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04/05/2024

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. Adjusting seeding rates for soybeans

Seed cost is a critical economic factor, and selecting the proper seeding rate is a key management practice. This article reviews key factors in determining optimal soybean seeding rates.

Key terminology: seeding rate, survival rate, and plant density

There are three important terms: (1) "Seeding rate" refers to the target number of planted seeds per acre. (2) "Plant population" or "plant density" refers to the effective number of plants growing in a field. (3) "Survival rate" refers to the percent of sown seeds that germinate and emerge. Normally, we may expect about 80% percent of the seeds planted to survive to become part of the final plant population. Thus, for calculation purposes, it's best to start by knowing the desired final plant density and then using the expected survival rate to calculate back to the number of seeds per acre you'll need to plant. Below is an example:

$$Seeding\ rate\ \left(\frac{seeds}{acre}\right) = \frac{Plant\ density\ target\ \left(\frac{plants}{acre}\right)}{Survival\ rate\ \left(\frac{plants}{seeds}\right)}$$

Example of seeding rate calculation with a plant density target of 100,000 plants/acre and expected survival rate of 80% (0.8 plants/seed):

$$\frac{100{,}000\ \cancel{plants}/acre}{0.8\ \cancel{plants}/seed} = 125{,}000\ \frac{seeds}{acre}$$

Note: The seed survival rate varies depending on specific environmental conditions and the quality of the planting practice. Thus, before deciding the seeding rates, it is necessary to consider potential soil and weather conditions that could affect the success of the final stand establishment to achieve the proper plant density required.

Adjusting by yield environment

Identifying yield potential for each environment in your field is a good practice to use when refining the soybean seeding rate decision. A recent study by Carciochi, Ciampitti, and collaborators published in Agronomy Journal evaluated soybean yield performance in a database of hundreds of experiments across the Midwest. Seeding rates ranged from 69,000 to 271,000 seeds/a, and final plant density and seed yield data were considered for the analysis. The data was classified by yield environments as follows: **Low** (<60 bu/a), **Medium** (60-64 bu/a), and **High** (>64 bu/a).

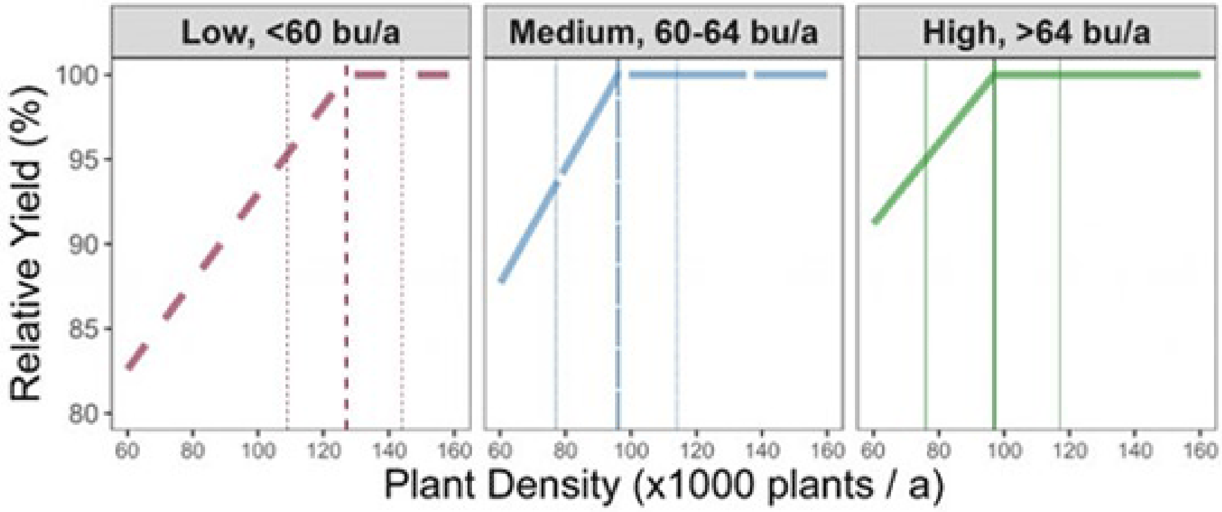

Figure 1. Expected soybean relative yield (%) with respect to the optimal plant density by yield environment. Vertical lines indicate expected optimal plant densities (Low: 127,000 plants/a; Medium: 96,000 plants/a; High: 97,000 plants/a) and their corresponding uncertainty (95% intervals). Ignacio Ciampitti, K-State Research and Extension.

The main outcomes of this study were:

- **Most probable values**. On average, optimum plant densities were:
    - Low-yield environments: 127,000 plants/a,
    - Medium-yield environments: 96,000 plants/a
    - High-yield environment: 97,000 plants/a.

- **Expected uncertainty**. In 50% of cases, optimum plant densities ranged from:
    - Low-yield environments: 109,000 - 144,000 plants/a
    - Medium-yield environments: 77,000 to 114,000 plants/a, and
    - High-yield environments: 76,000 to 117,000 plants/a

- In low-yield environments, the need for higher optimal plant density was not related to a low plant survival rate, but to a reduced potential growth rate per plant.
- Another reason for the need for higher plant density in low-yield environments is that there is often less precipitation during the reproductive period in these environments, reducing the crop's reproductive ability (reduction in yield contribution from branches).

Site-specific simulator

For site-specific management, the previous information can be used to generate prescriptions for variable rate seeding. In 2022, Kansas State University, in collaboration with the Iowa Soybeans Association, launched a free web-based simulator designed to assist farmers in implementing variable seeding rates (Figure 2).

Figure 2. View of the Soybean Variable Seeding Rate Simulator. Link: https://analytics.iasoybeans.com/cool-apps/SoybeanVRSsimulator/

Maintaining a fixed seeding rate for the whole field can reduce profitability compared to using a variable seeding rate. For example, Figure 3 shows a simulation of potential lost profit ($/a) for not adjusting the seeding rate by yield environment. The simulation comprises different scenarios with yield environments ranging from 40 to 70 bu/a, three survival rates (0.7, 0.8, and 0.9), two soybean grain market prices of ($12 and $16/bu), and three potential costs per bag of 140,000 seeds ($40, $55, $70/bag).

How the profits simulation works

The potential lost profits ($/a) for a given field will increase when using fixed seeding rates for the whole field compared to using the optimal rate for each yield environment zone (vertical lines). Regardless of the environment, conditions that reduce the survival rate will increase the seed costs, as they increase the seeding rate needed to achieve the optimal plant density.

On the one hand, a farmer may be using a fixed seeding rate for the whole field that is "below" the optimal rate for some of the yield environment zones within the field. In that case, adjusting the seeding rate for each zone will reduce the potential lost profit since achieving the extra yield will more than compensate for the additional seed cost. On the other hand, if a farmer is currently using a fixed seeding rate for the whole field that is "above" the optimal rate for some of the yield environment zones within the field, reducing the seeding rate to the optimal for each zone will reduce the potential lost profit due to investing in unnecessary seeds.

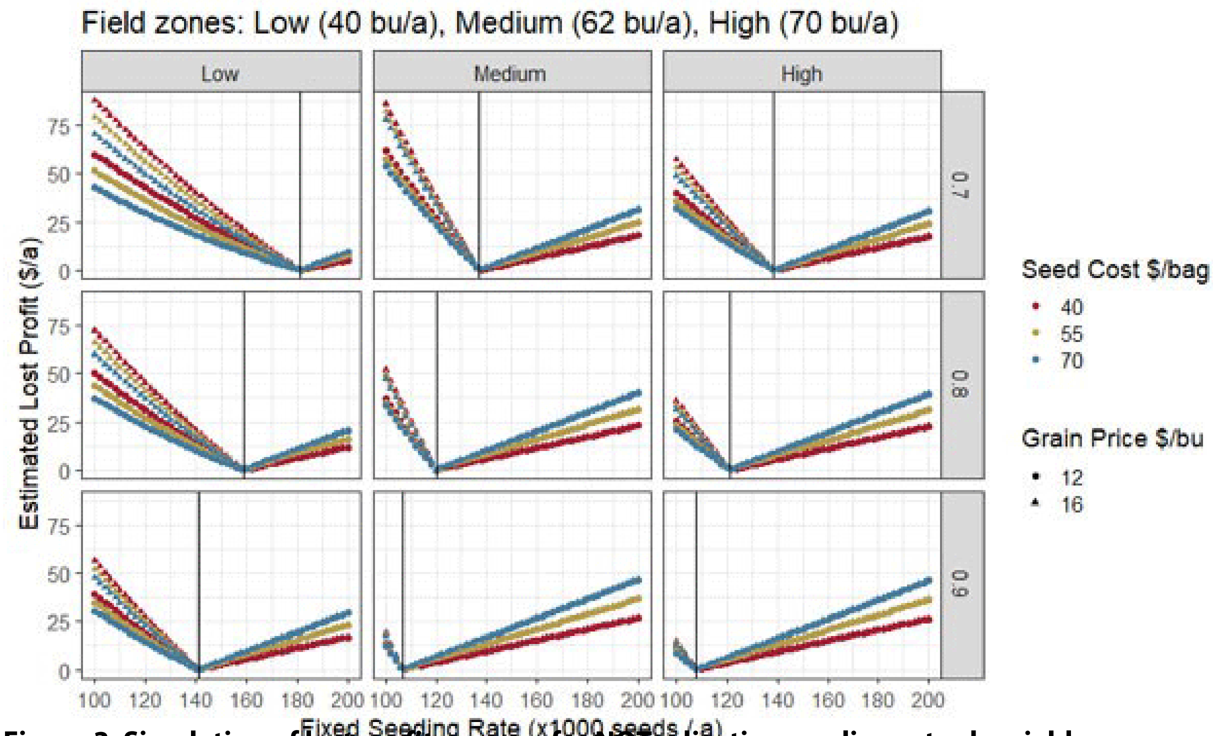

Figure 3. Simulation of lost profit per acre for NOT adjusting seeding rates by yield environment (Low, Medium, High) at three plant survival rates (0.7, 0.8, 0.9) and six combinations of seed cost ($40, 55, 70/bag) and grain price ($12, 16/bu). Hypothetical yield environments range from 40 to 70 bu/a. Hypothetical seed costs are based on 140,000 seeds per bag. The vertical lines indicate the optimal seeding rate for each situation.

Interaction with other practices

The soybean seeding rate is tied to other practices, such as row spacing and planting date. The final number of seeds per linear foot of row decreases as row spacing narrows. For example, at a target plant density of 105,000 plants per acre and 85 percent germination, 30-inch rows will have twice the number of seeds per linear foot as 15-inch rows (6 vs. 3 seeds per linear foot). However, the seeding rate per acre would remain the same for both row spacings, as only the number of seeds per linear foot would change, not the seeding rate per acre.

From a planting date standpoint, the seeding rate will need to increase at later planting dates to compensate for the reduction in the length of the growing season and reduced potential for branches to contribute to yield.

For more information about the optimal soybean seeding rates and optimal plant densities, please consult https://bookstore.ksre.ksu.edu/pubs/MF3460.pdf

Final considerations

In summary, adjusting seeding rates based on plant survival rates, soil conditions, and planting dates can reduce the risk of yield and profit losses due to suboptimal densities in a low-yield environment while limiting higher seed costs due to supra-optimal densities, especially for medium and high yield environments. Soybean plant density levels above the optimal plant density increase the risk of lodging and disease development without adding a yield benefit.

If planting early, try to maximize plant survival and reduce threats to emergence by:

- Avoid planting when soil temperatures are below 60°F. If planted into soils cooler than 60°F, seedlings may eventually emerge but will have poor vigor.
- Treating seeds with fungicide and insecticide.
- Selecting varieties with resistance to soybean cyst nematode and sudden death syndrome.

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2. 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).

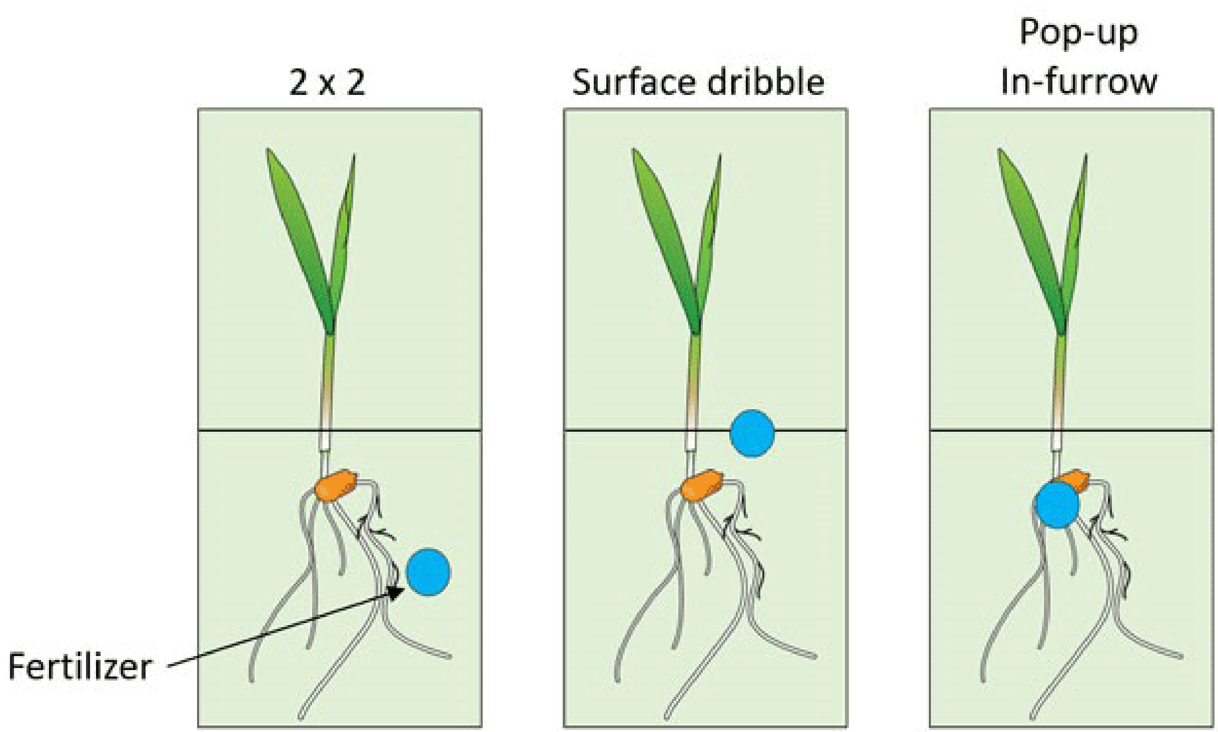

Figure 1. Example illustrations of starter fertilizer placement with respect to the corn plant. Graphic by Dorivar Ruiz Diaz, K-State Research and Extension.

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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3. Causes of yellow wheat - Weather and disease factors

Wheat producers may start seeing some wheat fields turn yellow during this time of the year. The pattern may vary from field to field, sometimes as large areas, small patches, or streaks of yellowish wheat in some fields this spring. What are some of the main weather and disease-related factors that can cause yellow wheat in the spring?

Poor root growth. Many potential causes exist for reduced root growth: dry soils, later sowing, waterlogging, or elevated crown height caused by shallow planting depth or excessive residue in the root zone (Figure 1). If the plants have a poor root system, then the root systems are not extensive enough to access enough water and nutrients, causing the plant to turn yellow. A companion article in this eUpdate issue provides more information on poor root growth associated with soil factors.

Figure 1. The left panel shows the lack of development of the crown rooting system of a wheat field due to drought conditions in the topsoil. Photo by Romulo Lollato, K-State Research and Extension. The right panel shows a slightly more developed but also extremely shallow rooting system, likely due to a restrictive dry topsoil layer. Photo by Tyler Ediger, wheat producer in Meade County, KS.

Cold weather injury at the tillering stage. A sudden drop in temperatures after the wheat has greened up but before it reaches the jointing stage will burn back the top-growth, often giving the field a yellowish cast but not necessarily reducing yield potential (Figure 2). This injury is likely cosmetic, provided the growing point is still healthy. Variety release from winter dormancy can also affect the extent of the symptoms, as early varieties would have been less cold-hardy and thus likely sustain more injury.

Figure 2. Yellowing wheat from cold weather injury at the tillering stage. The wheat variety on the left (WB-Grainfield) has a later release from winter dormancy than WB-Cedar (the variety depicted on the right). Thus, WB-Cedar sustained more leaf injury. Photo by Romulo Lollato, K-State Research and Extension.

Freeze injury at the jointing stage. Jointing wheat usually tolerates temperatures in the mid-upper 20s with no significant injury. But, if temperatures fall into the low 20's or below for several hours, the lower stems, leaves, or developing head can sustain injury (Figure 3). This could be the case this year due to the advanced crop development and the cold temperatures experienced on March 26-27 (https://bit.ly/3PFEekU). Producers are advised to scout their fields to assess the yield potential 10-14 days after the freeze event. If the leaves of tillers are yellowish when they emerge from the whorl, this indicates those tillers have been damaged. More information on assessing wheat for signs of injury can be found in this recent eUpdate article: https://bit.ly/49lqKl3.

Figure 3. Comparison between a healthy developing wheat head (left-hand side, typically light green and firm) versus a developing wheat head that sustained freeze injury (right-hand side, whitish/brown and mushy). Photo by Romulo Lollato, K-State Research and Extension.

While the extent of potential freeze damage depends on minimum temperatures achieved, duration of cold temperatures, and stage of wheat development, other factors such as crop residue, position on the landscape, wind speed, snow cover, and soil temperatures also play a role. Figure 4 shows an example of the effect of heavy residue on potential wheat damage. In this photo, parts of the field with a heavier layer of residue show greater cold damage than lighter residue. This can be partially explained because, under a thicker layer of residue, the wheat crown tends to form closer to the surface and, therefore, is more exposed to freezing temperatures.

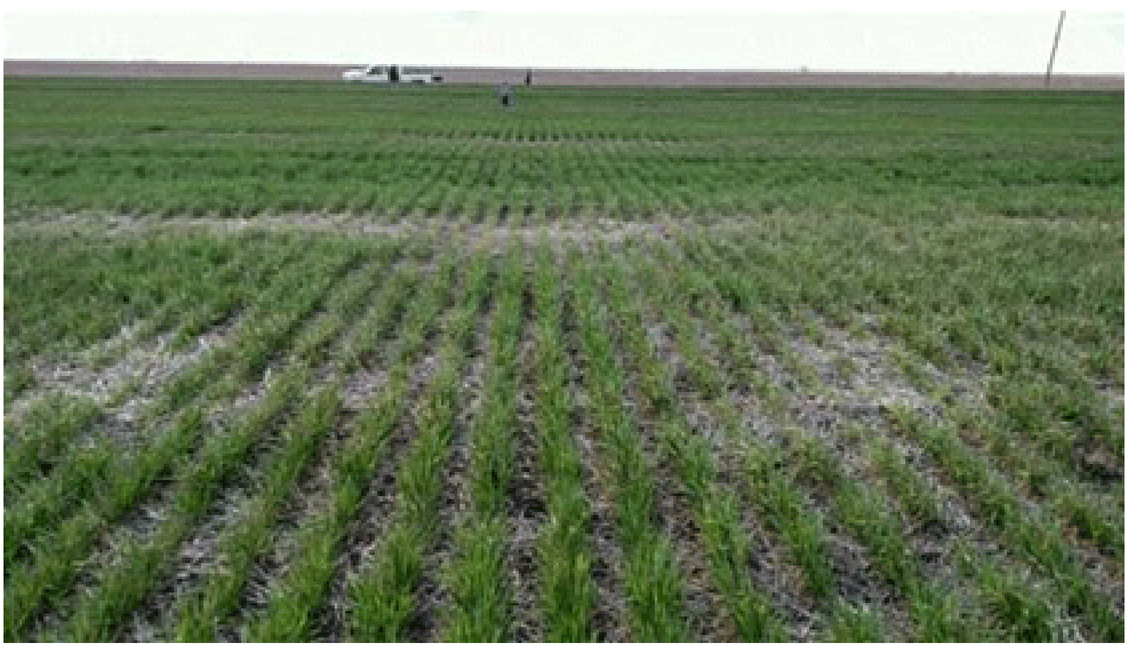

Figure 4. Effect of soil residue on wheat freeze damage. Wheat shows more damage from freezing temperatures in thicker residue layers. Photo by Tyler Ediger, a wheat producer in Meade County, KS.

Leaf senescence and opportunistic leaf spotting diseases. After the winter, it is normal for some of the leaves in the lower canopy to go through senescence and perish, sometimes translocating nutrients to the new growth and sometimes just due to different natural reasons. This causes a yellowing of the lower wheat canopy. Some opportunistic saprophytic fungi or fungal diseases, such as leaf spots (Septoria tritici blotch, Stagonospora nodorum leaf blotch, and tan spot), may colonize these dying tissues, as shown in Figure 5. For the most part, in Kansas, these diseases do not cause economic damage as long as they remain on the lower leaves, especially if they occur in tissue already dying. They might become a problem and warrant a fungicide application in specific situations, such as when a susceptible variety is planted into heavy wheat residue – especially under no-tillage practices, and when symptoms appear in the upper canopy after the flag leaf has emerged (see Stagonospora nodorum leaf blotch, in Figure 6).

Figure 5. Septoria tritici blotch (leaf spot) colonizing tissue from the lower wheat canopy that was already senescing. Photo by Romulo Lollato, K-State Research and Extension.

Figure 6. Stagonospora nodorum leaf blotch symptoms in the upper wheat canopy. Photo by Romulo Lollato, K-State Research and Extension.

Soilborne mosaic or spindle streak mosaic. Soilborne mosaic and spindle streak mosaic (Figure 7) are viral diseases that occur primarily in eastern and central Kansas but are rare in western Kansas. These diseases are most common in years with a wet fall followed by a cool, wet spring. These diseases are often most severe in low field areas where soil conditions favor infection. Symptoms are usually most pronounced in early spring, then fade as temperatures warm. Leaves will have a mosaic of green spots on a yellowish background. Infected plants are often stunted in growth. Many varieties in the eastern part of the state have high levels of resistance to these viral diseases.

Figure 7. Wheat with symptoms of wheat spindle streak mosaic. Notice the yellow, linear lesions that are tapered at both ends. Photo by Erick DeWolf, K-State Research and Extension.

Wheat streak mosaic complex. The wheat curl mite vectors this viral disease. Yellow areas in the field will appear in spring around the jointing stages of growth, usually on field edges adjacent to volunteer wheat. Leaves will have a mosaic of yellow streaks, stripes, or mottling (Figure 8). Plants infected with wheat streak mosaic are often smaller than healthy plants. Two additional viruses, Triticum mosaic virus, and high plains mosaic virus, also result in similar symptoms.

Figure 8. Typical symptoms of wheat streak mosaic virus. Photo by Kelsey Andersen Onofre, K-State Research and Extension.

Barley yellow dwarf. This viral disease is vectored by bird cherry oat aphids and greenbugs. Small or large patches of yellow plants will occur, typically around the boot stage (Figure 9). The leaf tip turns yellow or purple, but the midrib remains green. The yellowing caused by barley yellow dwarf is less botchy than the yellowing caused by other viral diseases. Plants infected by barley yellow dwarf are often stunted.

Figure 9. A typical patch of plants showing symptoms of barley yellow dwarf virus infection. (Photo by Romulo Lollato, K-State Research and Extension) as well as up-close symptoms of barley yellow dwarf (Photo by Kelsey Andersen Onofre, K-State Research and Extension)

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4. Causes of yellow wheat - Soil fertility factors

Wheat producers may start seeing some wheat fields turn yellow during this time of the year. The pattern may vary from field to field, sometimes as large areas, small patches, or streaks of yellowish wheat in some fields this spring. What are some of the main causes related to nutrients and soil fertility for yellow wheat in the spring?

Nitrogen deficiency. As the crop starts to grow in the spring, its nitrogen (N) demand increases. It is common to see N deficiency, especially when the temperatures are lower and little N is mineralized from the soil organic matter. Nitrogen deficiency causes an overall yellowing of the plant, with the lower leaves yellowing and dying from the leaf tips inward (Figure 1). Nitrogen deficiency also reduces tillering, top growth, and root growth. The primary causes of N deficiency are insufficient fertilizer rates, application problems, applying the nitrogen too late, leaching from heavy rains, denitrification from saturated soils, and the presence of heavy amounts of crop residue, which immobilize nitrogen.

Figure 1. Nitrogen deficiency on wheat. The lower leaves are the first to become chlorotic (yellow). Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Sulfur deficiency. Like nitrogen, the crop's sulfur requirement increases in the spring as it takes off on reproductive growth. Due to a historical decrease in sulfur deposition in the rainfall, there has been an increasing number of fields with sulfur deficiency symptoms in Kansas in recent years. Deficiencies can be more common in areas where organic matter levels are low -- especially on sandier soils or eroded areas of a field. Sulfur deficiency can also occur when soils are cold in the spring due to a reduced rate of sulfur release from organic matter. The symptoms of sulfur deficiency are very similar to nitrogen deficiency. However, sulfur deficiency differs from N deficiency in that the whole plant is pale, with a greater degree of chlorosis (yellowing of plant tissue) in the young/upper leaves (Figure 2). The pattern of chlorosis may show gradation in intensity, with the younger leaves at the tip yellowing first because sulfur is not easily translocated within the plant. However, the entire plant can quickly become totally chlorotic and take on a light yellow color. Symptoms often become more pronounced when plants begin growing rapidly, while soil conditions are such that organic matter mineralization and sulfur release rates are low. Symptoms may disappear as the temperature warms up and moisture conditions improve, which increases the rate of mineralization of sulfur from organic matter and the rate of root growth.

Figure 2. Sulfur deficiency in wheat, with symptoms appearing first on the younger leaves. Photo by Romulo Lollato, K-State Research and Extension.

Low pH and poor root growth. Many potential causes exist for reduced root growth: dry soils and later sowing are common situations this year. Root damage due to aluminum toxicity in acidic soils can also result in multiple deficiency symptoms and poor growth (Figure 3). Strongly acidic soils may present several problems for wheat production. These include the combination of aluminum toxicity and phosphorus, calcium, magnesium, and molybdenum deficiencies. These problems caused by acid soils are difficult to separate from one another and are often related to root damage due to Al toxicity. In general terms, aluminum toxicity will reduce the yield potential of wheat when soil pH levels get below 5.2 to 5.5, and KCl-extractable (free aluminum) levels are greater than 25 parts per million (ppm).

Typically, these symptoms become apparent in early spring and are exacerbated by drought such as this spring. Although the wheat crop may recover from this condition with sufficient moisture, the impact on yields may have already occurred. A corrective measure will require a lime application for the next crop.

Figure 3. Wheat growing on very acidic soils, such as this soil in Harper County with a pH of 4.6, is often spindly and has poor vigor. Photos by Dorivar Ruiz Diaz, K-State Research and Extension.

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5. Spring freeze effects on winter canola

Over the years, we have observed the effects of spring freezes on canola at the bolting and flowering stages. We can draw on these experiences to understand how the recent hard freeze might impact the crop. The extent of the damage will ultimately depend on several factors, including the low temperature reached, the amount of time below freezing, the growth stage of the crop, and other environmental factors such as soil moisture and exposure to the wind.

Some of the common damages to hard freeze include:

- leaf discoloration and loss,
- stem cracking and splitting,
- bud, flower, and pod loss, and
- plant lodging.

In some instances, the crop may suffer a yield penalty because the extent of the damage is too severe to overcome. In other instances, growing conditions afterward allow the crop to produce more flower buds, flowers, and seed pods; thus, a yield penalty is not observed. Canola is indeterminate (continues to flower and produce seed pods for an extended period), and because of this, it has numerous growing points on the plant. These growing points can develop new flowering sites to compensate for damaged ones when stresses occur.

The growth stage can affect the extent of crop damage depending on how low and how long temperatures are below freezing. Canola is most tolerant to freezing temperatures in the rosette stage prior to green-up and more susceptible in the bolting, flowering, and pod-filling stages. This year, canola was in the bolting to early-flowering stages across the state when temperatures dropped into the middle teens and 20s in central Kansas. At these stages, we have seen canola recover from freezes in the mid-20s, lasting for 3 to 7 hours with little substantive damage. However, temperatures below 20 for any extended period of time can be very damaging.

On March 26 and 27, temperatures at the South Central Experiment Field near Hutchinson dropped below 24 for 8 hours, with a low of 14. The chances of observing freeze injury were quite high with the canola crop at the early reproductive stage. Thus, what will the impacts of the freeze be this year?

Indicators of injury to spring freeze in canola

Leaf discoloration or bleaching is often observed at any growth stage following a spring freeze. The plant can easily tolerate some leaf discoloration without slowing new biomass development. However, the damage is likely severe if the crop does not return to normal growth after the freeze and turns pale green, white, or brown.

Discoloration is most evident on leaf tissue and, to a lesser extent, on the stem (Figure 1). Sometimes, stems and flower buds turn pale green or purple, a symptom of cold temperatures that does not necessarily indicate tissue damage. This was not observed.

Stem cracking was observed in early flowering varieties (Figure 1). Even if the stem cracks, the canola plant should continue to grow normally. Splitting occurs when the stem fills up with ice and ruptures. If the stem splits completely open, it may result in the plant eventually falling over. Severe freeze injury occurs when stems are translucent and mushy. This was not observed in Hutchinson. Cracked and split stems can become entry points for fungal decay. It is too early to determine if the stem cracking will result in weakening, disease issues, or yield loss.

Figure 1. Leaf discoloration and stem cracking were present on April 1 in winter canola plots near Hutchinson, KS after the recent spring freezes. Photo by Mike Stamm, K-State Research and Extension.

One observation is that the recent freeze severely impacted canola varieties with poor winter survival and weakened stems (Figure 2). Initially, the plants were physically damaged by fluctuating winter temperatures, causing decay of vascular tissues, and there was also a greater loss of overwintering biomass. The freeze will negatively impact these varieties because there is insufficient vascular tissue and biomass for normal plant development.

Figure 2. This variety is more susceptible to winterkill and shows negative impacts from the spring freeze. Photo by Mike Stamm, K-State Research and Extension.

At the flowering stage, we often see a bend or crook in the stem and flowering racemes. Often, these bends may take the flowering racemes to the ground; however, we have seen plants straighten and continue flowering normally. The only problem may be the racemes set seed below the main canopy of pods, potentially creating problems at harvest. The crop at Hutchinson was not far enough along in flowering for the freeze to drop flowering racemes to ground level.

After any spring freeze event, blank areas will likely be observed on flowering racemes. In severe cases, we have seen the main raceme and some secondary branches completely freeze off and die. However, the crop can compensate for the losses with secondary branching. Blank areas on flowering racemes will eventually be observed in Hutchinson, but the impact should be minimal.

Plants with later flowering can typically overcome spring freeze events because they are in a slightly more tolerant plant growth stage, i.e., bolting. Axillary buds are still being developed. Earlier flowering varieties can be more susceptible because they may be too far along to develop any new flowering clusters within a reasonable amount of time. Generally, varieties with greater winter hardiness and tolerance to winter decline syndrome can handle spring freezes better. This is because their vascular tissues had not been compromised before the freeze events occurred. In Hutchinson, there was no big difference in tolerance to freeze between genotypes that differed in earliness to flower (Figure 3).

Figure 3. Differences in earliness to flower did not have much of an impact on tolerance to freeze at Hutchinson. Photo by Mike Stamm, K-State Research and Extension.

Long-term impact of freeze damage

Repeated freeze events and longer durations of temperatures in the mid-20s may increase the severity of damage. The extent of damage and potential yield loss relative to how long it stays cold is somewhat of an unknown. However, as long as the plants show normal growth following freeze events, reasonable yields can be expected. The longer it takes the plants to recover may also indicate how severe the freeze impacts were.

Longer-term effects on the crop include differential maturity, delayed maturity, and reduced plant height. Differential maturity may occur if the freeze isn't quite severe enough to kill the plant completely and favorable conditions cause a secondary bloom to occur. Delayed crop maturity results in flowering and grain filling during a warmer period, which can reduce yield if temperatures are above 90. Yield reductions should be minimized if temperatures remain cool during flowering and early grain fill. Reduced plant height doesn't necessarily result in reduced yield but may reduce the amount of biomass that is available for photosynthesis.

The indeterminate growth habit still gives canola an opportunity to compensate for lost yield. How well the crop yields will be a function of the weather over the next few weeks.

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6. Timing, timing, timing: Alfalfa weevil season is upon us!

It doesn't seem like spring can decide to stay here for good. We experienced a wide range of temperatures in March, from +70°F to 15°F. Alfalfa weevil egg development threshold is above 48°F. This wide range of temperatures has placed the alfalfa weevil hatch over a relatively long period. If the alfalfa weevil larvae are in the terminal of the alfalfa plant, they often freeze below 25°F and become moribund. But sometimes, they crawl under the leaf litter and survive a freeze. Each field is different, and whether to treat or not requires scouting in each field.

Treatment is all about timing. Right now, much of the alfalfa is short, and treating too early may lead to part of the plant being untreated as the plant grows. Many different instars of alfalfa weevil larvae are present due to this fluctuation of temperatures this spring. Some of the larvae look brown and are moribund due to the freeze (see Fig. 1 right side), some have just hatched and are smaller larvae since the last freeze (you will find these most likely in the terminal part of the plant (see Fig. 1 middle larvae)), and some are bigger and hatched a few weeks ago, but may have sheltered in the leaf litter (see Fig 1. larvae on the left). The larger larvae 2-3 instars cause the most plant damage.

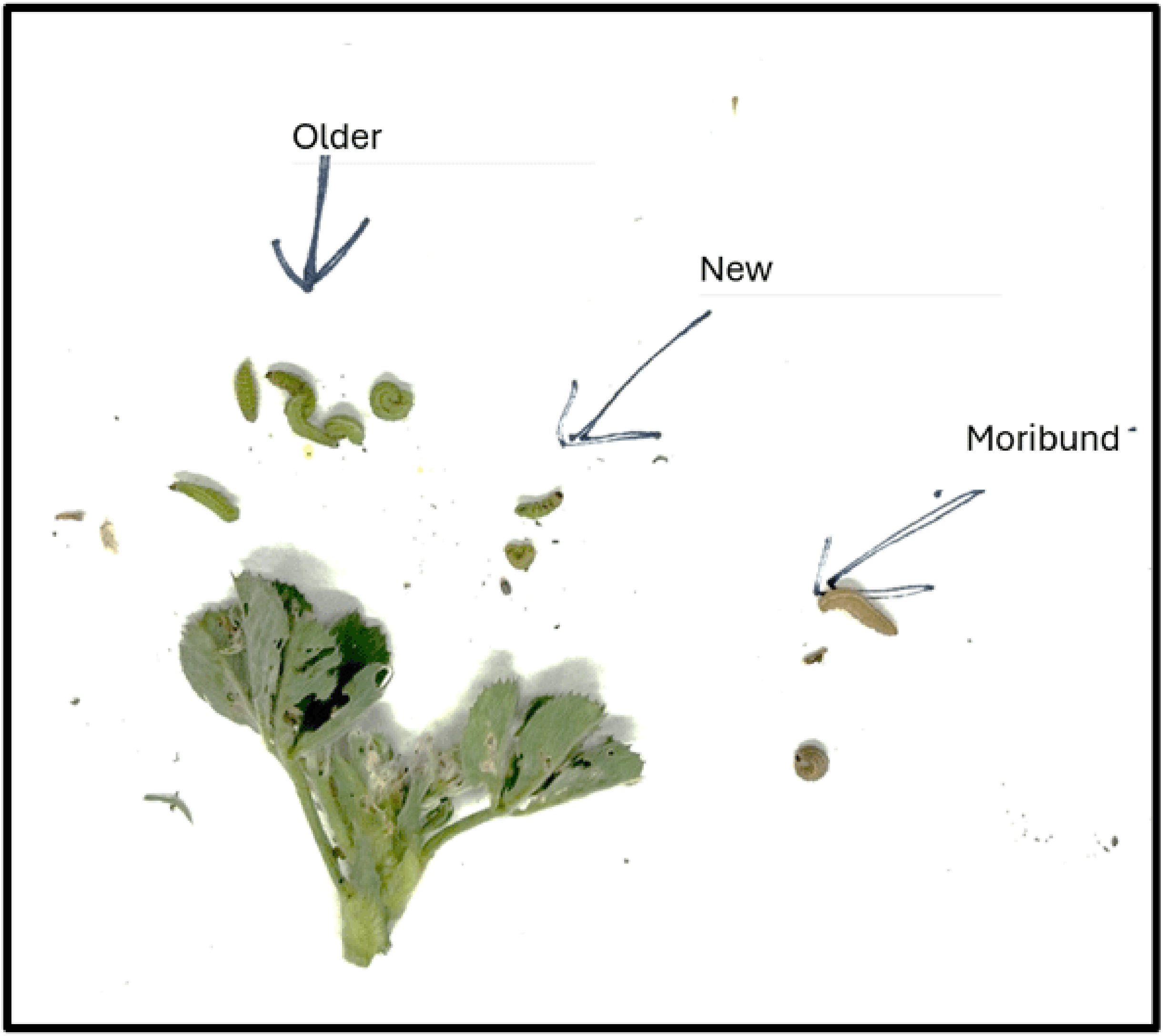

Figure 1. Different stages of alfalfa weevil larvae. Image from K-State Extension Entomology.

Alfalfa weevil larvae cause damage to the plant, as depicted above, and can be present through April. If it is late in the season, the best way to manage alfalfa is to just swath the field if possible.

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