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08/11/2017

These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, 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 Steve Watson, 785-532-7105 swatson@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Factors to consider when selecting a wheat variety

In recent years, wheat producers are faced with an increasing number of varieties from which to choose. One of the reasons behind having so many available varieties is that many public institutions and private companies are in the business of wheat breeding in the Plains: Colorado State University, Kansas State University, Oklahoma State University, Texas A&M University, University of Nebraska, AgriPro/Syngenta, Limagrain, and WestBred/Monsanto.

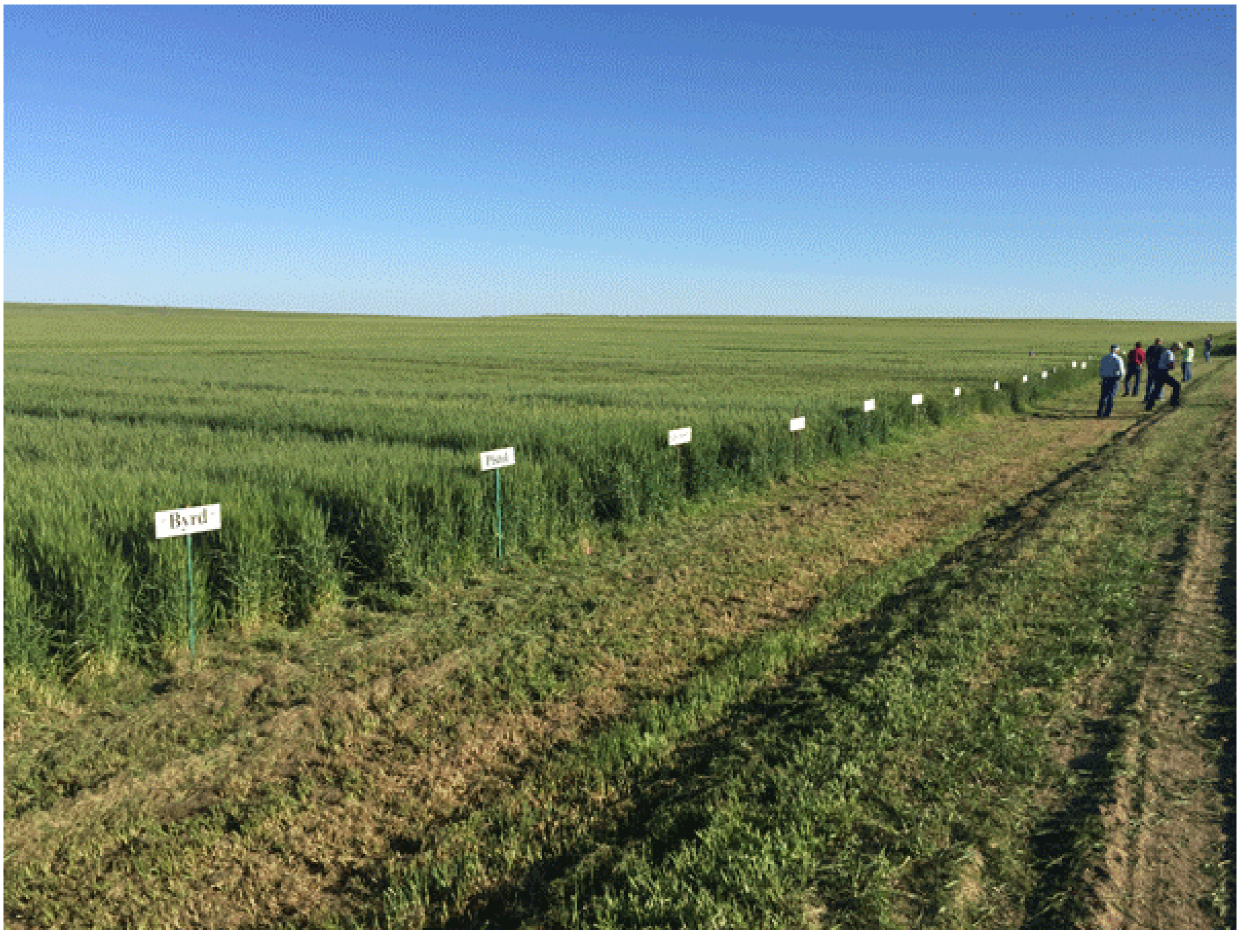

Figure 1. Producers in Kansas have many wheat varieties to evaluate. Photo by Romulo Lollato, K-State Research and Extension.

Producers can use different tools and publications to study each variety's strengths and weaknesses, selecting varieties that best match their needs.

Making a better decision: steps to select a wheat variety

The following information provides a step-by-step guideline, as well as relevant resources, to help producers make a better decision when selecting one or a few varieties to plant in their operation.

1. **Select several varieties that are adapted to your region of the state.**

Regardless whether you intend to plant one variety or several on your farm, it is important to start out with a list of several good candidate varieties. The final product of interest is grain yield and therefore, it is crucial to select varieties that have shown consistent performance in the region. Varieties that worked well for you and your neighbors in the past should be considered, but also make sure and check yield results from nearby K-State variety performance tests and demonstration plots. When looking at these results is very important that results from more than a single year, and possibly more than a single nearby location, are taken into consideration.

A few great resources to consult are:

a. K-State variety performance test: Start searching by year, narrow down your search by region and finally by site. Choose the site(s) nearest to you and look for varieties that are consistently toward the top. Repeat the procedure for different years to check the consistency of the variety performance. Click the link above to access the K-State variety performance test results.
b. OSU variety performance tests: If you are in southern Kansas or in Oklahoma, this is also an excellent resource. Click "Variety Testing" in the link above and then "Grain Yield" to have access to similar information to the one offered by K-State, but for variety performance tests from Oklahoma. Follow the steps described above. Click the link above to access the OSU variety performance test results.
c. Colorado Wheat Variety Database: This database encompasses replicated trial results from Colorado, Kansas, Oklahoma, and several other public state trials, so producers throughout the Plains can benefit. It is an excellent, easy-to-use resource that allows you to dig into data from single location, multiple locations, multiple years, and also allows for head-to-head variety comparisons. We suggest to start looking at "Single Location Trial Data", selecting the location nearest to you, and repeating this step for several years of data for that location. Check for varieties that tend to be consistently toward the top. Afterwards, look at "Multiple Location Trial Data," which will allow you to look at yields spanning a wider geographical region instead of a single location for one, two, three, or four years combined. Depending on region and number of years selected, you might be looking at more than 15 replicated trials combined. Thus, if a given variety remains a top yielding variety across all these replicated trials, it is a pretty good argument that you should at least look at that variety's characteristics and consider it in your farming operation. Click the link above to access the Colorado database.

2. **Narrow down the number of varieties in your list to a few solid candidates.**

After selecting several varieties that have shown good adaptability and stability in your region, the list needs to be narrowed down to the number of varieties you intend to plant. Ideally, at least two or three varieties (or a blend of two or more varieties) should be planted to spread the risk on your acres. Select varieties that are adapted and resistant/tolerant to the major concerns in your operation, but that have contrasting characteristics such as different maturities or disease resistance characteristics. This will help buffer the risk of a single event compromising production of the whole operation. Some factors to consider include:

a. _Production system:_ For producers who graze their wheat before taking it for grain (dual-purpose producers), selecting a variety with good forage yield: medium to late first hollow stem: Hessian fly, barley yellow dwarf, and wheat streak mosaic resistance; and good recovery from grazing is very important. Another consideration is whether the crop will be irrigated or dryland. Wheat varieties differ in their straw strength. There are a few varieties that should be restricted to dryland use, due to their high lodging potential. A history of feral rye in the field would dictate the need for a Clearfield variety and this also plays an important role in variety selection. Double-cropping wheat following soybeans may require varieties with excellent tillering potential and possibly early- to medium-early maturity to compensate for the delayed development due to late planting. No-till producers in western Kansas might be looking for tall varieties with good straw production potential to help improve water retention in the soil, so this could also play a role in selecting a variety.

b. _Tolerance to abiotic factors:_ Depending on the region of the state where your farm is located, it will be subjected to different abiotic stresses. Acid soils are a major concern in south central, central, and north central Kansas, and varieties that have good low soil pH tolerance are warranted. Meanwhile, drought is a dominant factor in western Kansas, and varieties with better drought tolerance should be favored there. Varieties differ in their tolerance to abiotic stresses, and selecting a variety with better tolerance to the major limiting factor in your operation will allow the variety's potential to be more easily achieved.

c. _Disease resistance:_ Producers who are willing to spray a foliar fungicide have more variety options to choose from than those who are not. Some varieties have many very good characteristics and yield potential, but may have lost their resistance to some major fungal diseases and thus require a fungicide. For example, Everest has many good characteristics, such as intermediate head scab resistance, some of the best barley yellow dwarf resistance available, and acid soil and Hessian fly tolerance; however, it is very susceptible to stripe rust. If a producer is willing to spray a foliar fungicide, Everest is still an excellent option. This is also true for varieties such as Byrd, TAM 111, TAM 112, Avery, etc. Diseases such as leaf or stripe rust can be controlled with a foliar fungicide and producers have the option to budget for it in their operation. Meanwhile, other diseases require more of a systems management approach and cannot be controlled after they are established. These include virus diseases such as wheat streak mosaic and barley yellow dwarf, and can also include a fungal disease such as Fusarium head blight, which is not always successfully controlled with fungicide spraying. If these diseases are common concerns in your region, evaluate each variety's ratings against these constraints and selecting the ones that provide better levels of resistance.

d. _Maturity:_ Selecting several varieties with differing maturities is a great tool to spread risk as well as to optimize harvest timing. You don't want to have too many acres ready for harvest at once and then have to wait for harvest for lack of combine capacity. Early-maturing varieties will most likely have a yield advantage over later-maturing varieties in years such as 2012 when the grain filling period turns hot and dry. Also, from a historical perspective, early-maturing varieties have been more successful in the southern portion of the state, especially south central Kansas, due to the typical hot weather pattern toward the end of the growing season. On the other hand, medium-late maturing varieties will benefit from growing seasons with an extended grain filling period, such as 2015 and 2016. It is important to keep in mind that recent years favored later-maturing varieties throughout the state. If we only look at the most recent years it will be tempting to plant later-maturing varieties, even in south central Kansas. However, nothing guarantees that the next growing season will be similar. At planting time, we don't know how the weather will turn out during grain fill. Therefore, spreading the risk in your operation by selecting varieties with differing maturities is always a good idea. In other words, you can plant a medium or medium-late maturing variety in south central Kansas, but keep it to a fraction of your acres.

Resources

A few great resources to help you walk through each variety's characteristics as far as maturity, disease ratings, drought and soil pH tolerance, date of first hollow stem, and other agronomic characteristics are:

a. *K-State Wheat variety Disease and Insect Ratings 2017*: This comprehensive guide to wheat varieties will allow you to compare different varieties in their agronomic and disease resistance characteristics in detail. Many varieties are individually described, others are shown in a table format which allows for easy and fast comparison. It is available online on the link above or in your county Extension office in Kansas.
b. *Wheat Varieties for Kansas and the Great Plains by Layton Ehmke*: This private-sector book is also an excellent, comprehensive source of information regarding different varieties and their characteristics. It provides detailed ranking of varieties by traits of interest, making it easy to use. It also has a good summary of several variety performance tests in the Great Plains. While not available online, producers can purchase it in the link above if interested.
c. *K-State Wheat Variety Date of First Hollow Stem, Fall Forage Yield, and Grain Yield 2017*: This new K-State publication compare several varieties in their fall forage production, date of first hollow stem, and grain yield under dual-purpose versus grain-only management in south central Kansas. It is a good resource for producers who graze their wheat before taking it for yield. It is available online at the link above or in your county Extension office in Kansas.
d. *OSU Fall forage production and date of first hollow stem in winter wheat varieties during the 2016-2017 crop year*: similarly to the publication above, this OSU publication compares varieties' forage yield and date of first hollow stem for north central and central Oklahoma. Available online at the link above or in your county Extension office in Oklahoma.

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2. Controlling tall, thick stands of weeds in wheat stubble

Where there has been plenty of rain this summer in Kansas, some fields that will be planted to wheat this fall may have become overgrown with broadleaf and grassy weeds.

Figure 1. Kochia and pigweeds in August, in a field to be planted to wheat. Photo by Curtis Thompson, K-State Research and Extension.

In those cases, some of the broadleaf weeds will have flowered and formed seed by now, which will make chemical control more difficult. Another potential problem for chemical control will be getting the spray down through the canopy to reach any weeds or grasses underneath the taller weeds.

The standard treatment over the years to control weeds and volunteer wheat in wheat stubble has been glyphosate plus 2,4-D LVE. If kochia was present, we may have added some dicamba. Where susceptible crops are nearby, it's especially important to manage spray drift, both droplet drift and vapor drift. Keep in mind, when adding AMS to a herbicide mixture containing dicamba, volatility of the dicamba increases greatly. This is true for all formulations of dicamba. If a crop sensitive to 2,4-D is adjacent to the weedy field, 2,4-D amine should be used instead of 2,4-D LVE to minimize the potential for damaging volatility drift. 2,4-D amine may not be safe around cotton fields.

Glyphosate plus 2,4-D and/or dicamba remain the primary options for weed control in stubble, but with the development of glyphosate-resistant weeds, these options certainly don't work as well or quickly as they used to. Glyphosate used to be fairly fool-proof, even on big weeds, but that is no longer the case. Dicamba and 2,4-D probably weren't contributing as much to the weed control in those tank mixes as we may have thought, so now we are struggling with acceptable control. Timing and weed size is much more critical with almost all other herbicides than it has been with glyphosate. Consequently, it is very important to try and apply those treatments before the weeds exceed 4 to 6 inches tall, but that often doesn't happen.

Higher rates of the 2,4-D and dicamba may improve control, but in most cases we probably don't want to exceed 1 qt/acre of 2,4-D or a pint/acre of dicamba. Sharpen is another herbicide tank-mix partner that may help with control of the pigweeds and provide some residual control. Sharpen works best with the addition of methylated seed oil and can provide some pretty good burndown on smaller weeds. If the weeds are very big, Sharpen tends to burn the tops and plants eventually resume growth. Sharpen requires complete coverage so using 15 to 20 gallons/acre spray solution is important.

One herbicide alternative to glyphosate that has worked pretty well on pigweed and kochia the last couple of years is Gramoxone 2SL (paraquat). Gramoxone is a contact herbicide, so spray coverage is critical. Spray volumes of 20 gallons/acre or higher are preferred, especially on larger and thicker weeds. Gramoxone also needs to be applied with a nonioinic surfactant or oil concentrate to enhance surface coverage of the plant foliage. A tank mix with atrazine will enhance control and provide some residual weed control if planning to plant corn or sorghum next spring. Likewise, metribuzin can be tank-mixed with Gramoxone if rotating to soybean to enhance control and provide some residual.

If planting wheat this fall, a tank mix with Sharpen is an option to provide some residual control. Using nozzles and application pressures resulting in uniform droplet sizes that provide sufficient coverage while minimizing the number of fine droplets can provide good control and reduce the potential for off-target movement. Keep in mind that flat fan nozzles and high pressure produce fine droplet sizes which are prone to move off target and can cause very striking paraquat injury wherever the droplet lands.

Producers should not expect perfect control of weeds and grasses from any treatments if the stands are unusually tall and thick, or if many of the weeds have flowered or formed seed. Producers should also be prepared for a second flush of weeds, and possibly volunteer wheat, once the main canopy is killed, so follow up treatments may be required.

Producers should be aware that burndown herbicides will not affect the viability of mature seeds in broadleaf weeds.

Using a sulfonylurea herbicide such as Finesse or Rave could improve control of certain broadleaf weeds and provide some residual control if planting wheat this fall, but will limit recropping options to sorghum or ALS-tolerant soybeans next spring. Many pigweed and kochia populations are ALS-resistant and may not be controlled by the ALS herbicides.

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3. Managing wheat for forage and grain: The dual-purpose system

Dual-purpose wheat management (wheat grown for forage and grain) spreads production risks by providing producers a second source of income in addition to the harvested grain. If wheat grazing is managed properly, its grain yield penalty can be minimized.

If cattle are removed prior to first hollow stem, the probability of grain yield reduction due to grazing decreases and in many cases no yield penalty occurs, depending on growing season weather. Still, research has demonstrated that grazing wheat during late fall, winter, and early spring reduces grain yields on average by 7% compared to wheat managed for grain only. If cattle are not removed prior to first hollow stem, greater grain yield reductions can occur. In years when early spring conditions are not favorable – such as when there is a spring freeze after some varieties have begun jointing or when the spring turns out dry – wheat that has been grazed may even outyield ungrazed wheat. That's because moderate to heavy grazing will typically delay maturity a bit in the spring and reduce some of the lush fall growth of early-planted wheat.

Overall, wheat pasture can provide high-quality forage when other forage sources are typically low in quality and quantity, and its management requires a few distinct considerations:

Seeding date. Early-planting is essential to ensure good fall forage production as long as soil moisture and temperature allows. Wheat grown under dual-purpose management is usually sown in September, at least two to three weeks earlier than wheat sown for grain-only. Research performed in north-central Oklahoma indicates that wheat fall forage production decreases approximately 1000 pounds per acre for each two-week delay in planting in September.

Seeding rate. Dual-purpose wheat management requires seeding rates 1.5 to 2.0 times greater than that for grain-only management. Research has shown that the increase in fall forage yield associated with increasing seeding rate from 90 to 120 lbs / acre pays for the increased seed cost in regions with approximately 30 inches annual precipitation or more, especially when planting is done early- to mid-September.

Basic Recommended Seeding Rates for Kansas		
Precipitation Zone	Grain only (lbs/acre)	Dual –purpose forage + grain production (lbs/acre)
Less than 20	40-60	60-90
20-30	50-60	75-120
More than 30	60-75	120
Irrigated	60-90	120

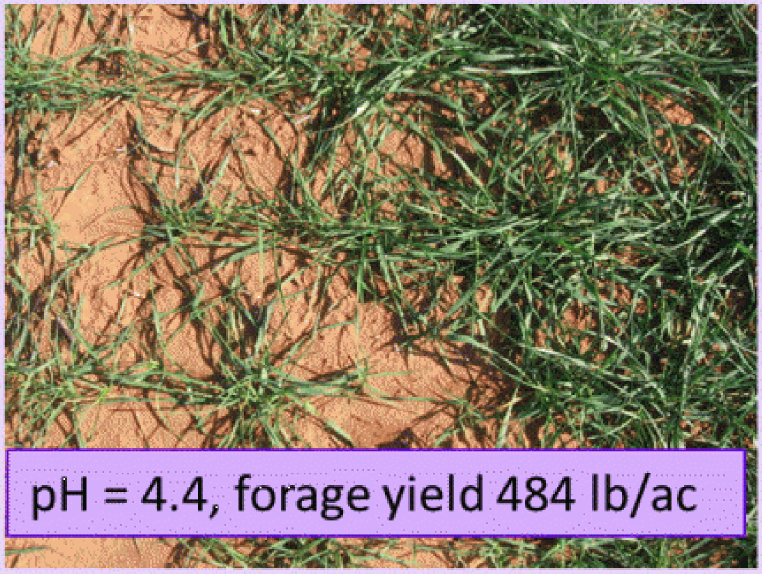
Seeding depth. Earlier planting date results in wheat planted into hotter soils. Increased soil temperature decreases the coleoptile length of germinating wheat, which can affect emergence of deep-planted seeds. Therefore, if moisture is not available in the top inch or inch-and-a-half of the soil profile, it is preferable to seed shallower and hope for rain ("dust the wheat in") than to try to reach moisture deeper in the profile.

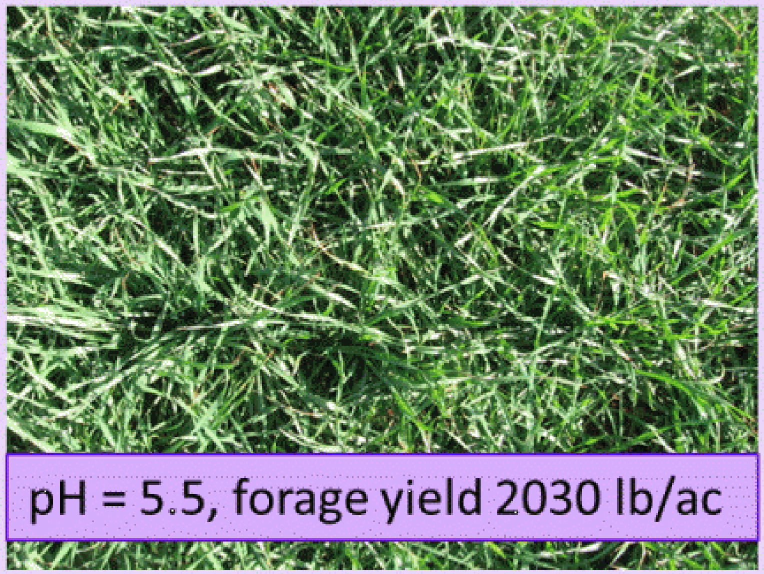
Variety selection. Wheat varieties grown under dual-purpose management should germinate well under high soil temperatures (> 85°F), should have excellent forage production and grazing potential in the fall, and recover well from grazing. Genetic resistance to barley yellow dwarf, wheat streak mosaic, and Hessian fly are also valuable traits as early planted wheat is at greater risk of damage by these diseases and pests. For more information on the first hollow stem and fall forage yield of different wheat varieties in Kansas, please click here. For information regarding variety-specific resistance to pests and diseases, please click here.

Nitrogen fertility. A bushel of wheat with 12.5% protein requires approximately 2 to 2.4 lbs N / acre during the growing season to be produced, regardless if management is for grain-only or dual-purpose. Additionally, approximately 30 pounds of nitrogen per acre are needed to produce 1000 pounds of wheat forage in the fall/winter in dual-purpose systems. Thus, nitrogen requirements of dual-purpose wheat are generally 60 to 90 lbs N / acre greater than that of grain-only wheat. Nitrogen removed by grazing should be accounted for by additional pre-plant nitrogen fertilizer or by a topdress application during spring to ensure proper grain formation.

Starter P fertilizer. Wheat forage yield responds remarkably well to phosphorus (P) application because of improved tillering and the typical jump-start resulting from banded P. Phosphorus deficiency reduces tillering and makes plants more susceptible to winterkill. Banded P applications at 50 to 60 pounds per acre diammonium phosphate (DAP) or the equivalent in P from other fertilizer sources at planting is more efficient than broadcasting, especially on acid soils low in available P.

Soil pH. Acidic soils are an especially important issue when growing wheat for forage and grain. Wheat forage production is more impacted by low soil pH than wheat grain yield, and extremely acidic soils can decrease forage production even in low pH tolerant varieties (Figure 1). A minimum soil pH of approximately 6 is needed to maximize wheat fall forage production for most wheat varieties. In-furrow phosphorus fertilizer can be used as a strategy to ameliorate the effects of low soil pH and increase wheat forage production in acidic soils.





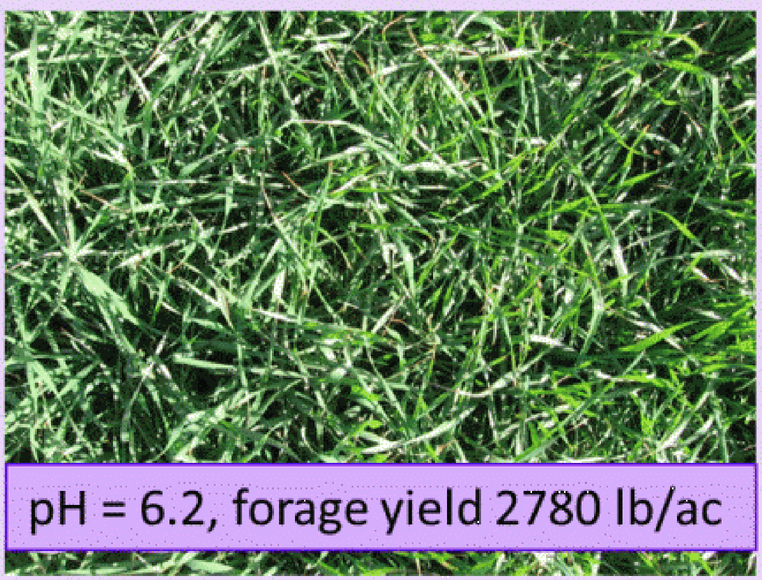


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Figure 1. Duster, a variety with excellent tolerance to acidic soils, showing decreased forage production under dual-purpose management due to extremely low soil pH. Photos by Romulo Lollato, K-State Research and Extension (courtesy of Oklahoma State University).

When to start grazing. Winter wheat should not be grazed before the secondary root system has developed enough to anchor the plant, which generally occurs with a minimum of 6 to 8 inches of top growth (Figure 2). If the grazing process is started before the wheat plants are well anchored, cattle will pull up the whole wheat plant with its root system, and decrease the plant population.

Figure 2. Wheat plants showing a good secondary root development during the fall. Secondary roots are important to anchor the plants and reduce the chances of plants getting pulled out of the soil by grazing cattle. Photo by Romulo Lollato, K-State Research and Extension.

Stocking rates. Climatic conditions such as precipitation and temperature will influence the optimum stocking rate, which will vary from year to year. Generally for fall grazing, the recommendation is 250 to 500 pounds of animal per acre (1 to 2 acres per stocker, depending on weight). Spring stocking rates are 1.5 to 2.0 times greater than that for fall due to the lush vegetative growth. Usually 0.75 to 1.3 acres per stocker, although rates as high as 1,400 pounds of animal per acre (2.5 stockers/acre) have been noted in some research trials during late spring graze out.

When to terminate grazing. Winter wheat should not be grazed past first hollow stem, otherwise developing wheat heads will be removed by cattle. Grazing past first hollow stem in the spring may reduce grain yields in as much as 5% per day depending on weather conditions.

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

Wheat planting is just a month or so away in parts of Kansas, so now is the time to get your soil sampling done to have good information on which to base your fertilizer inputs. This is particularly important now since 2017 wheat prices are currently lower than most of us would like and efficiency in production will be critical.

Which nutrients should be tested?

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

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

The 0-6" soil sample

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

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

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

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

The 0-24” soil sample

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

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

In many years, especially following dry summers, significant amounts of N can be present in soils at wheat planting. On the other hand, after good yields the residual N levels may be lower than the commonly used “default” value, and N fertilizer rates would need to be adjusted accordingly.

Sulfur deficiency is increasing across the state in wheat production also. Unheard of 10 years ago, S deficiency is now common in northeast and north central Kansas, and the area where these deficiencies are found is growing. There are two primary causes: the reduction in sulfur deposition from the atmosphere seen over the past 2-3 decades, and the reduction in S content in many P fertilizers. While not as soluble as nitrate, S is also a relatively mobile nutrient which accumulates in the subsoil. The S profile soil test is a good way to determine S needs.

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

Summary

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

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5. Correlation of soil test nitrate level and wheat yields

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

Analysis of yields taken from K-State research plots that received no N fertilizer shows a strong positive relationship with fall soil profile nitrate-N (Figure 1). Wheat yields increased rapidly as soil N levels increased to about 80 pounds soil N per acre, and then leveled off.

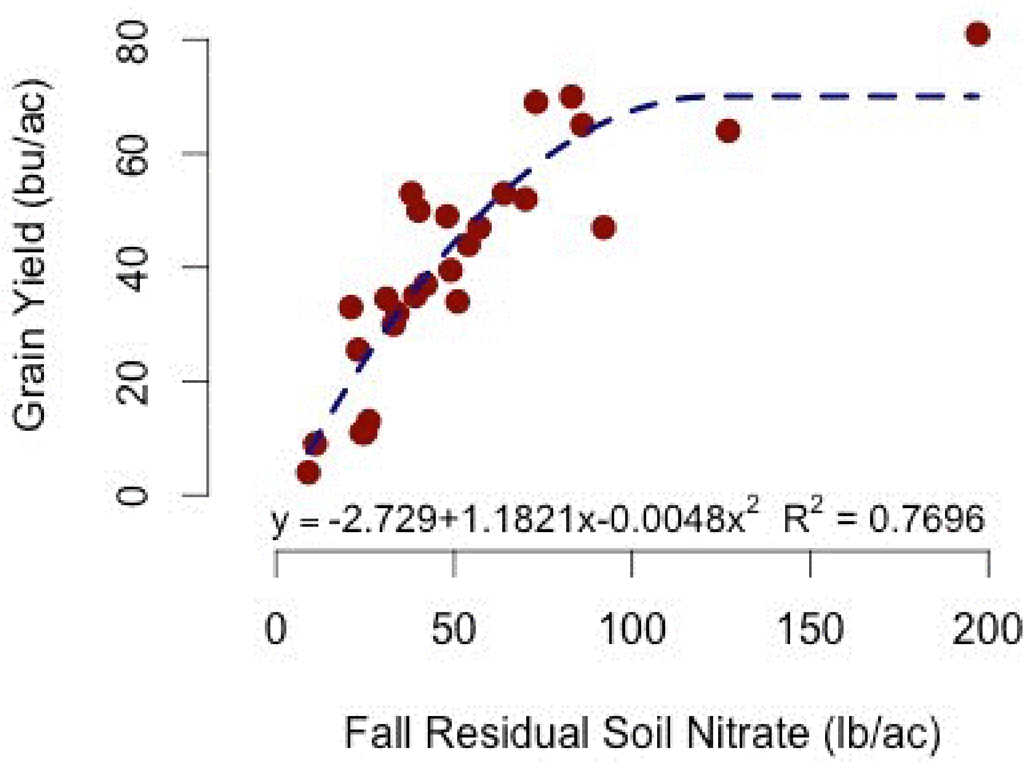

Figure 1. Relationship between fall soil profile nitrate-N level and wheat yield with no N fertilizer applied.

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

In short, a strong relationship was found between wheat yield and fall nitrate-N levels from 24-inch profile soil test analyses when no N fertilizer was applied. Although new practices have been developed to improve N management in winter wheat, soil sampling in the fall for nitrate-N remains an important practice to manage N efficiently and can result in considerable savings for producers.

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

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

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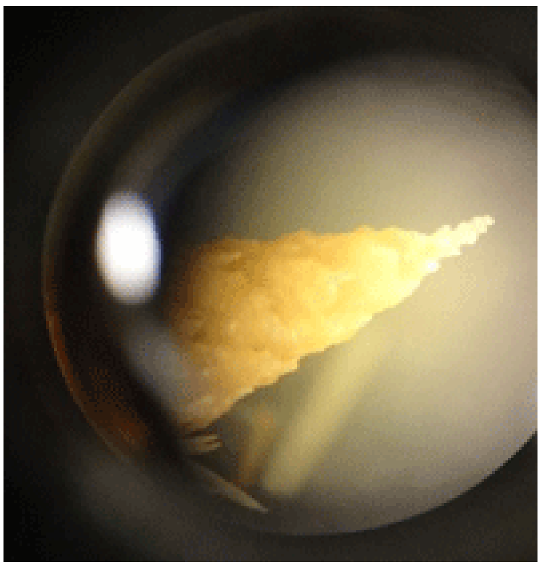
6. Estimating corn yield potential

The corn in many areas of Kansas is currently in the reproductive period. From this point until harvest, farmers and consultants can begin to make reasonable estimates of corn yield potential. If no ear was formed within a week or two after pollination, then that specific corn plant will remain "barren" until the end of the season. In that unfortunate situation, you need to choose whether to harvest it for silage or leave it in place for grazing the residue.

The number of potential kernels per ear can be adversely affected either before silking time (Figures 1 and 2), if no potential ovule develops, or after silking. After silking, kernel numbers are reduced under any or all of the following conditions (Figure 3):

- If the fertilization was not effective (unpollinated ovules).
- If there is abortion of the fertilized ovules.
- If there is abortion of developing kernels (before or at milk stage, R3 stage) (Fig. 4).



Figures 1 and 2. Determination of the potential kernel number in corn ears as seen under a microscope (left) and magnifying glass (right). The tip kernels are the first one to start the abortion process under stress. Photos by Ignacio Ciampitti, K-State Research and Extension.

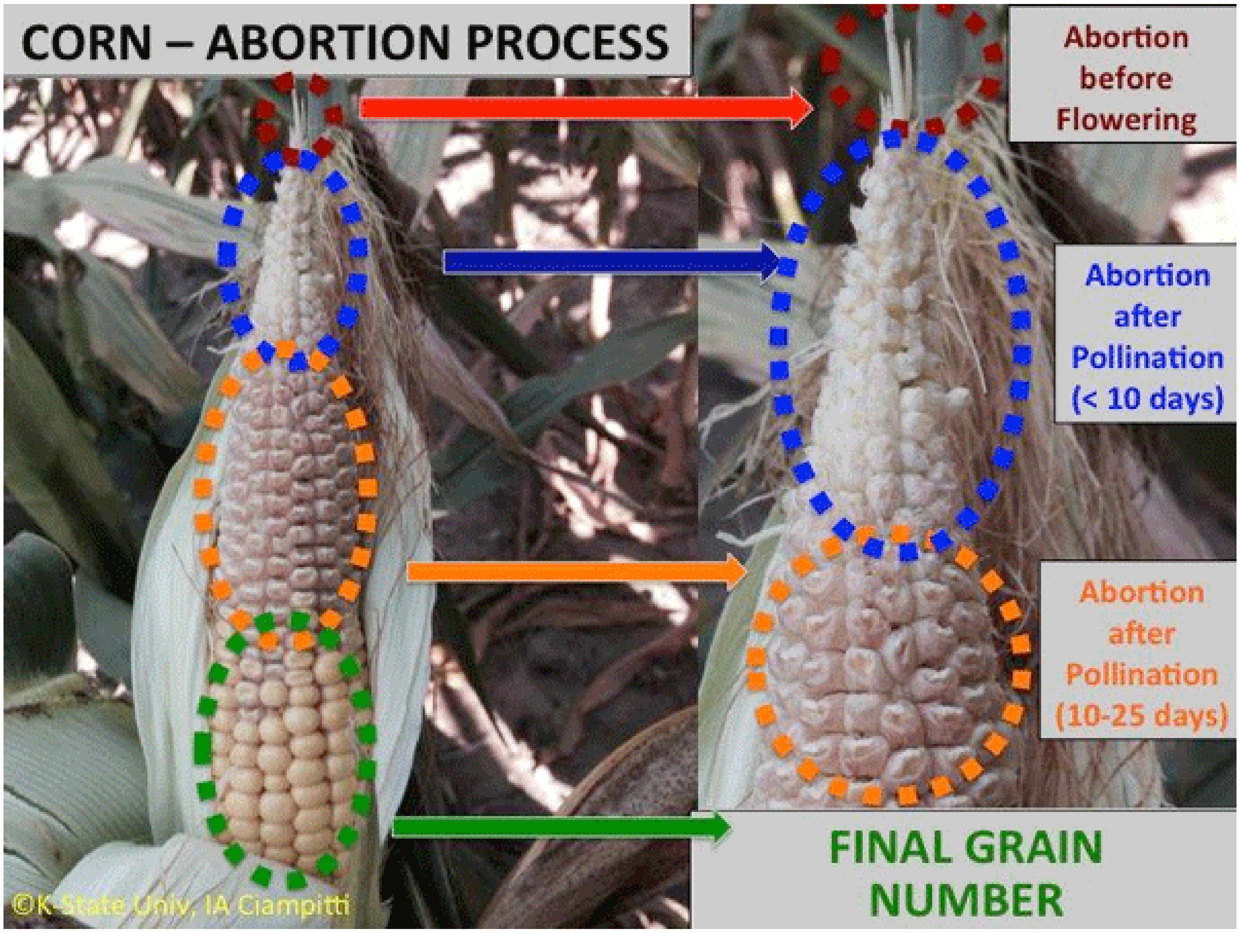


Figure 3. Kernel abortion process and final grain number formation. Photo by Ignacio Ciampitti, K-State Research and Extension.

If ears are present a week or two after silking, producers can get a reasonable yield estimate by the time the corn plants are at the milk or dough stages. Before the milk stage, it is difficult to tell which kernels will develop and which ones will be aborted (Figure 4). The milk stage takes place about 15 to 25 days after flowering, depending on the environmental conditions. We can easily recognize this stage by opening the husk. In the milk stage, a milky white fluid will be evident when the kernels are punctured with a thumbnail (kernel moisture is ~80%) (Figure 5).

Figure 4. Grain abortion at the top of the ear (early abortion) and in the mid-section of the ear (late abortion, brown coloration in right corner picture). Photos by Ignacio Ciampitti, K-State Research and Extension.

Figure 5. Corn at the milk stage (R3 growth stage), a milky white fluid is evident when the kernels are punctured with a thumbnail (kernel moisture is approximately 80%). Photo by Ignacio Ciampitti, K-State Research and Extension.

Farmers can get some estimate of the failure or success of the pollination process by examining several corn ear silks. Pollination is successful when silks turn brown (R2 stage, kernel blister stage) and when they can be easily detached from the ear structure as husks are removed. If the silks remain green and are still attached to the ear after growing several inches in length, pollination has failed (Figure 6). In this situation, the ovules will not be fertilized, and kernels will not develop.

Before estimating corn yields, a few points are noteworthy. Yield estimates are more accurate as the corn is approaching maturity. Also, yield estimates can be accurate as long as the sample areas reflect the "real" variation of corn yield within the field. The precision of the method increases as the number of sample areas increases, properly reflecting the variability within the field. Yield estimations before harvest can: (1) facilitate the decision of harvest timing, (2) estimate the need for additional inputs before maturity, and (3) serve as a scouting tool since the method of yield estimation involves examining diverse areas of the field.

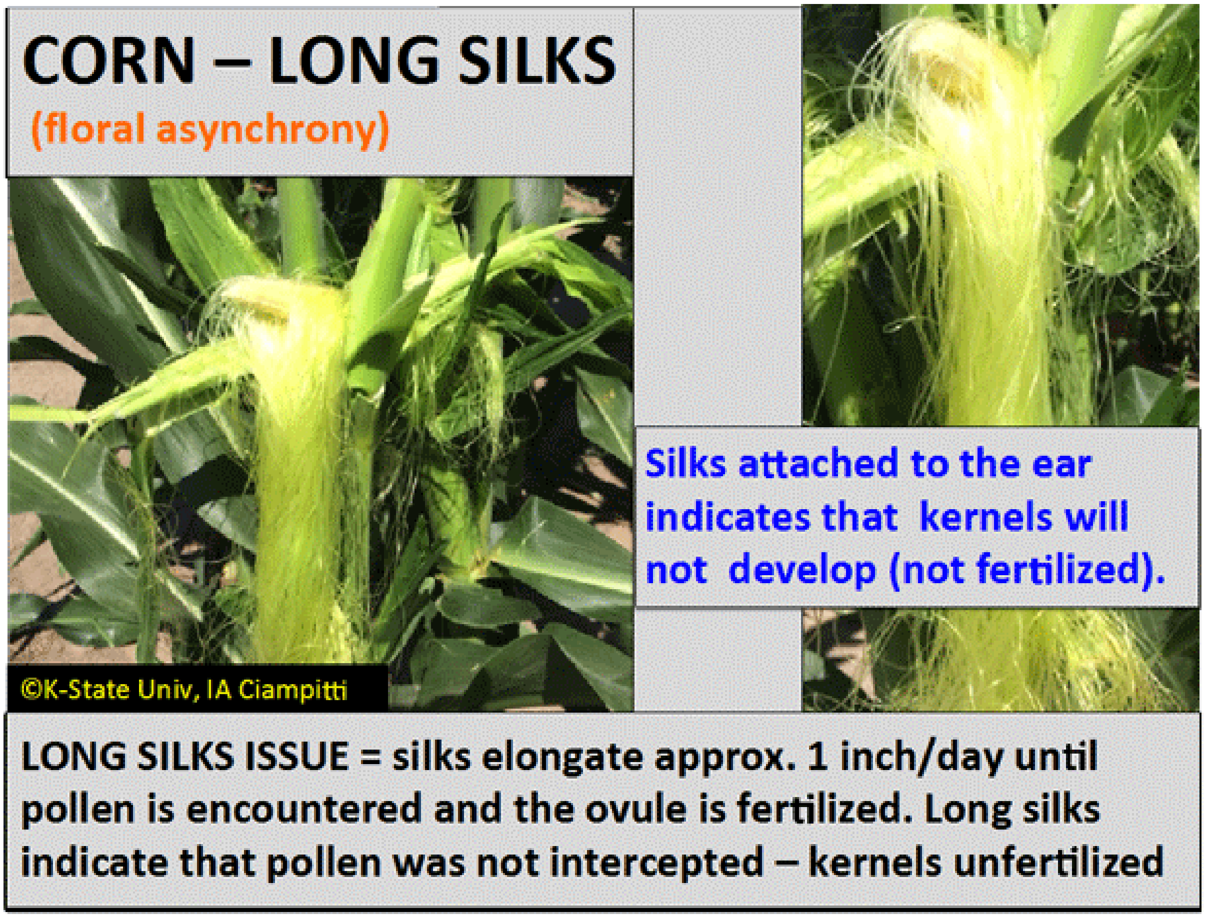


Figure 6. Unpollinated silks have grown in several inches in length. Photos by Ignacio Ciampitti, K-State Research and Extension.

Estimating yields using "yield component method"

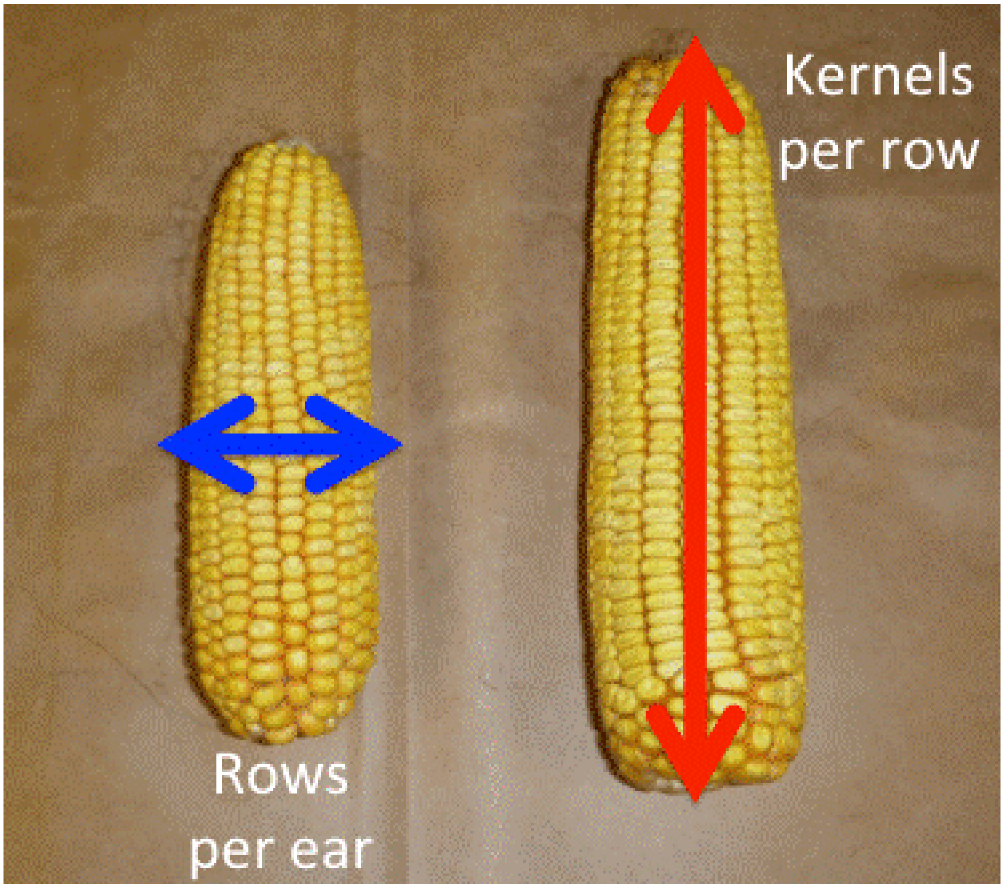
The concept of estimating yields using the "yield component method" has advantages and disadvantages. The primary advantage is that it can be used early in the growing season (milk stage, R3). It involves the assumption that the kernel weight is constant. The method only estimates the "potential" yield because the kernel weight component is still unknown until the crop reaches final maturity (R6 stage).

Estimating potential corn yield with this method uses the following elements:

1) Total number of ears (ears per acre): This is determined by counting the number of ears in a known area (Figure 7). With 30-inch rows, 17.4 feet of row = one-thousandth of an acre. This is probably the minimum area that should be used. The number of ears in 17.4 feet of row x 1,000 = the number of ears per acre. Counting a longer length of row is fine, just be sure to convert it to the correct portion of an acre. Make ear counts in 10 to 15 representative parts of the field or management zone to get a good average estimate which fairly represents the field variation. The more ear counts you make, if they are representative of the rest of the field, the more confidence you have in your yield estimate.

Figure 7. Total number of corn ears per unit area. Photo by Ignacio Ciampitti, K-State Research and Extension.

<u>2) Final kernel number per ear:</u> Count the number of rows within each ear and the number of kernels in each row (Figure 8). The final number of kernels per ear is calculated by multiplying the number of rows by the number of kernels within each row. This is just a quick estimation of the potential yield.



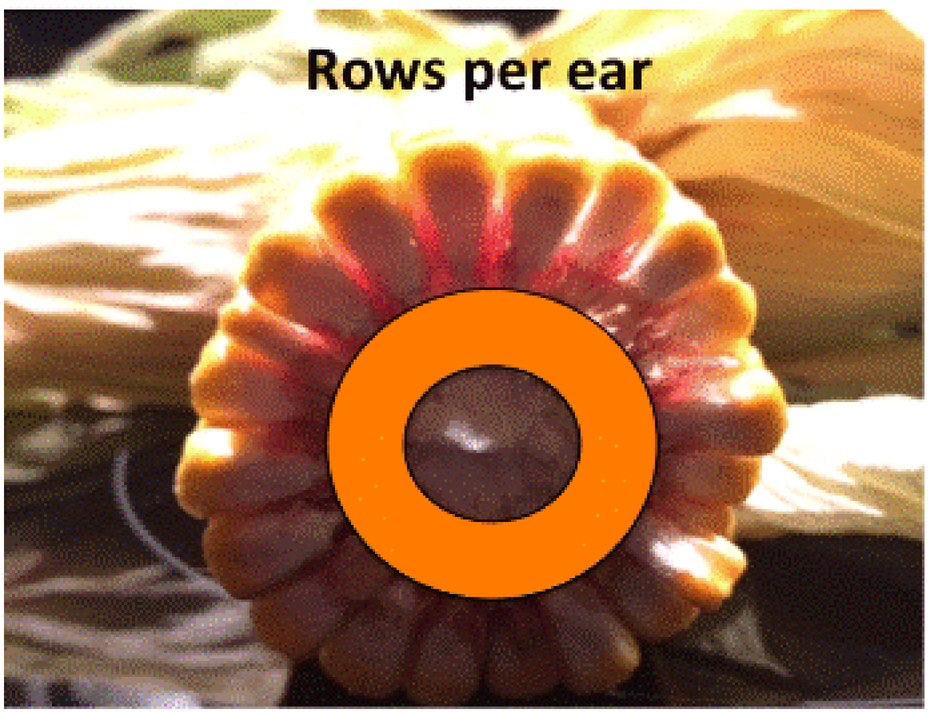


Figure 8. Two different size of ears with similar number of rows (16 rows in total) but different

kernel number per row and kernel sizes (left). The photo at right shows the determination of rows per ear from a vertical position (20 rows in total). The final number of rows per ear is defined earlier in the season than the number of kernels per row, and can be a function of the hybrid and growing conditions. Photos by Ignacio Ciampitti, K-State Research and Extension.

The number of kernels within each row is not standard and can vary from row to row, depending in part on the number of kernels aborted ("abnormal ears"). Do not count aborted kernels or the kernels on the tip of the ear; count only kernels that are in complete rings around the ear. Do this for every 5th or 6th plant in each of your ear count areas. The more you can count, the more precise will be the estimation. Avoid odd, non-representative ears.

Finally the number of kernels per acre is estimated by multiplying the first and second components.

Kernels per acre = Ears per acre x Kernels per ear

Kernels per bushel: This will be more precisely defined at maturity. For this case, common values range from 75,000 to 80,000 for excellent grain filling conditions; 85,000 to 90,000 for average; and 95,000 to 105,000 for poor conditions. The best you can do at this point is estimate a range of potential yields depending on expectations for the rest of the season.

Example:

For corn in 30-inch rows with an average total number of ears in 12 areas of the field (17.4-foot lengths of row) of:

Number of ears = [(25 + 24 + 22 + 21 + 24 + 26 + 20 + 21 + 22 + 20 + 25 + 26)]/12 = **23 (a)**

An average of 23 ears were counted within the 17.4-foot lengths. This can be scaled up to an acre basis by multiplying the number of ears by 1,000 (constant factor if the counts were taken from a 17.4-foot length).

Ears per acre = 23 x 1000 = **23,000 (b)**

From those 23 ears, we will take between 2 and 5 ears to calculate the rows per ear and the kernels per row. The average number of rows was 14 with 27 kernels per row.

Kernel number per ear = 14 rows per ear x 27 kernels per row = **378 (c)**

The final number of kernels per acre is the outcome of the multiplication of (b) ears per acre and (c) kernel number per ear.

Kernels per acre = 23,000 ears per acre x 378 kernels per ear = **8,694,000 (d)**

Kernels per bushel

Under hot, dry conditions, grain filling duration and biomass translocation from the whole plant to the ear (kernels) can be severely affected. Otherwise, a reasonable value to use is about **105,000 kernels per bushel (e)**.

The final number of kernels per bushel is affected by diverse factors such as genotype, management practices (for example, plant density), and the environment. Plant density can strongly affect the kernel weight and the number of kernels per bushel. Lower plant densities (if growing conditions are optimum) will result in lower values for kernel number per bushel. Also, expect a lower kernel number per bushel as N is more deficient. More information regarding the influence of these management practices on the kernel weight and the number of kernels per bushel is available from an article titled "Corn Grain Yield Estimation: The Kernel Weight Factor" from Dr. Tony Vyn, Purdue University, at: http://extension.entm.purdue.edu/pestcrop/2010/issue22/index.html#corn

Final yield: Calculation of bushels per acre

The final calculation of the potential yield to be obtained at the end of the season is simply the outcome of dividing the component (d) by (e).

Bushels per acre = 8,694,000 kernels per acre ÷ 105,000 kernels per bushel = about **83**

In this example, if projected conditions prove to be accurate, the corn should obviously be kept and harvested for grain. From previous experiences, the yield component method of estimating yields often seems to provide optimistic outcomes (slightly overestimation). If the conditions during the reproductive period are predicted to worsen (severe heat stress and lack of precipitation), the kernel weight can be reduced and the number estimated for component (e), kernels per bushel, should be higher. That will reduce the yield expectations.

New technologies for estimating corn yields: App

If you have smartphone or tablet devices, there is a "free" app that can provide assistance in estimating corn yield at on-farm scale. The app, developed by the University of Wisconsin, is named "Crop Calculators for Corn" and can be downloaded at:
https://play.google.com/store/apps/details?id=ipcm.calc.cropmanager

The Crop Calculators app has a section for estimating yields: "Grain Yield Estimator." In that section only four inputs are needed for predicting the final yield: (1) plants per 1000th acre (17.4-feet length of row); (2) rows per ear; (3) kernels per row; and (4) kernel weight, or mass. The last factor refers to the individual kernel weight for corn and it is expressed in mg per kernel. This factor normally varies from 150 to 400 mg per kernel. If conditions will be favorable until harvest, then the "kernel mass" should be higher (e.g., 300 mg per kernel). On the opposite end, unfavorable conditions with a short-grain filling period will produce a lower value (e.g., 180 mg per kernel). This factor will ultimately be defined at maturity, but a projection can be used based on forecasted weather conditions for the remainder of the season.

Links with further discussions on the yield estimation can be found at:

http://corn.osu.edu/newsletters/2010/2010-25/201cpredicting201d-corn-yields-prior-to-harvest
The Ohio State University

http://www.ca.uky.edu/agc/pubs/agr/agr187/agr187.pdf

University of Kentucky

http://www.agry.purdue.edu/ext/corn/news/timeless/yldestmethod.html
Purdue University

http://corn.agronomy.wisc.edu/AA/pdfs/A033.pdf
University of Wisconsin

Further details on corn growth and development can be found at:
http://www.bookstore.ksre.ksu.edu/pubs/MF3305.pdf

Ignacio Ciampitti, Cropping Systems and Crop Production Specialist
ciampitti@ksu.edu

7. 2017 Kansas Performance Tests with Winter Wheat Varieties report now online

The *2017 Kansas Performance Tests with Winter Wheat Varieties* report is now online. In this report, you will find a recap of the 2016-17 wheat crop, with a detailed discussion of factors that may have played an important role in the record-breaking yields observed across the state. More importantly, the results of the 2017 wheat variety performance tests are also shown.

Producers and crop consultants can use this resource to help select wheat varieties for their operation by checking for varieties that show a consistently good performance in their region.

Click here to access the online version of the variety performance test results.

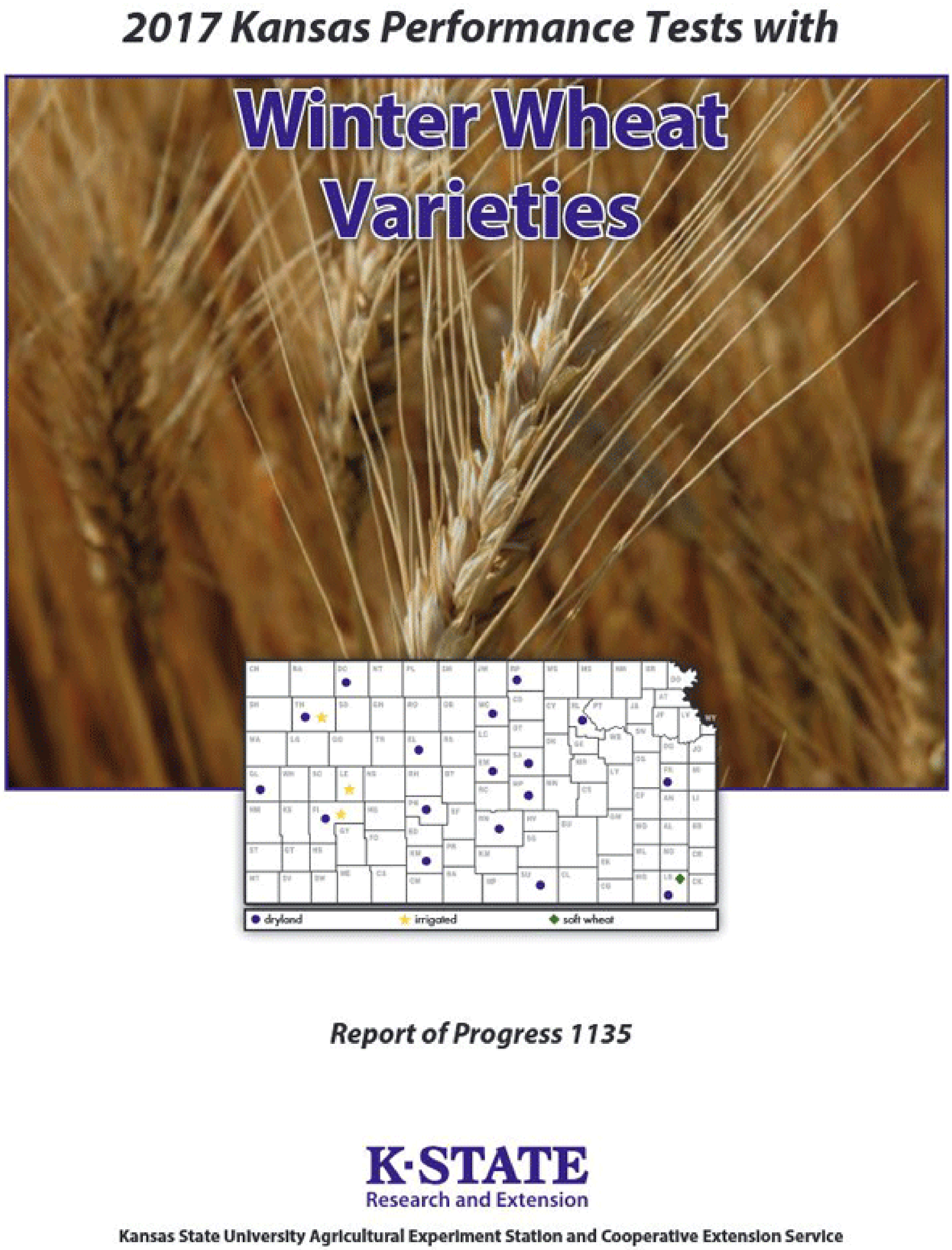


Figure 1. The 2017 Kansas Performance Tests with Winter Wheat Varieties **report is now online.**

8. Yield Monitor Workshop, August 14

A Yield Monitor Workshop will be held August 14 at K-State's Machinery Automation and Robotics Lab, 142 Seaton Hall. The school will run from 9 a.m. until 2 p.m.

Speakers include:

Jared Ochs, Topcon Precision Agriculture
Justin Atwood, LandMark Implements
Lucas Haag, K-State Northwest Area Crops and Soils Specialist
Terry Griffin, K-State Dept. of Agricultural Economics
Ignacio Ciampitti, K-State Crop Production and Cropping Systems Specialist
Ajay Sharda, K-State Dept. of Biological and Agricultural Engineering
K-State Research and Extension Precision Ag team

Topics include:

Yield monitor calibration for quality data
Yield data cleaning
New yield monitoring technologies
Yield monitor setup and data extract for FMIS/Analysis
Utilizing yield data for input prescription
Utilizing satellite imagery for yield prediction

Registration is free for members of Kansas Ag Research and Technology Association (KARTA) and for K-State Extension agents; and is $25 for all others. Lunch and refreshments are provided.

For more information or to register, contact one of the following:

Ajay Sharda, Biological and Agricultural Engineering, asharda@ksu.edu
Arlene Jacobson, 785-532-5825, ajacobso@ksu.edu

Yield Monitor School

August 14th, 2017

Machinery Automation And Robotics Lab

142 Seaton Hall, Biological and Agricultural Engineering

Kansas State University

9:00 AM – 2:00 PM

K-STATE PRECISION AG   KARTA   K-STATE Research and Extension

9. North Central Kansas Experiment Fields fall field day, August 15

The North Central Kansas Experiment Fields fall field day will be held Tuesday, August 15 at the Courtland field located at 1300 60 Rd., Courtland. The field day will start at 6 p.m. sharp.

Field day topics and speakers:

- Intensive Corn and Soybean Management: Lessons Learned in the Last Four Years – Guillermo Balboa, Graduate Research Assistant, K-State Agronomy
- Advancements in Drone Technology for Nitrogen Management in Corn – Ray Asebedo, K-State Precision Agriculture Agronomist
- Using Soil Moisture Information to Delineate Field Management Zones – Andres Patrignani, K-State Soil Water Processes Agronomist
- Lateral Move VRI – Paul Meyer, Reinke Manufacturing Co., Inc.

A catered meal, compliments of K-State Research and Extension and Kansas Corn, will follow the presentations. For more information, call the North Central Experiment Field office at 785-335-2836.

K·STATE
Research and Extension

KSU NCK Experiment Field
Fall Field Day

August 15, 2017
KSU Experiment Field Office Location
1300 60 Rd., Courtland, KS
6:00 P.M. Sharp

Tour Topics:

-Intensive Corn and Soybean Management: Lessons Learned in the Last 4 Years
Guillermo Balboa, Graduate Research Assistant K-State

-Advancements in Drone Technology for Nitrogen Management in Corn
Dr. Antonio "Ray" Asebedo, Precision Ag Professor K-State

-Using Soil Moisture Information to Delineate Field Management Zones
Dr. Andres Patrignani, Soil Water Processes Professor K-State

-Lateral Move VRI - *Paul Meyer, Reinke Manufacturing Co., Inc.*

Free Event

No registration required
Catered Dinner to Follow Program
Questions Call: 785-335-2836
Andrew Esser, Agronomist-in-Charge

Meeting sponsored by: K·STATE Research and Extension KANSAS CORN

10. East Central Experiment Field fall field day, August 16

The East Central Experiment Field in Ottawa will host its fall field day on Wednesday, August 16. The field day begins at 9 a.m. with registration, coffee and doughnuts, and the program starts at 9:30 a.m. A complimentary lunch will be served.

Field day topics and K-State presenters include:

- Increasing the Rate of Genetic Gain for Yield in Soybean Breeding Programs – Bill Schapaugh, Soybean Breeder
- When Corn Fungicides Are a Good Investment – Eric Adee, Agronomist-in-Charge, East Central Research Field and Kansas River Valley Research Field
- Row Crop Management Strategies – Ignacio Ciampitti, Crop Production and Cropping Systems Specialist
- New Research on Pigweed Control – Marshall Hay and Nate Thompson, Graduate Students

From I-35 at the Ottawa exit, the East Central Experiment Field is south 1.7 miles on Kansas Highway 59, then east 1 mile, and south 0.75 mile.

More information, including Certified Crop Advisor Credits, is available by contacting the East Central Experiment Field at 785-242-5616.

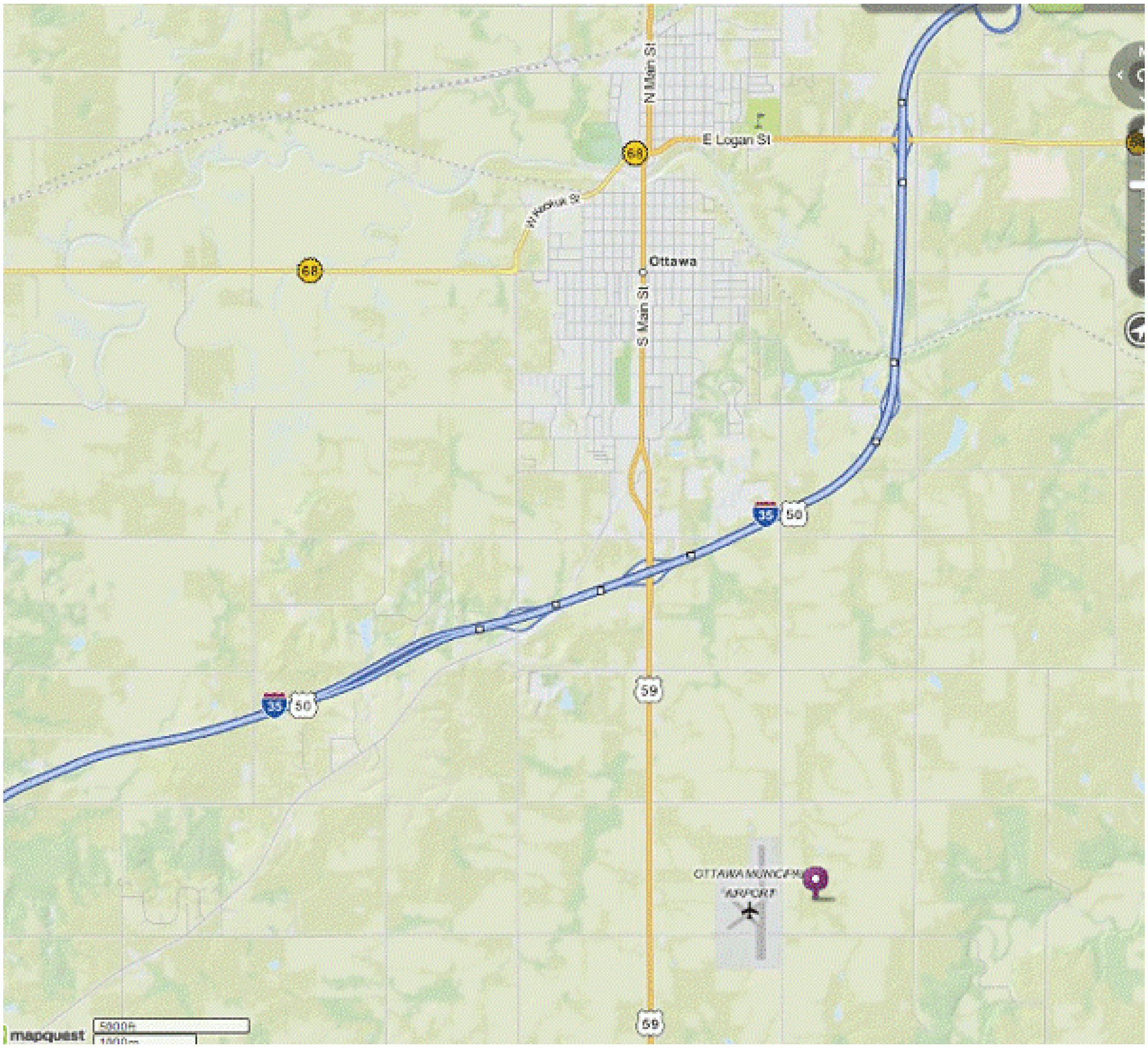


Figure 1. Location of East Central Experiment Field, south of Ottawa.

11. KLA & KSU Ranch Management Field Day, August 17

The Kansas Livestock Association and K-State Research and Extension will hold a Ranch Management Field Day on Thursday, August 17 at the Black Diamond Angus Ranch (also known as the Warner Angus Ranch) near Spearville.

Registration begins at 3:30 p.m., followed by a welcome and introductions at 4 p.m. Education sessions begin at 4:30 p.m. Dinner will be served at 6:45 p.m., sponsored by Farm Credit Associations of Kansas and Bayer.

Topics at the education sessions include:

Will Annual Forage Crops Work with Dryland Farming the High Plains? – John Holman, Cropping Systems Agronomist, K-State Southwest Research-Extension Center, Garden City

Do High Protein Forages Negatively Impact Fertility? – Sandy Johnson, Reproductive Physiologist, K-State Northwest Research-Extension Center

Opportunities for Enhancing Stock Water and Grassland Health – Brad Shank, Supervisory District Conservationist, USDA-NRCS, Jetmore

The Latest on Fly and Tick Control for Beef Cattle Operations – Justin Talley, Oklahoma State University Entomologist

Field day attendees will have an opportunity to learn about Morgan horses and see a sample of the ranch's horses that represent a legendary breeding program of more than 60 years.

Directions:

From Jetmore – Go south on Highway 283 approximately 12 miles to SE A Road. At this intersection, go east on SE A Road for 2 miles, then ¾ mile south on 120 Road to ranch headquarters.

From Hwy 283 and Hwy 50 intersection near Wright – Go north on Highway 283 for 9.2 miles to SE A Road. At this intersection, go east on SE A Road for 2 miles, then ¾ mile south on 120 Road to ranch headquarters.

For more information, contact the KLA at 785-273-5115 or email wendy@kla.org

12. Agricultural Research Center-Hays field day, August 23

Row crops, including the latest research into crop selection, tillage and pest management, will take center stage at the Agricultural Research Center's Row Crop Roundup Fall Field Day in Hays Aug. 23.

The day starts with registration at 9 a.m. with the program beginning at 9:30 a.m. The Center is at 1232 240th Ave. in Hays. A complimentary lunch will be served.

Field tours include:

- Occasional Tillage in Long-Term No-Till
- Management of Sugarcane Aphid in Sorghum

Indoor presentations include:

- Sorghum Early Planting: Perspectives and Challenges
- Managing Palmer Amaranth in Corn and Sorghum
- Crop Selection Considerations in West Central Kansas
- Sorghum vs. Corn vs. Soybean: Economic Returns in a Challenging Market
- Selection of Wheat Varieties: Lessons from the 2017 Harvest

K-State speakers include:

- Augustine Obour, Soil Scientist, Agricultural Research Center-Hays
- JP Michaud, Entomologist, Agricultural Research Center-Hays
- Ram Perumal, Sorghum Breeder, Agricultural Research Center-Hays
- Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist
- Dallas Peterson, Weed Management Specialist
- Lucas Haag, Northwest Area Crops and Soils Specialist
- Dan O'Brien, Northwest Area Agricultural Economist
- Romulo Lollato, Wheat and Forages Specialist

More information is available at www.hays.k-state.edu or by calling 785-625-3425.

13. Southwest Research-Extension Center field day, August 24

The Southwest Research-Extension Center hosts its annual fall field day on Thursday, Aug. 24 at 4500 E. Mary St. in Garden City.

The field day includes field tours, seminars, and commercial exhibitor displays, plus a sponsored lunch. Registration begins at 8 a.m. with the program starting at 9:15 a.m.

One credit hour and one core hour will be available for commercial pesticide applicator licensing.

Field tour and seminar topics include:

- Corn and Sorghum Insect Control Update
- Weed Control in Irrigated Corn
- Weed Control in Dryland Sorghum
- The Effect of Humic Products on Sorghum Yield and Nitrogen Use Efficiency
- Integrating Cover Crops and Annual Forages into Wheat-Sorghum-Fallow Cropping Systems
- Wheat Health Management
- Core Hour for Commercial Pesticide License

More information is available by contacting Randall Currie at rscurrie@ksu.edu or by calling the center at 620-276-8286.

14. Comparative Vegetation Condition Report: August 1 - 7

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 27-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:

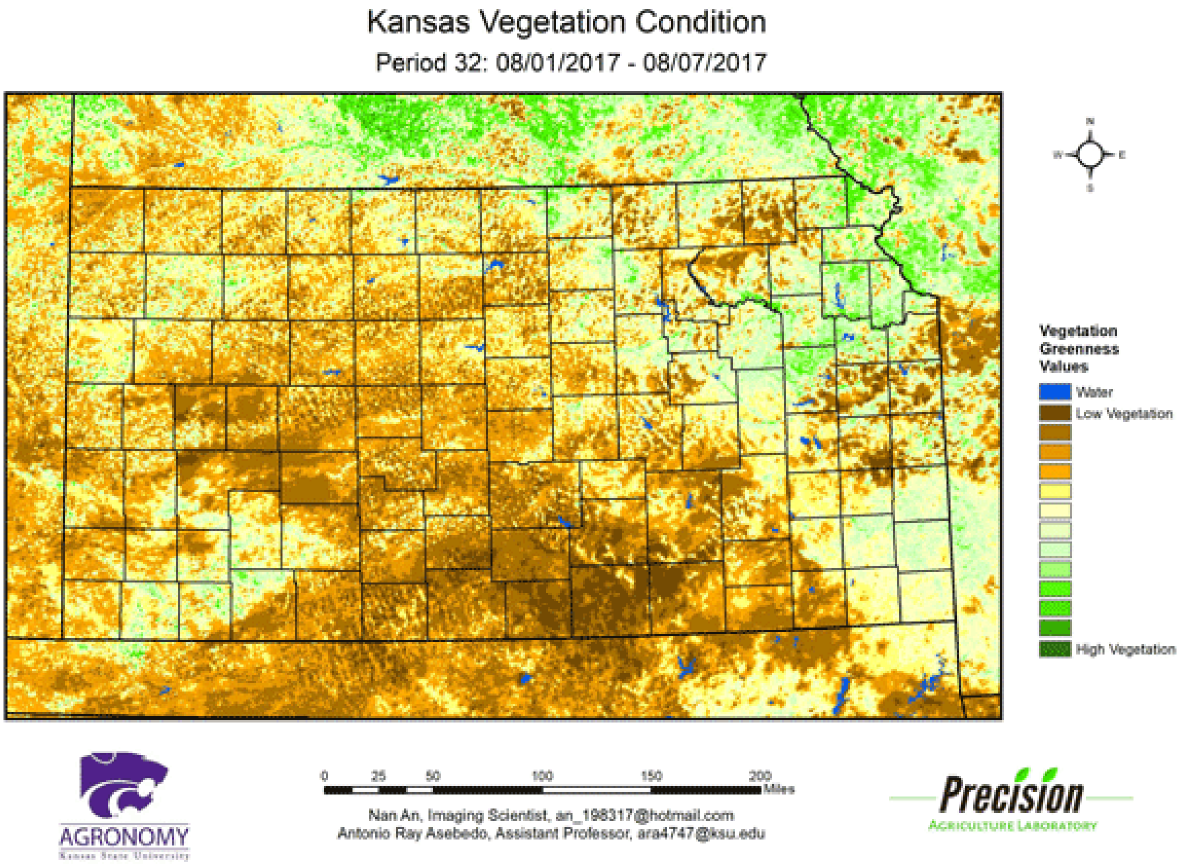


Figure 1. The Vegetation Condition Report for Kansas for August 1 – August 7, 2017 from K-State's Precision Agriculture Laboratory shows the greatest vegetative activity continues to be in eastern Kansas, particularly in extreme northeast Kansas. Warm weather has slowed vegetative activity in the west, but a pocket of increased activity is visible in southwestern Kansas, particularly south of Garden City, where heavier showers occurred.

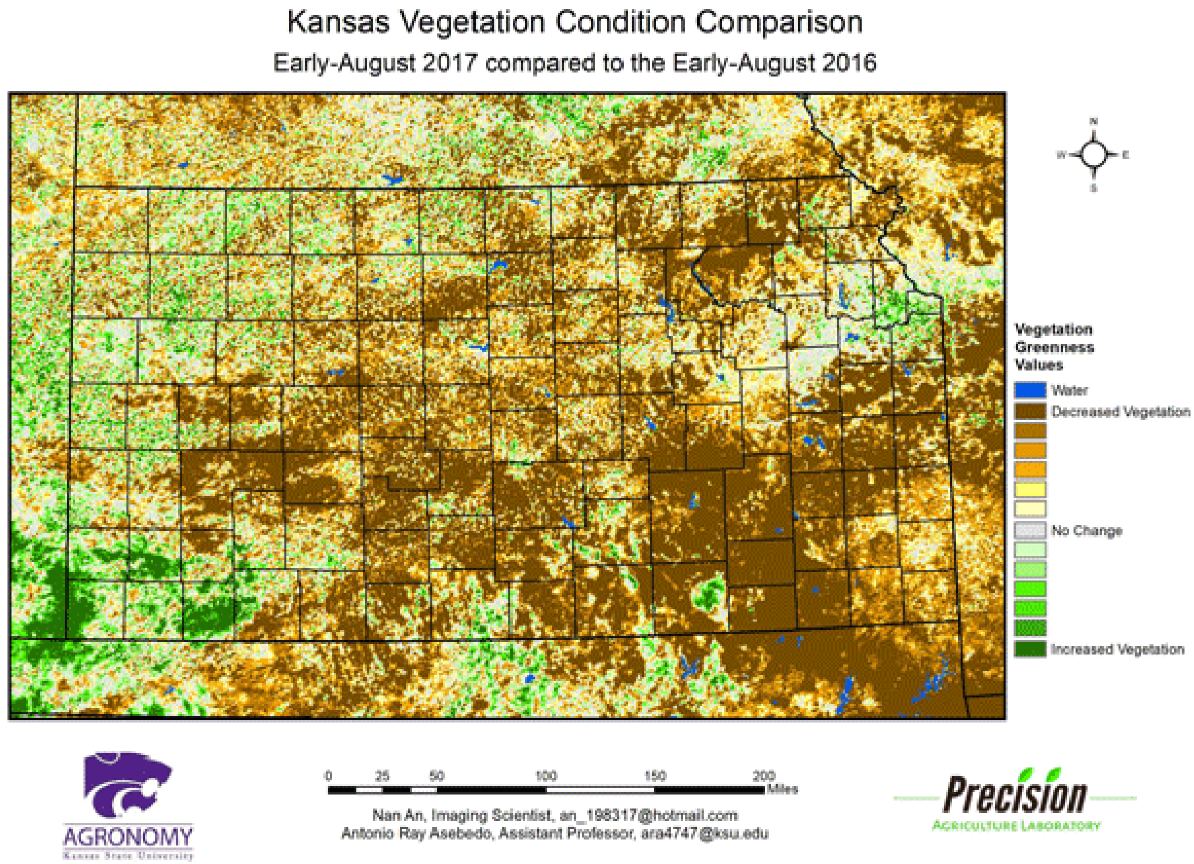


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for August 1 – August 7, 2017 from K-State's Precision Agriculture Laboratory shows the greatest change in vegetative activity is in the southwest, where rainfall has been more consistent this year. In contrast, much of the eastern half of the state has lower vegetative activity. This summer has been hotter and much drier than last in this area.

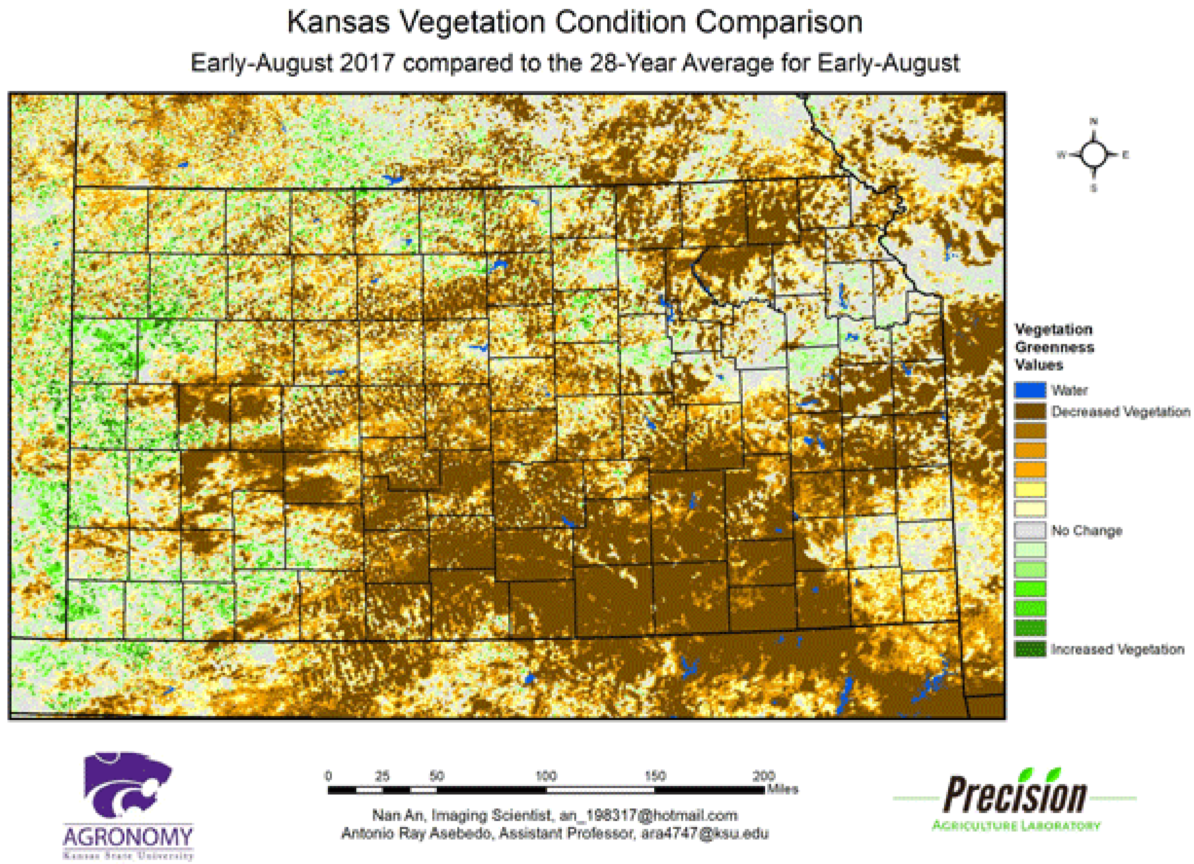


Figure 3. Compared to the 28-year average at this time for Kansas, this year's Vegetation Condition Report for August 1 – August 7, 2017 from K-State's Precision Agriculture Laboratory above average activity in the western parts of the state. Wetter-than-normal conditions have favored parts of the west, particularly Wallace County. Meanwhile continued hot, dry weather has stressed vegetation in the central parts of the state.

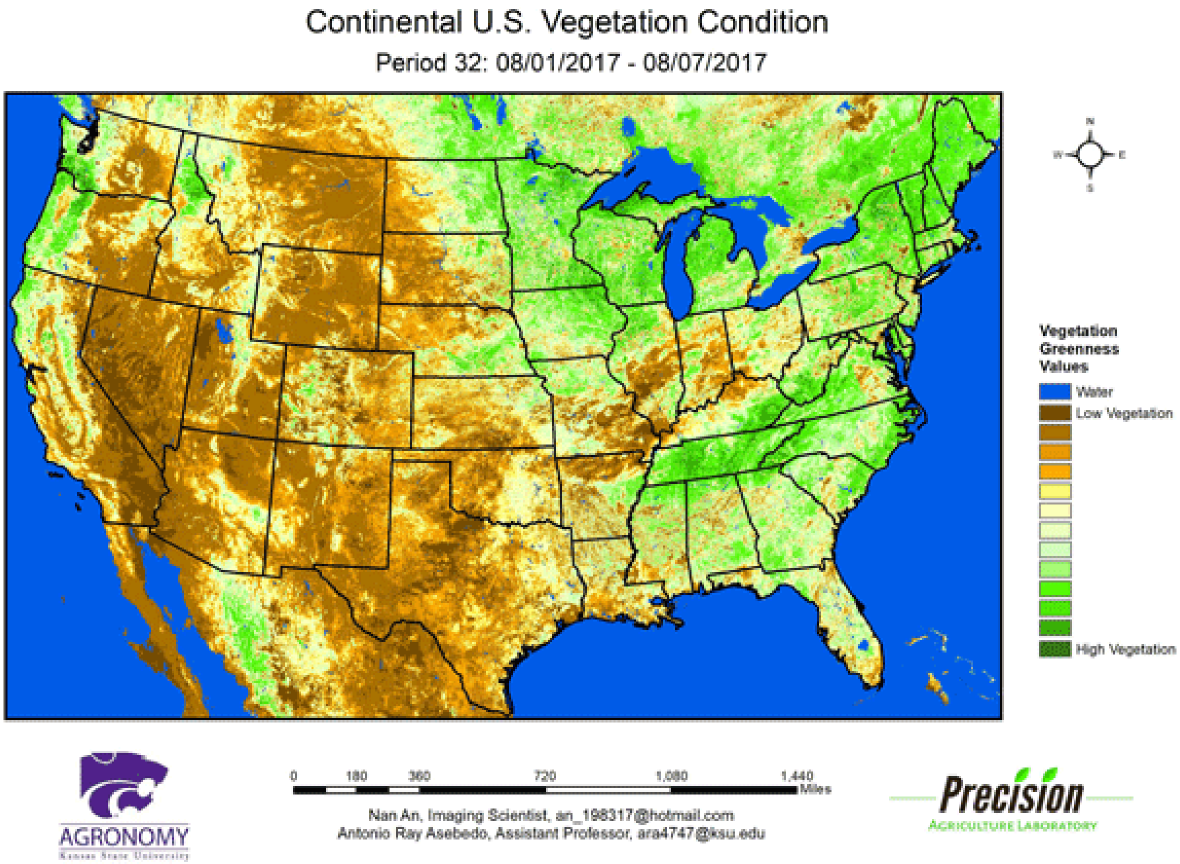


Figure 4. The Vegetation Condition Report for the U.S for August 1 – August 7, 2017 from K-State's Precision Agriculture Laboratory shows the area of highest NDVI is centered in the Midwest, particularly in Tennessee and parts of Kentucky. A second area of higher vegetative activity is also visible along 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.

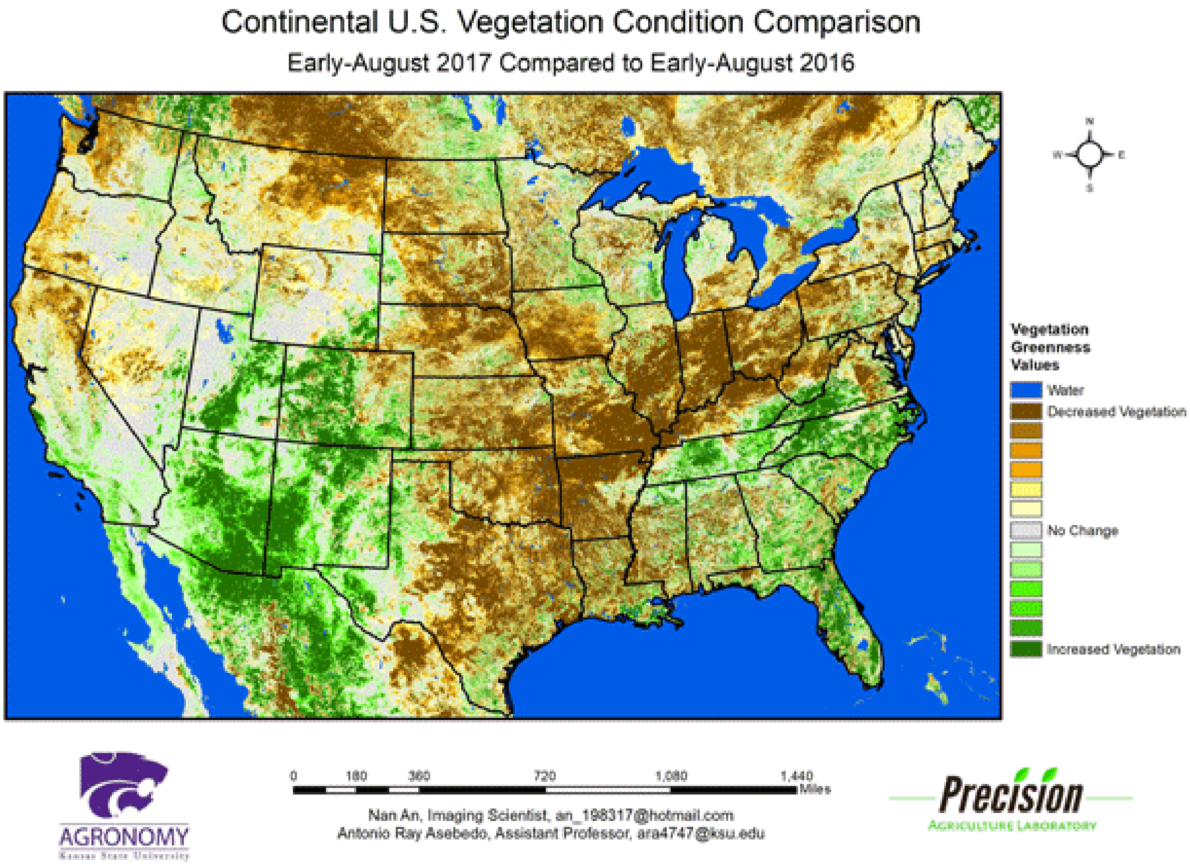


Figure 5. The U.S. comparison to last year at this time for August 1 – August 7, 2017, 2017 from K-State's Precision Agriculture Laboratory again shows the impact that the split in moisture has caused this year. Much lower NDVI values are visible from eastern Montana through the Dakotas and into the Oklahoma Panhandle. In contrast, the desert Southwest has much higher NDVI values than last year at this time.

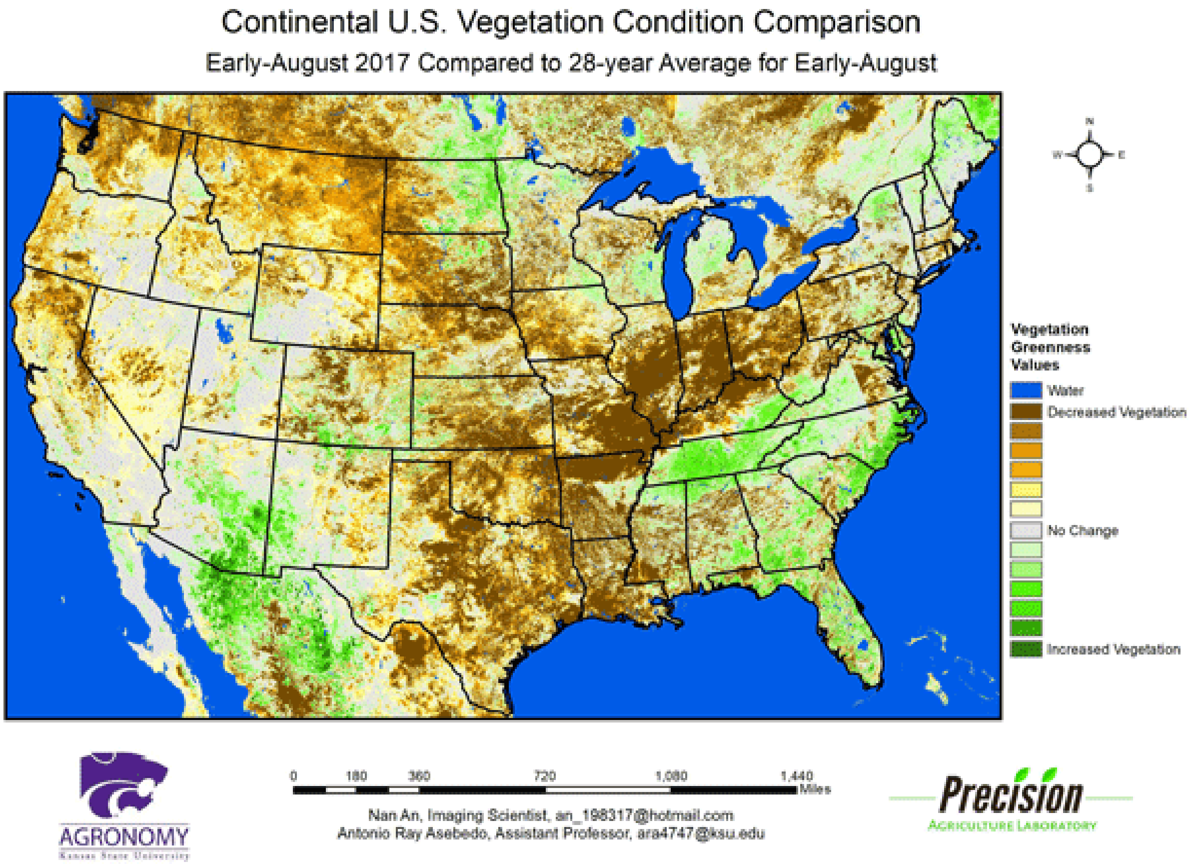


Figure 6. The U.S. comparison to the 28-year average for the period of August 1 – August 7, 2017 from K-State's Precision Agriculture Laboratory shows the drought impacts in the Northern Plains are visible as below-average NDVI values. In Colorado, parts of Idaho and the Sierra Nevada of California, the below-average NDVI values are due to monsoon moisture. Parts of the area have been under flood advisories most of the week.

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Nan An, Imaging Scientist
an_198317@hotmail.com