



Extension Agronomy

eUpdate

09/15/2017

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy e-Update 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 Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Optimum sowing dates and seeding rates for wheat in Kansas

Ensuring that the wheat crop is sown at the optimum date and seeding rate are two steps needed to ensure that the maximum yield potential can be attained for a given growing season (Figure 1).

Sowing date affects yield potential due to stand establishment, soil and air temperatures to which the crop is exposed, tiller formation, disease pressure, etc. Optimum seeding rate depends on sowing date and its adjustment is crucial to ensure the crop will maximize its yield potential.

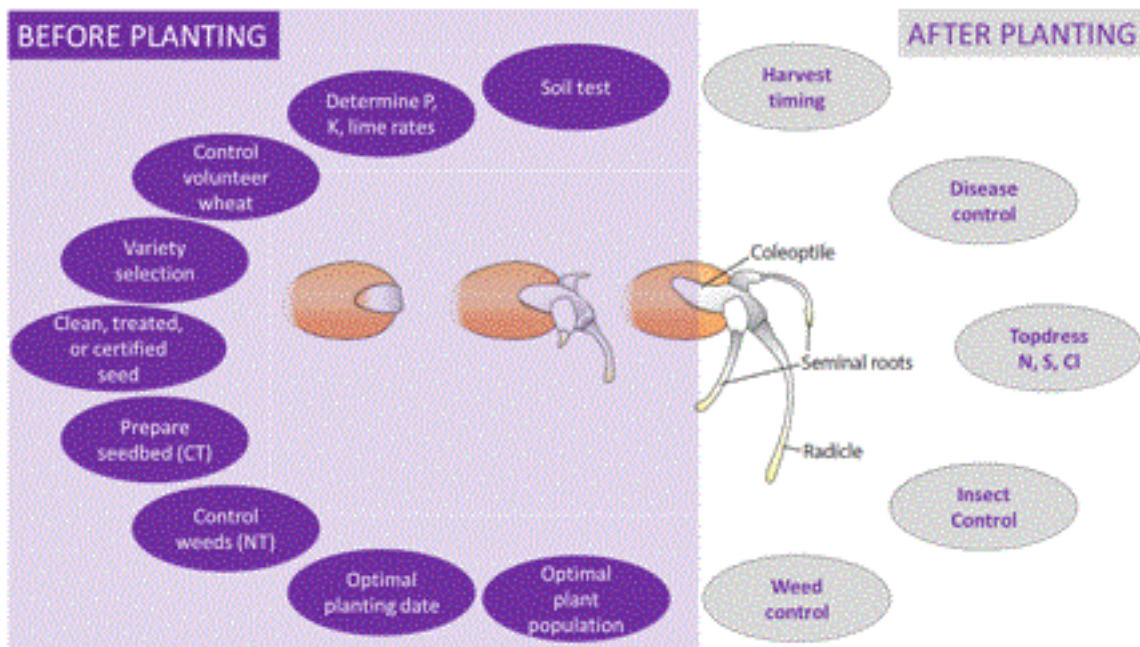


Figure 1. Best management practices to be adopted before and after planting to ensure maximum yield potential can be attained in a given growing season. Graphic by Romulo Lollato.

Sowing date

A) K-State recommendations

Optimum sowing date for winter wheat is quickly approaching for a large portion of Kansas (Figure 2). Depending on geographical location, optimum sowing window can start as early as September 10th and last until the end of September (northwest Kansas), or it can start as late as October 5th and last until October 20th (southeast Kansas). This gradient in sowing dates, with earlier dates in the northwest, is a function of temperature. Northern regions will have cooler air and soil temperatures earlier in the year as compared to southern regions.

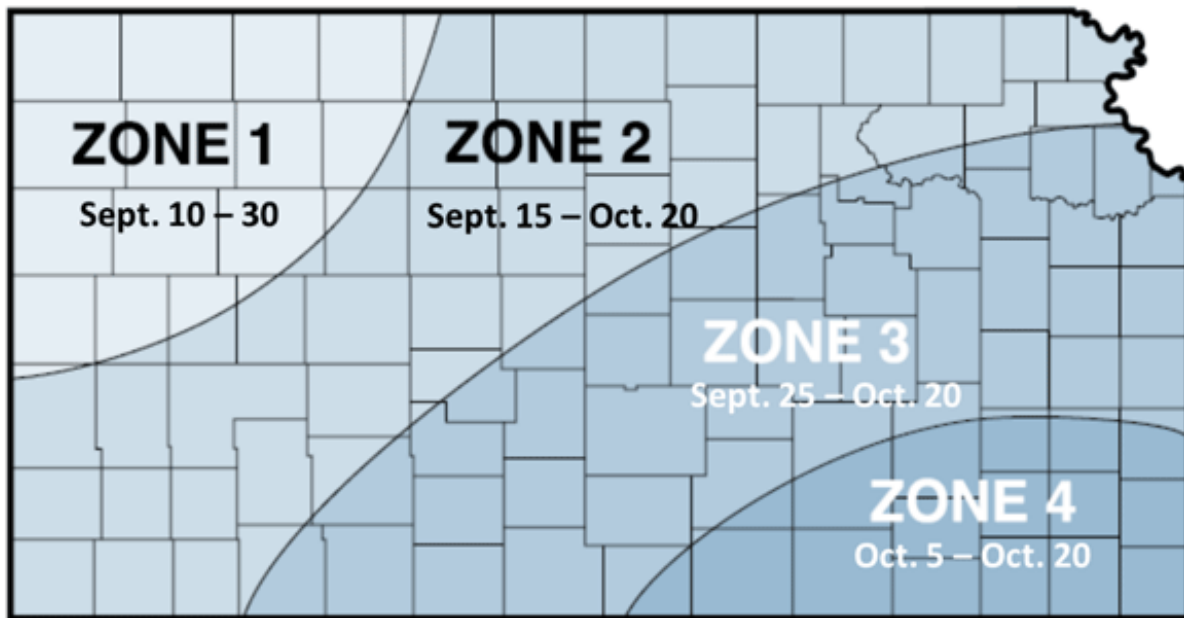


Figure 2. Optimum planting dates for winter wheat according to geographical location within Kansas. Figure adapted from KSRE publication L-818, Kansas Crop Planting Guide.

B) Actual Kansas wheat sowing dates

According to historical data released by the USDA-NASS crop progress reports, on average, producers in Kansas planted approximately 50% of the crop prior to October 4th and about 90% of the crop prior to October 25th during the 1994-2015 period (Figure 3).

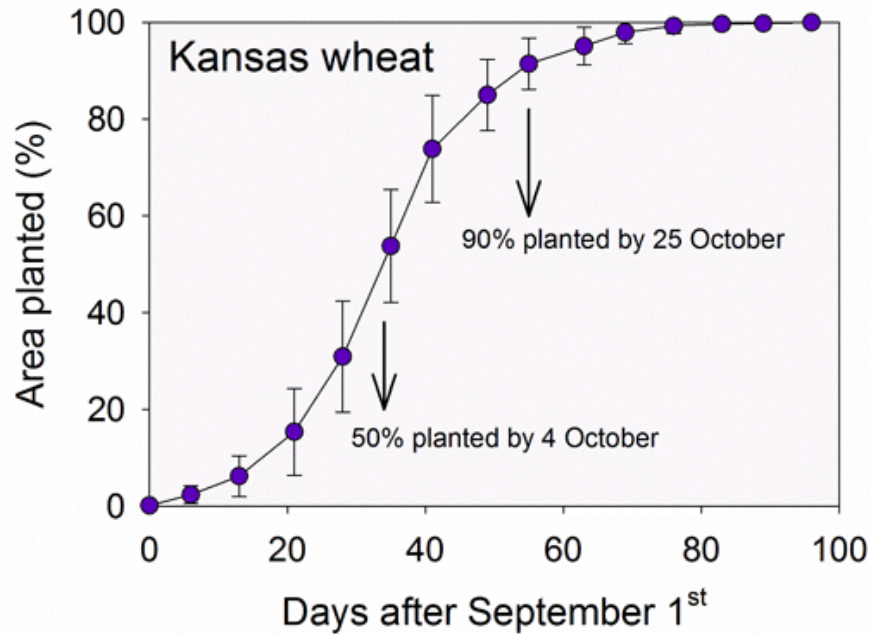


Figure 3. Average percent wheat area planted in Kansas after September 1st. Data represents average and standard deviation for percent planted area during the 1994 – 2015 period as reported by the USDA-NASS Crop Progress Reports (https://www.nass.usda.gov/Publications/National_Crop_Progress/).

Although 50% of the fields are, on average, planted by October 4th, there is large year-to-year variability in percent planted area within the aforementioned date range (see error bars on Figure 3). This year-to-year variability is led by sowing conditions as extremely moist or dry soils may keep producers from sowing at the optimum planting date.

The largest variability of area planted in Kansas in the period 1994-2015 occurred between September 20th and October 15th. During this period the difference in area planted between the earliest and the latest years on record was above 40% (Figure 4). In other words, while 50% of the wheat area was sown by September 21st in the earliest year on record, only 7% of the area was sown by the same date for the latest year on record. In the latest year, 50% wheat area sown was only achieved October 11th. The variability in planted area was lower at earlier planting dates (before September 20th), probably because most producers tend to wait until the optimum planting window with a smaller acreage planted early. Year-to-year variability in planted area also decreased towards the late planting window (after October 15th), as most of the acreage had been planted by that time in most years.

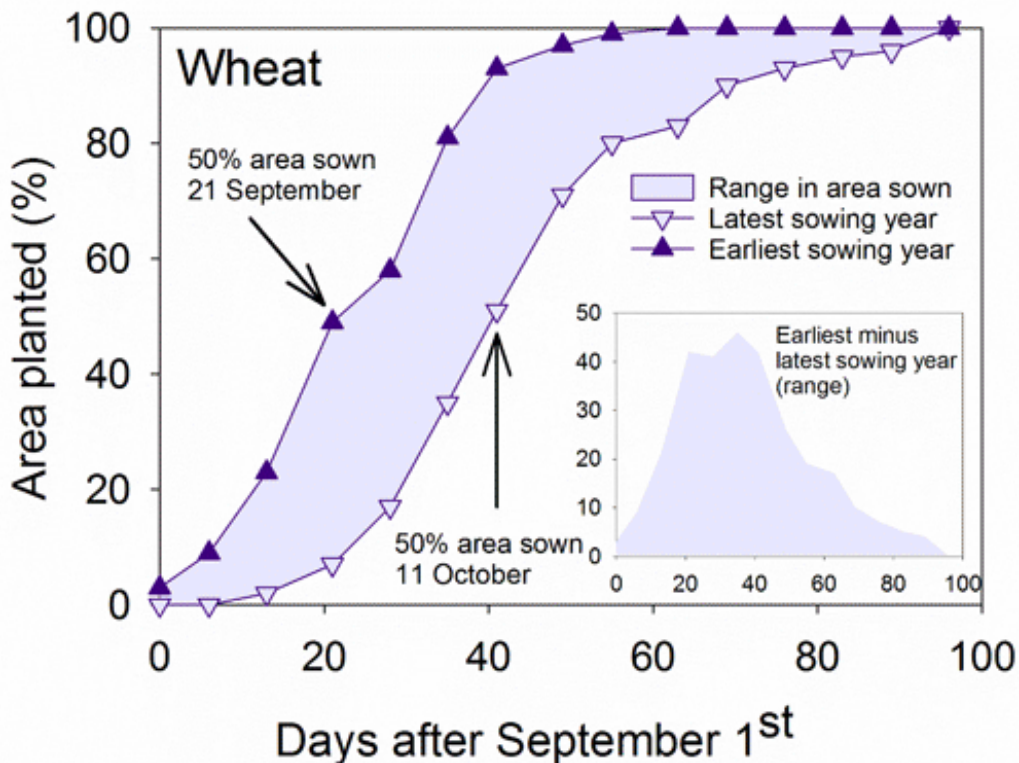


Figure 4. Percent wheat area planted in Kansas after September 1st for the earliest and latest years on record between 1994 and 2015 as reported by the USDA-NASS Crop Progress Reports (https://www.nass.usda.gov/Publications/National_Crop_Progress/). Range in area sown is shown as light purple area in the main graph. Inset shows the difference in percent area planted between the earliest and the latest sowing years on record.

C) Considerations of wheat growth affected by sowing date

1. Sowing wheat early: Sowing wheat at an earlier-than-optimal date can result in lush vegetative growth which will require more water to maintain the canopy later in the growing season. For that reason, producers who graze their wheat are encouraged to plant wheat two or three weeks earlier than the optimal sowing date for grain. Early sowing can also lead to an increased incidence of fall pest infestation, such as Hessian fly, and diseases transmitted by certain vectors more active in warmer temperatures, such as wheat streak mosaic (transmitted by wheat curl mites) and barley yellow dwarf (transmitted by aphids). The

consequences of an earlier-than-optimal sowing date are discussed in eUpdate issue 589 from September 9, 2017, available [here](#).

2. Sowing wheat at the optimal time: The optimal sowing time differs year-to-year due to environmental conditions, such as temperature and precipitation, but the optimal winter wheat sowing range for different regions in Kansas is shown in Figure 2. Sowing wheat at the optimal time stimulates the right amount of fall tiller formation as well as root development to optimize yields while avoiding a lush vegetative growth. Fall-formed tillers contribute more to yield potential than spring-formed tillers, therefore, it is crucial that about 3 to 5 tillers are well established before winter sets in. Additionally, this tiller formation combined with good crown root system development prior to winter dormancy increases winter hardiness of the crop, and consequently the chances of winter survival.

3. Sowing wheat late: Many reasons may lead producers to plant wheat late. Double-cropping wheat following a late-harvested summer crop, such as soybean or sorghum, is common in many regions of Kansas. Delayed planting date due to environmental conditions, such as low or high soil moisture levels, may also occur. When wheat is sown past the optimal window, it is generally sown into colder soils and the crop is exposed to cooler air temperatures during the fall. Sowing into colder soils will delay wheat emergence, so the importance of a seed fungicide treatment increases as planting date is delayed. Additionally, the crop will experience decreased fall tiller formation because wheat development is dependent on temperatures (Figure 5). An increase in seeding rates in these circumstances is warranted.

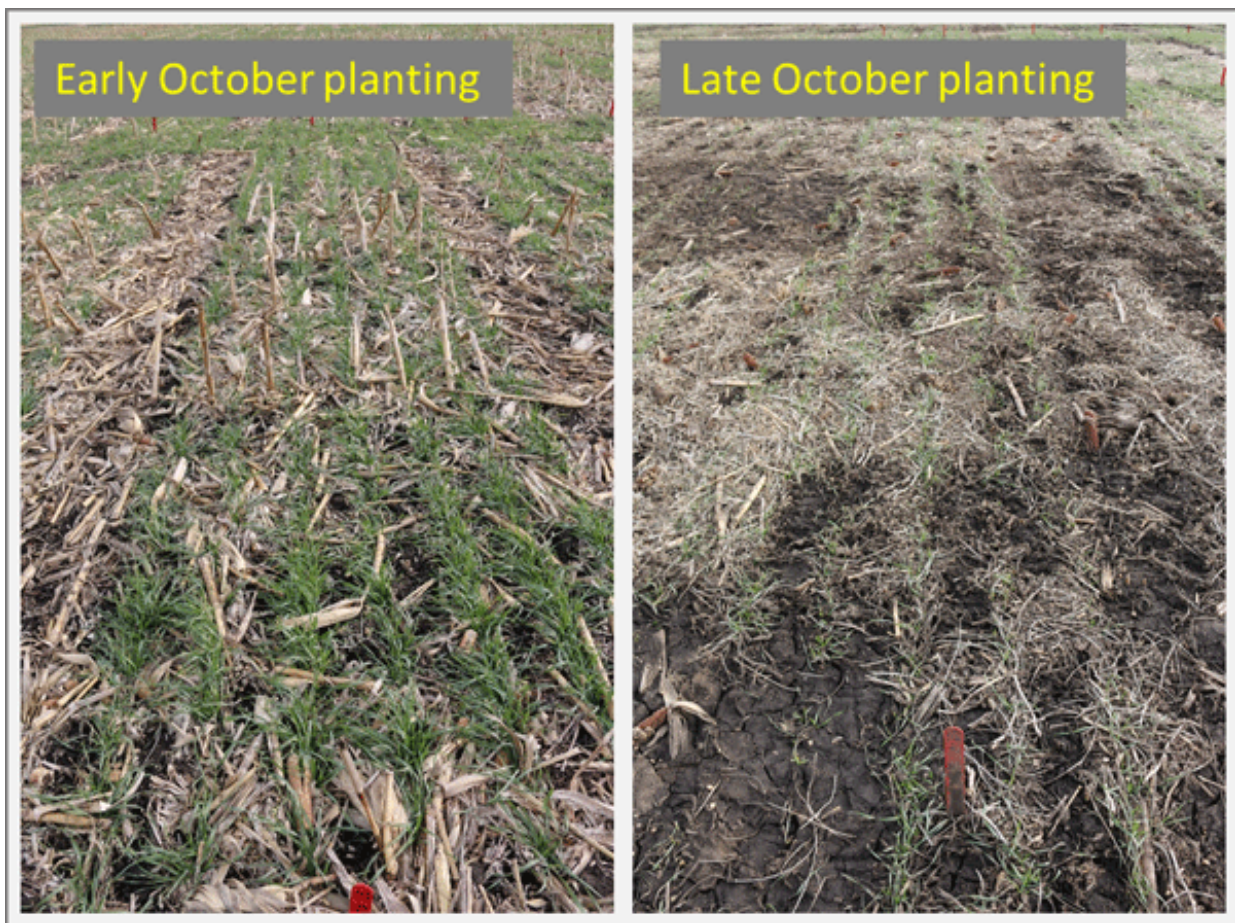


Figure 5. Difference in fall growth as a consequence of planting date following summer crops. Photos were taken December 8, 2016 from neighboring fields which were sown in early October in no-till following corn (left photo) or late October no-till following soybeans (right photo). Photos by Romulo Lollato.

Seeding rate

Optimum seeding rate varies with geographical location in Kansas, following the existing east-to-west precipitation gradient. If sown at the optimal date, optimum seeding rate should be about 1,125,000 – 1,350,000 seeds per acre in the eastern portion of the state, where annual precipitation is above 30 inches, or under irrigated conditions (Figure 6). Seeding rate should be decreased to 900,000 – 1,250,000 seeds/acre in the central region, where annual precipitation ranges between 20 and 30 inches; and a further decrease in seeding rate should occur in the western third of the state where annual precipitation is less than 20 inches, for a final seeding rate between 750,000 and 900,000 seeds per acre in that region (Figure 6).

Seeding rate should always be discussed along with planting date, and in many times with soil fertility status as well. As mentioned above, later planting dates will decrease the potential number of fall tillers formed and grain yield will be more dependent on the main stem and maybe one or two tillers formed during the fall. Thus, seeding rate should be increased as planting date is delayed (for more information see [“Management adjustments when planting wheat late” in eUpdate Issue 536](#)).

On the other hand, producers with a history of manure application and very high soil phosphorus and organic matter levels have been observing a yield increase from reduced plant populations. The reason behind this response is that high phosphorus levels and increased overall fertility resulting from long-term application of manure can increase the wheat tillering potential, decreasing the need for high plant populations.

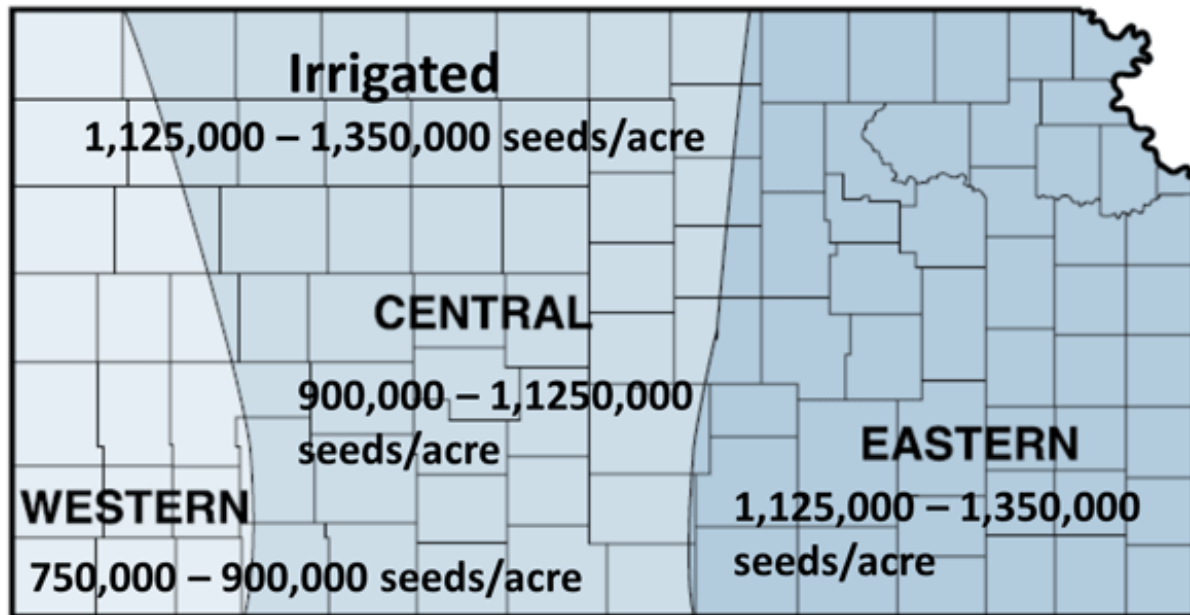


Figure 6. Optimum planting rates for winter wheat according to geographical location within Kansas. Figure adapted from KSRE publication L-818, Kansas Crop Planting Guide.

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2. Evaluating wheat seed size to improve wheat seeding density

Wheat seeding rate recommendations in Kansas are in pounds of seed per acre and vary according to precipitation zone. However, seed size can have an impact in the final number of seeds actually planted per acre. A variety with larger kernels, when planted in pounds per acre, will result in less seeds planted per acre and possibly thinner stands. If the weather and soil fertility during the growing season are not favorable for fall tiller formation and survival, grain yields may be reduced due to the thinner stand. Examples of varieties with large kernels include WB4458 and Ruby Lee. On the other extreme, a variety with small kernels can result in above-optimal stand establishment, increasing plant-to-plant competition for available resources such as water, nutrients, and incident solar radiation. Additionally, planting in pounds of seeds per acre can reduce seed costs when wheat kernel size is relatively small.

Seed size can be measured in terms of the number of seeds per pound. The “normal” range is about 14-16,000 seeds per pound, but it can range from 10,000 seeds per pound to over 18,000 seeds per pound. Although seed size is specific to each individual wheat variety, it can vary within variety depending on seed lot and seed cleaning process. Figure 1 compares three different wheat varieties and the seed size as affected by seed cleaning. For this simple study, the varieties Everest, WB Grainfield, and SY Wolf were evaluated at different times during the seed cleaning process, hereafter referred to as ‘Unclean’ (harvested seed before cleaning), ‘Air screened’ (seed following air cleaning or the blower), ‘Mid gravity’ (seed from the low end of the gravity table), and ‘Top gravity’ (the seed from the top end of the gravity table). It is clear from Figure 1 that wheat variety plays a major role in determining wheat kernel size as does the quality of seed cleaning. Overall, the number of seeds per pound decreased (or individual seed size increased) as the quality of the seed cleaning process increased.

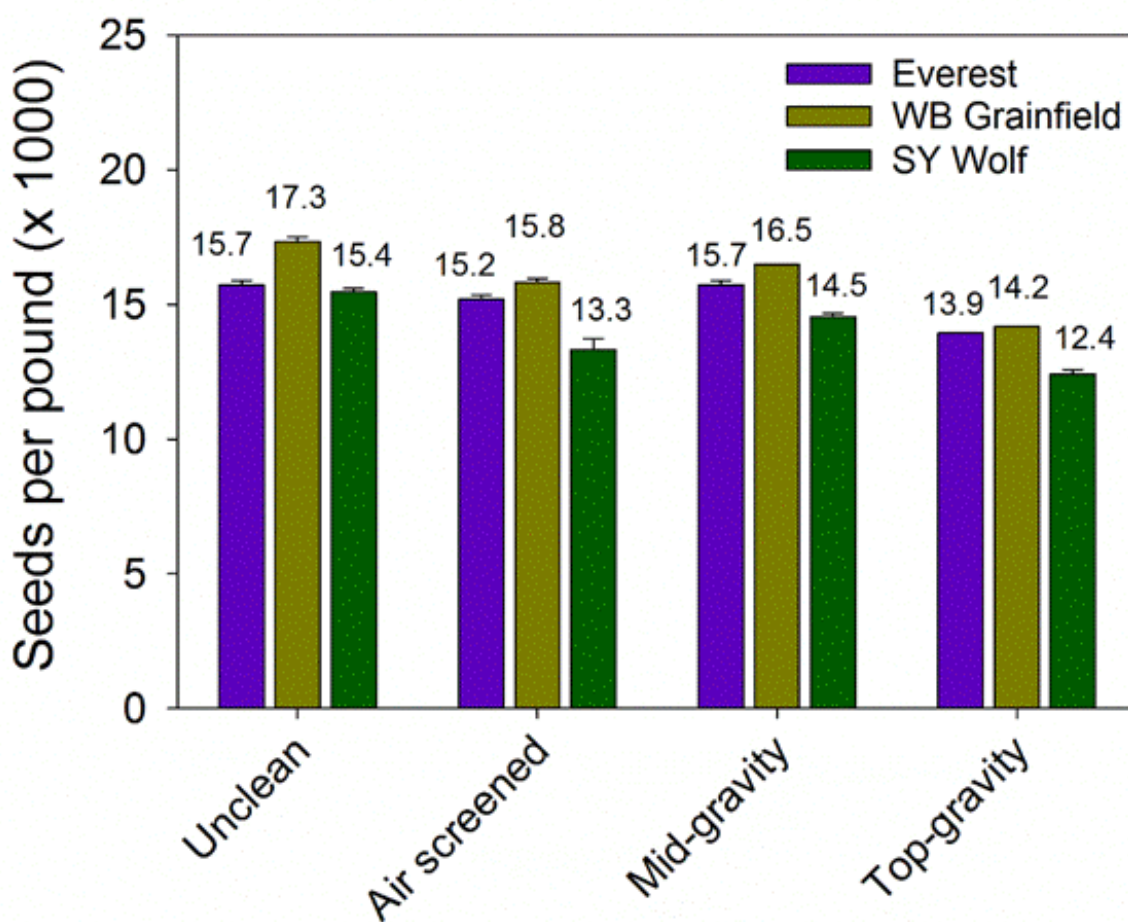


Figure 1. Effects of wheat variety and seed cleaning on final number of seeds per pound. Seed for this research provided by Ohlde seeds, research by Romulo Lollato.

Figure 2 highlights the two most contrasting treatments from the above study, the 'Unclean' WB-Grainfield (top figure, 17,335 seeds per pound) versus the 'Top-gravity' SY Wolf (bottom figure, 12,427 seeds per pound). To achieve the same number of seeds per acre, 'Top-gravity' SY Wolf would require a 39% increase in pounds per acre planted when compared to 'Unclean' WB-Grainfield. In other words, if both varieties are planted at a seeding rate of 75 pounds/acre, final number of seeds planted per acre will be 1.3 million seeds/acre for 'Unclean' WB-Grainfield and 930,000 seeds/acre for 'Top-gravity SY' Wolf. If the goal was to achieve 1.2 million planted seeds per acre, wheat would be over-seeded at about 8% for the smaller seed and under-seeded in about 22.5% for the larger seed. This assumes the same emergence rate for the cleaned and uncleaned seed, which would not necessarily be expected.

17,335 seeds per pound



12,427 seeds per pound



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Figure 2. Differences in seed size between treatments 'Unclean' WB-Grainfield (17,335 seeds per pound; top photo) and 'Top-gravity' SY Wolf (12,427 seeds per pound; bottom photo). Photos by Romulo Lollato.

If planting occurs in seeds per acre instead of pounds per acre, we might see the opposite results where seed cleaning will actually increase stand establishment. The seeds above were no-tilled in heavy corn residue in an experiment during the 2015-16 growing season, with final seeding rate established in seeds per acre. The resulting stand counts are shown in Figure 3. These results indicate that the seed cleaning process increased stand establishment. These results were possibly due to better seed quality as the cleaning process removed small and shriveled grains that may have lower vigor than larger, healthier grains. Regardless of planting in seeds per acre or pounds per acre, these results highlight the importance of measuring wheat seed size before planting to avoid the final amount of seeds planted per acre being too far away from the original target.



Figure 3. Final wheat stand establishment as affected by seed cleaning process. Plots were sown in seeds per acre, and the improved seed quality resultant from the cleaning process increased final stand establishment. Research by Romulo Lollato.

Certified seed, or seed submitted for germination testing, will have seeds per lb information

available. However, an easy on-farm method to estimate the average seed weight of a seed lot is to collect several representative 100-seed samples and weight each 100-seed sample in grams. To calculate seeds per lb, divide the conversion factor 45,360 by the average weight the 100-seed samples. Samples should be collected from the lot as is, including large and small kernels in the same proportion as found in the seed lot. The targeted number of seeds per acre is then divided by the number of seeds per pound to determine the number of pounds to be planted per acre. The following table is a quick reference guide to adjust the planting rate in pounds per acre based on seed size and the targeted number of seeds planted per acre:

Table 1: Reference guide to adjust planting rate in pounds per acre

	Target planting rate (seeds per acre)				
	600,000	750,000	900,000	1,200,000	1,500,000
Seeds/lb	Pounds of seed per acre				
10,000	60	75	90	120	150
12,000	50	63	75	100	125
14,000	43	54	64	86	107
16,000	38	47	56	75	94
18,000	33	42	50	67	83
20,000	30	38	45	60	75

How to use Table 1:

A dryland wheat producer in western Kansas whose target may be 750,000 seeds per acre has a seed lot with large kernels, averaging 12,000 seeds per pound. Seeding rate in pounds per acre for this seed lot for a final placement of 750,000 seeds per acre should be ~63 lb/ac. The same producer, planting a different lot with smaller seeds averaging of 16,000 seeds per pound, should plant ~47 lb/ac to achieve the same final seed placement of 720,000 seeds per acre.

A wheat producer in eastern Kansas whose target may be 1.2 million seeds per acre has two seed lots, the first averaging 14,000 seeds per pound and the second, with slightly smaller kernels, averaging 16,000 seeds per pound. This producer should use a seeding rate of 86 lb/ac in the first seed lot and 75 lb/ac in the second seed lot to achieve the same final seed placement. In this case, both seed lots were in the “normal” range of about 14,000-16,000 seeds per pound, and a simple $\pm 10\%$ adjustment on the seeding rate should compensate for differences in seed size.

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3. Calibrating the seed drill prior to wheat planting to improve seed distribution

Decisions taken prior to wheat planting can account for a large proportion of the success or failure of the wheat crop. These decisions include:

- selecting a variety well adapted to the area and with a good yield stability record
- soil sampling to determine fertility needs
- pre-plant fertilization (N, P, K, lime)
- tillage for weed control and seedbed preparation (or using a contact herbicide in no-till situations)
- proper drill calibration

Proper drill calibration can increase the chances of success of the wheat crop by ensuring the amount of seed planted per acre is close to the target.

There are several methods to calibrate seed drills. The stationary method, which is a simple 5-step method to calibrate a wheat drill prior to planting, is discussed in this article. In stationary drill calibration, a drill operation is simulated by turning the drive wheel freely above ground, weighing the seeds delivered from the drill spouts, and comparing to a targeted seed weight by length of drill-row.

The five steps are as follows:

1. Determine seeding density.

Targeted seeding density varies within the State of Kansas based on annual precipitation. A target range of seeds per acre based on current K-State recommendations is shown in Table 1.

Table 1. Target seeding density based on annual precipitation

Annual precipitation	Target seeding density
	(seeds per acre)
> 20 in	675,000 - 900,000
20 - 30 in	900,000 - 1,125,000
>30 in	1,125,000 - 1,350,000
Irrigated	1,350,000 - 1,800,000

2. Determine the number of seeds to be placed in 50 drill-row feet based on row spacing and targeted seeding density.

Determine the number of linear row feet per acre based on the drill's row width (Table 2). Next, estimate the number of seeds to be collected in 50 drill-row feet based on row width and the target seeds per acre. This can be done by dividing the number of target seeds per acre by the number of linear row feet per acre based on row width and multiplying the result by 50. Percent emergence can be accounted for by dividing the result by the fraction of emergence (for example, dividing by 0.85 for 85% emergence). Table 2 shows calculations for selected row widths and targeted number of seeds per acre considering 85% emergence.

After determining the number of seeds to be collected from 50 drill-row feet, weigh the equivalent amount of seed of each variety you intend to plant. For instance, if the target is 675,000 seeds per acre and row width is 12 inches, a total of 775 seeds need to be planted in a 50 drill-row feet. Assuming 85% emergence, this number increases to 912 seeds (Table 2). Count and weigh 912 seeds from each variety. If no scale is available, place the 912 seeds in a clear graduated cylinder (i.e. a rain gauge) and mark the level for each variety.

Table 2. Seeds per 50 drill-row feet as function of row width and target number of seeds per acre. Feet of linear row per acre as a function of row width is also shown.

Row width (inches)	Feet of linear row per acre	Target number of seeds per acre					
		675,000	750,000	900,000	1,125,000	1,350,000	1,800,000
		Seeds per 50 drill-row feet					
6	87,120	456	506	608	760	912	1,215
7	74,674	532	591	709	886	1,063	1,418
7.5	69,696	570	633	760	950	1,139	1,519
8	65,340	608	675	810	1,013	1,215	1,620
10	52,272	760	844	1,013	1,266	1,519	2,026
12	43,560	912	1,013	1,215	1,519	1,823	2,431

3. Determine the number of wheel revolutions needed for 50 drill-row ft.

First, attach the seed drill to a tractor and raise the drill off the ground. Measure the drive wheel's circumference using a tape measure, and divide 50 drill-row feet by the length of the circumference to determine how many times the drive wheel needs to be rotated to account for 50 drill-row feet. For example, if the drive wheel's circumference is 7 feet, dividing 50 by 7 indicates that the wheel needs to be rotated 7.15 times to account for 50 drill-row feet. Mark a starting point in the wheel with tape (i.e. duct tape) to facilitate counting how many times the wheel is being turned.

4. Calibrate the drill.

Adjust the seed meter using the rate chart provided by the manufacturer for the desired seeding

rate, which should result in a first approximation of final calibration. Add enough seed of the variety to be calibrated to ensure seed cups will remain covered throughout the calibration process. Rotate the wheel the number of revolutions needed to cover 50 drill-row feet as calculated in step 3 and collect the seed from each spout in a bucket or similar container. The more spouts evaluated, the more accurate the calibration. Weigh the collected seed (or pour it in the marked graduated cylinder from step 2) and compare to the target seed per 50 drill-row feet as determined in step 2. If the collected seed weighs too low or too heavy compared to the target, adjust the metering system to deliver more or less seeds, respectively. It is recommended to keep a record of the different seeding rates achieved at each setting for future reference. Repeat this process until the number of seeds delivered from the drill spouts matches the target established in step 2.

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4. Late-season stalk lodging in corn

Stalk lodging in corn occurs when the stalk weakens and breaks at some point below the ear (Figure 1). When this occurs, it results in harvest losses and slows down harvesting considerably. Grain moisture levels may also be unacceptably high in lodged corn.



Figure 1. Stalk rot in corn at Kansas River Valley Experiment Field, 2016. Photo by Eric Adee, K-State Research and Extension.

The first things to consider when stalk lodging occurs are either stalk rot diseases or corn borer damage. In fact, we often find stalk rot disease organisms (charcoal rot, *Fusarium*, *Gibberella*, anthracnose, and *Diplodia*) on corn with stalk lodging and stalk rot is often the ultimate cause of lodging. But in most cases, the stalk rot diseases were only able to infect the plants because certain other factors predisposed the plants to disease infection.

What are the most common causes of stalk lodging in corn throughout the state?

Carbohydrate depletion in the stalk during grain fill. Higher-yielding, “racehorse” hybrids tend to produce superior yields at the expense of late-season stalk integrity. These hybrids translocate a high percentage of carbohydrates from the stalks to the ears during grain fill. The latter is reflected with a substantial reduction in the stalk diameter from flowering until maturity (stem shrinking process). This weakens the lower stalk until eventually it will break over, possibly after becoming infected with a stalk rot disease. However, this doesn’t mean producers should stay away from these hybrids. These hybrids have to be managed well. They should be harvested early, shortly after physiological maturity. This may mean harvesting the corn at about 20-25 percent grain moisture. Early harvest can result in discounts for high moisture, but it’s better than leaving those hybrids in the field so long that stalks break.

Hybrid differences in stalk strength or stalk rot susceptibility. Some hybrids have genetically stronger stalks than others. This is often related to a hybrid’s yield potential, as mentioned above, and how it allocates carbohydrates during grain fill. But there are also genetic differences in stalk strength due to other reasons, including better resistance to stalk rot diseases. If a field of corn has stalk lodging problems, it could be due in part to hybrid selection.

Poor root growth and other stresses. Cold, waterlogged soils, severe drought, and soil compaction can all result in short, inadequate root systems and crowns that are damaged to the point that water and nutrients cannot effectively move through them. Under these conditions, the roots may not be able to extract enough water and nutrients from soil to support plant growth and carbohydrate production. When carbohydrate production is below-normal during any part of the growing season, the ears will continue to take what they need during grain fill, which can leave the stalks depleted even under average yield conditions. The developing ear always has priority for carbohydrates within the plant.

Poor leaf health. Any factor that results in poor leaf health will reduce carbohydrate production. When carbohydrate production from photosynthesis is inadequate due to loss of green leaf area in the leaves, the plant will mobilize reserves from the crown and lower stalk to complete grain fill (see carbohydrate depletion above).

Southern rust continues to arrive in Kansas earlier in the growing season, perhaps due to the overall warming trend in recent years (Figure 2). Where delays in planting from spring rainfall occur, southern rust can build to high levels earlier in the plant’s life cycle, resulting not only in direct loss from the disease, but also in secondary losses from increased levels of stalk rot.



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Figure 2. Southern leaf rust in corn. Photo by Doug Jardine, K-State Research and Extension.

Gray leaf spot is the other important foliar disease in Kansas that can affect stalk rot (Figure 3). While 2017 was an “average” year for gray leaf spot, there were individual fields with high levels of the disease. Unfortunately, many of these fields went untreated due to reduced input investments related to low corn prices.



Figure 3. Gray leaf spot on corn. Photo courtesy of Alison Robertson—© APS. Reproduced, by permission, from Wise, K., et al., eds. 2016. A Farmer's Guide to Corn Diseases. American Phytopathological Society, St. Paul, MN.

Many of the highest yielding hybrids lack good resistance to leaf diseases because the use of resistance genes can cause a “yield drag” in the hybrid. Therefore, when growing these hybrids, producers should be ready to apply a fungicide should leaf diseases develop. Bacterial leaf streak continues to spread in the state, however, its relationship to yield loss or increases in stalk rot are still unknown.

Spider mites were also bad in many cornfields in 2017, especially in the southwest. Previous research from the 1980s indicated a high correlation between spider mite leaf damage and increases in stalk rot incidence and severity.

Stay green, another characteristic in hybrids, is highly correlated to stalk rot resistance and reduced lodging. The stay green effect associated with the use of strobilurin fungicides has also been reported to reduce lodging. This same characteristic may also interfere with grain dry down in the field.

High plant density. Plants become tall and thin when supra-optimal populations are used, which result in thin stalks with inadequate strength. In addition, plant-to-plant competition for light, nutrients, and water enhances the competition for carbohydrates between the stalk and ear within the plant, thus reducing the vigor of the cells in the stalk and predisposing them to invasion by stalk rot.

Nutrient imbalances and/or deficiencies. Nutrient imbalances and/or deficiencies predispose corn plants to stalk rot and stalk lodging. Both potassium and chloride deficiency have been shown to reduce stalk quality and strength, and stalk rot resistance. High nitrogen levels coupled with low potassium levels increase the amount of premature stalk death and create an ideal situation for stalk rot and lodging. Soil chloride levels should be maintained above 20 lbs per acre.



Figure 4. High plant density corn presenting late-season stalk lodging. Photo by Ignacio Ciampitti, K-State Research and Extension.

Corn rootworm and corn borers. Damage caused by the corn rootworm and the European corn borer can predispose the corn plant to invasion by stalk rotting organisms, as well as lead to outright yield loss.

Mid-season hail damage. Similar to the damage caused by insects, the physical damage caused by mid-season hail can set up the plant for invasion by stalk rotting organisms. Stalk bruising and the resulting internal damage may also physically weaken corn stalks, making them more likely to lodge later in the season.

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5. Late-season purpling in sorghum

Purpling of plant tissues in sorghum can become more frequent during the fall. In many cases, this is related to an abundance of photosynthetic sugars and accumulation of a pigment called anthocyanin (reddish-purple pigment) within the plants. Anthocyanin is a sugar-containing glucoside compound. The accumulation of reddish-purple anthocyanin pigment within the plant is primarily due to an imbalance between continued production of photosynthetic sugars by leaves (the “source”) and weak demand for those sugars by grain (the “sink”). Basically, this results in sugar and anthocyanin buildup within the plants during the late-reproductive period.

From a physiological perspective, such a sugar buildup might be related to biotic/abiotic stresses that resulted in poor pollination, which reduced the number of grains per head. When this happens, the total amount of grain produced by the head is insufficient to utilize all the sugars generated by photosynthesis. Thus, the sugars and anthocyanin accumulate in the leaves and stems.



Figure 1. Purpling in sorghum during grain filling. Photo by Ignacio Ciampitti, K-State Research and Extension.

Symptoms are typically seen in the upper stem and leaves, close to the head (Figure 1). Less frequently, the symptoms occur in lower sections of the stems (Figure 2). Purpling is sometimes found in sorghum heads when there is poor grain formation and when there has been stressful weather conditions around flowering, followed by a return to favorable conditions during grain filling.

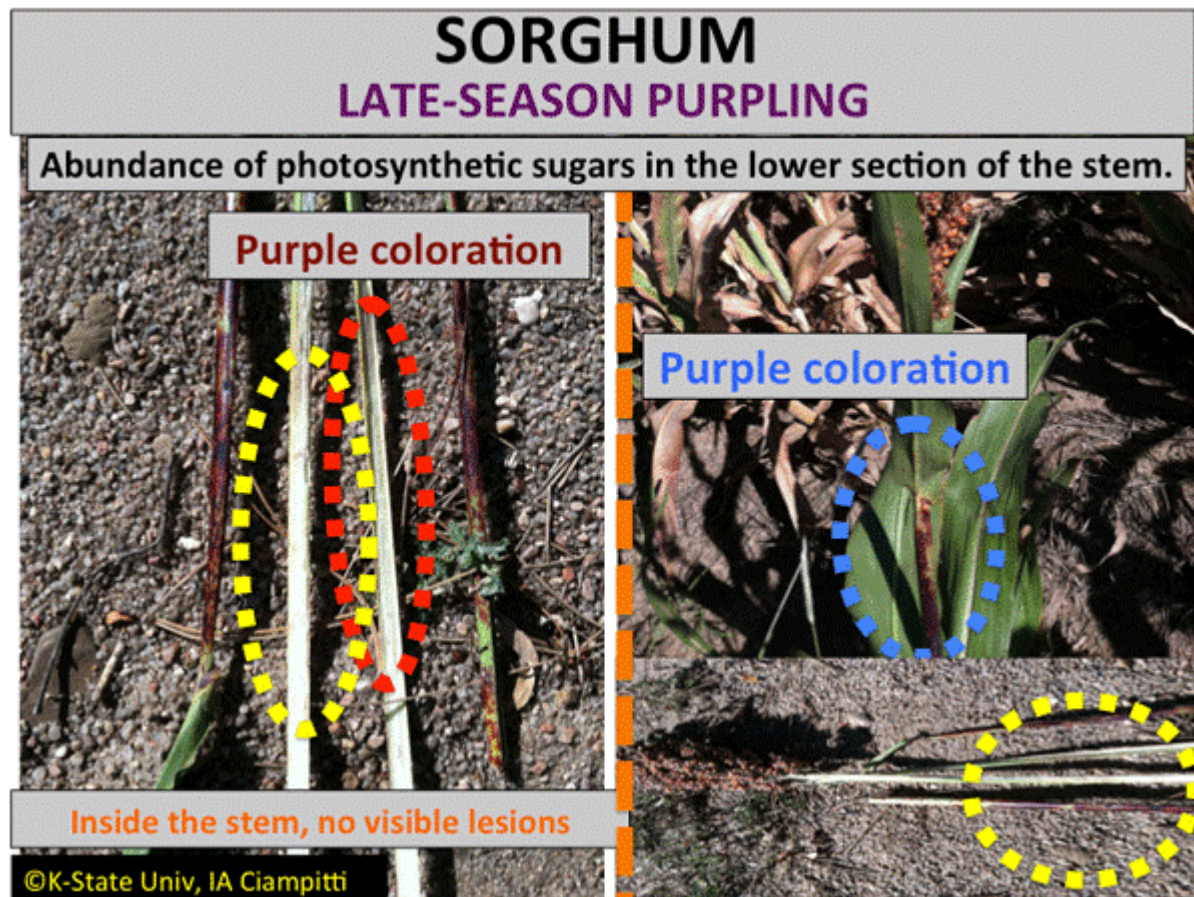


Figure 2. Reddish-purple sorghum plants during the grain-filling period. Photo by Ignacio Ciampitti, K-State Research and Extension.

To properly diagnose the cause of purpling in the stem, split the stem open to check for any damage or discoloration inside. If the stem is white with a creamy texture, and without brown spots or lesions, this indicates the stem is still functional and mobilizing nutrients (carbon) and water from the main plant to the head. In that case, we can say that the purpling is related to an accumulation of sugar within the plant due to lower-than-normal demand by the grain.

Regardless of the specific factor causing this buildup of reddish-purple coloration by anthocyanin late in the season, the purpling does not affect plant functionality. Instead, it is a warning sign associated with the occurrence of an earlier biotic or abiotic stress that affected the plant and reduced grain development.

Will the purpling reduce yields?

Not directly, but whatever stress that occurred earlier to reduce grain counts within the head will almost surely affect yields. A reduction in grain counts due to any biotic (insects, diseases) or abiotic (heat, drought) stresses will produce an unbalance of sugar and anthocyanin buildup if weather conditions during the reproductive stages are favorable for good photosynthesis and plant growth (Figure 3).



Figure 3. Purpling in sorghum, September 2016. Photo by Tom Maxwell, K-State Research and Extension.

Remember to continue scouting your acres for early identification of any potential problems affecting your crops before harvest time.

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6. Tips to avoid subsoil compaction during row crop harvest

Across much of Kansas the soil conditions are dry as of the time of this publication. On one hand that's a problem for crop production, but on the bright side, soil compaction is less of a problem when soil conditions are dry. Soil water content is a critical factor in soil compaction potential. Moist soils are the most susceptible to compaction. There are different types of soil compaction, but the deep compaction is the main concern at harvest time. Soil compaction occurs when soil particles are pressed together, limiting the space for air and water. The results are decreased permeability, moisture and nutrient stress, and the reduced exchange of gases.

Deep compaction is related to the maximum axle load and is not reduced by distributing the weight across more tires or larger tires. Deep compaction is very difficult to remove with tillage as it occurs at a depth that is beyond the depth of most tillage implements. For example, a moist soil can be compacted to a depth greater than 18 inches by a 10-ton axle load. Removing compaction at that depth will require more horsepower. As the depth of tillage doubles, the necessary horsepower increases by four-fold.

Much agronomic research has been conducted on subsoil compaction. The conclusions are that axle loads greater than 10 tons per axle can be very destructive to soil structure and lead to decreased crop yield potential. These yield effects will be most severe in a dry year, and less so in a wetter year, since soil strength increases as soils dry.

Harvest time is when most fields experience the heaviest loads from combines, silage harvest, and grain carts. Consider the following example:

- An *empty* 1,050-bushel grain cart weighs ~19,700 lbs.
- A *full* 1,050-bushel grain cart weighs ~78,500 lbs (assuming grain weight is ~56 lbs per bushel).
- Assume the cart transfers about 8,000 lbs to the tractor through the wagon tongue.
- The grand total for this example is **70,500 lbs**.
- If the grain cart has two axles, that equals **17.6 tons per axle**.
- A 12-row combine full of corn often exceeds 20 tons per axle.

Of course, producers must traffic fields at harvest time. Two key points for minimizing compaction from heavy axle loads are to limit traffic when fields are wet, and to confine the majority of traffic to end rows when possible. Keep in mind that the first wheel pass causes 70 to 90 percent of the total soil compaction, so preventing random, unnecessary traffic routes on the field is very beneficial.

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7. Sugarcane aphid in Kansas sorghum - September 2017 update

As we reach the midpoint of September, it is becoming clear that the impact of sugarcane aphid (SCA) in Kansas will be only a fraction of what it was in 2015 or 2016. [Multi-state monitoring](#) efforts using "[myfields.info](#)" to track SCA have reported SCA in 138 different counties in 8 states in 2017; the first record in Kansas was on August 1 in Sumner Co. You can track county movement by visiting the [myFields distribution map](#), or [sign up for an account](#) to receive an email alert when SCA has been detected in your area. Only southwestern Kansas has had some fields with infestations heavy enough to [warrant treatment](#), and many others have remained below threshold (see our [Scouting Card](#) for more information). A large proportion of the earlier planted fields are now mature enough to be safe from yield losses, even though SCA may be able to survive on these plants for some time. At this point, only the latest planted fields that have not yet filled grain remain at risk. Also, cooler overnight temperatures are slowing aphid activity. Remember, SCA can survive overnight freezes and continue to feed on plants as long as any green tissue remains, although without any further impact on yield if grain fill is complete.

Decreased acreage

A substantial decrease in sorghum acreage this year, especially in the most affected regions of central Kansas in 2016, has likely impeded northerly movement of the aphid this year. Reduced sorghum acreage, much of it converted to soybeans and dryland corn, has meant the aphid must traverse longer distances to reach suitable plants on which it can establish populations capable of producing the winged migrants that enable further spread. However, several other factors have likely been even more important.

Improved management

Awareness of SCA among sorghum growers is much higher. Management of the aphid, both preventive and remedial, in the southern regions that are the source of aphids for Kansas infestations has greatly improved. The widespread adoption of seed treatments in south Texas effectively prevents the infestation of young plants for up to a month or longer. An increase in the acreage planted to the many hybrid [varieties expressing resistance](#) to the aphid has greatly impeded its ability to produce large populations so quickly. Timely scouting and [identification](#) by concerned growers has resulted in the early discovery and [effective treatment](#) of fields that did exceed economic thresholds, which in turn reduced the number and size of late swarms that dispersed northward in 2017. Look for more help on scouting and determining treatable infestation levels here: [KSU Scout Card](#)

Evolving natural enemies

Just as pest species can evolve new behaviors (for example, attacking a new host plant), beneficial species can quickly evolve new pest/host plant associations. An example of this is provided by the [Asian multicolored lady beetle](#), *Harmonia axyridis*, which last summer produced very large

populations in Kansas sorghum for the first time, feeding primarily on SCA. This lady beetle was not previously found in sorghum, but was drawn into fields by abundant SCA, and is now responding to sorghum as a habitat containing many types of suitable prey. This year we have found it regularly feeding on corn leaf aphids and greenbugs, in the absence of SCA, something we had not previously observed. Similarly, *H. axyridis* did not frequent soybeans until the arrival of soybean aphid in 2002, whereupon it quickly became a key source of mortality for this aphid, and has remained a regular resident of soybean fields ever since.

While the example of *H. axyridis* is quite obvious and visible, many changes in the responses of other aphid natural enemies in the sorghum agroecosystem are more subtle, but also important. For example, the greenbug parasitoid, *Lysiphlebus testaceipes*, appears to be gradually overcoming SCA immunity to parasitism, and we are starting to find some successfully mummified SCA. Aphid natural enemies are now colonizing sorghum faster, and in greater numbers, in response to SCA. Surveys for SCA in central Kansas revealed many small colonies of greenbug, corn leaf aphids, yellow sugarcane aphids, and English grain aphids, all approaching extinction due to heavy predation and parasitism. [Lacewings](#) and [hoverflies](#) were especially abundant, with adults flying everywhere and several lacewing eggs on almost every lower leaf, independent of the presence of any aphids.

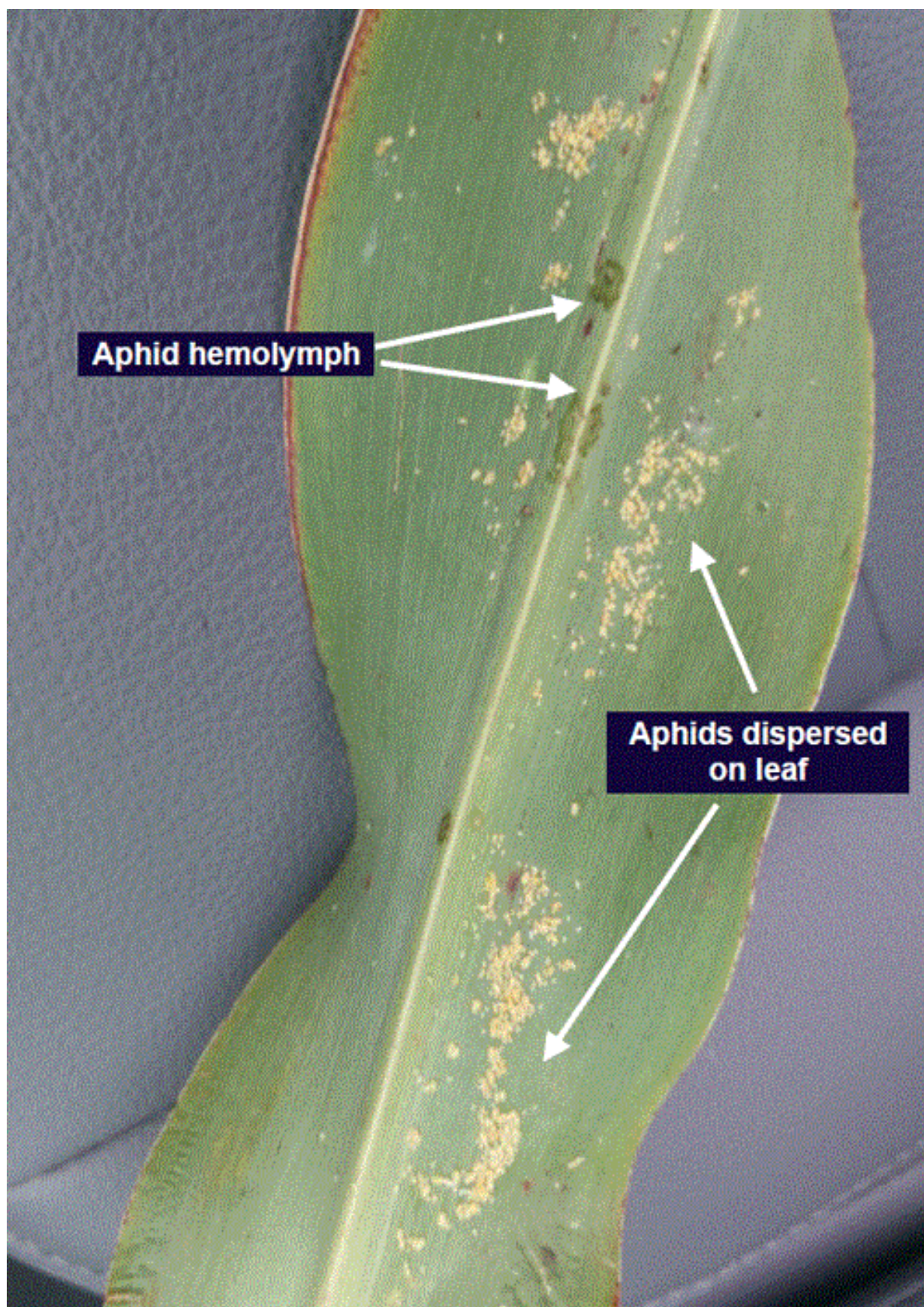


Figure 1. A colony of sugarcane aphid showing evidence of substantial predation. Note

'bloodstains' (aphid hemolymph) along leaf midrib and the fact that aphids are widely scattered rather than forming a compact colony. Photo by Casi Jessie, Oklahoma State University.

Summary

We are clearly advancing from the epidemic phase of the SCA invasion to the attenuation phase, and considerably faster than we might have expected. Vigilance will be required for the next few years. Appropriate monitoring and management will need to be maintained, but it is quite possible that 2016 will mark the high point for SCA problems in Kansas and we will not see another year that bad again.

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8. Comparative Vegetation Condition Report: September 5 - September 11, 2017

The weekly Vegetation Condition Report maps below can be a valuable tool for making crop selection and marketing decisions.

The objective of these reports is to provide users with a means of assessing the relative condition of crops and grassland. The maps can be used to assess current plant growth rates, as well as comparisons to the previous year and relative to the 28-year average. The report is used by individual farmers and ranchers, the commodities market, and political leaders for assessing factors such as production potential and drought impact across their state.

The Vegetation Condition Report (VCR) maps were originally developed by Dr. Kevin Price, K-State professor emeritus of agronomy and geography, and his pioneering work in this area is gratefully acknowledged.

The maps have recently been revised, using newer technology and enhanced sources of data. Dr. Nan An, Imaging Scientist, collaborated with Dr. Antonio Ray Asebedo, assistant professor and lab director of the Precision Agriculture Lab in the Department of Agronomy at Kansas State University, on the new VCR development. Multiple improvements have been made, such as new image processing algorithms with new remotely sensed data from EROS Data Center.

These improvements increase sensitivity for capturing more variability in plant biomass and photosynthetic capacity. However, the same format as the previous versions of the VCR maps was retained, thus allowing the transition to be as seamless as possible for the end user. For this spring, it was decided not to incorporate the snow cover data, which had been used in past years. However, this feature will be added back at a later date. In addition, production of the Corn Belt maps has been stopped, as the continental U.S. maps will provide the same data for these areas. Dr. Asebedo and Dr. An will continue development and improvement of the VCRs and other advanced maps.

The maps in this issue of the newsletter show the current state of photosynthetic activity in Kansas, and the continental U.S., with comments from Mary Knapp, assistant state climatologist:

Kansas Vegetation Condition

Period 37: 09/05/2017 - 09/11/2017

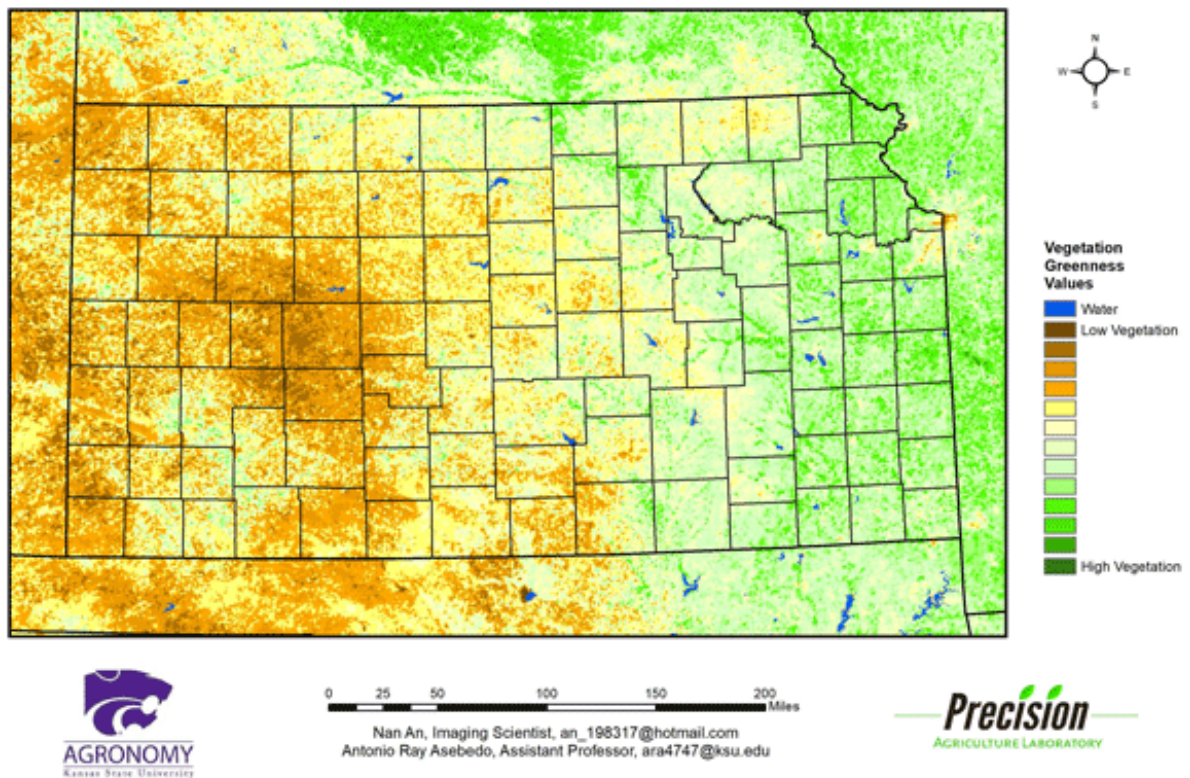


Figure 1. The Vegetation Condition Report for Kansas for September 5 – September 11, 2017 from K-State’s Precision Agriculture Laboratory continues to show a split in vegetative activity. The greatest vegetative activity remains in eastern Kansas, particularly in extreme northeast Kansas. The impact from the recent rains continues to be visible, and the flooded areas of Wyandotte and Johnson counties show reduced photosynthetic activity. Parts of western Kansas with higher rainfall show increased activity compared to the areas that missed the storms.

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Kansas Vegetation Condition Comparison
Early-September 2017 compared to the Early-September 2016

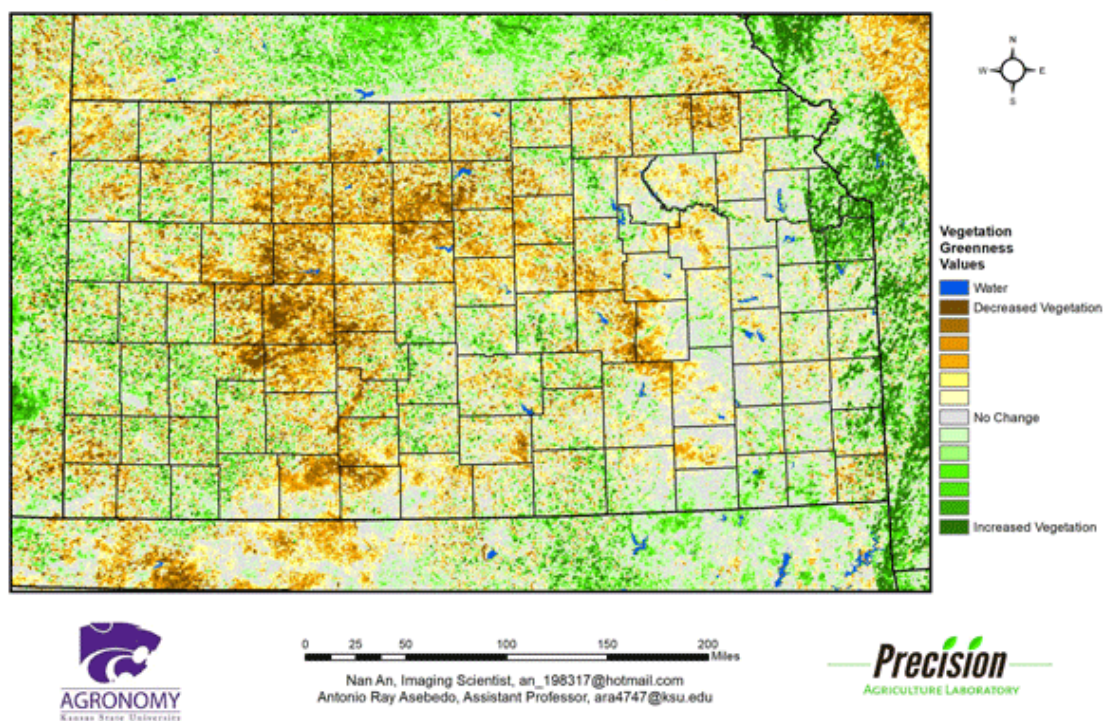


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for September 5 – September 11, 2017 from K-State’s Precision Agriculture Laboratory shows lower vegetative activity in the Central and North Central divisions. Rainfall in these areas has been lower and temperatures are near normal.

Kansas Vegetation Condition Comparison

Late-Aug/Early-Sept 2017 compared to the 28-Year Average for Late-Aug/Early-Sept

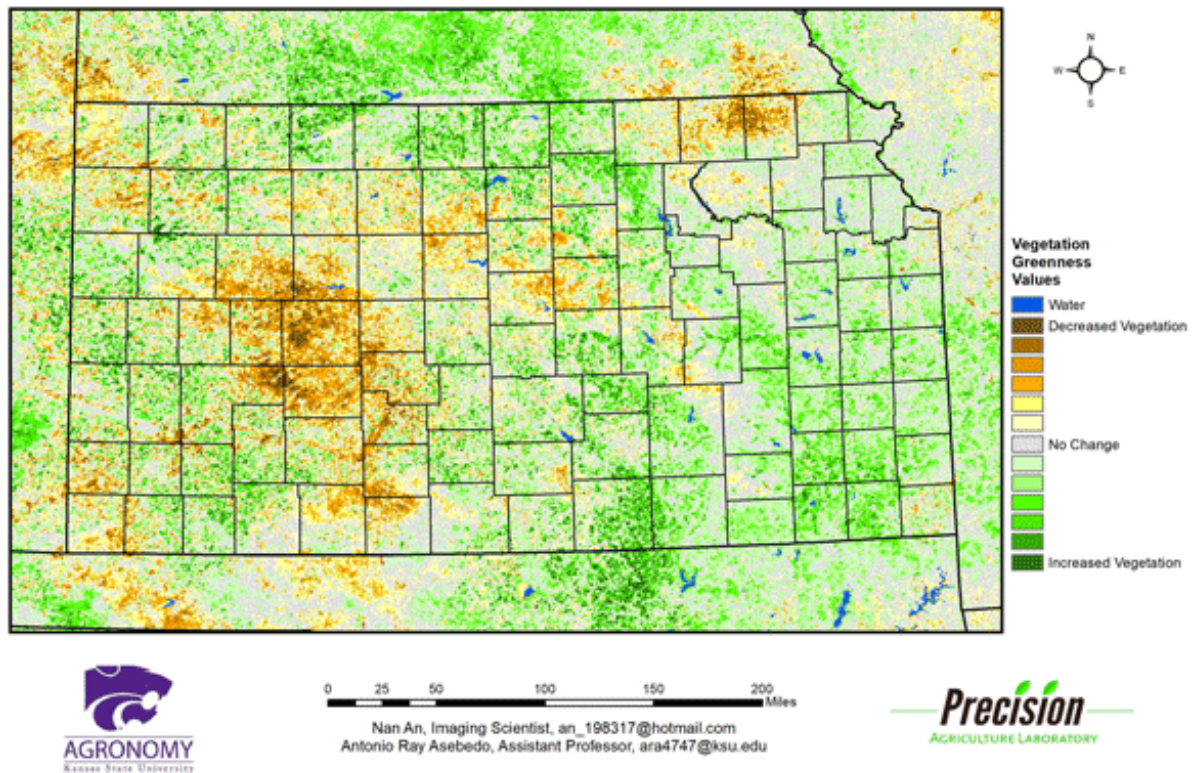


Figure 3. Compared to the 28-year average at this time for Kansas, this year's Vegetation Condition Report for September 5 – September 11, 2017 from K-State's Precision Agriculture Laboratory above- average activity in much of the state. The mild, wet weather has particularly favored the southwest corner of the state, while lingering drought has reduced vegetative activity in parts of central Kansas and in northeast Kansas, particularly in Nemaha and Marshall counties.

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Continental U.S. Vegetation Condition

Period 37: 09/05/2017 - 09/11/2017

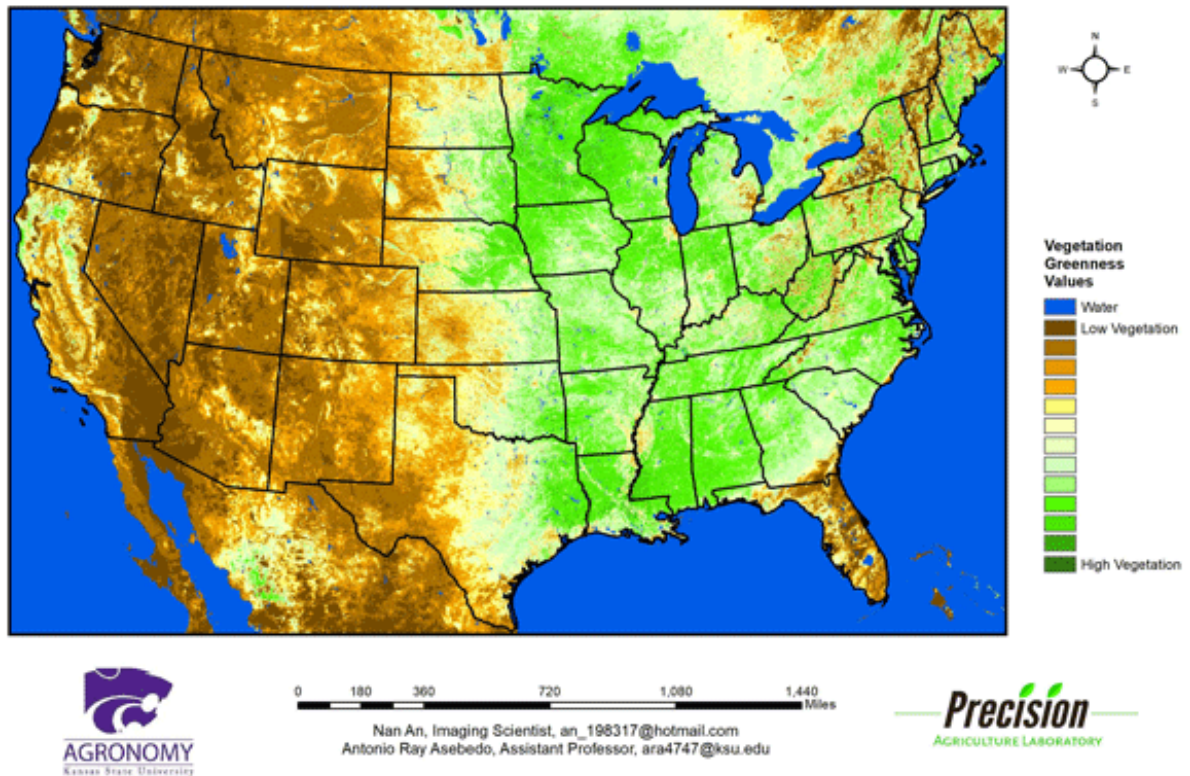


Figure 4. The Vegetation Condition Report for the U.S for September 5 – September 11, 2017 from K-State’s Precision Agriculture Laboratory shows the highest NDVI values centered in the Midwest, particularly in eastern Nebraska and western Iowa. A second area of higher vegetative activity is also visible along the West Coast, where the recent warm weather has yet to have a visible impact. Extremely low NDVI values continue to highlight the severe drought in eastern Montana and western South Dakota, while the excess rainfall along the Gulf Coast is beginning to show visible impacts, particularly in Florida which experienced Hurricane Irma.

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Continental U.S. Vegetation Condition Comparison
Early-September 2017 Compared to Early-September 2016

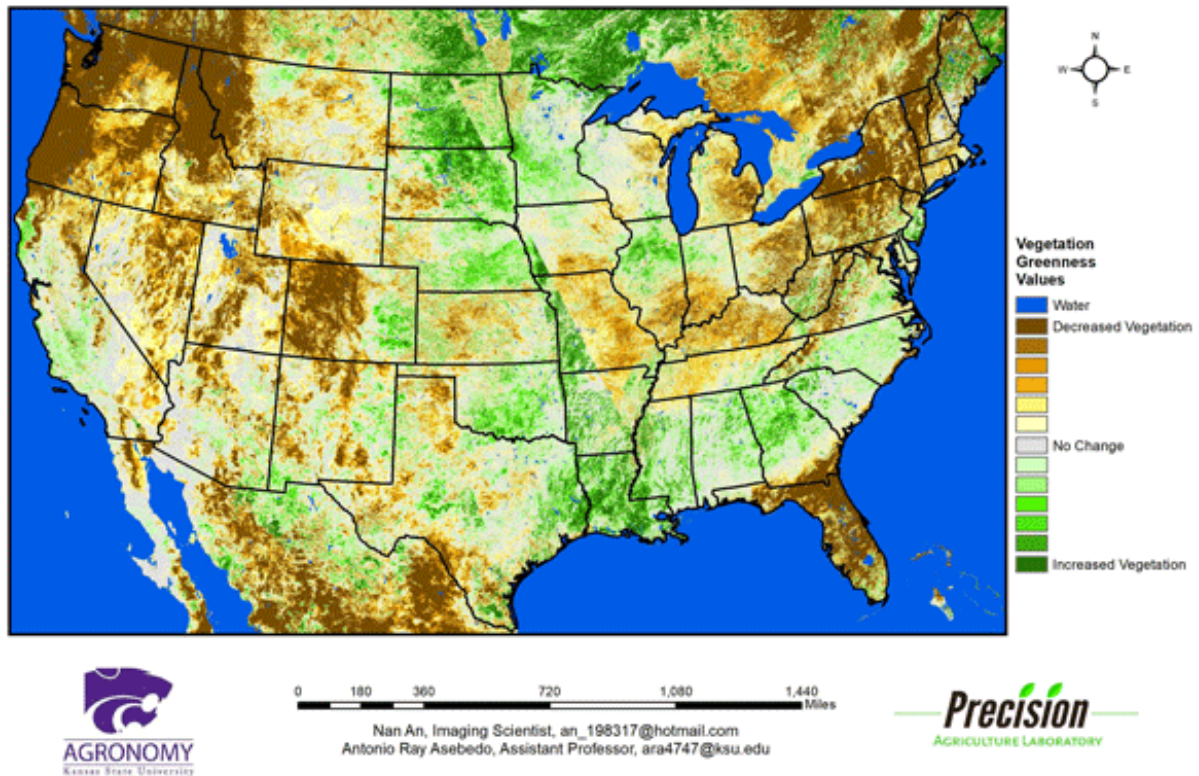


Figure 5. The U.S. comparison to last year at this time for September 5 – September 11, 2017 from K-State’s Precision Agriculture Laboratory again shows the impact that the split in moisture has caused this year. Much lower NDVI values are visible in Louisiana, with slightly lower values in the Plains. In contrast, the desert Southwest has much higher NDVI values than last year at this time. Parts of Texas, Louisiana, and into the Ohio River Valley are showing the impacts of the excessive moisture from Hurricanes Harvey and Irma.

Continental U.S. Vegetation Condition Comparison
Early-September 2017 Compared to 28-year Average for Early-September

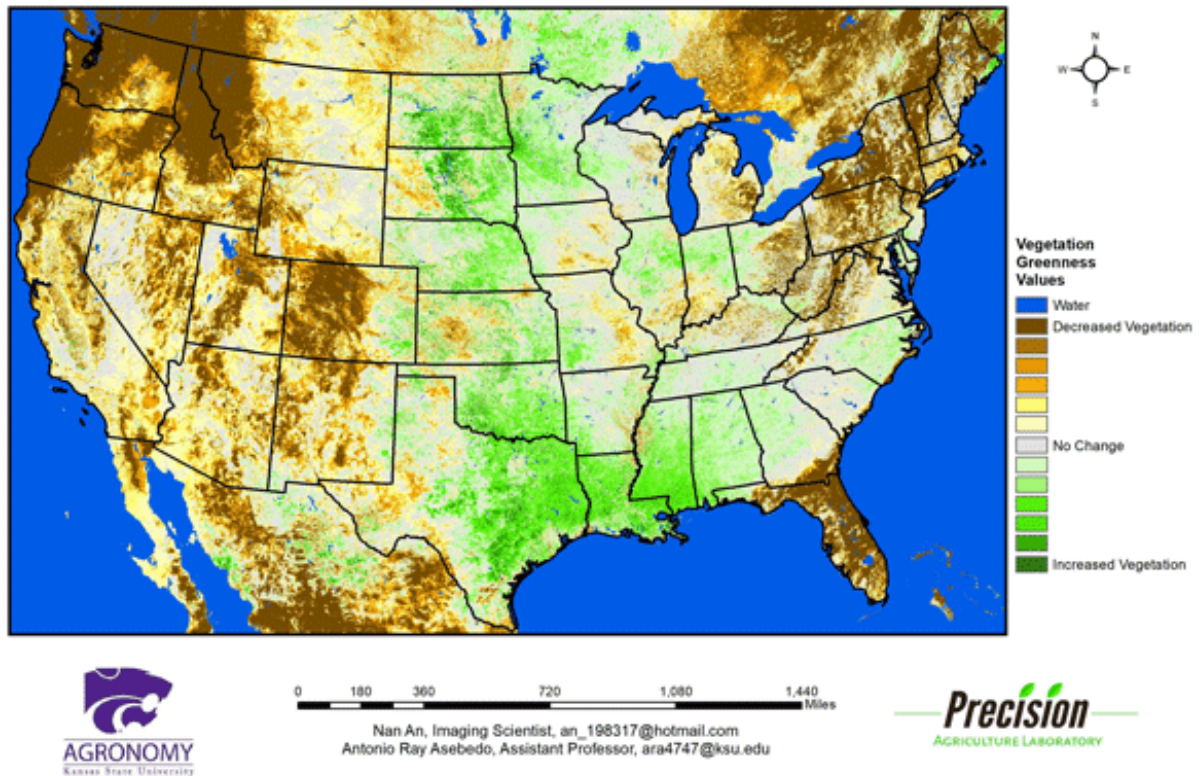


Figure 6. The U.S. comparison to the 28-year average for the period of September 5 – September 11, 2017 from K-State’s Precision Agriculture Laboratory shows the drought impacts in the northern Plains are visible as below-average NDVI values. In Louisiana and the Ohio River Valley, below-average NDVI values are associated with cloud cover and rain from Hurricane Harvey. Higher-than-average vegetative activity is most visible in west Texas and eastern New Mexico where rainfall and temperatures have been favorable.

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