *Bradyrhizobium* bacteria in the soil to nodulate the soybeans adequately.. However, if there is not enough *Bradyrhizobium* in the soil, then the inoculant may increase yields by 2 bushels per acre or more on fields that have had soybeans in the recent past. On fields where soybeans have never been grown, the inoculant can often increase yields by 10 bushels per acre or more (Table 1).

Table 1. Effect of soybean inoculant on land with no prior history of soybeans

	Kansas River Valley Experiment Field, Rossville	**Southwest Research-Extension Center, Garden City**
Treatment	Soybean yield (bu/acre)	
None	56.9	33.9
Seedbox inoculant	57.8	39.6
Seed-applied inoculant	66.4	43.5
LSD (.05)	9.8	3.6

Source: C.W. Rice and L.D. Maddux, Kansas Fertilizer Research 1992, K-State Report of Progress 670; C.W. Rice and M. Witt, Kansas Fertilizer Research 1991, K-State Report of Progress 647.

Even on fields with no history of soybean production, inoculation may increase nodulation but still have no effect on yields. This is dependent on other yield-limiting factors and if the soil has enough available N to supply the crop's needs.

Yield response to inoculants can also depend on soil pH, environmental conditions, and other factors. For instance, if lack of precipitation limits yields to less than 30 bushels per acre, poor nodulation may not impact yield. However, if rainfall is favorable and yield potential is high, poor nodulation could result in a substantial N deficit and reduced yield.

Based on previous information, inoculation is most likely to increase soybean yield when:

1. Soybean has not been planted in the past 3 to 5 years or if it is only the second or third soybean crop on the field, regardless of time since the last soybean crop.
2. Soil pH is below 6.0.
3. Soil has a high sand content.
4. Field has been flooded for more than a week, creating anaerobic conditions when nodulation was supposed to become established.
5. Early-season stress conditions (e.g. heat) affect plant-bacteria establishment.

Producers should be aware that inorganic soil N will reduce nodulation and N fixation by *Bradyrhizobium japonicum* bacteria – the bacteria don't have to work for the N. Where soil N levels are 40-60 lbs per acre or more, soybean plants may look fine yet have reduced nodulation. There may be little or no nodulation at very high N levels, such as where the field was fertilized for corn, but the producer decided to plant soybeans instead. Depending on soybean yield and amount of residual N, this may be enough to carry the soybean crop for much of the season, but it may end up being N deficient during seed fill. In most cases, up to 40 lbs N per acre can be applied as a starter fertilizer to help get the soybeans started without having any detrimental effect on nodulation during the growing season (unless the upper layer of soil is already rich in inorganic N at planting time).

As soybean yields increase, effective nodulation becomes more important. With higher yield goals for soybeans, inoculation is becoming a standard practice regardless of cropping history. Soybean inoculation is basically "cheap insurance" against a potential N deficiency problem. Even if soybeans have been planted in the field recently, it costs little to inoculate the seed.

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4. Spring update on winter canola conditions

The 2024-2025 winter canola crop is gearing up for the race to the finish. Recent observations indicate the majority of the crop survived the winter. However, with nearly all the state under abnormally dry to moderate drought conditions, the greatest concern right now is timely precipitation. Peak water demand is nearing as the crop is entering the reproductive stage.

To better understand how the current drought conditions are impacting canola, we think back to establishment conditions last fall. Across most of Kansas, limited soil moisture in the planting zone made establishment challenging or effectively delayed it until precipitation arrived. Winter canola needs to emerge promptly to attain adequate top growth going into the colder months. Fortunately, after late September rains fell, the crop emerged quickly after planting. Rainfall in early November and some snow cover helped sustain it over winter.

Winter temperatures in 2025 were colder on average in January and February than last year. Figure 1 shows the daily low temperatures from October to mid-April for Manhattan in the past two growing seasons. We cannot rely on snow cover to aid the overwintering of canola every year. But snow cover was very beneficial to survival during two bitterly cold stretches in January and February, especially near Manhattan. Also, the bitter temperatures arrived when the crop was fully acclimated and the most tolerant to the cold. As a result, limited winterkill was observed, even where snow wasn't always present. Some differential winterkill was observed at the North Central Experiment Field near Belleville and at Ashland Bottoms near Manhattan. Figure 2 shows differences in winter survival in hybrids evaluated near Manhattan. The hybrid on the left is not well adapted and was prone to excessive fall growth, resulting in growing point elevation and eventual winterkill. The hybrid on the right possessed a more prostrate growth habit, leaving the growing point at a more protected position at the soil surface. Most of the winterkill observed this year was caused by elevated crowns above the soil surface, brought on by too much fall growth. Some winterkill in research trials is essential for selecting and advancing better-surviving materials.

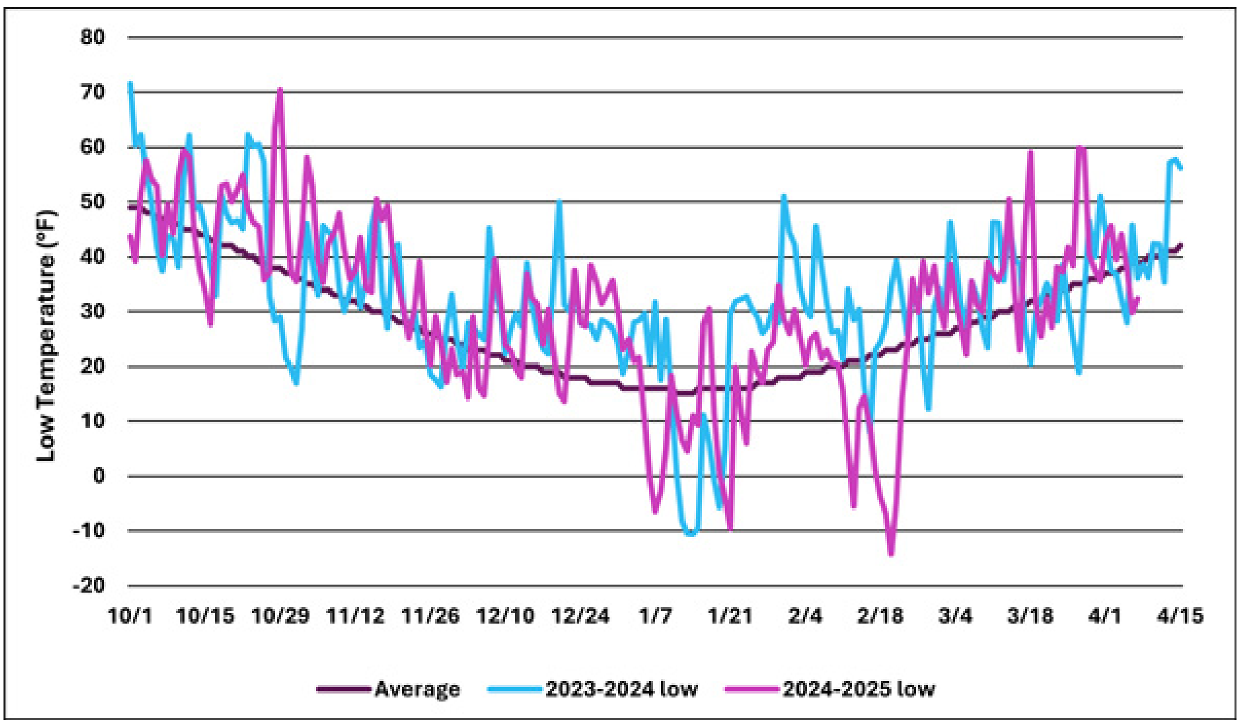

Figure 1. Low temperatures near Manhattan, KS for the fall and winter months of the 2023-2024 and 2024-2025 growing seasons. Data courtesy of the Kansas Mesonet.

Figure 2. Differential winterkill observed in winter canola near Manhattan, KS. Photo by Mike Stamm.

Fortunately, the low temperature did not cause a significant reduction in the amount of above-ground biomass. The above-ground biomass was reduced, but not to a large extent, because the warm fall allowed for greater than average biomass accumulation. In addition, where snow was present, biomass was better preserved over the winter. In simple terms, canola yield and leaf area work hand-in-hand. Typically, in the years where we carry the most leaf area through the winter, we see greater potential for high yields. In the years where we lose most of the fall leaf area we can often see lower yields. The crop retained sufficient biomass this spring to produce a strong yield if moisture conditions improve.

Only time will tell how well the current canola crop will yield. We've seen the resiliency of canola carry it through challenging weather conditions before, and one significant rainfall event can change the narrative rather quickly.

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5. Aphids in Kansas alfalfa: Species, damage, and treatment thresholds

Alfalfa is off and growing in most areas of the state, so now would be a good time to review the various species of aphids that can be found in the crop. Knowing how to recognize aphids and their damage and understanding their treatment thresholds is important for making proper management decisions.

Aphid Damage

Aphid damage in alfalfa can cause yellowing or distorted leaves, stunted growth, and reduced plant vigor (Figure 1). Heavy infestations can lead to significant yield loss. Additionally, the aphids' saliva expresses varying degrees of toxicity, which can further contribute to plant decline.

Figure 1. A field exhibiting symptoms of aphid damage. Image courtesy of University of Idaho Extension.

Pea Aphid (Acyrthosiphum pisum)

Pea aphids are the most common aphid found in alfalfa in Kansas (Figure 2). These aphids are typically light green and shiny, but pink morphs do occur. They are large for aphids, and adults are easy to spot due to their size. They have long legs, long antennae, and long cornicles (tailpipes) with black tips. A key feature that distinguishes pea aphid from the similar blue alfalfa aphid is its antennae, which have narrow dark bands on each segment, and the antenna tips are not darkened. Thresholds for pea aphids depend on the maturity of the alfalfa and consideration of the presence of predators and parasitoids. Ten-inch-tall alfalfa with 50 pea aphids per stem or 20-inch-tall alfalfa with

100 aphids per stem may be grounds for treatment.

Figure 2. Pea aphid adults along with pink morph nymphs. Image courtesy K-State Entomology.

Blue Alfalfa Aphid (Acyrthosiphon kondoi**)**

Blue alfalfa aphids are also green-colored aphids, but they have a waxy blue-green appearance rather than a light shiny green like the pea aphid. Their cornicles are long and darkened at the tips, but the darker color runs down the cornicle beyond the tip. This aphid's antennae are an important feature; the tips are solidly darkened rather than just banded (Figure 3). Blue alfalfa aphid is smaller than the pea aphid. Thresholds are also determined by plant maturity and the presence of beneficial insects. Twenty blue alfalfa aphids per stem on 10-inch-tall alfalfa, or 50 blue alfalfa aphids on 20-inch-tall alfalfa, may justify treatment.

Figure 3. Blue alfalfa aphid, note the darkened tips of the antenna. Image courtesy K-State Entomology.

Cowpea Aphid (Aphis craccivora**)**

The Cowpea aphid is the easiest aphid to identify in Kansas alfalfa fields. Adults are very dark-colored, rounded aphids with white antennae and white legs. The nymphs are gray-blue, waxy, and smaller than the adults. Another feature of this aphid that helps with identification is its feeding behavior. Cowpea aphids prefer to feed near the very tips of stems and are often easy to spot. Thresholds for cowpea aphids are considered to be similar to pea aphids.

Figure 4. Cowpea aphid adults and nymphs. Image courtesy K-State Entomology.

Spotted Alfalfa Aphid (Therioaphis trifolii**)**

Spotted alfalfa aphids are pale to yellow in color and get their name from the distinct rows of dark spots on their backs. The spots have spines that are easily seen with a hand lens. Due to the nature of this aphid's potent salivary toxins, thresholds for young plants are low. Plants 2-3 inches tall can only tolerate four to five aphids per plant. Older plants can tolerate larger numbers of aphids. The threshold for 10-inch-tall alfalfa is 50+ aphids per stem. For 20-inch tall alfalfa, 100+ aphids per stem are needed.

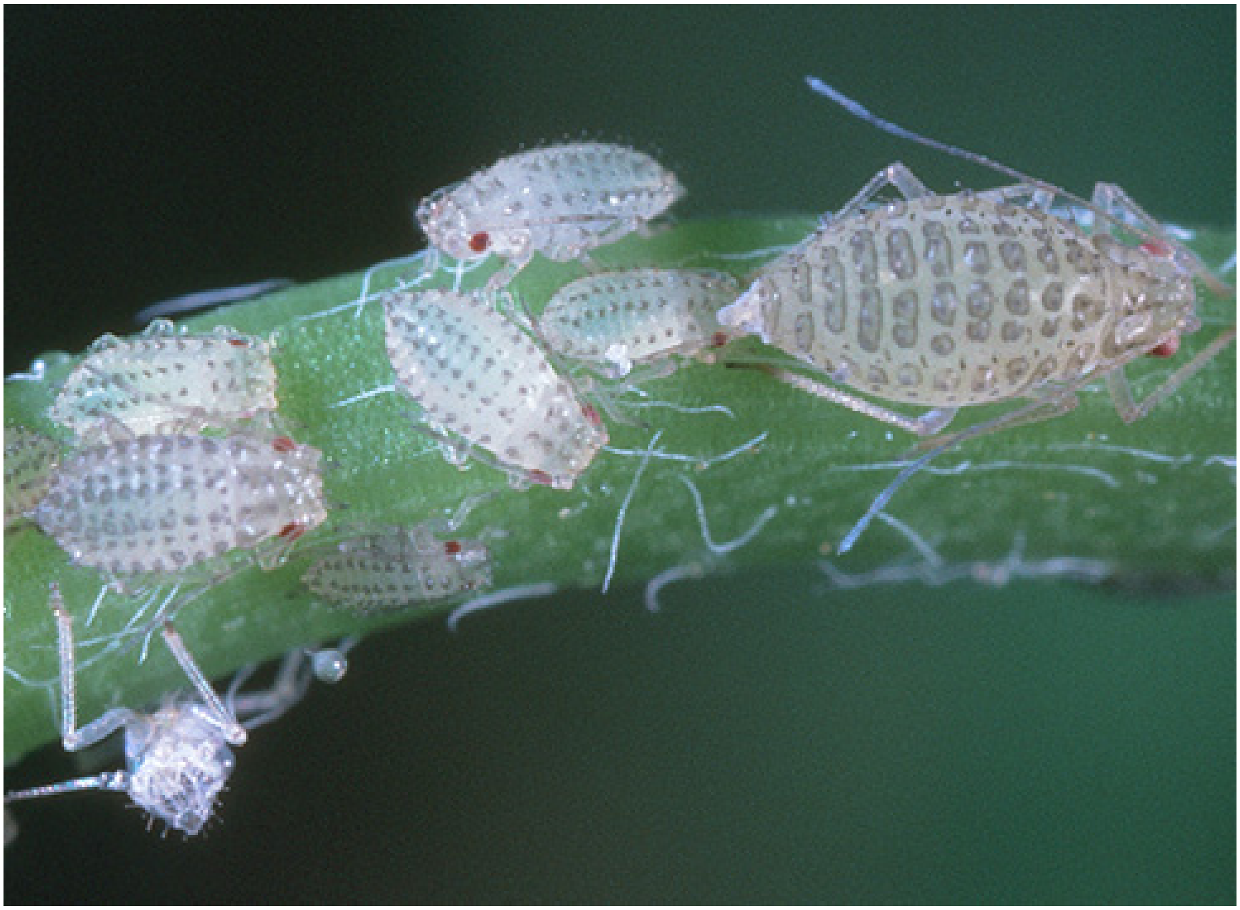

Figure 5. Spotted alfalfa aphid. Image courtesy K-State Entomology.

Final considerations

Note the relatively large thresholds for some of these aphids. It is important to scout properly so you don't make unnecessary treatments. Remember, aphid populations can be a good thing by promoting the presence of various beneficial insects that can help suppress the aphids' populations and other potential pests. Consider the presence and density of beneficials when making treatment decisions. If treatment is warranted, a variety of products are easier on beneficial insects compared to standard pyrethroids and organophosphates. For a full list of products available to treat aphids in Kansas, consult the Alfalfa Insect Pest Management Guide at https://bookstore.ksre.ksu.edu/pubs/alfalfa-insect-pest-management-2024_MF809.PDF.

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