



K-STATE
Research and Extension

Extension Agronomy

eUpdate

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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. Long-time soil fertility specialist and former agronomy head to retire in June



Dave Mengel

Dave Mengel, former head of the agronomy department and long-time extension soil fertility specialist and eUpdate contributor, will retire in June. Mengel was hired as head of the agronomy department in 1998 and served in that position until late 2005. Since stepping down as head, he has served as professor and extension soil fertility specialist at K-State. Previously, Mengel was professor of agronomy at Purdue University.

A retirement reception will be held for Mengel on Friday, June 3, from 3 to 6 p.m. at the IGP Institute Conference Center on the north side of Kimball Ave. in Manhattan. There will be a short program about 4 p.m.

"All are welcome to come celebrate the career of this dedicated teacher, researcher, and communicator," said Gary Pierzynski, head of the K-State agronomy department and university distinguished professor of agronomy.

"I would encourage anyone who would like to submit a letter regarding Dr. Mengel and his tenure in agronomy to send it to me by June 1," he said.

Letters for Mengel's retirement reception can be submitted to Pierzynski at gmp@ksu.edu. For more information, contact the main agronomy office at 785-532-6101.

Mengel said the highlight of his career has been serving as a mentor to undergraduate and graduate students and young faculty members, and watching them succeed in their chosen careers.

"My greatest achievement and honor has been to have worked with so many talented young people over my career, both as a professor and department head -- and hopefully to have helped them develop their careers in agronomy," Mengel said. "It has been with a great sense of pride that I've seen them grow and succeed in their careers."

Mengel has also been active in conducting research on soil fertility issues throughout Kansas, and

has been a familiar face at many extension meetings around the state.

His many connections with producers, crop advisors and students have been a source of pleasure over the years, he said.

“I’ve learned more from our producers in Kansas and my students than they have ever learned from me,” he said. “These experiences will stay with me for the rest of my life.”

He plans to remain active on his farm in Riley County after he retires. He raises wheat, soybeans, grain sorghum and cattle, and especially enjoys his flock of sheep. He also plans to enjoy spending more time with his wife and family.

Those who cannot make it to Mengel’s retirement reception in Manhattan on June 3 are welcome to call him at 785-532-2166 or email him at dmengel@ksu.edu.

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2. Is there any value to starter fertilizer on soybeans?

Soybean is a crop that can remove significant amounts of nutrients per bushel of grain harvested. Because of this, soybeans can respond to starter fertilizer applications on low-testing soils, particularly phosphorus.

In many cases, corn shows a greater response to starter fertilizer than soybean. Part of the reason for that is that soils are generally warmer when soybeans are planted than when corn is planted. The typical response in early growth observed in corn is usually not observed in soybeans. However, yield response to direct soybean fertilization with phosphorus and other nutrients can be expected in low-testing soils.

K-State guidelines for soybeans include taking a soil test for phosphorus (P), potassium (K), sulfur (S), zinc (Zn), and boron (B). If fertilizer is recommended by soil test results, then fertilizer should either be applied directly to the soybeans or indirectly by increasing fertilizer rates to another crop in the rotation by the amount needed for the soybeans.

The most consistent response to starter fertilizer with soybeans would be on soils very deficient in one of the nutrients listed above, or in very high-yield-potential situations where soils have low or medium fertility levels. Furthermore, starter fertilizer in soybeans can be a good way to complement nutrients that may have been removed by high-yielding crops in the rotation, such as corn and help maintain optimum soil test levels.

Banding fertilizer to the side and below the seed at planting is an efficient application method for soybeans. This method is especially useful in reduced-till or no-till soybeans because P and K have only limited mobility into the soil from surface broadcast applications.

However, with narrow row soybeans, it may not be possible to install fertilizer units for deep banding. In that situation, producers can surface-apply the fertilizer. Fertilizer should not be placed in-furrow in direct seed contact with soybeans because the seed is very sensitive to salt injury.

Soybean seldom responds to nitrogen (N) in the starter fertilizer. However, some research under irrigated, high-yield environments suggests a potential benefit of small amounts of N in starter fertilizer.



Figure 1. Visual differences with starter P fertilizer on low testing soils. Picture by Nathan Mueller, former K-State Agronomy graduate student and current University of Nebraska Cropping Systems / Ag Technology Educator.

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3. Double crop options after wheat

Double cropping after wheat can be a high-risk venture. The available growing season is relatively short. Heat and/or dry conditions in July and August may cause problems with germination, emergence, seed set, or grain fill. Still, the good soil moisture conditions so far this year improve the odds of success.

The most common double crop options are soybean, sorghum, and sunflower. Other possibilities include summer annual forages and specialized crops such as proso millet or other short-season summer crops – even corn. Cover crops are also an option for planting after wheat.

One major consideration before deciding to plant a double crop or cover crop after wheat is the potential for herbicide carryover. Cover crops can be challenging in this regard. There is little or no mention of rotational restrictions for specific cover crops on the labels of most herbicides. If a crop isn't listed on the label, that doesn't mean there are no restrictions. Generally, there are statements on most labels that indicate "no other crops" should be planted for a specified amount of time, or that a bioassay must be conducted prior to planting the crop. Most of the brassica, or mustard type, crops are likely to be very susceptible to residues of the sulfonylurea herbicides.

Management considerations, production costs, and yield expectations for several double crop options are discussed below.

Soybean

Soybeans are probably the most commonly used crop for double cropping, especially in central and eastern Kansas. With glyphosate-resistant varieties, often the only production cost for planting double crop soybeans in recent years has been the seed, an application of glyphosate, and the fuel and equipment costs associated with planting and harvesting. However, with the development of glyphosate-resistant weeds, additional herbicides may be required to achieve acceptable control and minimize the risk of further development of resistant weeds.

The cost for weed control can't really be counted against the soybeans, however, since that cost should occur whether or not a soybean crop is present. In fact, having beans on the field may even reduce herbicide costs compared to leaving the field fallow. Still, it is highly recommended to apply a pre-emergence residual herbicide before soybeans are planted especially if weed resistance to glyphosate has been a problem. Later in the summer, a healthy soybean canopy may suppress weeds enough that a late-summer burndown application may be avoided.

Variety selection for double cropping is important. Soybeans flower in response to a combination of temperature and daylength, so shifting to an earlier-maturing variety when planting late in a double crop situation will result in very short plants with pods that are close to the ground. Planting a variety with the same or perhaps even slightly later maturity rating (compared to soybeans planted at a typical planting date) will allow the plant to develop a larger canopy before flowering. Planting a variety that is too much later in maturity, however, increases the risk that the beans may not mature before frost, especially if long periods of drought slow growth. The goal is to maximize the length of the growing season of the crop, so prompt planting after wheat harvest time is critical. The earlier you can plant, the higher the yield potential of the crop if moisture is not a limiting factor.

Adding some nitrogen (N) to double crop soybeans may be beneficial if the previous wheat yield was high and depleted soil N. A soil test before wheat harvest for N levels is recommended. Use no more than 30 lbs/acre of N. It would be ideal to knife-in the N. If that's not possible, banding it on the soil surface would be acceptable. Do not apply N in the furrow with soybean seed as severe stand loss can occur.

Recommended seeding rates for double crop soybeans are no different than for soybeans planted at a typical planting date in a given area or cropping system. Still, seeding rate can be slightly increased if soybeans are planting too late, in order to increase canopy development. Narrow row spacing (15-inch or less) has often resulted in a yield advantage compared to 30-inch rows in late plantings. Soybeans planted in narrow rows will canopy over more quickly than in wide rows, which is important when the length of the growing season is shortened. Narrow rows also offer the benefits of increasing early-season light capture, suppressing weed control and reducing erosion. On the other hand, the advantage of planting in wide rows is that the bottom pods will usually be slightly higher off the soil surface to aid harvest. The other consideration is planting equipment. Often no-till planters will handle wheat residue better and place seeds more precisely than drills, although the difference has narrowed in recent years.

What are typical yield expectations for double crop soybeans? It varies considerably depending on moisture and temperature, but yields are usually several bushels less than full-season soybeans. A long-term average of 20 bushels per acre is often mentioned when discussing double crop soybeans in central and northeast Kansas. Rainfall amount and distribution can cause a wide variation in yields from year to year. Double crop soybean yields typically are much better as you move farther southeast in Kansas, often ranging from 20 to 40 bushels per acre.

Sorghum

Sorghum is another double crop option. Unlike soybeans, sorghum hybrids for double cropping should be earlier maturing. Sorghum development is primarily driven by accumulation of heat units and the double crop growing season is too short to allow medium-late or late hybrids to mature before frost in most of Kansas.

Late-planted sorghum will likely not tiller as much as early plantings and can benefit from slightly higher seeding rates than would be used for sorghum planted at an earlier date. Narrow row spacing is advised, especially if the outlook for rainfall is good.

A key component for estimation of N application rates is the yield potential. This will largely determine the N needs. It is also important to consider potential residual N from the wheat crop. This can be particularly important when wheat yields are lower than expected. In that situation, additional available N may be present in the soil.

Double crop sorghum planted into average or greater-than-average amounts of wheat residue can result in a challenging amount of residue to deal with when planting next year's crop. Nitrogen fertilizer can be tied up by wheat residue, so use application methods to minimize tie-up, such as knifing into the soil below the residue.

Weed control can be important in double crop sorghum. Warm-season annual grasses such as crabgrass can reduce double crop sorghum yields. Using a chloracetamide-and-atrazine preemergence product may be key to successful double crop sorghum production.

No-till sorghum studies at Hesston documented 4-year average double crop sorghum yields of 75 bushels per acre compared to about 90 bushels per acre for full-season sorghum. A different 10-year study that did not have double crop planting but did compare early and late planting dates averaged 73 bushels per acre for May planting vs. 68 bushels per acre for June planting.

Sunflowers

Sunflowers can be a successful double crop option anywhere in the state, provided there is enough moisture at planting time to get a stand. Sunflowers need more moisture than any other crop to germinate and emerge, so the biggest hurdle to sunflower production is getting a successful stand. Once that hurdle is overcome, sunflowers are more drought-tolerant than most crops so the chances of having a yield in any kind of environment are good.

When double cropping sunflowers, producers should use slightly lower seeding rates to reflect the lower yield expectations compared to full-season sunflowers. It is also necessary to use shorter-season hybrids so they bloom and mature before frost.

Weed control can be an issue with double crop sunflowers since herbicide options are limited, especially postemergence. Thus, controlling weeds prior to sunflower planting is critical and may be complicated by the presence of glyphosate-resistant weeds and preplant restrictions with other herbicides. Consequently, double crop sunflowers may be most successful where glyphosate-resistant weeds are not present. Planting Clearfield or Express Sun sunflowers will provide additional postemergence herbicide options, but ALS-resistant kochia and pigweeds still could not be controlled. Beyond, the product used in Clearfield sunflower, does have activity on annual grasses as well as broadleaves (except for ALS-resistant biotypes).

Summer annual forages

With mid-July plantings, and where herbicide carryover issues are not a concern, summer annual sorghum-type forages are also a good double crop option. A test planted July 21 near Holton in 2008, when summer rainfall was very favorable, provided yields of 2.5 to 3 tons dry matter/acre for hybrid pearl millet and sudangrass at the low end to 4 to 5 tons dry matter/acre for forage sorghum, BMR forage sorghum, photoperiod sensitive forage sorghum, and sorghum x sudangrass hybrids. Earlier plantings may be able to produce even more tonnage, as long as there is adequate August rainfall. One challenge with late-planted summer annual forages is getting them to dry down when harvest is delayed until mid- to late-September. Wrapping bales or bagging to make silage are good ways to deal with the higher moisture forage this late in the year.

Corn

Is double crop corn a viable option? Corn is typically not recommended for June or July plantings because yield is usually substantially less than when planted earlier.

Typically, corn planted in mid-July has a difficult time pollinating and seldom receives sufficient heat units to fill grain before frost. This was illustrated in a study at the South Central Experiment Field in 2007 where 100 to 112 RM corn planted in late June yielded only 40 bushels per acre compared to over 130 bushels per acre for an April planting. In Manhattan in 2007, the same hybrids planted on June 25 yielded over 130 bushels per acre, which is certainly acceptable but substantially less than the 150 bushels per acre for earlier plantings.

In another study at Manhattan a 112-day corn hybrid planted in mid-July produced nearly 100 bushels per acre. No grain production was expected from that planting, but July rains were above normal at this location, allowing for successful pollination in August and grain fill in September. Note however that the corn could not be harvested until January because it took so long to dry down with the cool fall temperatures. Also note that 2007 was somewhat unusual in the amount and distribution of July and September rains at this location.

Very short-season corn hybrids (80 to 95 RM) have the greatest chance of maturing before frost in double crop plantings, but generally have less yield potential than hybrids that are 100 RM or more used for full-season plantings. Short-season hybrids often will set the ear fairly close to the ground, increasing the difficulty of harvest. Glyphosate-resistant hybrids will make weed control easier with double crop corn, but there may still be problems with late-emerging summer weeds such as pigweeds, velvetleaf, and large crabgrass. Keep in mind that corn is very susceptible to carryover of most residual ALS herbicides used in wheat.

Volunteer wheat control

One of the issues with double cropping often overlooked by producers is the potential for volunteer wheat in the crop following wheat. If volunteer wheat emerges and goes uncontrolled, it can cause serious problems for nearby planted wheat fields in the fall.

Volunteer wheat can generally be controlled fairly well with glyphosate in Roundup Ready crops. It can also be controlled in sunflowers and soybeans with the labeled postemergence grass herbicides such as Assure II, Select, or Poast Plus, but control is reduced during times of drought stress. Atrazine can provide control of volunteer wheat in corn and sorghum, but can be erratic depending on rainfall patterns.

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4. Kansas climate basics: Part 2 -- Temperature trends 1895-2015

(Editor's note: The following article is one in a series of articles in the Agronomy eUpdate that examines the historical record of temperature and precipitation in Kansas. The methods used to do this analysis of temperature trends in Kansas is explained in the [introductory article](#) in this series, from eUpdate No. 571, May 20, 2016. – Steve Watson)

Temperature trends in Kansas

Air temperatures over last decade have been among of the warmest on record for Kansas, with the only exception being the extreme heat of 1930s "Dust Bowl" era (Fig. 1, bottom panel). The state-wide annual average temperature varied from a low of 52.3 degrees F in 1912 to a high of 58.8 degrees F in 2012. Such a 6.5 degrees F swing of temperatures is one of factors that makes the Kansas agricultural economy vulnerable to climate changes.

One pronounced observation over last 121 years was that the minimum temperatures (nighttime temperatures) have warmed much more than the daily maximum temperatures. There is no statistically significant trend in maximum temperatures over last 121 years. However, there is a significant warming rate in minimum temperatures of 0.138 ± 0.06 degrees F per decade. The Kansas average temperature increase, 0.105 ± 0.06 degrees F per decade, was mainly driven by the rise in minimum temperatures.

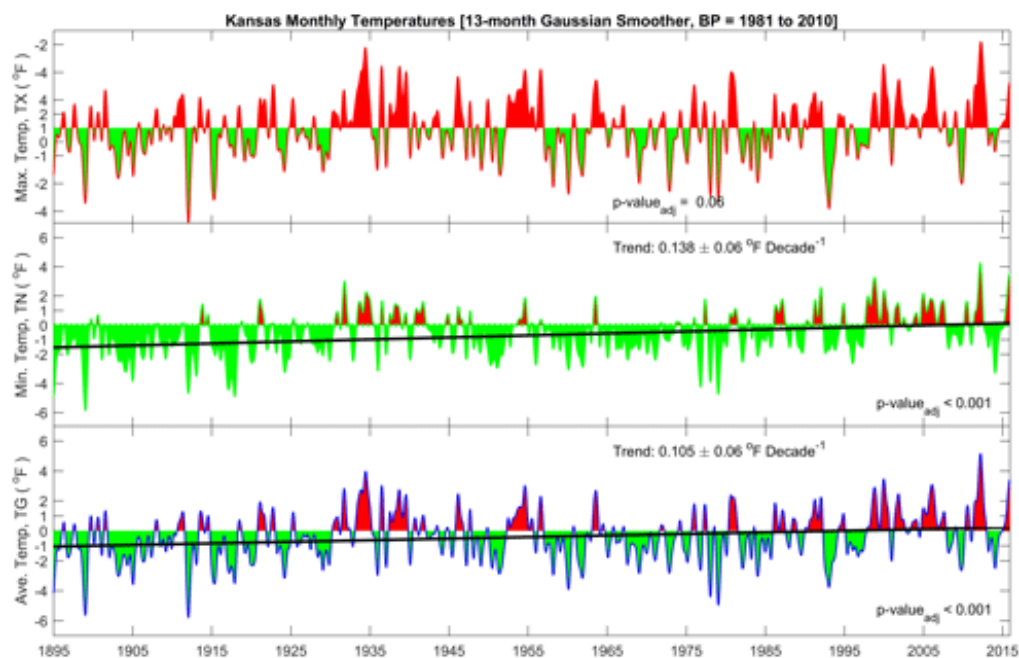


Figure 1. Kansas monthly temperature anomaly time series over 1895 to 2015: maximum temperatures (top panel); minimum temperatures (middle panel); and average temperatures (bottom panel). The base period used is 1980 to 2010 and a 13-point Gaussian filter was used to smooth the data. When trends are statistically significant the trend rates are displayed. All adjusted p values are shown.

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5. Soil pH and Liming in KS: Part 2 -- Is my soil acid and how much lime is needed?

In [Part 1](#) of this series of Agronomy eUpdates articles we discussed how acids and soil acidity are defined, the concept of buffering and how the balance of cations on the soils cation exchange sites maintains a relatively constant pH in the soil solution -- especially in the common range of pH's seen in agricultural soils, roughly 5 to 7. In this article we will discuss different methods of soil sampling to measure soil pH and acidity, how lime recommendations are made, and different approaches one might take to applying lime today.

Soil sampling for limestone needs

Soil acidity and resulting lime needs can vary widely across a field or across the landscape. A number of factors impact lime needs, such as past soil erosion, previous soil management including N application rates, and differences in soil organic matter and clay content. Thus lime needs will often vary within a field, making a precision or site-specific liming program economical and something that should be considered by many farmers.

The role of soil buffer capacity in liming. The amount of lime needed to obtain a required change in soil pH, varies with the soil's cation exchange capacity (CEC) and buffering capacity. Cation exchange capacity refers to the amount of the soil's negative charge and the amount of positively charged ions such as calcium and magnesium or hydrogen which can be held. Cation exchange capacity is a function of soil organic matter and clay content. The higher the organic matter content and the heavier the soil texture, the higher the soil's CEC. Since soil pH is a reflection of the percent acids on the exchange sites, acidic soils with a high CEC contain more acidity than low-CEC soils with the same pH. Thus, more lime will be required to get the same change in pH in a high-CEC soil than a low-CEC soil.

Fortunately or unfortunately depending on your perspective, soils are most highly buffered -- or resistant to change in pH -- at the extremes: very acid, and very basic. Soil organic matter is by nature a weak organic acid, and has a number of reactive chemical groups such as carboxyl and phenolic hydroxide structures which can donate hydrogen ions to the soil solution as the pH goes up. This serves to prevent a rapid rise in pH. The reverse happens as the pH of the soil begins to go down. The hydrogen ion re-associates with the carboxyl group, removing it from the soil solution, reducing the hydrogen/acid concentration in the soil solution, and in effect maintaining or raising the pH. This process effectively provides a bottom limit of around pH 4 for most soils.

Calcium carbonate (limestone) provides a similar upper limit on pH in most soils where calcium is the dominant exchangeable cation. Calcium carbonate tends to precipitate at a pH of 8.2. So when lime is added to the soil, it will react with the hydrogen in the soil water at low pH and dissolve, releasing calcium into the soil solution. This will replace both the hydrogen in the solution and that on the CEC. As the pH increases, the lime becomes less soluble and no longer dissolves. So unless large quantities of salts, especially sodium, are present the pH stabilizes around that 8.2 point. Adding more lime will not increase the pH further.

Variation in pH and buffer requirement across a field. Many fields vary in organic matter content and soil texture. It is important that soil samples are taken in a manner that captures the variations in pH and buffering capacity rather than mixing everything together into one sample and obtaining an average. This process may require carefully selecting sample locations within a field to minimize the variation and more efficiently use lime.

A detailed soil survey is available online for all Kansas counties and provides a helpful guide to soil difference that can be expected in a field. Out in the field, soil samples should be separated primarily on the basis of soil color differences, which reflect variations in organic matter. Separate soil samples should be taken also where the texture of soil surface varies widely or when historical differences in management between parts of a field are known to have occurred. Old aerial photographs can provide excellent information on previous farming activities.

With the advent of Geographic Positioning Systems and yield monitors, a number of other methods to assess soil variability have also become widely used. Management zone sampling has become popular among farmers who utilize yield monitors. This system entails identifying management zones, or areas with similar yields and soils, and using these as soil sampling areas.

Grid sampling has also been used in some areas as a routine way to estimate soil variability. Grid sampling systems are not new, and have been recommended by the University of Illinois since the 1920's. Grid cells will routinely vary from 1 to 5 acres in size. Lime and fertilizer may be applied based directly on the sample results from the grid, or the data may be analyzed using geo statistical techniques to develop nutrient maps. Smart zones utilizing grid samples, soil maps, and yield maps provide very good ways to build lime application maps.

Use the appropriate sampling depth. Soil samples for routine pH, P, and K recommendations for grain crops are normally taken using a 6- to 7-inch sampling depth. However, sample depth needs to be adjusted when working with conservation tillage systems or in forage fields. If a moldboard plow or twisted shank chisel plow is used at least once every four or five years, take samples for fertilizer and lime recommendations at a 6- to 7-inch depth. While most of the soil mixing occurs in the upper one-half to two-thirds of the chisel depth (depending on the type of chisel points used), and nutrient stratification is known to occur, enough mixing occurs to get lime, and lime effects, throughout most of the surface soil.

Where fields are in continuous no-till for four years or more, especially where nitrogen fertilizer is broadcast or sprayed on the soil surface, or in pastures and hayfields, soil samples for pH and lime requirement should be taken from the top 3 inches of soil. This will identify the acidity stratified near the surface, which is also the acidity which a surface application of lime will neutralize. An adjustment of lime rate recommendations will also be necessary in these situations. Most soil testing laboratories make lime recommendations assuming that the lime will be mixed with 6 to 7 inches of soil. Since lime is relatively insoluble, the effects are limited to the top 3 to 4 inches of soil when applied on the surface. Thus normal lime rates should be cut in half when surface applying lime to no-till fields, pastures, or hay fields.

Measuring acidity and lime requirement

Soil testing labs routinely use a two-step process to measure soil acidity and determine lime requirement. The first step is to mix a sample of dry soil with deionized water and measure soil or water pH. If the soil:water pH falls more than 0.2 pH units below the recommended minimum pH level for the crop being grown, lime is normally recommended. The recommended pH varies with both crop being grown and soil characteristics. Subsoil depth and pH are important factors that influence response to lime. The recommended pH's for different crops grown in different areas of Kansas are summarized in Table 1.

Table 1. Recommended soil pH for the principal crops grown in Kansas

Crop	Recommended pH in Kansas			
	Southeast	Northeast	Central	West
Alfalfa and most clovers	6.8	6.8	6.0	6.0
Red clover and trefoil	6.0	6.0	6.0	6.0
Most forage grasses	6.0	6.0	6.0	6.0*
Soybeans	6.4	6.0	6.0	6.0*
Corn, small grains, canola	6.0	6.0	6.0	6.0*

* In central and western Kansas when lime is not readily available a recommended pH of 5.5 is used for corn, sorghum, wheat, soybeans, and canola due to high subsoil pH.

Soil pH vs. Buffer pH or Lime Index

The pH measured in water reflects the environment plant roots are exposed to and is routinely used to determine if lime is needed. Water pH is not a good measure of the amount of lime needed to change soil pH, however. The water pH is a reflection of the percent base saturation of the soil. But it does not give any indication of the quantity of acids or bases that are present or the buffer capacity of the soil. To determine the amount of lime that will be required to neutralize the acidity on the exchange sites, a buffer test is used. Buffers are solutions designed to resist change in pH. By mixing a buffer of known pH with an acid soil and measuring the drop in pH that results, one can calculate the amount of lime needed to reach the desired pH on that particular soil.

In most of the Midwest, the SMP buffer, or the Sikora modification of the SMP, is used to estimate the lime requirement of mineral soils. The SMP buffer is adjusted to an initial pH of 7.5, and upon mixing the buffer with an acid soil the pH drops. The more the pH drops, the more lime will be required. Most soil test reports will give the measured pH of the soil:buffer mixture as either the SMP Buffer pH or the Lime Index. Lime index is created from buffer pH by removing the decimal point, i.e. a buffer pH of 6.4 is a lime index of 64.

The lime recommendations for mineral soils based on the SMP buffer test used in Kansas are summarized in Table 2. The rates are given as pounds of Effective Calcium Carbonate as ag lime, and assume that primary tillage such as moldboard or chisel plowing will be used to incorporate the lime to a 6- to 7-inch depth. For no-till or conservation-till systems or established forages, mixing of lime with the soil is minimal, and reaction and change of pH only occurs in the surface 2-4 inches of soil. Therefore the lime rates should be reduced 50%. The recommended lime application rates for no-till or forage production are given in Table 3.

Buffer pH	Lime Index	Desired pH level			
		6.8	6.4	6.0	5.5
		lb ECC/acre			
7.4	74	0	0	0	0
7.2	72	750	575	375	250
7.0	70	1,750	1,325	875	500

6.8	68	3,000	2,250	1,500	750
6.6	66	4,500	3,375	2,250	1,125
6.4	64	6,250	4,700	3,125	1,625
6.2	62	8,250	6,200	4,125	2,000
6.0	60	10,250	7,700	5,125	2,625
5.8	58	12,500	9,375	6,250	3,125
5.6	56	15,250	11,800	8,325	3,750
5.4	54	18,000	13,500	9,000	4,500
5.2	52	20,000	15,200	10,375	5,250

If the lime recommendation is for 6,000 lbs ECC per acre or less, the lime can be applied at any time in a cropping sequence. When the lime recommendation exceeds 6,000 lbs ECC per acre, apply half the lime before primary tillage to improve mixing with the total tillage zone, and then re-test in 12 to 18 months to determine the remaining amount needed.

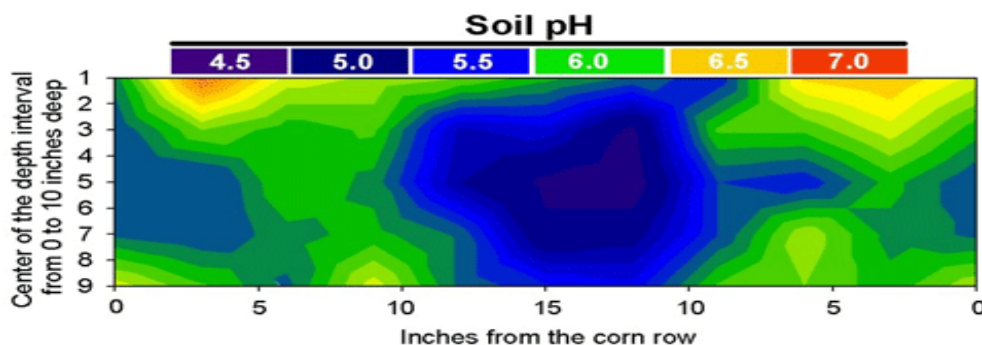
Table 3. Pounds of ECC from ag line needed to raise the soil pH to the desired level based on the SMP buffer test, no-till or established pastures or hayfields with no incorporation

Buffer pH	Lime Index	Desired pH level			
		6.8	6.4	6.0	5.5
		lb ECC/acre			
7.4	74	0	0	0	0
7.2	72	375	300	200	125
7.0	70	875	675	450	250
6.8	68	1,500	1,125	750	375
6.6	66	2,250	1,700	1,125	575
6.4	64	3,125	2,350	1,575	825
6.2	62	4,125	3,100	2,075	1,025
6.0	60	5,125	3,850	2,575	1,300
5.8	58	6,250	4,700	3,125	1,575
5.6	56	7,625	5,875	4,175	1,875
5.4	54	9,000	6,675	4,500	2,250
5.2	52	10,000	7,600	5,200	2,625

Low CEC Soils. Sandy soils have a low CEC and are very weakly buffered. In some cases the water pH may be below the recommended target pH, but the buffer pH may not indicate a need for lime. This is because these soils do not have enough acidity to lower the pH of the buffer solution. When this occurs, apply 750 lbs ECC per acre if the water pH is more than 0.3 pH units below desired, or 1,500 lbs ECC per acre if the pH is more than 0.6 pH units below desired.

What if you knife-in N and have bands of acid soil below the surface? Our standard recommendation for liming and pH management is to take one set of samples to a 6-inch depth in conventional-till, or a set of soil samples 0-3 inches deep on continuous no-till or grass hayfields. When most or all of the nitrogen (N) is surface-applied without soil mixing, the most common way Kansas no-till farmers apply N, the resulting acidity is normally confined to the soil surface, and easily corrected with surface-applied lime. But what if you knife in UAN solutions or anhydrous ammonia as your primary N source?

Where anhydrous ammonia or liquid UAN is knifed-in or coulter-banded below the surface, an acid zone will develop deeper in the soil. With ammonia, this will usually be 2-3 inches above the release point where the fertilizer is placed in the soil. So if the ammonia is injected 8 inches deep, there will be acid bands 5 to 8 inches below the soil surface. In controlled traffic systems these bands will expand over time as more and more N fertilizer is placed in the same general area. The graphic below illustrates the effect of a high rate of ammonia (200 lbs N/acre or more) placed in the same general area in the row middle on a high CEC soil for more than 20 years.



Source: Mengel and West, Purdue University

The actual depth of the acid zone in fields fertilized with ammonia gets tricky as application depth can vary depending on the tool used to apply the ammonia. Traditional shank applicators generally run 6 to 8 inches deep, so a sample for pH measurement could be taken at 3-6 inches or 5-8 inches deep, depending on how deep the shanks were run. The new low-disturbance applicators apply the ammonia 4-5 inches deep. A sweep plow or V-blade applies ammonia only 3-4 inches deep. So sampling depth for pH should really depend on where the acid-forming N fertilizer is put in the soil.

Where do you place the lime in continuous no-till? If you surface apply N, then surface apply the lime. That's a simple but effective rule. But remember that surface-applied lime will likely only

neutralize the acidity in the top 2-3 inches of soil. So if a producer hasn't limed for 20 years of continuous no-till and has applied 100 to 150 pounds of N per year, there will probably be a 4-5 inch thick acid zone, and the bottom half of that zone may not be neutralized from surface-applied lime. So, if a producer is only able to neutralize the top 3 inches of a 5-inch deep surface zone of acid soil, would that suggest he needs to incorporate lime? Not necessarily.

Research has shown as long as the surface few inches of soil is at an appropriate pH and the remainder of the acid soil is above pH 5, crops will do fine. In fact, in some situations acid bands of soil below the surface could be an advantage by increasing the availability of some essential metals such as zinc, iron, and manganese.

Summary

Liming benefits crop production in large part by reducing toxic aluminum, supplying calcium and magnesium, and enhancing the activity of some herbicides. Aluminum toxicity doesn't normally occur until the soil pH is below 4.8. At that pH the Al in soil solution begins to increase dramatically as pH declines further. Aluminum is toxic to plant roots, and limiting root growth will reduce the plant's ability to take up nutrients and water.

Yield enhancement is not the only concern with low-pH soils, however. Herbicide effectiveness must also be considered. The most commonly used soil-applied herbicide impacted by pH is atrazine. As pH goes down, activity and hence performance goes down. So in acid soils weed control may be impacted. We do see that in corn and sorghum production.

Acidity levels and resulting lime needs can vary widely across a field. So a soil sampling plan should be used which will define this variation and allow a farmer to apply lime efficiently where it is needed.

Making lime recommendations is a two-step process: Use the soil pH to determine if lime is needed, and a buffer pH to determine the rate needed to achieve the desired pH change.

Nitrogen fertilizer is the primary cause of soils becoming acid. The N application placement method and the tillage system used will determine where the acidity will accumulate in the soil. If the soil is tilled regularly, the acidity will be distributed throughout the tillage zone. Adding lime and incorporating it through tillage will also neutralize the acidity throughout the tilled zone. However in no-till systems or in established forage crops, lime incorporation is not possible and surface-applied lime will only react with acidity in the top 2-4 inches of soil. Soil sampling and lime rates are adjusted to reflect this limited zone of activity.

With the relatively high cost of liming and the variability in recommended lime rates across a field, development of variable-rate lime programs should be considered. By adjusting rates to fit the needs of specific areas within fields, costs can be reduced and the over-application of lime – which reduces the availability of some nutrients such as zinc and iron – can be avoided.

The final part of this series, evaluating and selecting liming materials, will be in the next issue of the Agronomy eUpdate.

Dave Mengel, Soil Fertility Specialist
dmengel@ksu.edu

6. Purple color in corn seedlings: Cause for concern?

The rainy season in combination with unusual low temperatures are causing slow plant growth for all summer crops, including corn. Cold temperatures and saturated soils are not only affecting corn stands through uneven emergence and lack of uniformity, but are also causing a phenomenon in young corn seedlings known as “purple corn.”

In many cases when the purple color is identified in small corn plants, the first thought that comes to the mind of agronomists and producers is that this could be an indication of “phosphorus deficiency.” Phosphorus deficiency is also generally associated with stunted plants and thin stalks. Other potential causes of purple color can be hybrid-related, a buildup of sugars (sunny days/cold nights), and restricted root growth. Thus, the question becomes: What is the main factor affecting the plant color if the crop otherwise looks very healthy, uniform, and vigorous?

In recent years, purple coloring on corn seedlings has been documented in different environments under diverse management practices and hybrids. The color is coming from the expression of genes for anthocyanin pigment formation. Multiple genes govern the expression of this color, and certain “cold sensitive” genes react to low temperatures (40-50 degrees F).

Therefore, low nighttime temperatures such as those we have experienced at times over the past several days/weeks will promote purpling in corn seedlings. This condition is only expressed up until the six-leaf (V6) stage. Producers do not need to worry about this phenomenon. As soon as the temperature warms up and plants grow rapidly, the purple color should disappear (after the six-leaf stage). If not, then consider taking a soil sample for potential phosphorous deficiency.

At this point, the purple color is simply the result of a small degree of cold temperature stress -- nothing severe. The plant is growing very slowly due to the cool weather (not related to the purple color), but good growth and development should resume after the temperatures go back to the normal for this time of year.

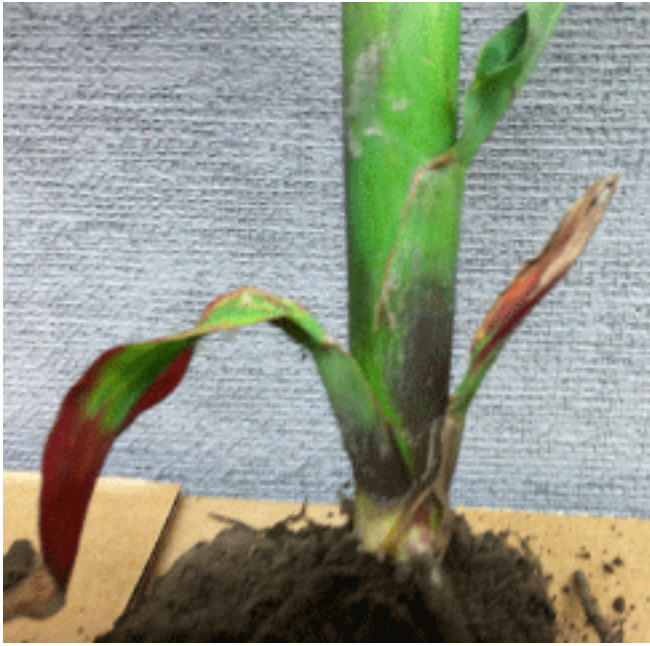








Figure 1. Purple coloration in corn at diverse growth stages -- a result of the expression of genes for anthocyanin pigment formation. A close-up look with a microscope reveals that the pigment is only present on the top layer of the leaf tissues, without affecting the chlorophyll. The purpling effects varied with the leaf position in the canopy, with no clear pattern. Photos by Ignacio Ciampitti, K-State Research and Extension.

Will the yield be affected by this stress? Previous information collected by several researchers concluded that yield is not likely to be affected by this phenomenon. Still, it is always good to continue scouting your acres for early identification of any potential problem affecting your crops.

Ignacio Ciampitti, Crop Production and Cropping Systems Specialist
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7. Nitrogen loss potential in wet soils

Some areas of Kansas are faced with the potential for leaching or denitrification loss of nitrogen in fields planted or intended for corn or sorghum due to recent persistent rains and very wet soils.

The leaching and denitrification processes are quite different, and normally occur on different types of soils and under different situations. But both involve the loss of nitrate nitrogen. The nitrate-N present in fertilizers such as ammonium nitrate (50% nitrate) or UAN solution (25% nitrate) is immediately susceptible to leaching or denitrification loss. The residual soil nitrate-N measured by a soil test is also susceptible to leaching or denitrification loss. Other forms of nitrogen have to be converted in the soil to nitrate-N before leaching or denitrification would become a problem. This conversion is a biological process, and requires conditions appropriate for the activity of the bacteria involved.

Before estimating how much N may have been lost in wet soils from leaching or denitrification, producers should first try to get some idea of how much of the N they applied may have undergone nitrification into nitrate-N at this point in the season.

Factors affecting nitrification

Since nitrification is a biological process, how quickly ammonium-N in soil converts to nitrate-N is a function of soil oxygen content, soil temperature, pH, how the N is applied, some characteristics of the fertilizer, and perhaps most importantly, how long the N has been in the soil. Nitrification is an aerobic process and requires high levels of soil oxygen. Conditions that reduce oxygen supplies, such as wet soils, will inhibit nitrification and keep N in the ammonium form.

Optimum soil temperatures for nitrification are in the range of 75-85 degrees. But nitrification occurs any time the soil temperature is above freezing, just at a slower rate. As a result, the timing of N application is critical for estimating the amount of N that may be present as nitrate. For example, winter applications of urea are much more likely to have been converted to nitrate by this time of year than a preplant application of urea made in late April.

Another key factor impacting nitrification rate is how the fertilizer was applied. When urea or UAN are broadcast, nitrification will occur more rapidly than when those materials are banded. Broadcast fertilizer is in contact with more soil containing the bacteria responsible for nitrification, so the nitrification process occurs more rapidly. Banded UAN or urea reduces fertilizer-soil contact, and has fewer potential microorganisms in contact with the fertilizer, thus slowing the conversion rate.

The nitrification rate of anhydrous ammonia is even slower, due to the toxic effect of the ammonia on the organisms in the application band. Under the warm soil temperatures found in early fall or late spring, it can take 2-3 weeks for nitrification to begin where ammonia has been applied. Cooler soil temperatures, such as often found in late fall or very early spring applications, cause the conversions of ammonia to ammonium, and the recolonization of the ammonia band area by the organisms to be much slower. In addition, the wider the fertilizer spacing and higher the rate, the slower nitrification will proceed. This is why many people refer to ammonia as a self-inhibiting product. The addition of a nitrification inhibitor, especially with banded ammonia, will slow the process of nitrification even further. This has been shown to be an especially effective tool on dark colored, poorly drained, heavier-textured soils.

Leaching

Leaching involves the physical movement of nitrate-N below the root zone with water. Leaching losses are primarily a concern on coarse-textured, sandy soils, where water moves quickly through the soil profile. Fortunately, many of our sandy soils contain lenses or layers of heavy-textured soil below the surface which can slow water movement and reduce the rate of leaching. This can significantly reduce the loss of nitrate from the root zone by leaching. Unlike nitrate-N, ammonium-N is not rapidly lost to leaching, even on coarse-textured soils. Ammonium-N has a positive charge and is retained on the cation exchange capacity (CEC) sites of soils, while nitrate-N has a negative charge and is repelled by the soil and remains in the soil water.

Denitrification

Denitrification is the conversion of nitrate-N to gaseous N by soil microbes in anaerobic (low-oxygen, waterlogged) soils. These organisms are always present in the soil, but are capable of utilizing the oxygen from nitrate to support their respiration when free oxygen is not present in the soil. Denitrification loss is a problem normally associated with medium- to fine-textured soils under wet conditions, when the soil pores fill with water and oxygen is depleted. There are several conditions that must be met for denitrification to occur. These include:

- Lack of soil oxygen. Denitrification only occurs under anaerobic soil conditions. Poorly drained, compacted, and/or waterlogged soils have the highest potential for denitrification loss. Poorly drained soils in central and eastern Kansas, and the claypan soils of southeast Kansas are normally the soils in the state with the most significant potential for denitrification. Well-drained soils normally pose little risk of significant denitrification loss.
- Nitrate-nitrogen. Denitrification only affects nitrate-N; it has no impact on ammonium-N. Maintaining N in an ammonium form is an effective strategy to avoid denitrification losses, and is the reason there are differences among N sources in denitrification potential.
- Warm soil temperatures with organic residue and/or organic matter. Denitrification is a microbial process, and ample food (organic materials) and warm soil temperatures are required for microbial activity. Like nitrification, the optimum temperatures for denitrification are in the 75-85 degree range.

What should you do now?

While it has been a cool spring, it has been warm enough that a large part of the N applied early, especially the fall- and winter-applied N, has likely been nitrified. Where recent heavy rainfall resulted in several days of saturation, some significant denitrification loss likely has or will occur. Not all of the N has been or will be lost, but producers who applied all their N in the fall, winter or very early spring should be in position to apply additional N if needed.

All corn that appears yellow at this time won't be seriously N deficient. In fields where the N application was made in late April or early May, especially where ammonia was applied, the majority of the N is likely still present as ammonium and the corn is likely yellow due to the effect of soil saturation. In this case, the corn will green up when conditions dry out and oxygen gets back into the soil. No additional N may be needed at all. Watching several fields in northern Riley County over the last week to 10 days, the green-up of the corn has been noticeable.

If you have access to a chlorophyll meter or active crop sensor, you can use these instruments to

make measurements of greenness and growth, and make some fairly good estimates of the amount of N needed. One idea to help you assess your situation is to create some reference strips in the field by adding some additional N when conditions become a little drier. Adding 1 pound of urea to an area 4 rows wide by 25 feet long would be equivalent to adding around 80 pounds of additional N. Observing the differences between the “reference strip” and the balance of the field can provide a good idea of the degree of N loss which has occurred.

One important thing to remember is that corn doesn’t take up a lot of N until it reaches the 6 or 7 leaf stage, when the primary or nodal root system becomes well established. At that point vegetative growth and nutrient uptake explode. Also keep in mind that all of the N you have applied is not going to be lost. So there will be N present to support early growth. If N deficiency is going to occur, it likely won’t be noticeable or measurable until after the corn is at least waist-high. This may be too late for normal N application techniques such as sidedressing or over the top applications of urea with ground equipment. But dribble application of N solutions with a high clearance sprayer can be an effective way of applying N later in the season. Recent work at K-State has shown that N applied by dribbling N on between the rows to minimize leaf damage with high-clearance application equipment as late as the 16-leaf stage can be used effectively and efficiently by both dryland and irrigated corn.

If you don’t have access to a chlorophyll meter, counting fired leaves at the base of the plant is another simple way to assess N loss.

If the wet weather continues your corn may “run out of gas” in a few weeks. But this gives you some ideas of options available to both assess and correct the problem. Establishing some reference strips now can help you better understand the situation in your fields later.

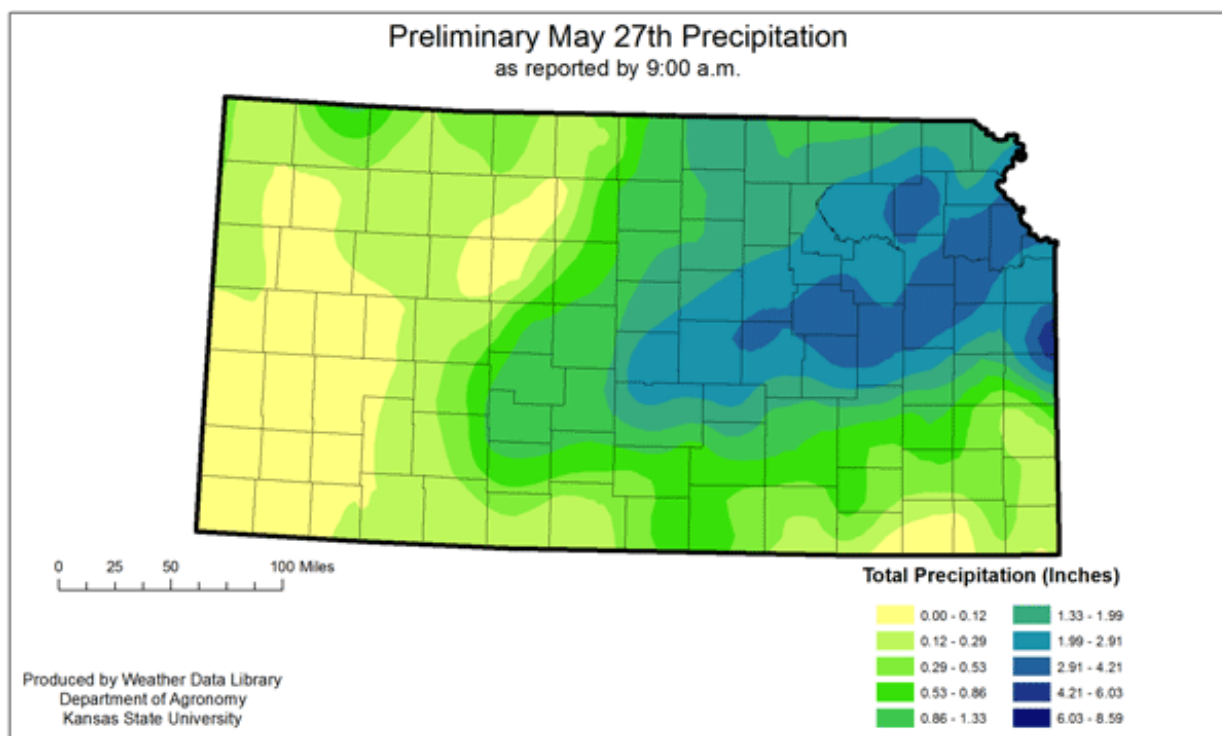
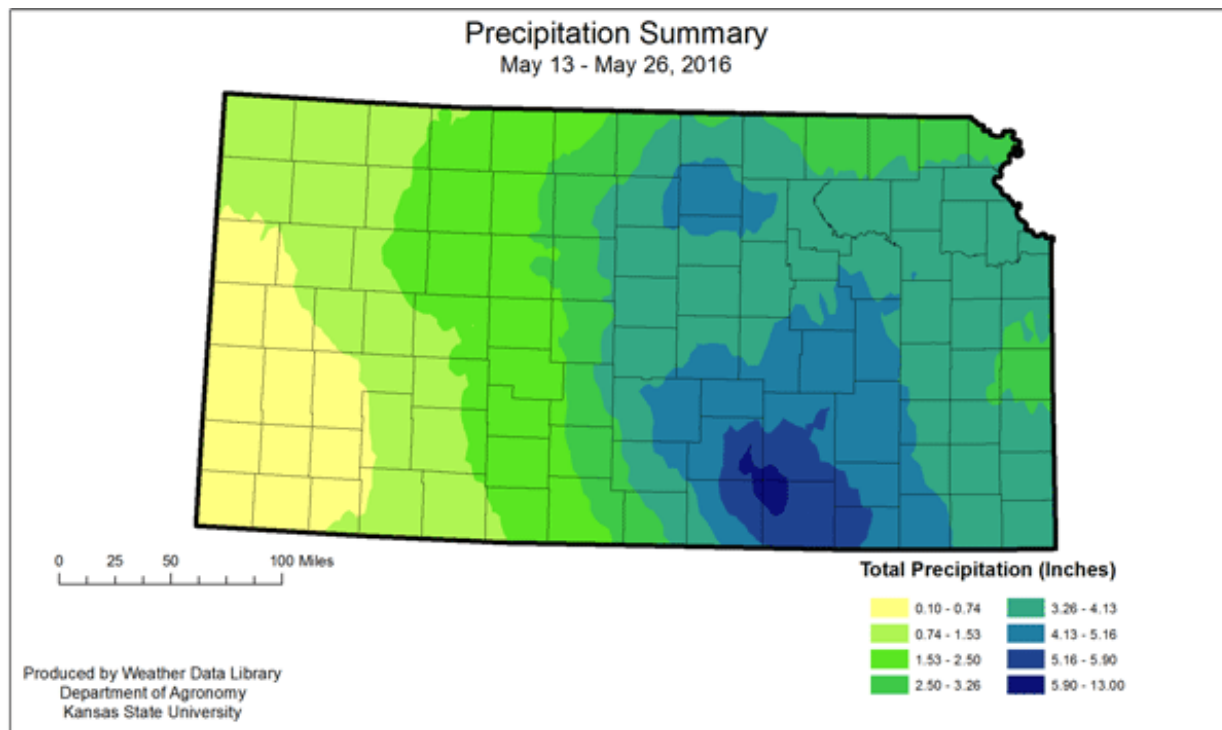
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8. Slow planting and emergence progress for summer row crops

For the week starting on May 23, temperatures were 6 to 8 degrees below normal across the state.

Only 50 percent of the days during this week were suitable for fieldwork, and even less than that for several areas that receive large quantities of rain. Muddy fields are common now in many areas of the state.



Kansas State University Department of Agronomy

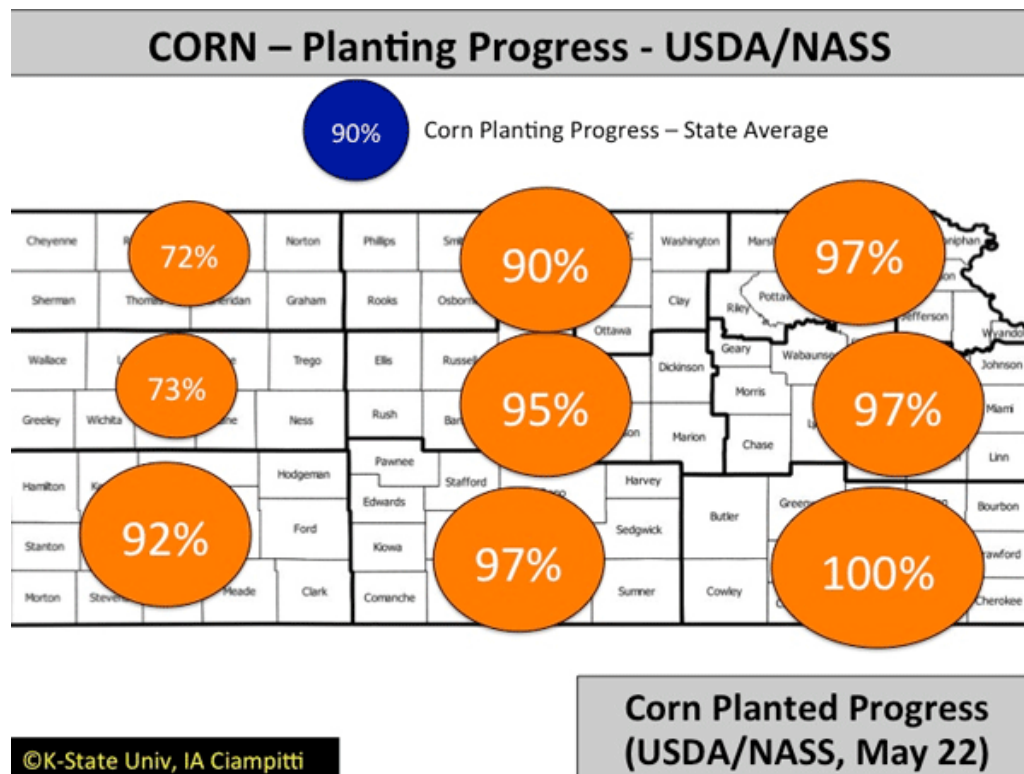
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Figure 1. Precipitation summary for the 2-week period of May 13-26 (upper panel) and the overnight rains on May 27 (lower panel) across Kansas. Source: K-State Weather Data Library

Corn

Corn planting status across the entire state is 90% as of May 22 (Fig 2, upper panel), with more than 60 % of all corn emerged (Fig 2, lower panel). The crop reporting districts of Northwest and West Central are the ones where the most progress is still needed on planting corn.



CORN – EMERGED Progress - USDA/NASS

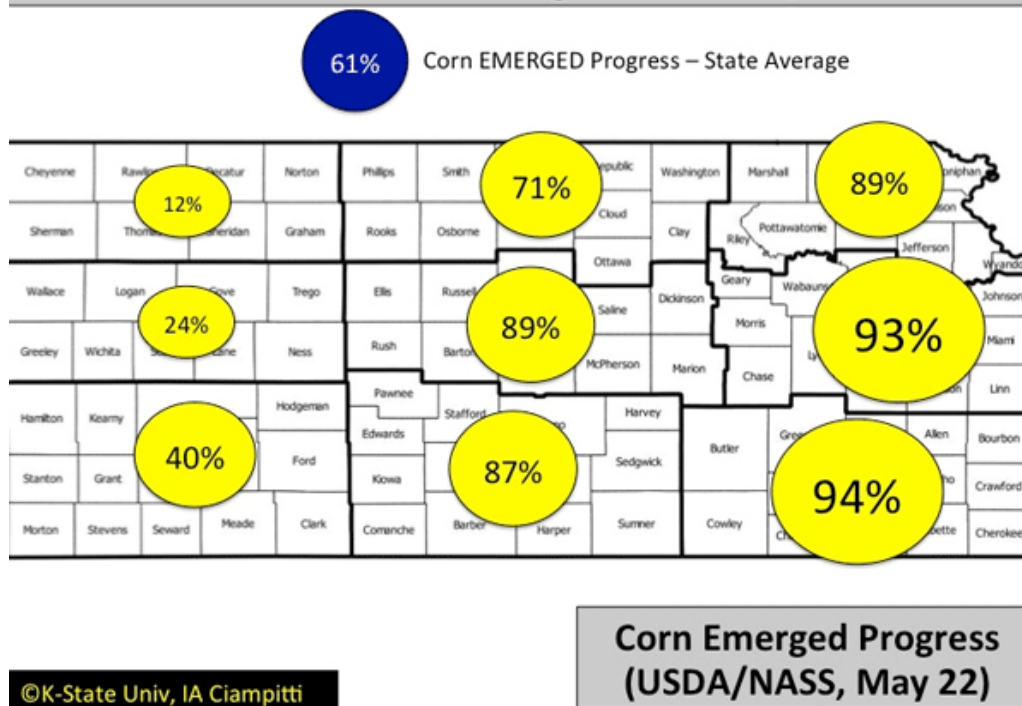


Figure 2. Corn planting (upper panel) and emergence (lower panel) progress based on USDA/NASS report of May 22, 2016.

Soybean

Soybean planting status across the entire state is 21% as of May 22 (Fig. 3), with only 7% of all the crop emerged. As related to the most recent 5-year average as reported by USDA-NASS, soybean planting progress is roughly 20% behind average. Overall, most of the Crop Reporting Districts need to make progress on planting, which will potentially occur close to the end of next week (June 1-4).

SOYBEAN – PLANTED Progress - USDA/NASS

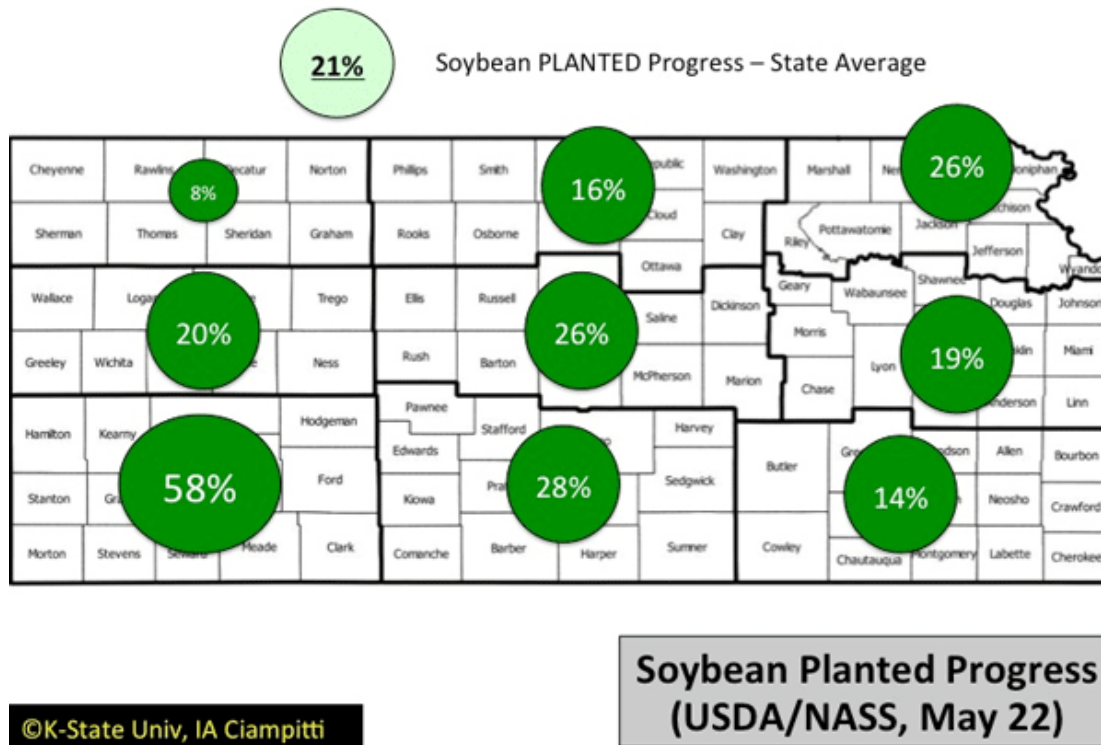
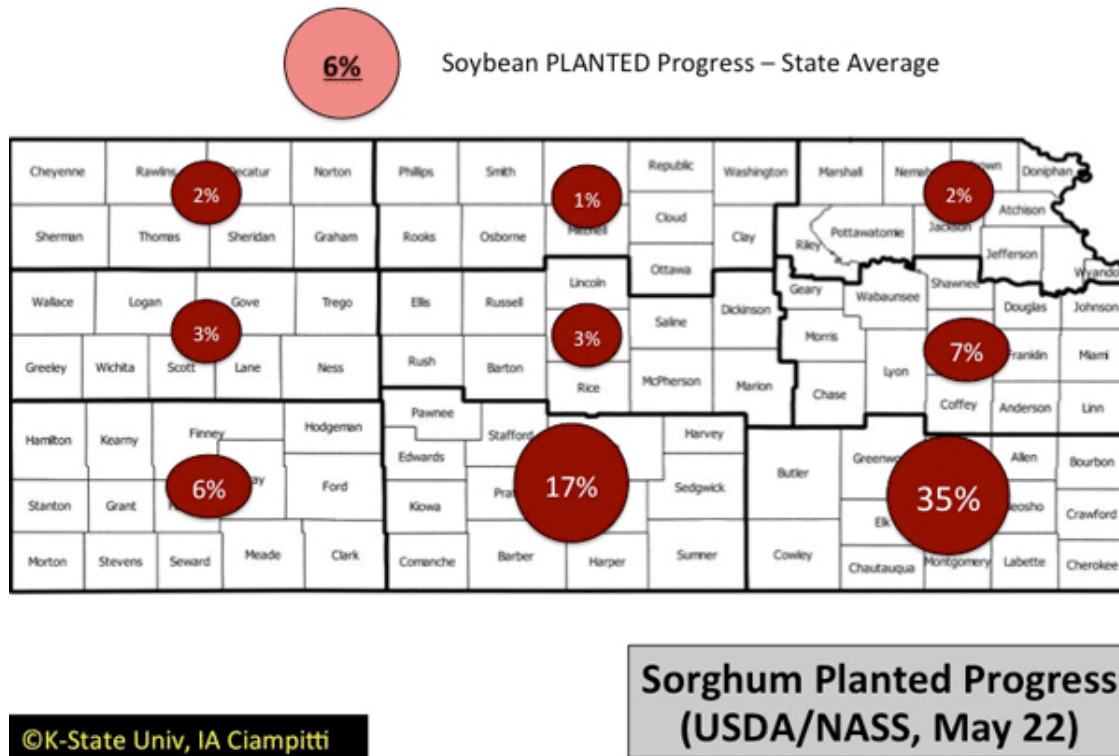


Figure 3. Soybean planting progress based on USDA/NASS (May 22, 2016).

Sorghum

Sorghum planting across the entire state is 6% completed as of May 22 (Fig. 4), with primary planting progress done in Southeast and South Central districts. As related to the most recent 5-year average reported by USDA-NASS, sorghum planting progress is 10% behind average. Still, sorghum producers have time to plant the crop and get the maximum yield potential for each specific environment. As related to optimal management practices, check the Agronomy eUpdate No. 570 article ("[Sorghum Management considerations](#)") posted in the May 13, 2016 issue. That article highlights early June as the optimal planting date, depending on the locations across the state and the timing of dry/hot conditions around flowering.

SORGHUM – PLANTED Progress - USDA/NASS



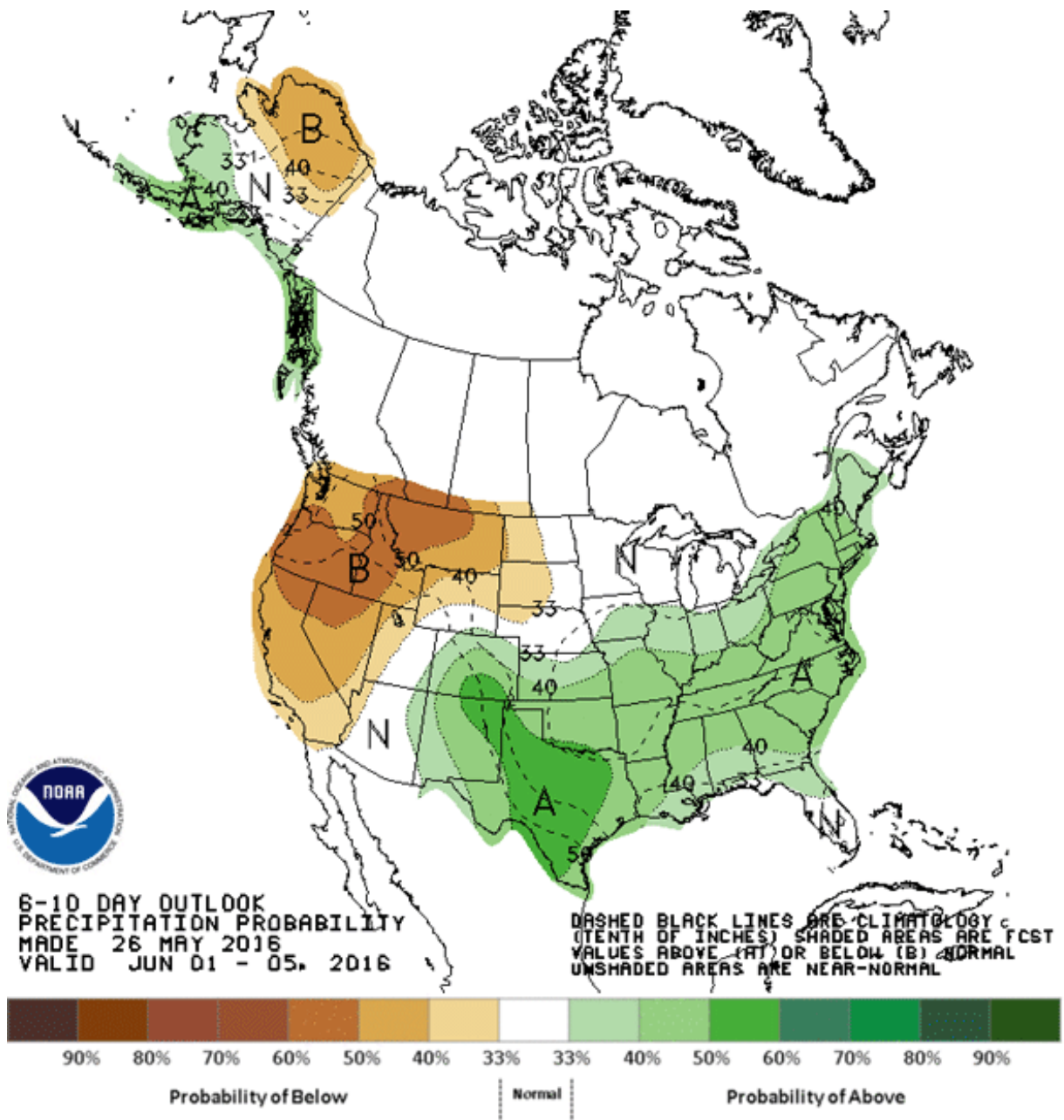
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Sorghum Planted Progress
(USDA/NASS, May 22)

Figure 4. Sorghum planting progress based on USDA/NASS (May 22, 2016).

Short-term weather outlook

The short-term 6-10 day weather outlook (Figure 5, left panel) reflects above-normal precipitation. In the 8-14 day weather outlook this changes to a “normal” probability of precipitation for the central and northern parts of the state.



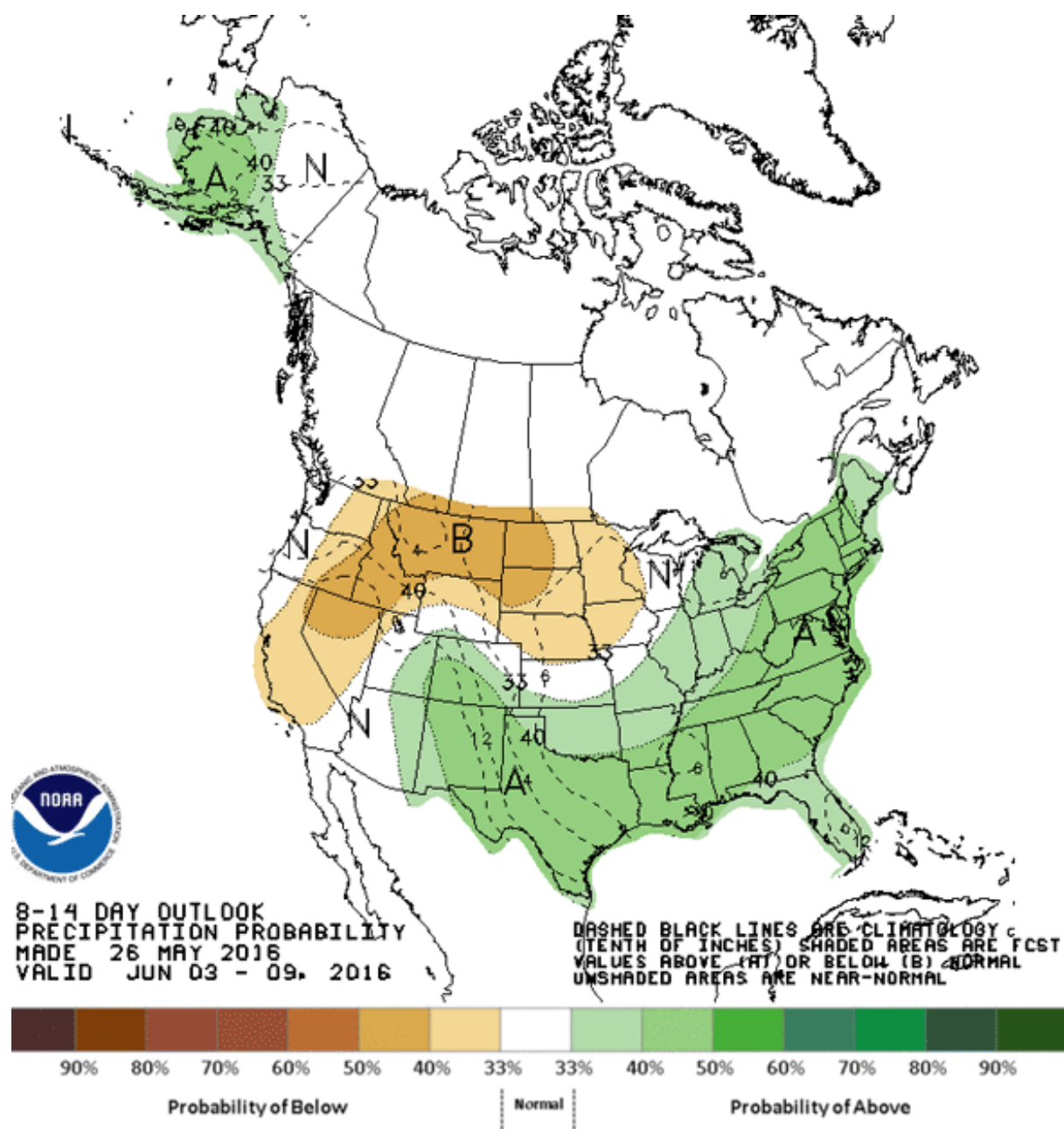


Figure 5. Weather outlooks, 6-10 day (top panel) and 8-14 day (bottom panel). Source: NOAA.

Considering the weather outlook for the coming week, farmers could have a chance to get back to normal planting operations by the end of next week. Rapid soybean and sorghum planting progress are expected to occur in the following weeks, making up for the slow start.

The main concerns from now on are related to the effects of standing water and saturated soils, early-season production problems, management considerations, additional nitrogen (N) needs, and herbicide applications. For further details on these topics check the following Agronomy eUpdate articles:

Corn:

https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=920

https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=934

https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=956

Soybean:

https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=922

Sorghum:

https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=941

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

Mary Knapp, Weather Data Library
mknapp@ksu.edu

9. K-State wheat plot tours for May 31 - June 3

The week of May 31 to June 3 offers another exciting lineup of wheat plot tours! Producers willing to learn about the different varieties can choose to attend one (or several) plot tours in their county or agricultural district.

The plot tours generally include a discussion of wheat conditions across the state, as well as tips on what to look for when selecting wheat varieties for one operation. New and upcoming varieties are discussed, as well as older and more established ones and a discussion of how all these varieties are responding to this growing season's conditions.

To find the nearest 2016 K-State wheat plot to you, [click here](#). This list is an ongoing effort, and some details on it might change and plot tours might be added or moved around. Make sure to double check it as the time to your selected tour approaches.

For the week of May 31 to June 3, the schedule plot tour locations include:

Tuesday, 5/31/2016, 7:30 a.m.

Location: Dickinson Co., Abilene

Contact: James Coover, 785-263-2001, jcoover@ksu.edu

Directions: Intersection of Hwy K-15 and Hwy K-18

Tuesday, 5/31/2016, 6:00 p.m.

Location: Dickinson Co., Abilene

Contact: James Coover, 785-263-2001, jcoover@ksu.edu

Directions: 1207 Hwy K-15

Wednesday, 6/01/2016, 7:30 a.m.

Location: Republic Co., Belleville

Contact: Kim Larson, 785-243-8185, kclarson@ksu.edu

Directions: NC Experiment Field, 1 mile west of Belleville

Wednesday, 6/01/2016, 10:00 a.m.

Location: Republic Co., Munden

Contact: Kim Larson, 785-243-8185, kclarson@ksu.edu

Directions: Tipton Plot, 2 mi east and ¾ mi south of Munden

Wednesday, 6/01/2016, 1:00 p.m.

Location: Cloud Co., Concordia

Contact: Kim Larson, 785-243-8185, kclarson@ksu.edu

Directions: Kocher Plot, 4 mi north and ¼ mi west of intersection of US Hwy 81 and US Hwy 24

Wednesday, 6/01/2016, 5:30 p.m.

Location: Washington Co., Palmer

Contact: Kim Larson, 785-243-8185, kclarson@ksu.edu

Directions: Ohlde Seed, https://www.google.com/maps/d/viewer?mid=z_tKufyEqtDs.kG3Dvp0i6H4A

Thursday, 6/02/2016, 9:30 a.m.

Location: Washington Co., Greenleaf

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Contact: Kim Larson, 785-243-8185, kclarson@ksu.edu.
Directions: Hateshol Plot, 4 mil west of Barnes on Hwy 9

Thursday, 6/02/2016, 12:00 noon

Location: Washington Co., Clifton

Contact: Kim Larson, 785-243-8185, kclarson@ksu.edu.
Directions: 2 mi east and 1 mi south of Clifton

Thursday, 6/02/2016, 6:00 p.m.

Location: Ellis Co., Herzog

Contact: Stacy Campbell, 785-628-9430, scampbel@ksu.edu.
Directions: From I-70, take Victoria exit 168. Go 2.5 mi north on Cathedral Ave/Hwy 255. Turn west onto Fairground Rd., go 3 mi, turn south onto 310 Ave., go ½ mile and turn onto oil lease road and drive past a trench cement silo to plot.

Friday, 6/03/2016, 8:00 a.m.

Location: Gove Co., Quinter

Contact: Candi Fitch-Deitz, 785-938-4480, cfitchdeitz@ksu.edu.
Directions: Paramount Seed Farms

Romulo Lollato, Extension Wheat Specialist
lolato@ksu.edu

Erick DeWolf, Extension Wheat Pathologist
dewolf1@ksu.edu

10. Wheat plot tour scheduled at North Central Experiment Field, June 1

The North Central Experiment Field Wheat Plot Tour is scheduled for Wednesday, June 1, starting at 7:30 a.m. The field is located about two miles west of Belleville on Kansas Highway 36. Juice and rolls will be served ahead of the tour.

K-State speakers will include Romulo Lollato, Wheat and Forages Specialist; Erick DeWolf, Extension Wheat Disease Specialist; and Stu Duncan, Northeast Area Crops and Soils Specialist. Tour topics include:

- Wheat Varieties
- Intensive Wheat Management

More information is available by calling the North Central Experiment Field at 785-335-2836 or contacting Andrew Resser, Agronomist-in-Charge, at aresser@ksu.edu.

11. K-State field pea plot tours, June 6 and 17

K-State Research and Extension will be hosting a series of field pea plot tours on June 6 and 17.

Topics will include variety selection, herbicide options, production practices, producer experiences, and pea plant growth and development.

Gove County, Monday June 6 at 9 a.m.

- Performance test with 13 entries, seeding rate study, in-furrow fertilizer study, and seeding rate strips
- Faba bean and lentil seeding rate studies

Directions: From Grainfield/Hoxie exit on I-70 go $\frac{3}{4}$ miles south on Road 50, 1 mile east on Road BB, 1 mile south on Road 52, 1 mile east on Road AA, $\frac{1}{4}$ mile south on Road 54.

Rawlins County, Friday, June 17 at 8 a.m.

- Field pea seeding rate study and variety performance test with 18 entries
- Lentil variety and seeding rate study
- Demonstration strips of flax, Austrian winter pea, faba beans, and spring forage pea

Directions: From the intersection of Hwy US 36 and K-25 in Atwood go 6 miles north on K-25, 1 $\frac{1}{2}$ miles east on Road X, South 1 $\frac{1}{4}$ miles on Road 22. Refreshments provided.

K-State Northwest Research-Extension Center, Friday, June 17 at 10:30 a.m.

- Field pea variety performance test with 22 entries, seeding rate study, and in-furrow fertilizer study
- Lentil seeding rate, variety, and date of planting study

Directions: 105 Experiment Farm Road, Colby, KS. Come in the main drive and follow the signs.

For questions or more information please contact:

Lucas Haag, K-State Northwest Area Agronomist (785) 462-6281, LHaag@ksu.edu

Rawlins County Extension office (785) 626-3192

Golden Prairie Extension District office (785) 938-4480

12. Dryland Ag Day, June 15, Tribune

Dryland Ag Day is scheduled for June 15 at the Southwest Research-Extension Center Tribune location, 1 mile west of Tribune on Highway 96. Registration is at 8:30 a.m. (MDT) and the field tours begin at 9 a.m.

Field tours will feature:

- Wheat Varieties
- In-furrow Nitrogen on Wheat
- Update on Solid Stem Wheat Varieties
- Wheat Seeding Rates
- Tillage in Dryland Systems
- Dryland Crop Rotations (wheat, corn, and grain sorghum)
- Rainfall Simulator Demonstration

Indoor seminars will start at 11:15 a.m., and feature:

- Soil Test Trends in Western Kansas
- Weed Management Update

Presenters include:

Lucas Haag, K-State Northwest Area Crops and Soils Specialist
Curtis Thompson, K-State Weed Management Specialist
Fred Vocasek, Servi-Tech Laboratory, Dodge City
Dale Younker, USDA-NRCS, Garden City
Alan Schlegel, Agronomist, Southwest Research-Extension Center, Tribune

A complimentary lunch will be served at noon. There will be an optional tour of irrigated weed management trials after lunch.

13. Comparative Vegetation Condition Report: May 17 - 23

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. 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 21: 05/17/2016 - 05/23/2016

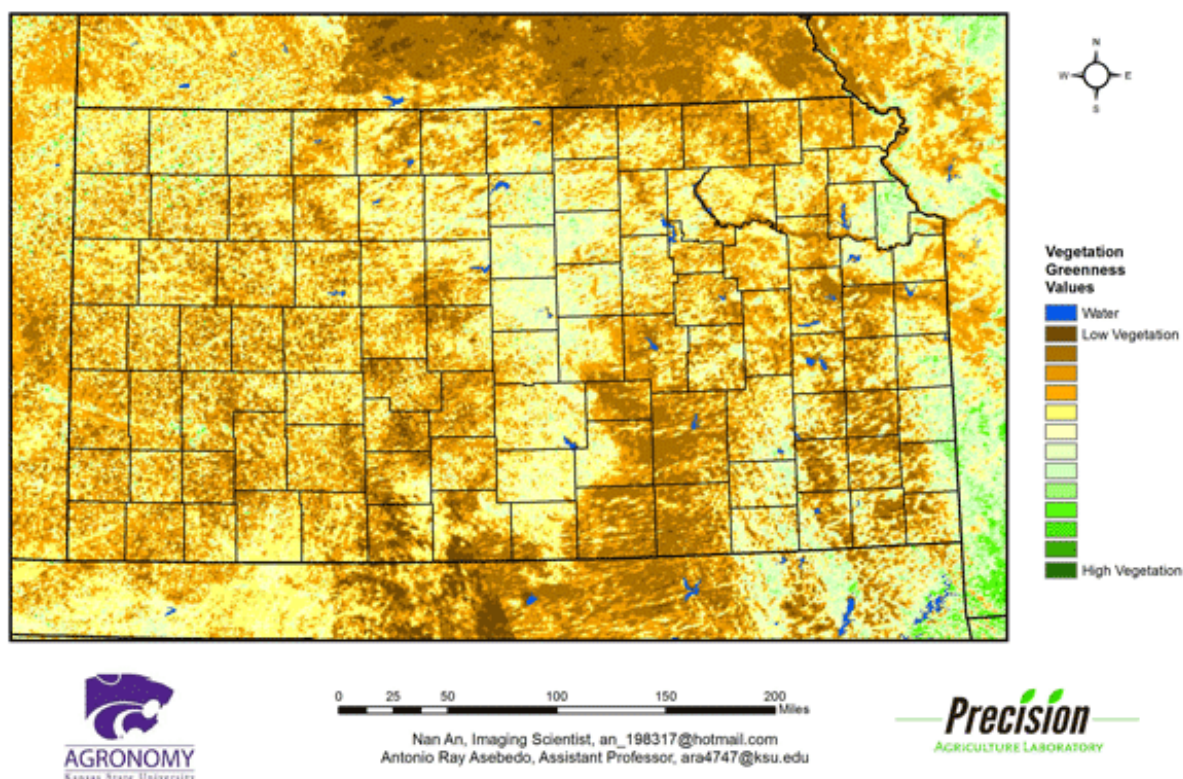


Figure 1. The Vegetation Condition Report for Kansas for May 17 – 23 from K-State’s Precision Agriculture Laboratory continues to show widespread low NDVI values. The continued rainy pattern and cool temperatures have delayed vegetative activity. The impact from the warmer temperatures at the end of the period will be more visible in next week’s map.

Kansas Vegetation Condition Comparison Mid-May 2016 compared to the Mid-May 2015

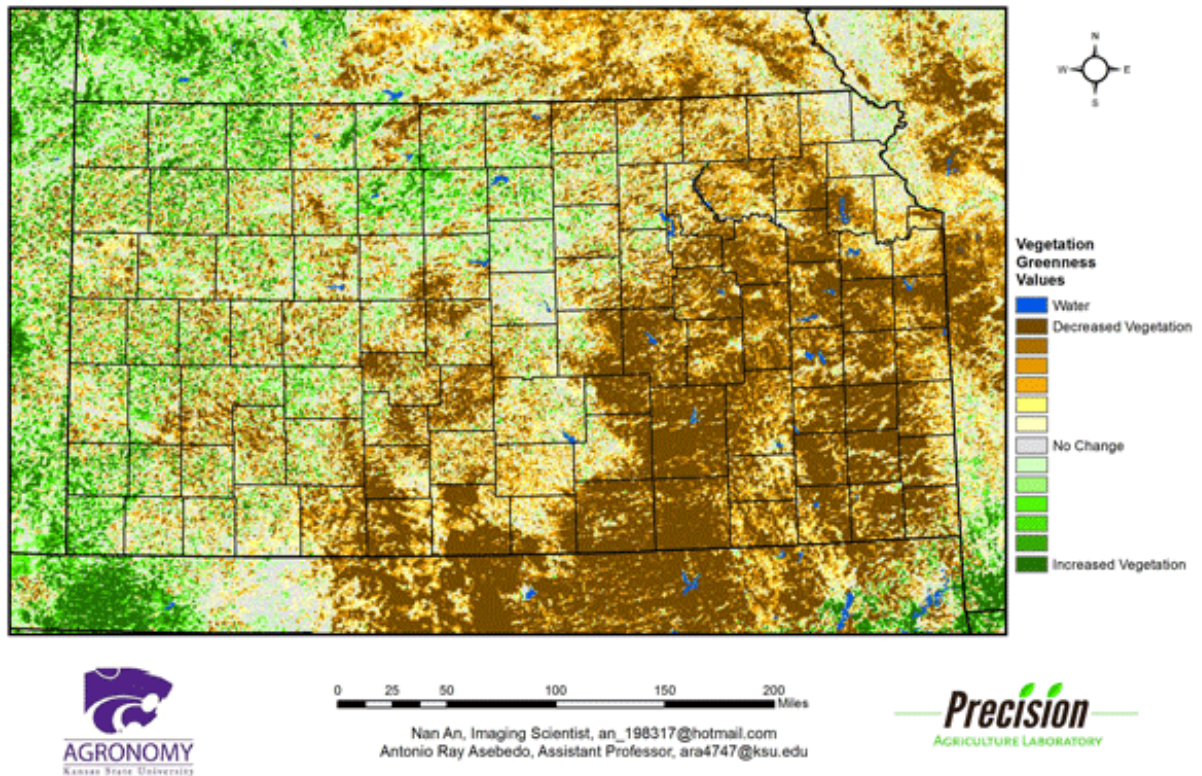


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for May 17 – 23 from K-State’s Precision Agriculture Laboratory shows vegetative production much lower across the northeast and east central areas of the state. Much of this is due to cooler temperatures this year as compared to last.

Kansas Vegetation Condition Comparison Mid-May 2016 compared to the 27-Year Average for Mid-May

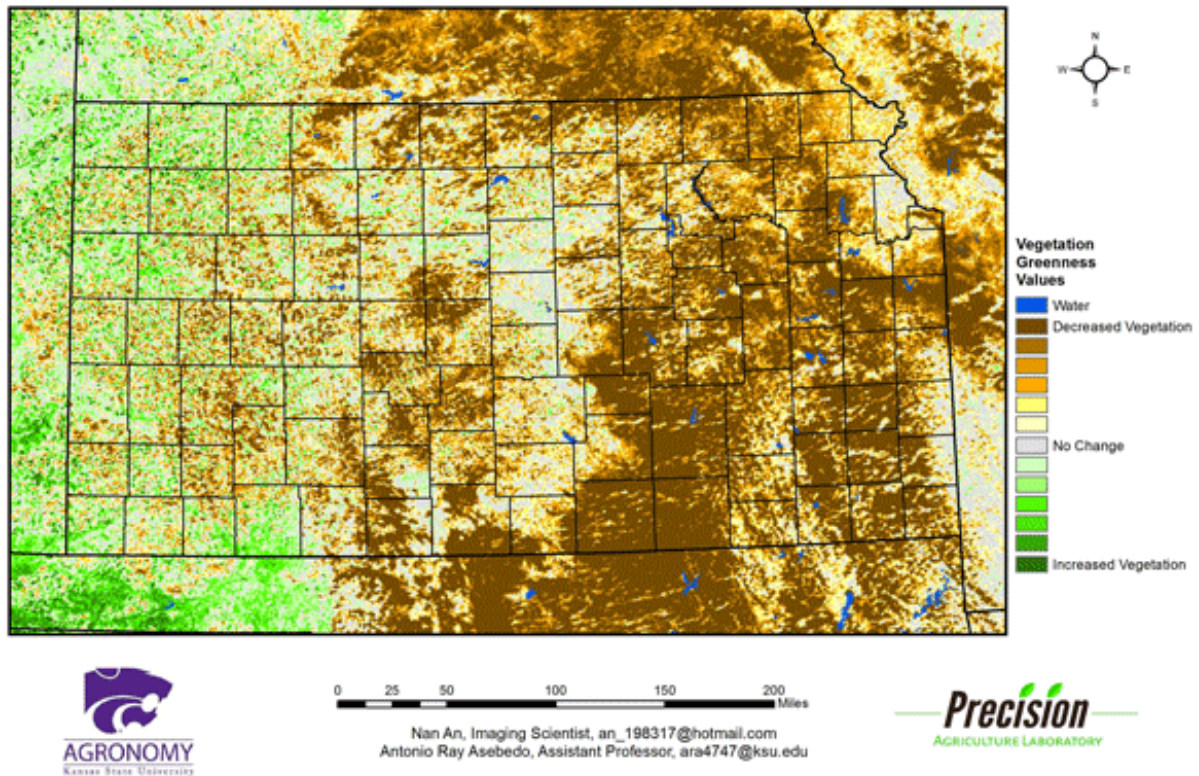
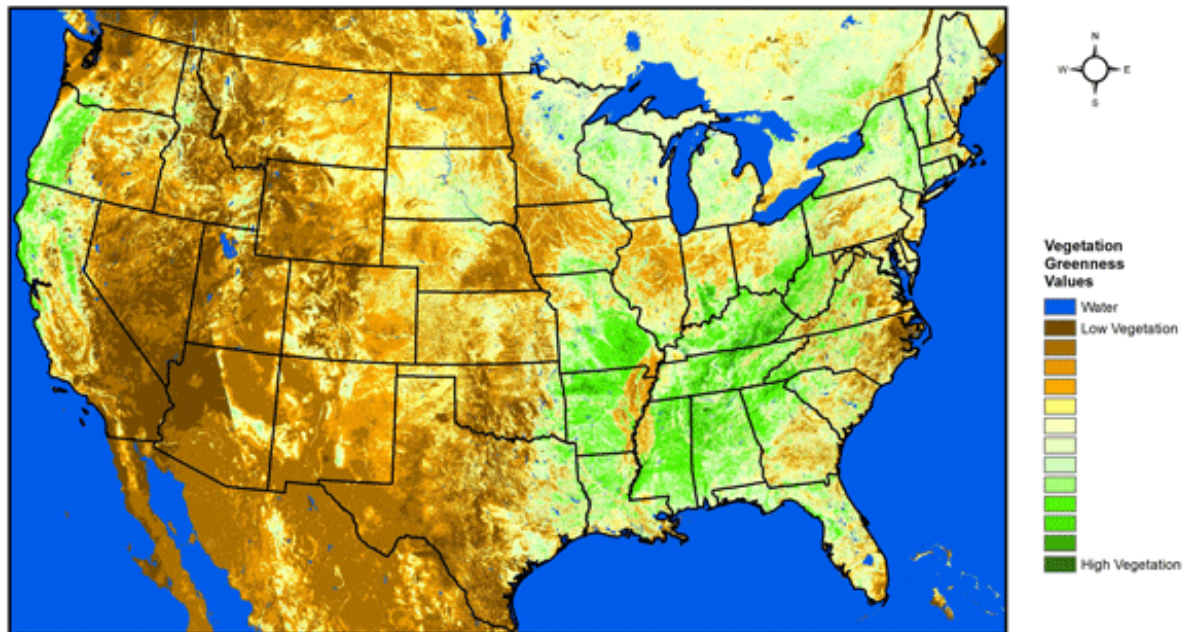


Figure 3. Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for May 16 - 23 from K-State's Precision Agriculture Laboratory shows below-average vegetative activity continues in the eastern areas of the state, where rain lingered. Above-average photosynthetic activity is most visible in the southwest. Warmer temperatures in these regions have allowed vegetation to capitalize on the wetter-than-average April.

Continental U.S. Vegetation Condition

Period 21: 05/17/2016 - 05/23/2016



0 180 360 720 1,080 1,440 Miles

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Figure 4. The Vegetation Condition Report for the U.S for May 17 – 23 from K-State’s Precision Agriculture Laboratory shows high NDVI values across much of the West Coast, and in northern Idaho. Favorable moisture continues to drive active photosynthesis in these areas. A pocket of lower photosynthetic activity continues to be visible along the lower Mississippi River, where flooding is an issue. Low photosynthetic activity from the Central Plains through the Ohio River Valley is due to heavy rainfall and lingering cloud cover.

Continental U.S. Vegetation Condition Comparison
Mid-May 2016 Compared to Mid-May 2015

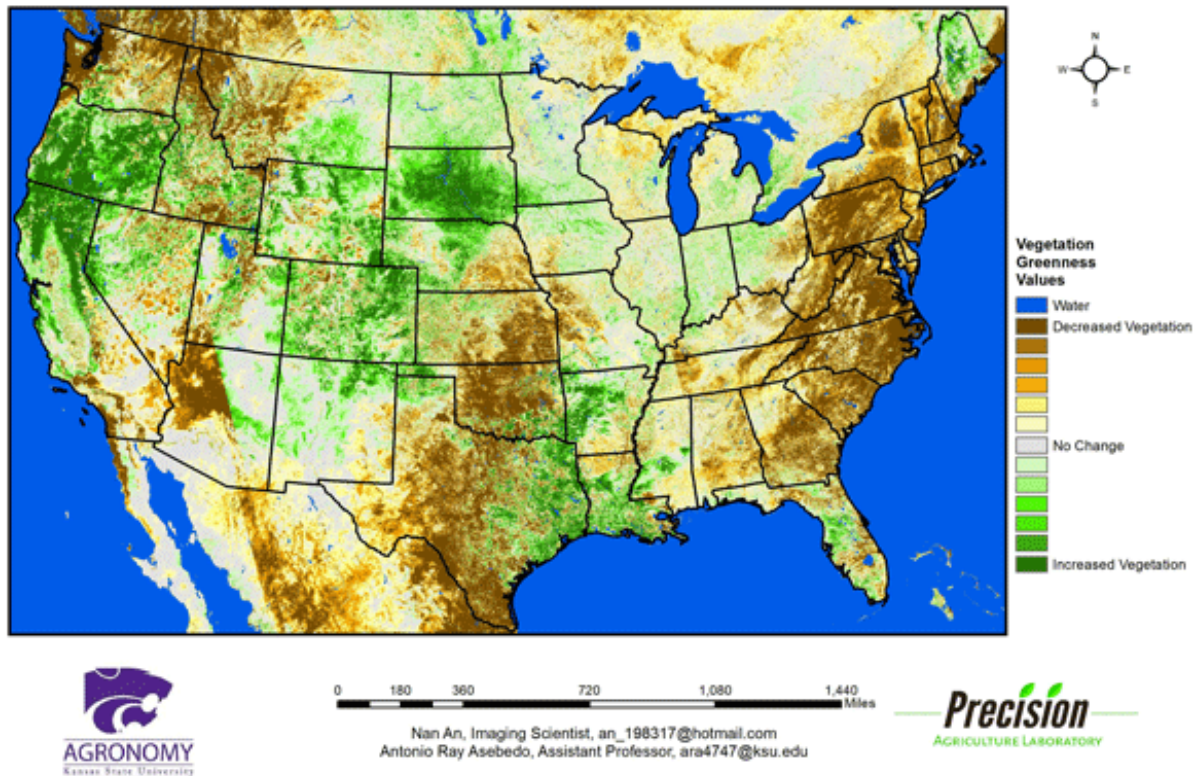


Figure 5. The U.S. comparison to last year at this time for the period May 17 – 23 from K-State’s Precision Agriculture Laboratory shows that lower NDVI values are most evident in the Eastern U.S. Drier-than-average conditions have delayed vegetation compared to last year. In contrast, the lower NDVI values in the Central Plains and East Texas are due to greater rainfall and cloud cover in the region this year. South Dakota stands out in the Plains with much higher photosynthetic activity, as the vegetation continues to take advantage of favorable soil moisture and temperatures.

Continental U.S. Vegetation Condition Comparison
Mid-May 2016 Compared to 27-year Average for Mid-May

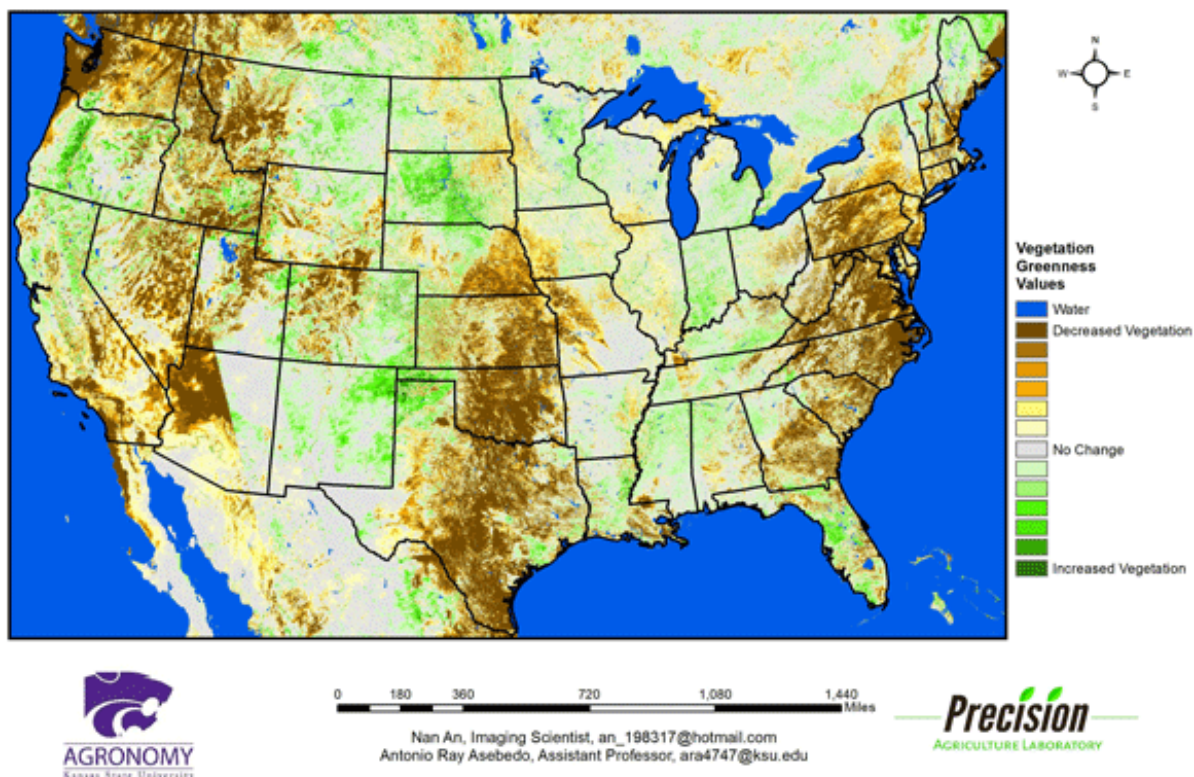


Figure 6. The U.S. comparison to the 27-year average for the period May 17 – 23 from K-State’s Precision Agriculture Laboratory shows above-average photosynthetic activity across the Pacific Northwest, where winter moisture has reduced drought impacts. The heavy rains from last week moved east, and the resulting cloud cover has reduced NDVI readings in those areas. Vegetative activity has rebounded in east Texas as the floods of April recede, but lower-than-average activity continues from central Texas through eastern Nebraska as cool, wet weather dominates these areas.

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