



K-STATE
Research and Extension

Extension Agronomy

eUpdate

04/29/2016

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, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthomпсо@ksu.edu.

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1. Effect of standing water and saturated soils on corn growth

Where there has been standing water or saturated conditions in areas of a field for a couple straight days or more, producers may wonder if this will have any effect on corn, either now or as the season goes along. Periods of early-season water saturation can cause immediate problems for small corn plants, and can at times have season-long implications as well. Hopefully the affected areas are small and confined to spots that are low-lying or poorly drained.

If corn is yet to be planted, please check the companion article published on this issue of the eUpdate titled "Consideration for corn planted under wet conditions."

After corn emerges, saturated soils inhibit root growth, leaf area expansion, and photosynthesis because of the lack of oxygen and cooler soil temperatures. Yellow leaves indicate a slowing of photosynthesis and plant growth. Leaves and sheaths may turn purple from accumulation of sugars if photosynthesis continues but growth is slowed. Corn plants can recover with minimal impact on yield if the plants stay alive and conditions return to normal fairly quickly.



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Figure 1. Young corn plants affected by water standing and soil erosion. Photo by Ignacio Ciampitti, K-State Research and Extension.

Although root growth can compensate to some extent later in the season, a saturated profile early in the season can confine the root system to the top several inches of soil, setting up problems later in the season if the root system remains shallow. Corn plants in this situation tend to be prone to late-season root rot if wetness continues throughout the summer, and stalk rots if the plants undergo mid- to late-season drought stress. Plants with shallow root systems also become more susceptible to standability problems during periods of high winds.

Young corn plants can tolerate only a few days of full submersion. In some cases, symptoms and stand problems seen late in the season may trace back to flooding when the plants were young. Before V6, when the growing point is at or below the soil surface, corn can survive only 2-4 days of flooding. Chances of plant survival increase dramatically if the growing point was not completely submerged or if it was submerged for less than 48 hours. After 48 hours of soil saturation, soil oxygen is depleted and critical plant functions (photosynthesis, water and nutrient uptake) are impaired. Thus, young corn plants are more susceptible than corn beyond the V6 stage, when the plants are taller and the growing point is above the surface. Research has demonstrated yield reductions from early-season flooding ranging from 5% to 32% depending on soil nitrogen status and duration of flooding.

Temperatures can influence the extent of damage from flooding or saturated soils. Cool, cloudy weather limits damage from flooding because growth is slowed and because cool water contains more oxygen than does warm water. Warm temperatures, on the other hand, can increase the chances of long-term damage.

Silt deposition in the whorls of vegetative corn plants can inhibit recovery of flooded corn plants. Enough soil can be deposited in the whorl that emergence of later leaves is inhibited. A heavy layer of silt on leaf surfaces can potentially inhibit photosynthesis or damage the waxy surface layer of the leaf (cuticle), making the leaves subject to drying out. New leaves should not be affected if they can emerge normally. In some instances, the soil in the whorl may contain certain soft-rotting bacteria. These bacteria can cause the top of the plant to rot. The whorl can easily be pulled out of a plant infected with these soft-rotting bacteria. In addition, a rather putrid odor will be present. These plants will not recover.

Flooding can increase the incidence of moisture-loving diseases like crazy top downy mildew. Saturation for 24 to 48 hours allows the crazy top fungus spores found in the soil to germinate and infect flooded plants. The fungus grows systemically in the plant, often not causing visual symptoms for some time. Symptom expression depends on the timing of infection and amount of fungal growth in the plant. Symptoms include excessive tillering, rolling and twisting of upper leaves, and proliferation of the tassel. Eventually the tassel can resemble a disorganized mass of small leaves, hence the name "crazy top."



Figure 2. Crazy top in corn. Photo by Doug Jardine, K-State Research and Extension.

Saturated soils can also cause loss of nitrogen fertilizer by either denitrification (loss of nitrogen to the atmosphere, mainly as nitrous oxide) or leaching (movement of nitrogen beyond the rooting zone). Thus, under wet spring planting conditions, split N applications are more effective in insuring a greater synchrony between crop N demand and soil N supply as compared when all the fertilizer N needed by the crop is applied at planting time. Corn may respond to in-season nitrogen applications if a large portion of early-applied nitrogen is lost to these processes. If corn remains nitrogen deficient later in the season, expect considerably higher levels of stalk rot.

Another condition associated with extended periods of cool, wet soils is commonly referred to as *cold weather crown stress*. Internal stalk cells in the crown nodes can become "leaky" when cell membranes become chilled and oxygen is limited because of the saturated soils. Hybrids with "southern" genetics are more susceptible to this problem than are northern types. Plants may

recover from this damage, but they will be much more susceptible to stalk rot later in the season if hot, dry temperatures occur since water and nutrients cannot be efficiently moved through the damaged crown.



Figure 3. Corn plant showing symptoms of cold weather crown stress. Photo by Doug Jardine, K-State Research and Extension.

Stalk breakage (green snap) or root lodging (plants uprooted) can also occur if plants are affected by wind damage, with older corn plants being more susceptible than young plants. Young plants have better ability to straighten up. Stalk breakage and root lodging can be seen later in the season if the roots were inhibited by flooding during early growth stages. Hybrid differences are a factor that can influence the susceptibility to lodging, but no hybrid is immune to this production issue.



Figure 4. Corn showing effects of wind damage, “green snap,” early during the vegetative period. Photo by Ignacio Ciampitti, K-State Research and Extension.

The best advice is to scout your corn after water drains from the fields. Check the appearance of new leaves and the standability of the corn.

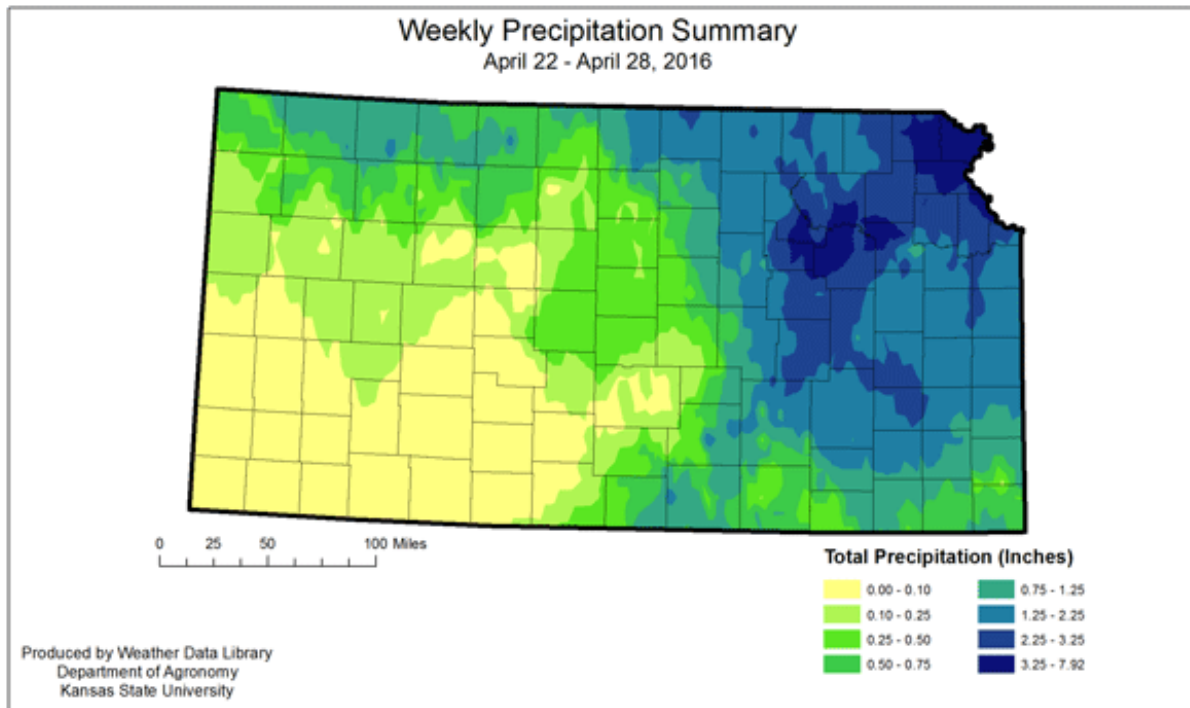
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2. Considerations for corn planted under wet conditions

Recent rains have created very wet soil conditions in parts of Kansas. Some corn remains to be planted (about 50 percent as of April 25, 2016). Weekly and two-week precipitation summaries are presented in Figure 1. The forecast the coming week is also showing potential chances of rain across the state, presenting a challenge for planting the remaining corn acres and for starting soybean planting in eastern and central Kansas (Fig. 2).



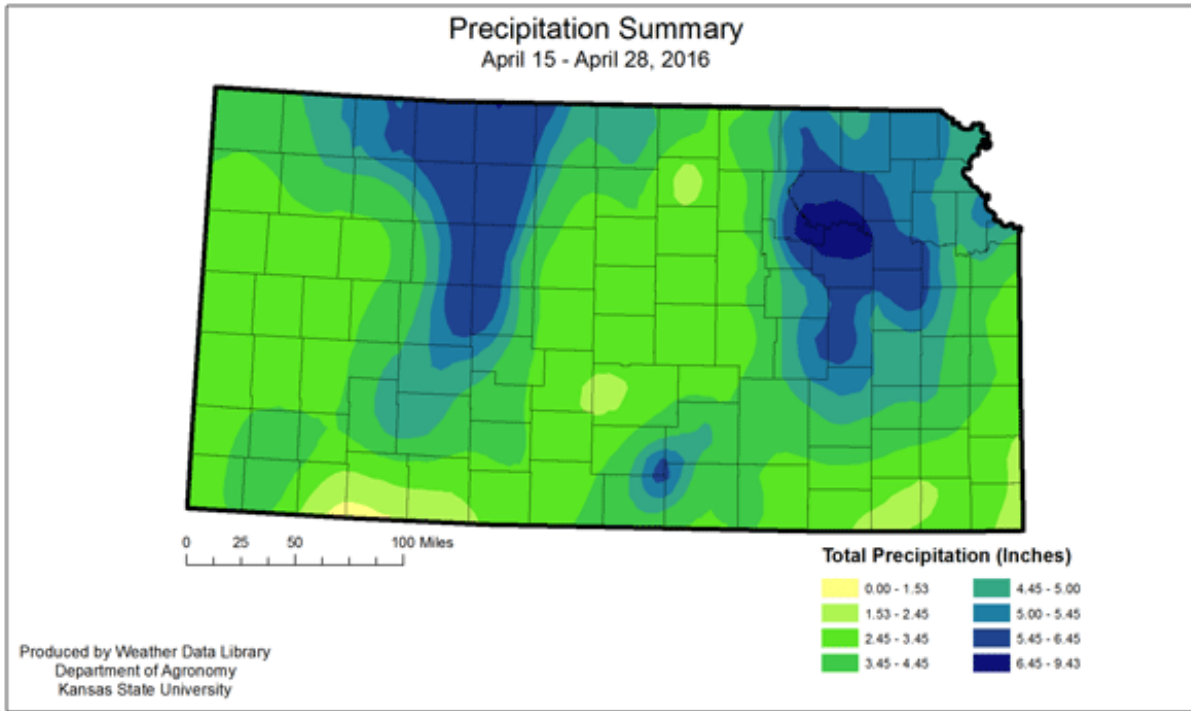


Figure 1. Weekly (upper panel) and two-week (lower panel) precipitation summary, April 15-28, 2016 for Kansas.

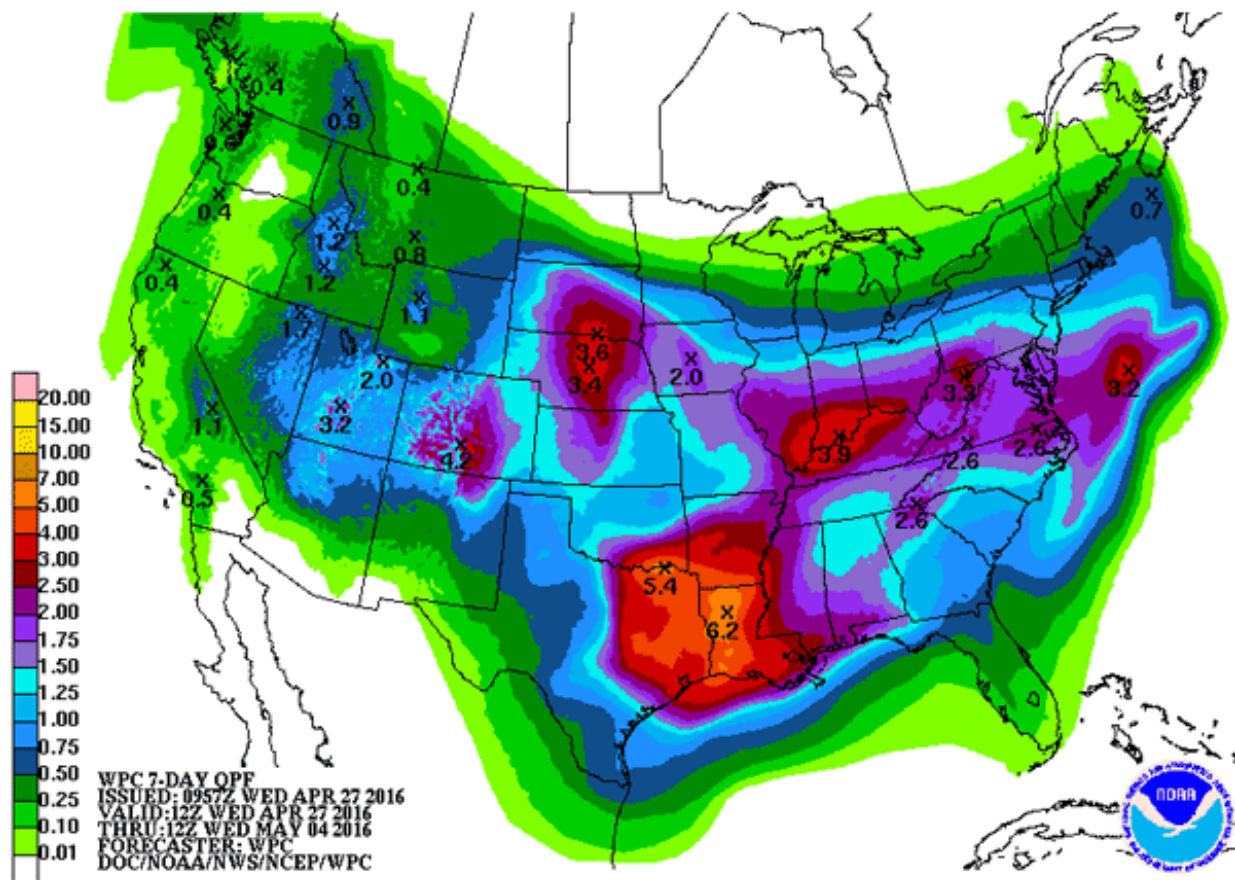


Figure 2. Weekly precipitation forecast (7-day from April 27, 2016). Source: NOAA.

What should producers expect if they plant corn into soils that are too wet, and what can they do to minimize any problems?

It is best, of course, to allow time for the soil to dry adequately before tillage or planting operations if at all possible. Wet conditions will make the soil more susceptible to compaction. Tilling some soils when they are too wet can produce large, persistent clods, complicate planting, reduce herbicide effectiveness, and destroy the seedbed. Also, compaction can occur in the seed furrow itself, restricting proper root development (also diminishing nutrient accessibility) and early plant growth.

If soils remain or become unusually wet after the corn has emerged, corn may look sickly for a while. Saturated soils inhibit root growth, leaf area expansion, and photosynthesis because of the lack of oxygen and cooler soil temperatures. Yellow leaves indicate a slowing of photosynthesis and plant growth. Leaves and sheaths may turn purple from accumulation of sugars if photosynthesis continues but growth is slowed. For further details on these points check the companion article in this issue of the eUpdate: "Effect of standing water and saturated soils on corn growth and yield."



Figure 3. Uneven corn stand. Photo by Ignacio Ciampitti, K-State Research and Extension.

If wet weather conditions persist for more than a week, corn emergence will be delayed and seedlings will be more vulnerable to the presence of insects and diseases. Uneven corn stands likely will be greater when planting in cold and wet soils. This situation will directly affect plant-to-plant uniformity (Fig. 3), impacting potential yield.

Fortunately, the longer 6-10 day outlook is for a drier-than-normal pattern (Fig. 4), particularly in the eastern half of the state. This doesn't exclude some rain during the period, but heavy amounts are unlikely. Also, coupled with warmer temperatures and sunshine, drier-than-normal conditions would allow for quicker drying of the soils.

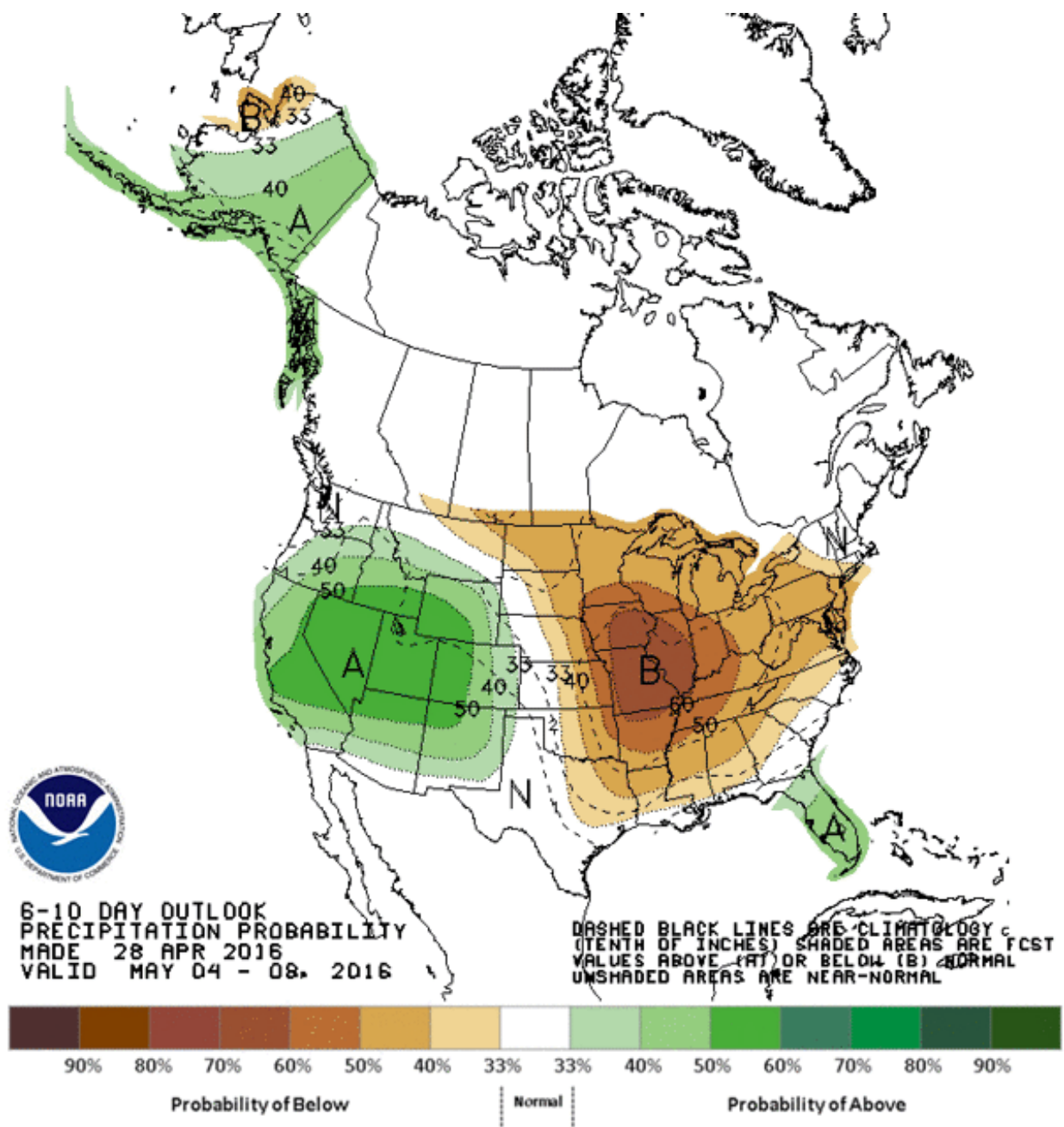


Figure 4. 6-10 Day Outlook (May 4- May 8, 2016) issued April 28, 2016. Source: NOAA.

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3. Soybean response to standing water and saturated soils

Soybean planting has yet to begin in earnest in Kansas, based on the USDA Crop Progress and Condition Report from April 25, 2016. Nonetheless, some farmers have already planted some of their soybeans. These beans have gotten off to a very slow start, constrained by rain events and wet soil conditions.



**Figure 1. Soybean slowly emerging and showing lack of uniformity, planted April 14, 2016.
Photo by Ignacio Ciampitti, K-State Research and Extension.**

Wet soil conditions will slow emergence, make the soil more susceptible to compaction (limiting root growth), and cause poor plant-to-plant uniformity after emergence. Sidewall compaction occurs when soybean is planted when the soil is too wet, immediately followed by a dry weather. Soil surface crusting is another potential challenge for soybean emergence.

After emergence, how will soybeans respond to standing water and saturated soil conditions? If soybean plants are submerged for less than 48 hours, there is a good chance they will survive. Plants can survive under water longer under cool than warm temperatures. Submerged soybean plants can survive for up to 7 days when temperatures are less than 80 degrees F.



Figure 2. Soybean seedlings under water. Photo by Doug Shoup, K-State Research and Extension.

To find out whether the soybeans are damaged after the water recedes, split the stem at the tip and examine the growing point. A healthy growing point will be firm and white or cream colored. A soft, dark growing point indicates injury. In some cases, the silt coating the plant after short-term flooding can cause more injury and plant death than the water itself.

Even if the fields did not have standing water and plants were not totally submerged, waterlogged soils can cause problems if the waterlogging lasts too long. When soils are saturated for a prolonged period of time, a lack of oxygen in the roots can lead to the accumulation of lactic acid and other products of anaerobic respiration. This is the underlying cause of damage to plants in waterlogged soils where only the roots are flooded.

Injury can depend on variety, growth stage, duration of waterlogging, soil texture, fertility levels, and diseases present. Interactions of these factors make it hard to predict how a given soybean field will react to waterlogged soils.



Figure 3. Soybean seedlings under full submersion. Photo by Ignacio Ciampitti, K-State Research and Extension.

Variety differences have been reported and researchers have identified possible genes associated with tolerance to waterlogged conditions. Scientists in Missouri have screened a number of soybean varieties, subjecting them to two periods of flooding, each two weeks in duration. The average yield reduction for all varieties was 61%. Yields were reduced by 39% for the most tolerant varieties and 77% for the least tolerant. Producers should check with their seed supplier regarding information about a particular variety.

Growth stage factors

Research examining the influence of growth stage on the degree of injury from waterlogged soils has provided mixed results.

- Germination. Saturated conditions during germination can reduce successful germination by up to 40% and can inhibit seedling growth. Seeds that are further in the germination process at the time of saturation sustain more injury.
- Vegetative growth stages. Excess water during vegetative stages usually causes less injury than waterlogging during the reproductive and grain filling stages. Short-term waterlogging (2 to 3 days) at V2 to V4 can cause yield reductions of 0% to 50%, depending on soil texture, variety, and subsequent weather. Yield reductions from waterlogging during the early vegetative stages have been attributed to reduced plant population and shorter plants with

reduced branching and fewer pods per plant.

- We're a long ways from the reproductive stages at the moment, but for the record, waterlogging for 2 to 3 days at R2 usually causes greater yield reductions than if it occurs during the vegetative stages. Waterlogging at R1 reduced the number of pods per node. At R5, yield reductions have been attributed to reduced seed size.

Duration of soil saturation

The longer the soil is saturated, the greater the injury, mortality, and consequent yield reductions. During germination, saturated conditions for 48 hours can decrease germination by 30% to 70% depending on the timing of the saturation, nearly twice the yield decrease resulting from durations of 24 hours or less. For plants that have emerged, a waterlogged condition that lasts for less than two days often causes little or no noticeable yield reduction. Intolerant varieties begin to show yield reductions after 2 days of saturation, but tolerant varieties can withstand up to 4 days of waterlogging with little reduction in yield. As the duration of soil saturation increases, researchers have documented greater reductions in population, height, pods per plant, yield, and leaf tissue nitrogen.

Other factors

Soil conditions play a role in the severity of injury from waterlogging as well. Coarser textured soils will drain more quickly, minimizing the duration of oxygen deprivation to the roots. Fine textured soils maintain saturation longer, increasing the chances of injury.

Fields that are flooded, or are at or above the water-holding capacity of the soil, will be more likely to develop root rot problems. Flooding accompanied by cooler temperatures would be favorable to *Pythium* root rot whereas warmer temperatures would favor *Phytophthora* and *Rhizoctonia* root rots. Whether *Phytophthora* root rot develops often depends on the tolerance or resistance of the variety used. If the flooding occurs beyond the first week or two after emergence, any seed treatment fungicides that may have been used will no longer be effective.



Figure 4. Stand loss in a wet area due to Phytophthora root rot. Photo by Doug Jardine, K-State Research and Extension.

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4. Current status of the Kansas wheat crop: storms, yield potential, and imminent problems

A variety of events have recently affected the Kansas wheat crop. Some of this has been very positive and should contribute to grain yield formation, but some has not.

Precipitation and yield potential

The last two weeks brought much-needed precipitation to most of Kansas (Figure 1). Precipitation totals ranged from less than 1.5 inches in isolated spots in southwest Kansas to as much as 9 inches or more in the west central and northeast portions of the state. Most of the wheat-producing region of Kansas received at least 2.5 to 3.5 inches of precipitation.

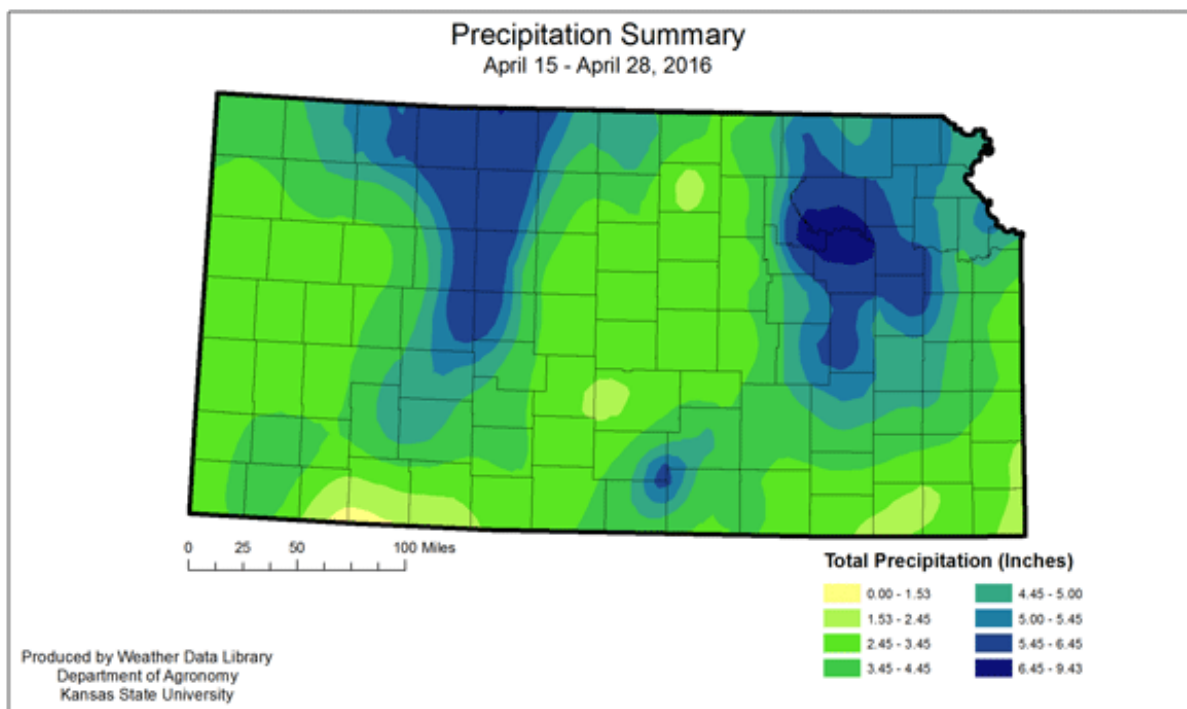


Figure 1. Total precipitation received in the April 15 – 28 period.

This precipitation was very timely and helped alleviate drought stress in portions of the state where the wheat was turning blue, or even brown, such as north central and southwest Kansas. This timely rain can potentially increase the crop's yield potential. The benefits of these precipitation events to Kansas wheat yield can be estimated based on the crop's water-use efficiency, which in Kansas is approximately 4 bushels per acre per inch (although higher water-use efficiency values can be attained under certain conditions). For more information on wheat water-use efficiency and the potential to translate the recent precipitation events in grain yield, see article ["How much yield potential did the latest round of precipitation add to the wheat crop?"](#) in the Agronomy eUpdate issue 565 of April 22nd.

Potential disease problems

Conditions that are favorable for wheat yield are generally also favorable to the development of certain pathogens, such as stripe rust and Fusarium head blight (head scab). Stripe rust has been present in the central corridor of Kansas for the last several weeks, and has recently increased in incidence and severity due to optimal conditions for its development (cool temperatures and available moisture). Fields planted to susceptible varieties that have not been sprayed with a foliar fungicide may now be showing severe stripe rust infection on the flag leaves (Figure 2), which can result in yield losses of 40% or more. For more information on stripe rust development across Kansas, please see the accompanying article in the [current eUpdate issue](#) titled "Wheat stripe rust update."

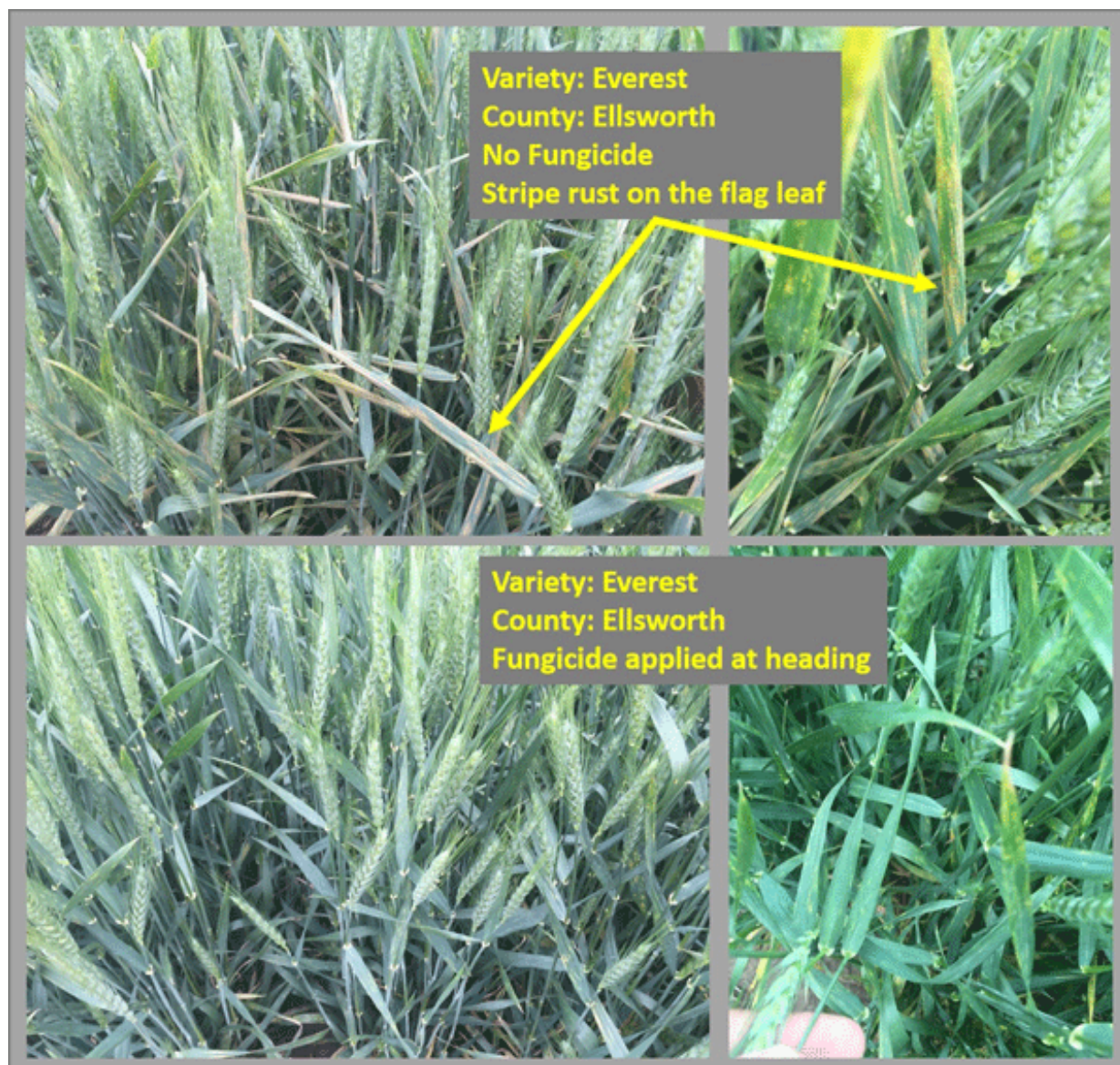


Figure 2. Incidence and severity of stripe rust on the susceptible variety Everest, with and without a foliar fungicide application at heading, in Ellsworth County. Photo by Romulo Lollato, K-State Research and Extension.

The precipitation also coincided with heading and flowering in many parts of the state, which is conducive for Fusarium head blight. The infection by head scab occurs when there is available moisture during anthesis, and might be a concern in south central and southeast Kansas at this point. For more information on potential threat of head scab to the Kansas wheat crop, please see the accompanying article in the [current eUpdate issue](#) titled "xx."

Hail and freeze damage

Another factor that could concern producers this growing season is possible hail and freeze damage. The storms of April 24th and 26th brought hail to the eastern half of the state (Figure 3). Depending on hail size and duration of hailstorm, some fields may have sustained damage.

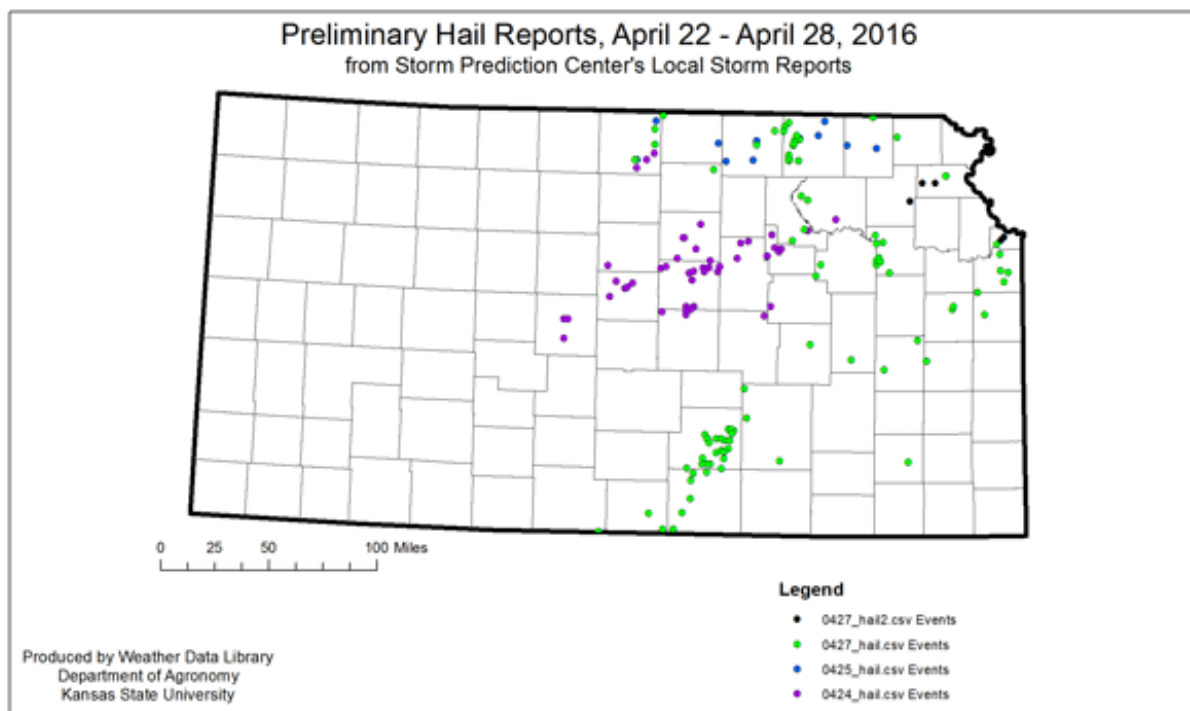


Figure 3. Preliminary reports of hail from the storms this week across Kansas.

Finally, reports of freeze damage from the April 12th freeze have been minor, mostly restricted to lower areas in fields in Saline and Cloud counties. Additionally, damage seems to have been generally restricted to the top spikelets within the wheat head (Figure 4). The preliminary reports and field assessments indicate that very little freeze damage may have been sustained by the crop despite having more than 5 hours of below freezing temperatures on April 12th.



Figure 4. Slight freeze damage showing up in early planted wheat in Cloud County. Photo by Kim Larson, River Valley District Crop Production Agent.

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5. Risk of Fusarium head blight (scab) in wheat

The recent rains and extended periods of high relative humidity are increasing the risk of problems with Fusarium head blight (FHB, or scab) in wheat. We are concerned about Fusarium for two reasons.

1. The wheat crop is at or will soon reach the flowering and early grain fill stages that are most vulnerable to the disease (Figure 1).

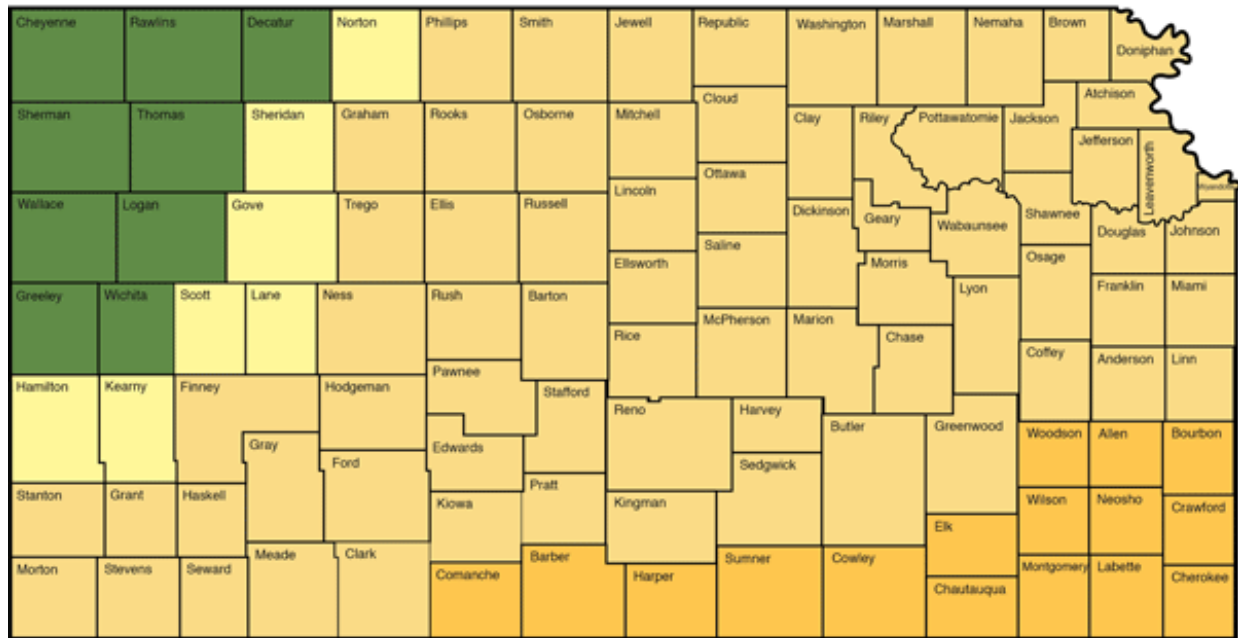
2. Weather conditions have been favorable for the reproduction and development of this disease.

The Fusarium Head Blight Prediction Center suggests that most of the eastern half of the state is at moderate to high risk of severe FHB. You can find risk maps prediction tools at: <http://www.wheatscab.psu.edu>. This prediction is largely driven by extended periods of high relative humidity and frequent rainfall (Figures 2 and 3).

Growers can help reduce the risk of Fusarium head blight in their fields with fungicide applications. Choosing the right fungicide is important with FHB; much more so than with stripe rust or leaf rust. Products such as Prosaro, and Caramba are the best options because these products offer about 50% suppression of the disease. Folicur or generic tebuconazole can also offer about 35% suppression of the disease. All of these fungicide must be applied after the heads have fully emerged to be effective. These fungicides can be applied through flowering and into the grain filling stages of growth but producers must stay within the 30-day pre-harvest interval on the label. Fungicides containing strobilurin active ingredients should be avoided during high risk periods for FHB. These products are not labeled for FHB, and in some situations can actually aggravate the DON mycotoxin problems caused by this disease.

Estimated Wheat Growth Stage

April 29, 2016



Wheat Growth Stage

- | | |
|---|---------------------------------|
| Tillering or strongly upright tillers | Boot or flowering |
| Strongly upright tillers or jointing | Flowering or watery ripe |
| Jointing or approaching flag leaf emergence | Watery ripe or milk |
| Approaching flag leaf emergence or at flag leaf emergence | Milk or dough |
| Flag leaf emergence or boot | Dough or physiologically mature |

Growth observation map based on reports from: E. De Wulf, R. Lollato, D. Shoup, L. Haag, S. Durcan, E. Adee, M. Buchanan, G. Cramer, A.J. Foster, S. Campbell, J. Carr, J. Coltrane, J. Falk-Jones, J. Green, D. Hallauer, R. Hein, J. James, A. Johnson, K. Larson, C. Long, T. Maxwell, C. Miller, M. Ploger, Z. Simon, S. Wick

Figure 1. Estimated growth stage in wheat based on model estimated development and K-State observations of crop stage. Local growth stage may vary with planting date and variety.

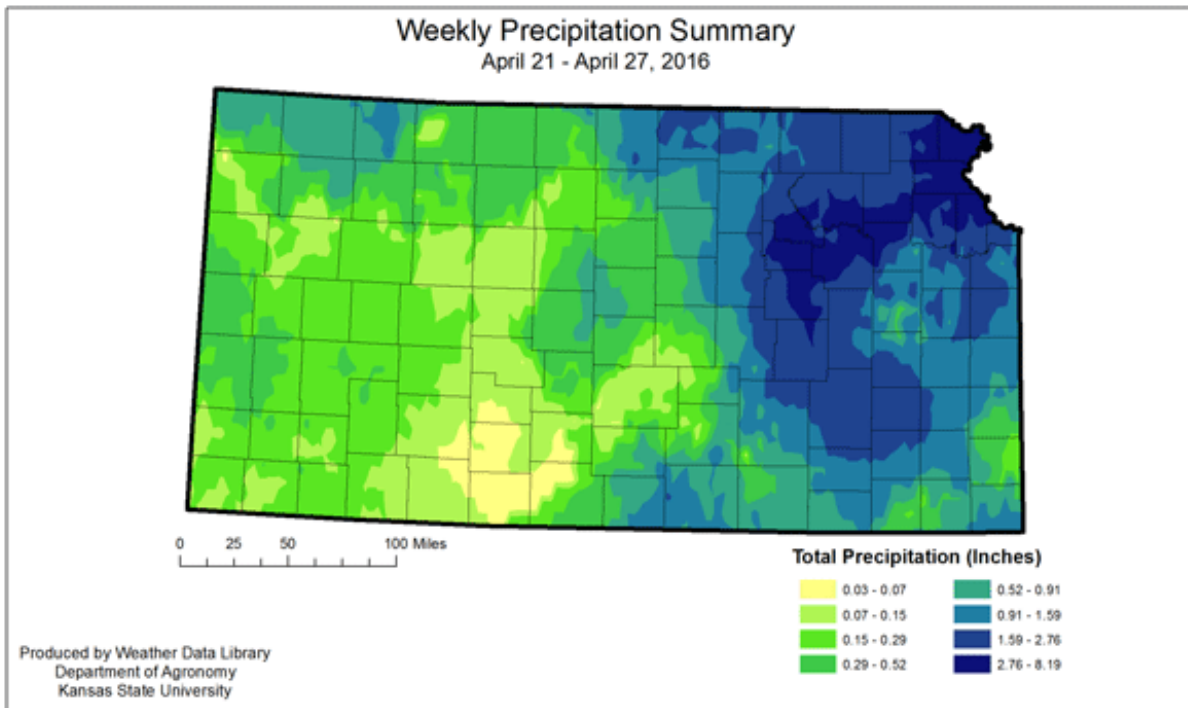


Figure 2. Rainfall summary for Kansas during the week of April 21-27.

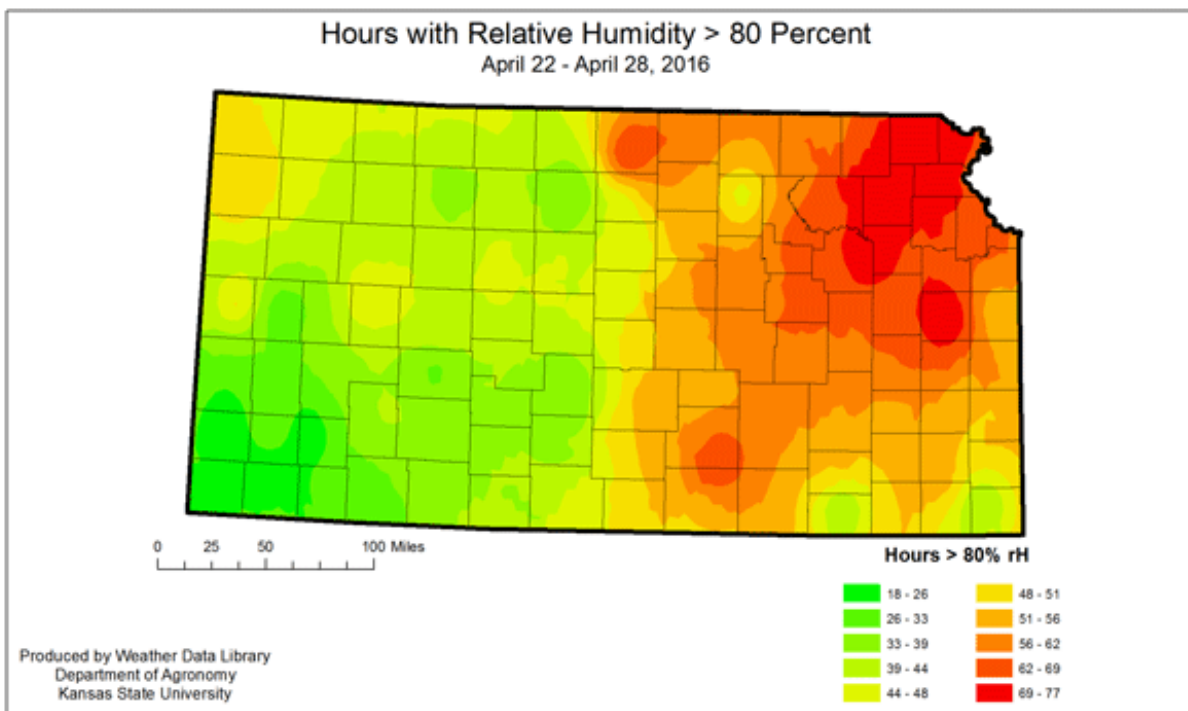


Figure 3. Hours of relative humidity greater than 80% for Kansas. These periods of high relative humidity are very favorable for the development of Fusarium head blight.

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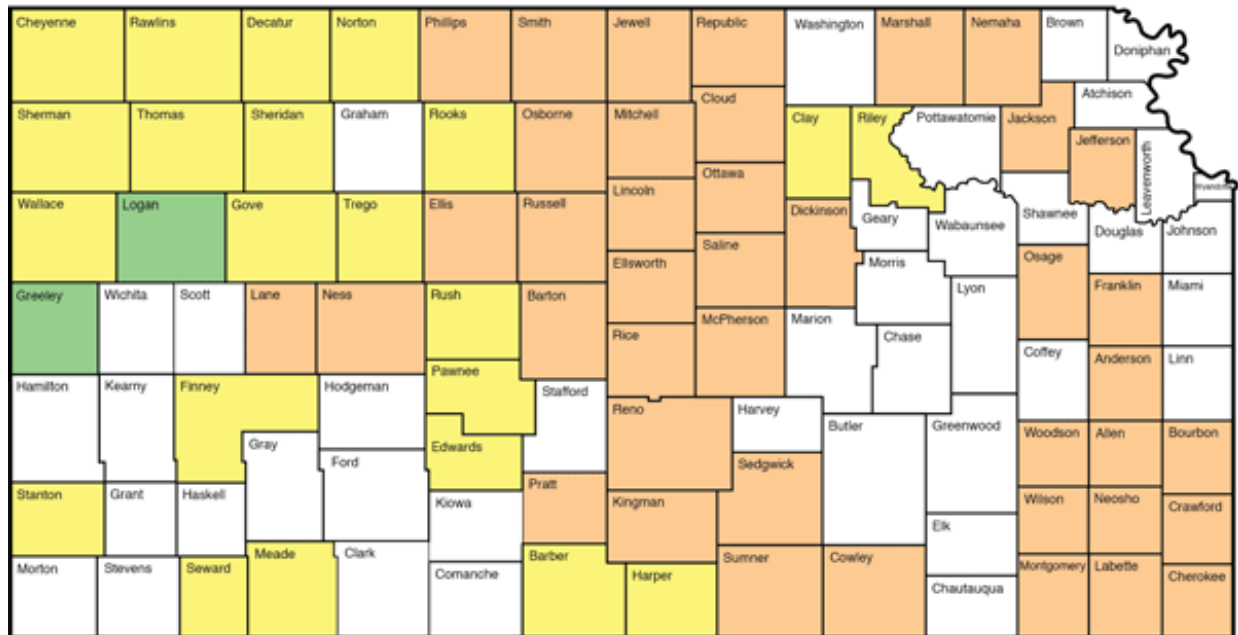
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6. Latest information on wheat stripe rust

Wheat stripe rust continues to emerge as a serious problem in many areas of Kansas. Key developments this week include the detection of stripe rust on the upper leaves of the wheat crop in many counties in central Kansas (Figure 1). This is important because these upper leaves are critical for production of the grain, as the flag leaf and flag leaf-1 can produce as much as 90% of the photosynthates used for grain fill. We also have received reports of low levels of the disease in the western regions of the state. The weather forecast suggests continued cool temperatures and above normal rainfall for the next few weeks (Figure 2). These conditions will favor continued development of stripe rust.




Wheat varieties that are known to be susceptible to stripe rust should be a top priority for scouting and protecting with fungicides. The evidence to date suggests that the stripe rust reaction of our wheat varieties this year is very similar to last year. The list of susceptible varieties includes Armour, Byrd, Denali, Everest, KanMark, RedHawk, Ruby Lee, TAM 111, TAM 112, and Winterhawk. These varieties represent some of the most widely planted varieties in the state. Varieties that are looking more resistant include Oakley CL, SY-Monument, T158, WB4458, and WB-Grainfield. These resistant varieties will often have some low levels of disease, but the rust develops more slowly and often remains less severe during the critical stages of grain development.

Distribution of Wheat Stripe Rust April 29, 2016



Disease observation map based on reports from: E. De Wolf, R. Lollato, D. Shoup, L. Haag, S. Duncan, E. Adee, M. Buchanan, G. Cramer, A.J. Foster, D. Busick, S. Campbell, J. Carr, J. Coltrain, J. Falk-Jones, C. Fitch-Deitz, J. Green, D. Hallauer, R. Hein, J. James, A. Johnson, K. Larson, C. Long, T. Maxwell, C. Miller, M. Ploger, Z. Simon, S. Wick

Disease Risk

-  Stripe rust not observed
-  Stripe rust observed on lower leaves
-  Stripe rust observed on upper leaves

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Figure 1. Current distribution of wheat stripe rust in Kansas based on observations from K-State Extension.

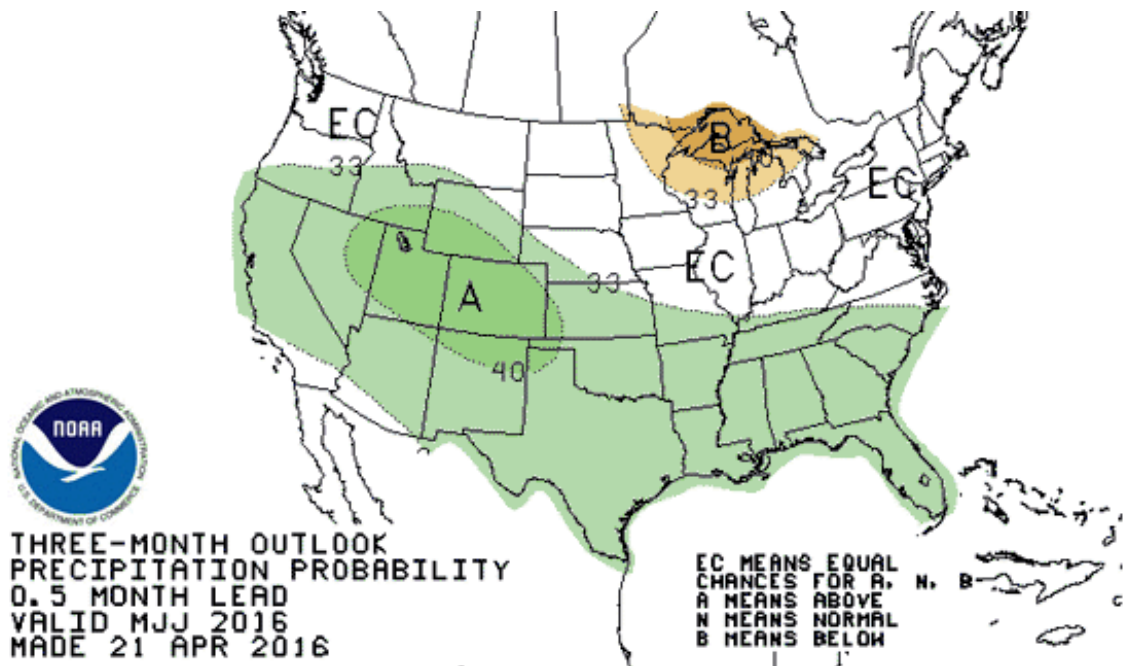


Figure 2. Long-range forecast for rainfall from the NOAA. Much of Kansas is projected to have above-normal rainfall, which would increase the risk of severe disease problems in wheat.

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7. Beef Cattle and Forage Crops Field Day, Mound Valley, May 5

The Southeast Agricultural Research Center will host a Beef Cattle and Forage Crops Field Day on Thursday, May 5, at the Mound Valley Community Center, 505 Hickory St., in Mound Valley.

Registration on-site for the free event begins at 8:30 a.m., with the program starting at 9 a.m. Numerous agriculture-related companies will have displays available and will sponsor a complimentary lunch for attendees.

Presentations will include:

Development of Tall Fescue Hybrids – Bryan Kindiger, research plant geneticist, USDA-ARS Grazinglands Research Laboratory;

Utilization of Teff for Forage – Joe Moyer, forage agronomist K-State Southeast Agricultural Research Center;

Understanding Forage Analysis – Jaymelynn Farney, southeast area extension beef specialist;

Alfalfa Weed Management – Doug Shoup, southeast area extension crops and soils specialist; and

Considerations for Storage of Large Round Bales of Hay – Lyle Lomas, animal scientist and head, Southeast Agricultural Research Center.

An optional tour of the university's Mound Valley unit will be available after lunch, weather permitting.

More information about the field day is available by calling 620-421-4826.

8. Spring Field Day, May 26, Garden City

9. 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.

10. Comparative Vegetation Condition Report: April 19 - 25

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 17: 04/19/2016 - 04/25/2016

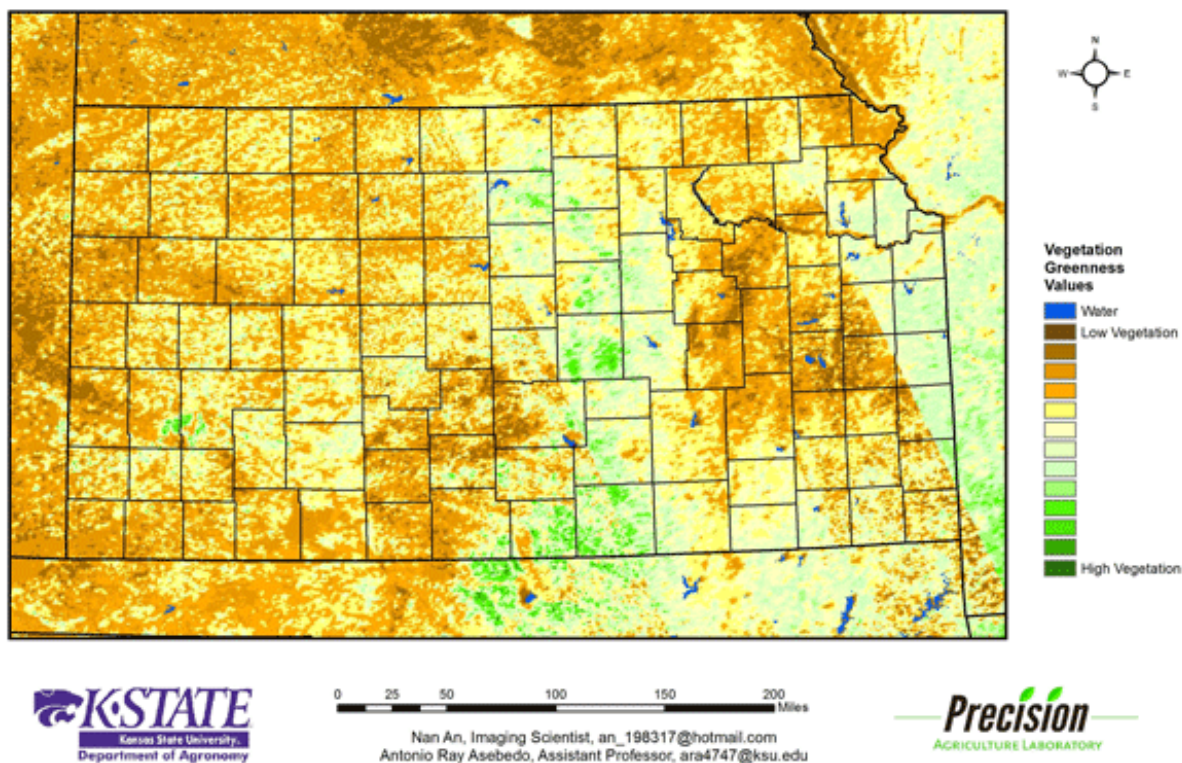


Figure 1. The Vegetation Condition Report for Kansas for April 19 – 25 from K-State’s Precision Agriculture Laboratory continues to show further expansion of the area of highest plant production into north central Kansas. The highest NDVI values are still in Sumner and Harper counties. The Flint Hills continue to show relatively low photosynthetic activity. Recent rainfall is likely to accelerate the greenup in this region, but cooler temperatures and cloudy conditions will limit that progress.

Kansas Vegetation Condition Comparison Late-April 2016 compared to the Late-April 2015

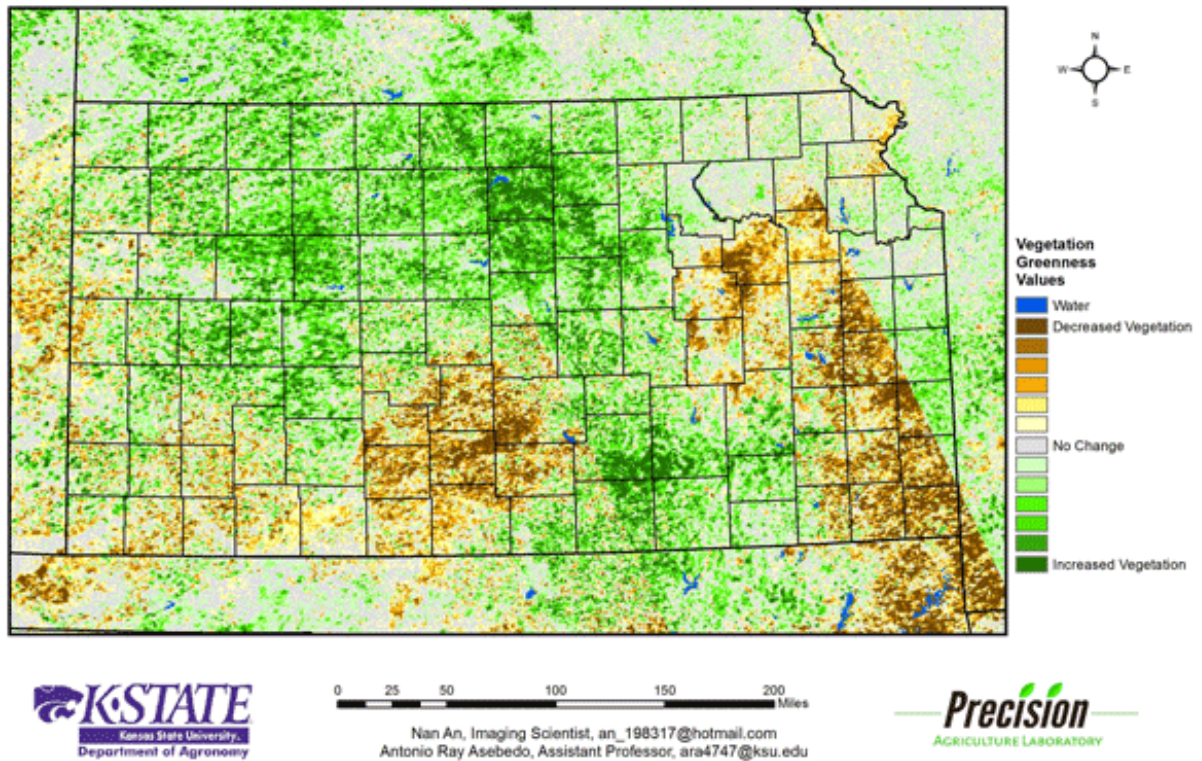
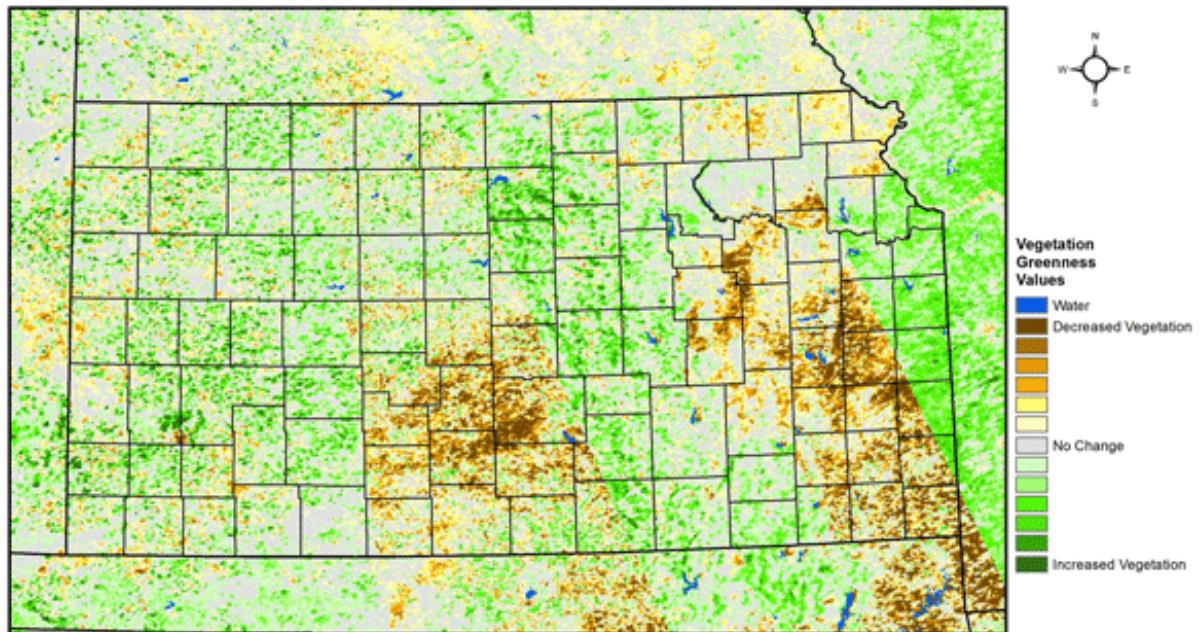


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for April 19 - 25 from K-State's Precision Agriculture Laboratory shows a small portion of the state has lower photosynthetic activity. Part of that is due to dry conditions in March and early April, while some is due to excessive rain.

Kansas Vegetation Condition Comparison
Late-April 2016 compared to the 27-Year Average for Late-April



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Figure 3. Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for April 19 – 25 from K-State's Precision Agriculture Laboratory shows that the area of above-average photosynthetic activity has begun to expand again. The areas of lower productivity in east central and southeast Kansas are due to recent cloud cover.

Continental U.S. Vegetation Condition

Period 17: 04/19/2016 - 04/25/2016

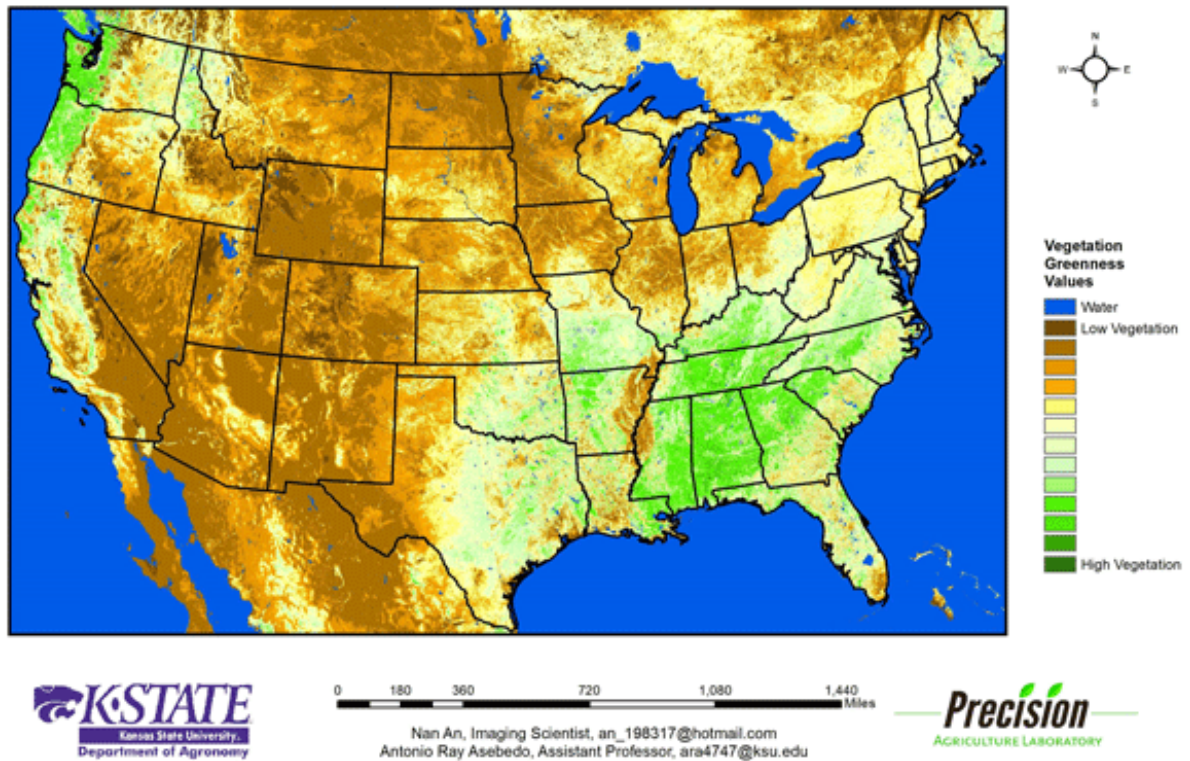


Figure 4. The Vegetation Condition Report for the U.S for April 19 – 25 from K-State’s Precision Agriculture Laboratory shows high NDVI values along much of the West Coast, and in northern Idaho. Favorable moisture continues to drive active photosynthesis in these areas. A pocket of lower photosynthetic activity continues to be visible along the lower Mississippi River, where flooding is an issue.

Continental U.S. Vegetation Condition Comparison
Late-April 2016 Compared to Late-April 2015

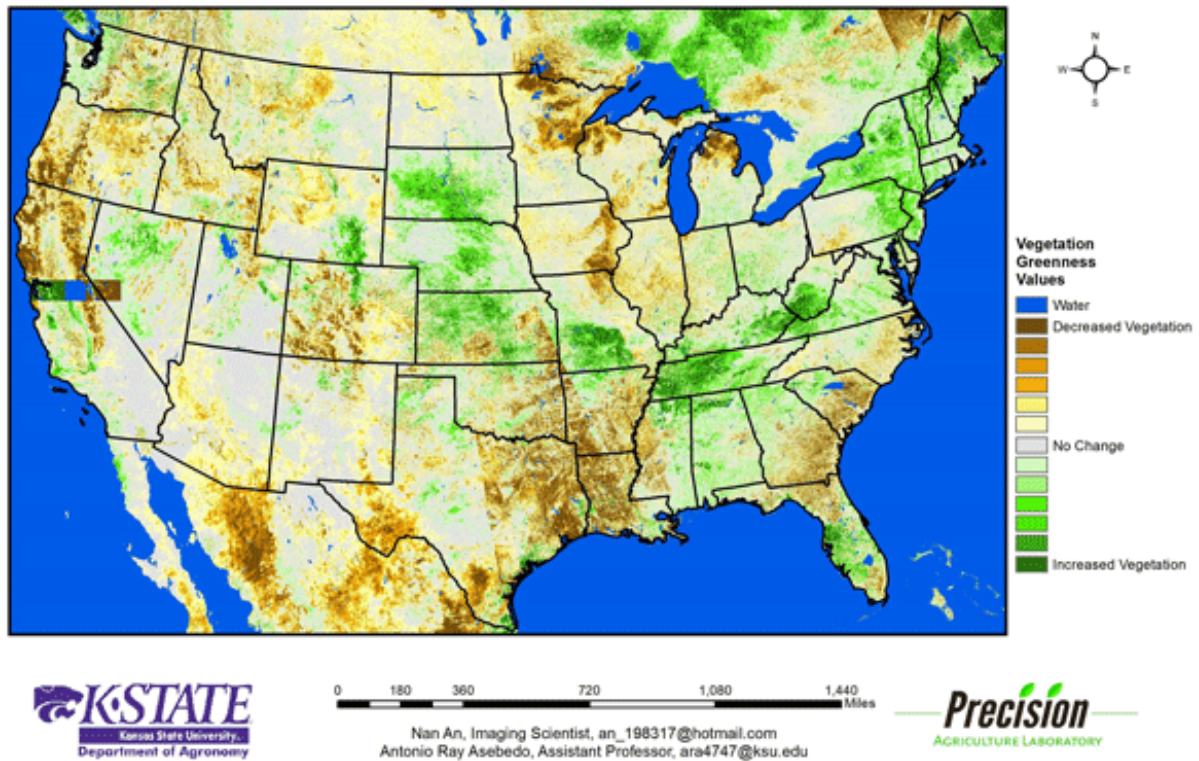


Figure 5. The U.S. comparison to last year at this time for the period April 19 – 25 from K-State’s Precision Agriculture Laboratory shows that lower NDVI values are most evident in Minnesota and Wisconsin, thanks to a late-season snow event. This is also true in Colorado and Wyoming, although to a lesser degree. In contrast, much higher NDVI values are visible in New England. Despite the recent snows in this area, the overall snow depth is less than last year, and more vegetation is active. In the Southern Plains, lower NDVI values are the result of heavier rains this season.

Continental U.S. Vegetation Condition Comparison
Late-April 2016 Compared to 27-year Average for Late-April

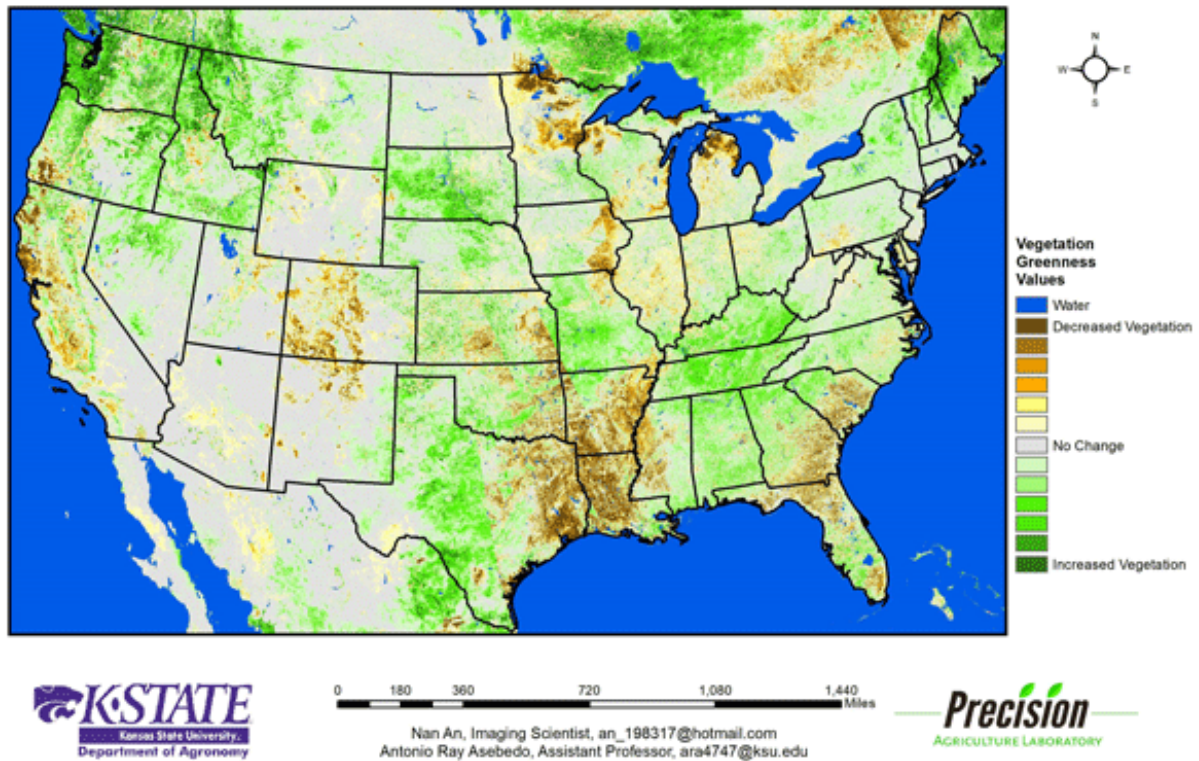


Figure 6. The U.S. comparison to the 27-year average for the period April 19 – 25 from K-State’s Precision Agriculture Laboratory shows above-average photosynthetic across the Pacific Northwest, where winter moisture has reduced drought impacts. Snow pack from the late-season storms in the central Rockies has reduced photosynthetic activity in these areas. Persistent clouds in southeastern Oklahoma, east Texas, Louisiana, and eastward have masked NDVI readings in those regions.

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