



**K-STATE**  
Research and Extension

## Extension Agronomy

# eUpdate

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*03/18/2016*

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](mailto:swatson@ksu.edu), Jim Shroyer, Crop Production Specialist 785-532-0397 [jshroyer@ksu.edu](mailto:jshroyer@ksu.edu), or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 [cthompso@ksu.edu](mailto:cthompso@ksu.edu).

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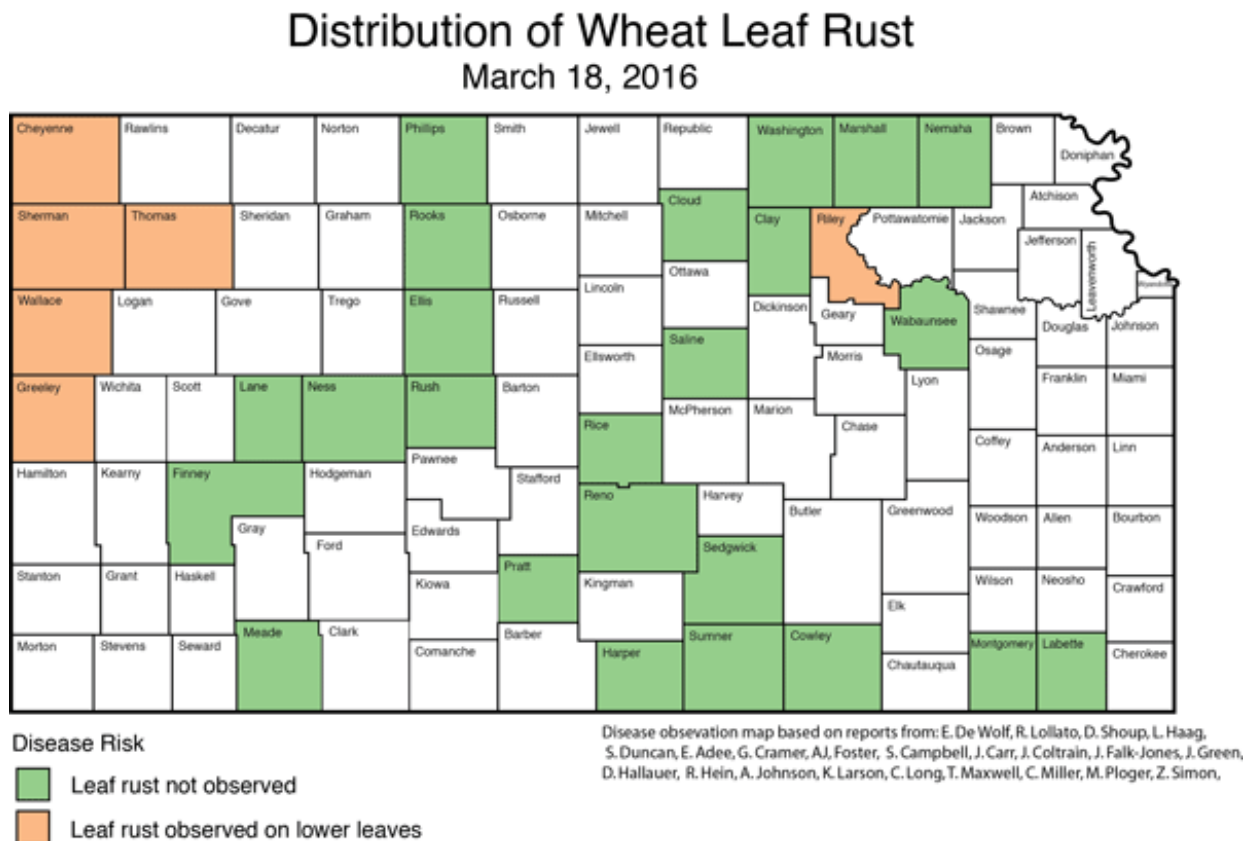
## 1. Reports of leaf rust and stripe rust; fungicide application timing

The wheat crop is growing rapidly throughout Kansas. The crop in the more advanced fields are approaching jointing in the northwest and are about a week away from flag leaf emergence in the south central and southeast portions of the state. The crop is generally considered to be about 3 weeks ahead of schedule with respect to normal growth and development. There are multiple reports of leaf rust and stripe rust in Texas, Oklahoma, and other surrounding states.

### Disease presence and implications for growers

The Crops Extension team has been busy scouting for disease in recent weeks. We are finding active leaf rust and stripe rust in the state (Figures 1 and 2). Leaf rust was reported in west central and northwest, Kansas with most activity in counties bordering Colorado. Low levels of leaf rust were also observed in research plots in Riley County, which is located in northeast Kansas. The winter has been very mild in Kansas and it is very likely that the leaf rust has overwintered in the state. Stripe rust was reported in multiple counties this past week. Stripe rust is generally at very low levels with most activity reported in the southeast portion of the state (Figure 2).

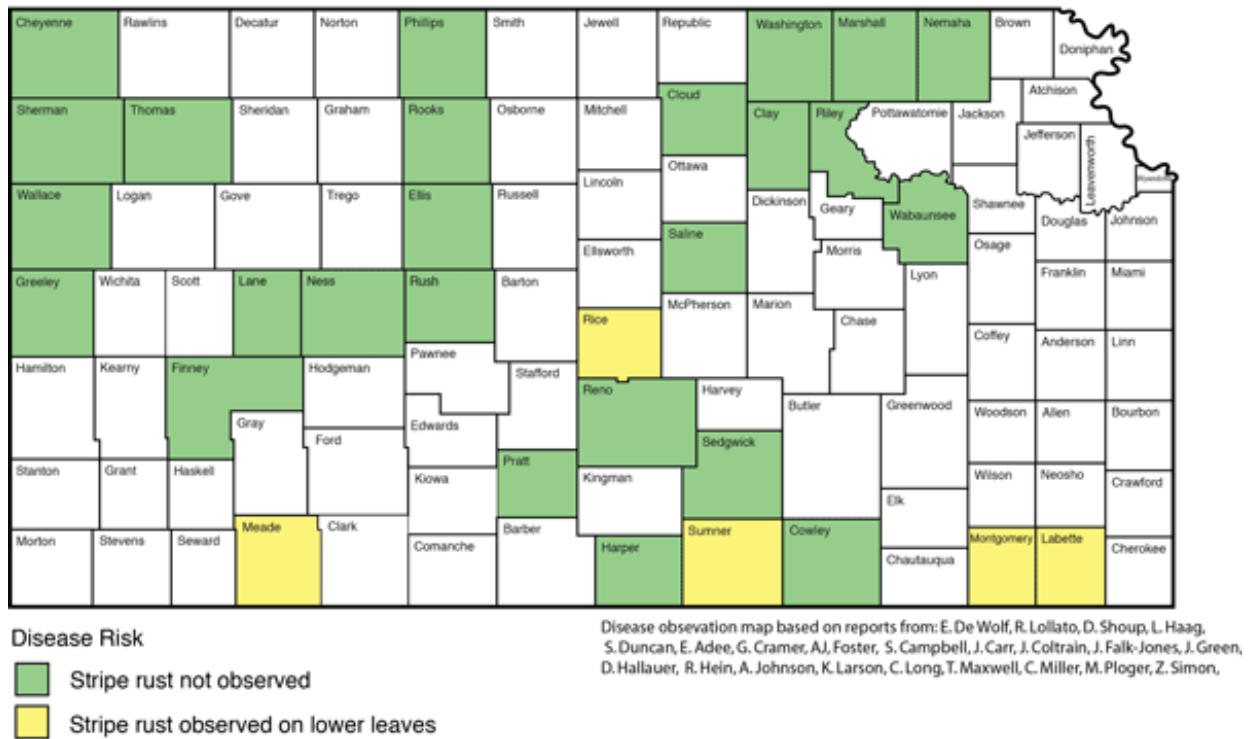
Tan spot and powdery mildew have also been reported in some areas of the state.



**Figure 1. Risk of leaf rust in Kansas March 18, 2016**

# Distribution of Wheat Stripe Rust

## March 18, 2016



**Figure 2. Risk of stripe rust in Kansas March 18, 2016**

*What does this mean for wheat growers in Kansas?*

The early reports of leaf rust and stripe rust are cause for concern. The risk of disease outbreaks and disease-related yield loss increases dramatically when the rust becomes established in the state prior to heading. Reports of increasing disease in Oklahoma and Texas suggest that, if weather conditions are right, more disease may move into the state soon.

*What might growers consider doing to prepare for possible disease problems?*

The most important thing growers can do at this stage is check their fields for disease. Scouting can help inform critical decisions about fungicides that will need to be made soon. Checking wheat varieties reaction to rust can help growers set priorities for scouting. Everest, Armour, TAM 112, and TAM 111 are widely planted in state. All of these varieties are susceptible to stripe rust and should be monitored carefully for symptoms of stripe rust. In western Kansas, where leaf rust has been more active, TAM 111 and TAM 112 are a top priority for scouting for disease because these varieties are susceptible to both rust diseases.

### Fungicide options and considerations

Growers may also begin to gather information about fungicides options. Growers have access to many excellent product options. However, the price of these products and applications will be particularly important this year, because the value of wheat grain is lower relative to some recent years.

The timing of these applications is also very important. Research has demonstrated that a single fungicide application applied between boot and flowering stages of development results in the maximum yield benefit.

Fungicide applications made prior to jointing, followed by second application may also be an option. In K-State tests, these two application programs rarely result in much additional yield. It is the second application, between boot and flowering, that does the heavy lifting in terms of yield response. Also keep in mind that label restrictions often specify the total amount of active ingredient that can be applied to a crop. Using a low-cost option early could limit the product options later in the season when a second application is needed to protect the upper leaves.

One final note of caution. Keep an eye on the forecast. It may be unwise to apply a fungicide when there is a significant risk of a freeze event or other hazard on the horizon that can limit the crop's yield potential. It is a good idea to be checking for disease and making other preparations for a potential fungicide application if conditions are right. It will be important to gather information and make a good decision in what looks like a challenging wheat production year.

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## 2. Diagnosis of late winter/early spring freeze injury on wheat

A series of hard freezes has occurred in recent days in southwest and west central Kansas, and a hard freeze is predicted throughout Kansas this weekend. It is still several weeks before the normal dates of the last spring freeze in the state, and a freeze during the week of March 14-18 normally does not cause any problems for wheat. However, this year the wheat is much more advanced in development than normal.

Warmer-than-normal temperatures in February and March (about 6 and 9 degrees F, respectively) coupled with increased day length has sped up wheat development this winter. The most advanced wheat fields in Kansas are currently about Feekes 7 (second node) in selected fields in southern Kansas. However, many fields have not jointed yet across the state, especially in northwest Kansas and other northern areas of the state.

Developmental stage of wheat is directly affected by temperature and is variable within a region. Major management factors that influence current stage of development include variety selection, tillage practice (soil temperature), and planting date (Figure 1). In general, early-maturing wheat tends to be more susceptible to freeze injury than later-maturing wheat as the probability of a freeze event matching more sensitive stages of development is greater.



**Figure 1. Stage of development is affected by planting date. In this photo, Overley planted in September is close to jointing while the same variety planted in October is still starting to elongate the stem, with the growing point still below ground. Wheat sensitivity to freeze damage is dependent on stage of development. Photo taken near Hutchinson on March 15, 2016 by Romulo Lollato, K-State Research and Extension.**

### **Important factors determining freeze damage**

A number of key factors determine freeze damage: the stage of development of the wheat, the density of the stand and condition of the plants, the amount of residue on the soil surface, the extent and duration of low temperatures, temperature gradients within the field (position on the landscape), soil moisture, and the wind speed.

Stage of development.

-- Greenup. Wheat that hasn't started to joint yet (Feekes 3 through 5) might suffer damage to the existing foliage, but the growing points are still below the soil surface and will be protected by the soil. As a result, the plants should escape injury. This wheat will have cosmetic damage to the leaves, however, that will show up almost immediately as leaf tip burn (Figure 2).

-- Jointing. Wheat that is jointed or beyond is more sensitive to freeze damage than wheat at greenup because the growing point is above ground. It can still tolerate temperatures in the mid to upper 20's with no significant injury, but if temperatures fall into the low 20's or even lower for several hours, the lower stems, leaves, or developing head can sustain injury.



Figure 2. Leaf burn from freeze damage. By itself, this is cosmetic damage only. Photos by Romulo Lollato, K-State Extension Wheat and Forages Specialist.

Density of the stand and condition of the plants. If the stand is thick, that will tend to reduce the extent of freeze damage as the warmth of the soil will radiate up into the canopy. On the other hand, well-fertilized succulent wheat has often sustained more freeze injury than wheat that is not as well fertilized. Thin stands are at higher risk of injury because the air can penetrate the stand more easily. If the plants were wet before the freeze, this can result in a coat of ice on the plants that may protect the growing point to some extent. If temperatures get too low, however, the cold will go through the ice.

Residue. No-till fields can many times sustain more freeze damage because the residue acts as a



blanket and doesn't allow the heat from the soil to radiate up into the plant canopy.

Extent and duration of low temperatures. Significant injury becomes much more likely if the temperatures in the damaging range last for two hours or longer.

Soil moisture. There is often less freeze injury at a given temperature when soils are wet than when dry. Wetter soils tend to radiate a little more warmth than dry soils. On the other hand, drought-stressed plants tend to be more hardened against cold injury and their lower leaf water content tends to decrease the severity of the freeze injury.

Wind speed. Windy conditions during the nighttime hours when temperatures reach their lows will reduce the amount of warmth radiating from the soil and increase the chance of injury.

Temperature gradients within the field (position on the landscape). Low spots in the field are almost always the first to have freeze injury. The coldest air tends to settle in the low areas, especially under calm wind conditions.

Wheat variety. Although the sensitivity to freezing temperatures at a given growth stage is very similar across all varieties, varieties can differ in their release from winter dormancy in as much as three weeks. Because of differences in winter-dormancy release, late-release varieties may escape a freeze injury because they are delayed in their development. For instance, on March 18 this year a late-release variety may be at Feekes 4 or 5 and therefore less sensitive to freeze damage than an early-release variety planted at the same time which might have reached Feekes 6 or 7.

### **Injury symptoms**

There are many possible scenarios after a freeze, and producers should not take any immediate decision following a freeze event. Several days of warm temperatures are needed to properly assess freeze damage to the wheat crop. Where wheat was at the jointing stage, producers should watch their fields closely over the next 7 to 10 days from the freeze event for the following:

- The color of newly emerging leaves. If they are nice and green, that probably indicates the tiller is alive. If newly emerging leaves are yellow, that probably indicates the tiller is dead. The color of existing leaves is not terribly important, except for the flag leaf, which should not have emerged at this point in time yet. Existing leaves will almost always turn bluish-black after a hard freeze, and give off a silage odor. Those leaves are burned back and dead, but that in itself is not a problem as long as newly emerging leaves are green.
- The color of the developing head or growing point in wheat that has jointed. As long as heads are light green, crisp, and turgid, the head in that tiller is fine. If the head is whitish, flaccid, and mushy, it has died (Fig. 3).
- Ice in the stems. If there was ice in the stems below the first node the morning of the freeze, those tillers may be damaged (although not always) and may not produce grain. You may see split stems from ice accumulation.
- Stem integrity. If the wheat lodged immediately after the freeze, that indicates stem damage. Later tillers may eventually cover the damaged tillers. Even if there is no immediate lodging, look for lesions or crimps anywhere on the stems. If these symptoms are present, it usually means the wheat will lodge at some point during the season. If the stems look undamaged, that's a good sign.



Figure 3. A developing head still within the stem killed by freezing temperatures. The dead head is whitish and flaccid. If it were healthy, it would be light green and turgid. Photo by Jim Shroyer, professor emeritus, K-State Research and Extension.

The best thing producers can do for the first few days is simply walk the fields to observe lodging, crimped stems, and damaged leaves. Producers should not take any immediate actions as a result of the freeze, such as destroying the field for recropping. It will take several days of warm weather to accurately evaluate the extent of damage. After several days, producers should split open some stems and check the developing head.

Where stems and/or growing points were killed by the freeze, new tiller growth (coming from the crown area) will occur (Figs. 4 and 5). In many cases, new tiller growth can be observed even when the stems do not show any symptoms of freeze damage for some time. In those cases, the first sign that the tillers are dead is the sudden growth of new tillers at the base of the plant.

If secondary tillers may begin growing normally and fill out the stand, the wheat may look ragged because the main tillers are absent. Producers should scout for bird cherry oat aphids and other potential insect or disease problems on these late-developing tillers. Enough tillers may survive to produce good yields if spring growing conditions are favorable. If both the main and secondary tillers are injured, the field may eventually have large areas that have a yellowish cast and reduced yield potential.



Figure 4. A stem that was split open by having ice form within the stem. This stem has died and a new tiller has begun to grow at the base. Photo by Jim Shroyer, professor emeritus, K-State Research and Extension.

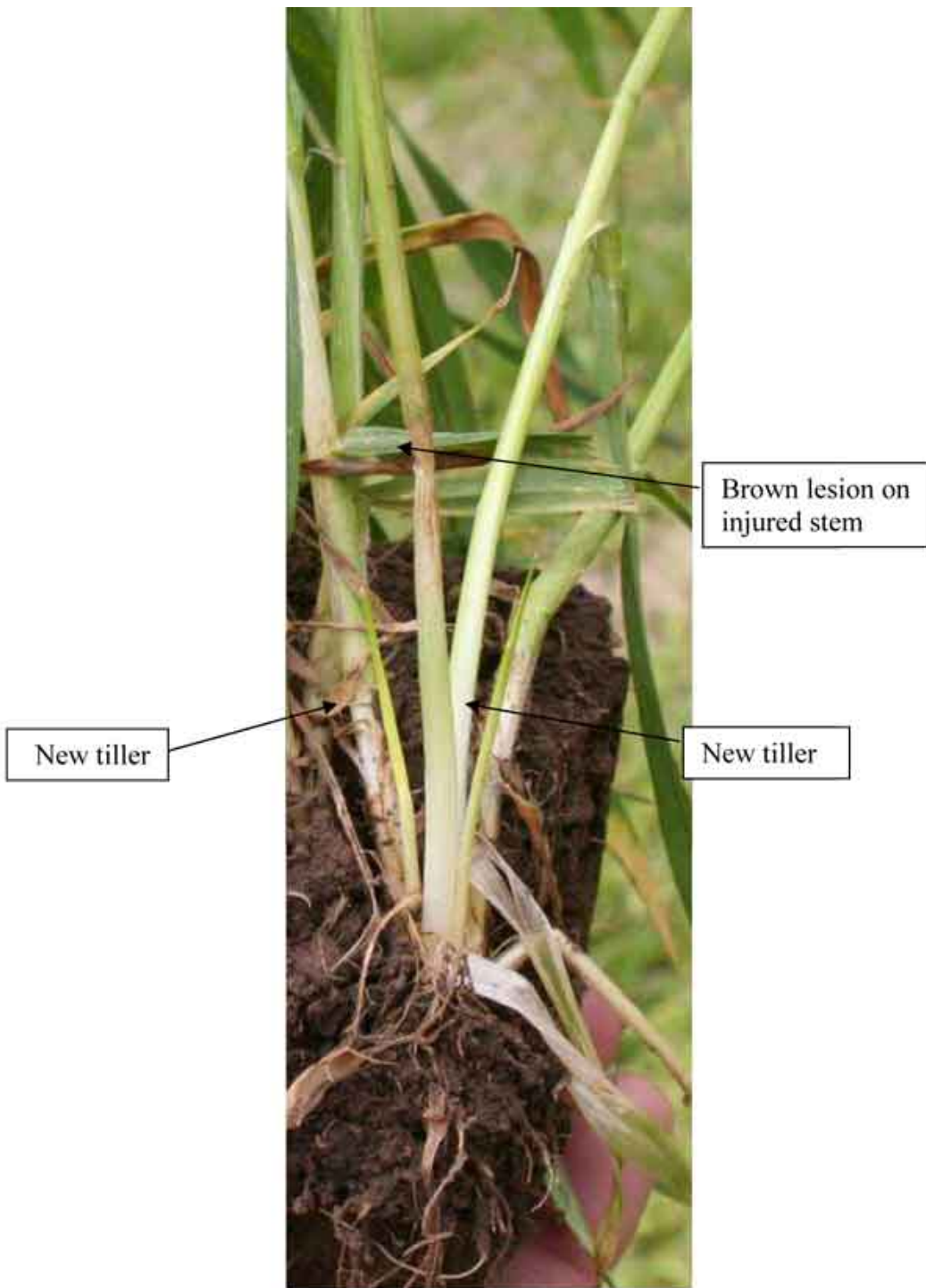


Figure 5. Some of the tillers on this plant had freeze damage to the lower stems. These stems are dying, but the symptoms may not be immediately evident. The growth of new tillers from the base of the plant is a sure sign that the main tillers are dead or dying. Note the brown lesion on the stem with the two new tillers. Photo by Jim Shroyer, professor emeritus, K-State Research and Extension.

More information on freeze damage to wheat is available in *Spring Freeze Injury to Kansas Wheat*, K-State Research and Extension publication C646, available at:

<http://www.ksre.ksu.edu/bookstore/pubs/C646.pdf>

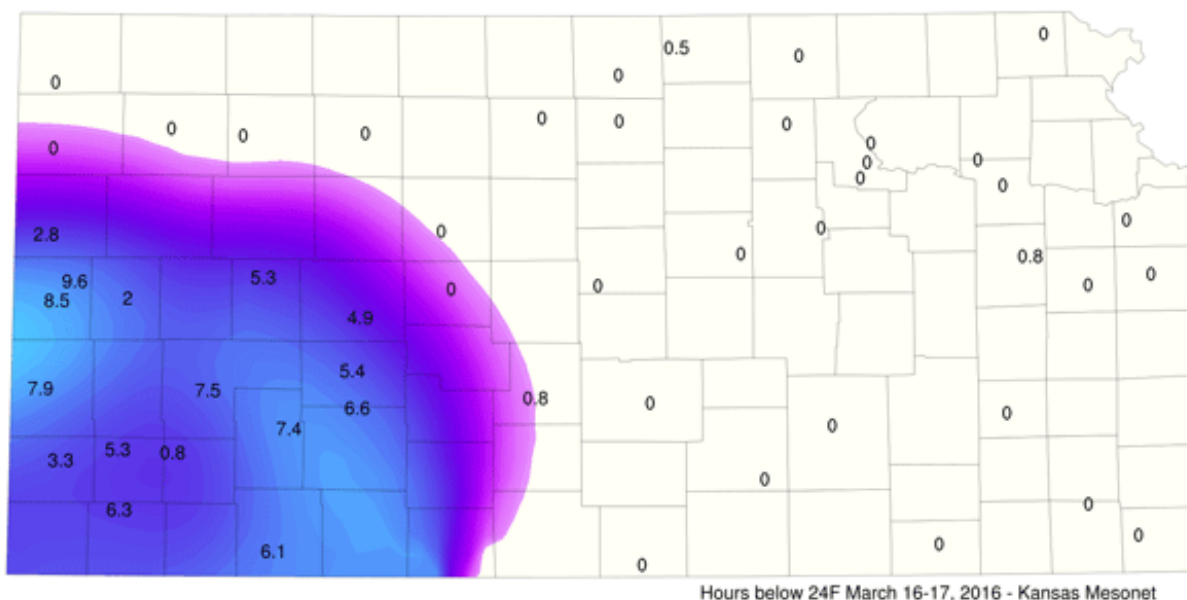
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### 3. Can low minimum temperatures observed March 16-17 damage the wheat crop?

Minimum air temperatures in southwest Kansas reached very low levels during March 16-17. Cold temperatures occurred from the very southwest border of Kansas all the way east to St. John and north to Sherman County, encompassing most of the southwest quarter of Kansas. The minimum temperature observed across the state was 14.6 degrees F at the K-State Mesonet station in Hamilton County.

Different stages of wheat development vary in their sensitivity to cold temperatures. Where the developing head is already above ground (jointing or later stages), cold temperatures can damage the developing wheat head. The threshold below which economic damage can occur when wheat is jointed is approximately 24 degrees F. Additionally, temperatures need to be sustained at levels below 24 degrees F for a minimum of two-to-three hours to be potentially damaging to the developing head.

Figure 1 shows the number of hours minimum temperatures were below 24 degrees F across Kansas. The number of hours below 24 degrees F ranged from 0 hours in most of central and eastern Kansas to as much as 9.6 hours near Tribune, in western Kansas. In southwest Kansas, the number of hours below 24 degrees F averaged 5.3 hours. While these observed temperatures are not uncommon for this time of the year, in most of the state the wheat crop is well advanced due to a relatively warm winter. Producers who have jointed wheat might be concerned with possible damage to their crop.



**Figure 1. Number of hours below 24 degrees F experienced during March 16-17.**

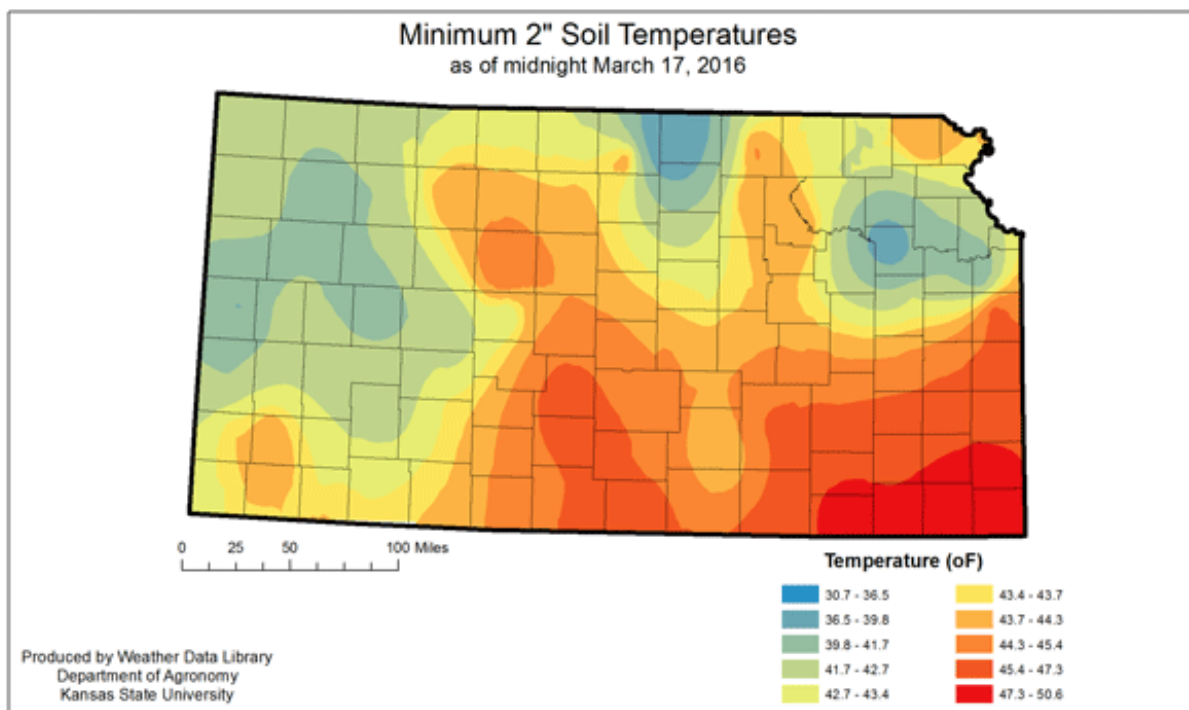
While this is a tangible concern for jointed wheat in southwest Kansas, it is important to consider that air temperatures reported by meteorological monitoring stations are often measured 5 feet aboveground, and do not fully reflect the microclimate to which the wheat canopy is actually exposed. For instance, a lush wheat canopy will tend to reduce the extent of freeze damage as the warmth of the soil will radiate up into the canopy. In addition, moist soil buffers temperature

changes better than dry soils and therefore there is often less freeze injury at a given temperature when soils are wet. Crop residue (or lack thereof) will influence how much heat will radiate out of the soil up into the plant canopy. Windy conditions will also increase the chance of injury.

As a result of so many interacting variables, evaluating solely air temperatures may not completely reflect the conditions experienced by the wheat crop. In this situation, soil temperatures can help determining the extent of the cold stress at crown and lower canopy levels.

Figure 2 shows the minimum 2" depth soil temperatures measured March 17. While air temperatures reached critical levels for damage to the developing wheat head (if the head is above ground), soil temperatures at the 2" depth were above 30 degrees F all across western Kansas, and well above 40 degrees F in southwest Kansas. Higher soil temperatures may have helped buffer the cold air temperatures experienced, minimizing possible injury to the wheat crop.

Where the developing head is still below ground and therefore insulated from cold air temperatures (Feekes 3, 4, or 5), little to no substantive damage should be expected from the cold temperatures of March 16-17. For wheat that has already jointed, it is still too early to define what possible yield losses the wheat crop may have experienced, if any.



**Figure 2. Minimum 2" soil temperature reported as of midnight March 17, 2016.**

Another update on minimum temperatures observed across the state will be released in the Agronomy eUpdate Monday, March 21<sup>st</sup>, to reflect temperatures measured during the weekend.

You can check temperatures through the weekend on the K-State Freeze Monitor page, part of the Kansas Mesonet web site, at: [mesonet.ksu.edu/freeze/](http://mesonet.ksu.edu/freeze/) A column for temperatures below 24 degrees

and a link at the bottom for a map showing the number of hours below 24 degrees have been added to the page.

For more information on freeze damage to wheat, please see accompanying article here or publication *Spring Freeze Injury to Kansas Wheat*, K-State Research and Extension publication C646, at: <http://www.ksre.ksu.edu/bookstore/pubs/C646.pdf>

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#### 4. First hollow stem update: March 17, 2016

All varieties in our report are currently past first hollow stem (FHS) in the Hutchinson region (Table 1).

Dual-purpose wheat producers wishing to harvest the wheat crop for grain should have already removed cattle from their wheat crop regardless of variety selection. Grazing past FHS can lead to yield losses ranging from 1-5 percent per day, depending on weather conditions at grazing termination. Hot, dry weather, increases yield losses associated with grazing past FHS. For more details on how to scout for FHS, please refer to Agronomy eUpdate article "[Optimal time to remove cattle from wheat pastures: First hollow stem](#)" in the Feb. 5, 2016 issue.

**Table 1. Length of hollow stem measured on March 15, 2016 of 23 wheat varieties sown Sept. 26, 2015 near Hutchinson. The critical FHS length for purposes of cattle removal is 1.5 cm.**

Variety	Hollow stem length cm	Stems at FHS %
1863	-	-
Bentley	1.8	70
Danby	1.8	80
Doublestop CL Plus	1.6	70
Duster	2.9	90
Everest	3.3	100
Gallagher	-	-
KanMark	3.7	100
LCS Chrome	1.5	60
LCS Mint	1.8	80
LCS Pistol	4.3	100
LCS Wizard	2.8	100
Overley	4.4	100
Ruby Lee	5.3	100
SY Flint	4.2	100
SY Wolf	3.2	100
T158	2.2	90
TAM 114	4.3	100
WB4303	-	-
WB4458	3.8	100
*WB-Cedar	-	-
WB-Grainfield	2.6	100
*WB-Redhawk	-	-

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Variety	P < 0.01
LSD (0.05)	1.3

\* These varieties were beyond FHS on the last report.

The intention of this seasonal report is to provide producers a weekly update on first hollow stem of different wheat varieties in the current growing season. Producers should use this information as a guide, but it is extremely important to monitor FHS from an ungrazed portion of each individual wheat pasture to take the decision of removing cattle from wheat pastures.

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## 5. Corn seeding rate recommendations

The optimal corn seeding rate for any situation will depend on the anticipated environment and how the hybrid responds to that environment. Thus, optimum seeding rate depends on the hybrid (genotype, G) and the interaction of that hybrid with the environment (E), in something that researchers call the G x E interaction. Producers can look back to their corn crop from the previous growing season, or wait until the current growing season is nearly complete, and evaluate whether the population they used was adequate.

Another factor that sometimes we neglect to consider as much as we should is the effect of management practices (M component). Planting date, row spacing, and crop rotations can also exert some influence on the yield response to plant populations.

Individual hybrids can respond differently, but the following guidelines may help in deciding if current seeding rates need to be adjusted. If more than about 5% of the plants are barren or if most ears have fewer than 250 kernels per ear, the population may be too high. If there are consistently more than 600 kernels per ear or if most plants have a second ear contributing significantly to grain yield, the population may be too low.

Of course growing conditions will influence ear number and ear size as well, so it is important to factor in the growing conditions for that season when interpreting these plant responses. In addition to the growing conditions, nutrient status can also exert some influence on the final number of grains per ear. For example, severe nitrogen (N) deficiency will have a significant impact on the final number of grains, ear size, and ear number.

Don't be too concerned if a half-inch or so of the ear tip has no kernels. If kernels have formed to the tip of the ear, there may have been room in that field for more plants contributing to grain yield. Again, "tipping back" will vary with the G x E x M interaction. Potential ear size and potential number of kernels (usually in the range of 1,000-1,200 per ear) are set before silking, but the actual final number of kernels is not determined until after pollination and early grain fill due to the potential for lack of fertilization or early abortion of grain numbers.

Always keep the long-term weather conditions in mind. The drought that affected much of Kansas in 2011 and 2012 made almost any population too high for the available moisture in some areas. Although it's not a good idea to make significant changes to seeding rates based only on what happened recently, it is worthwhile taking into consideration how much moisture there is in the soil profile and the long-term forecasts for the upcoming growing season.

Making a decision on whether to keep seeding rates at your usual level or cutting back somewhat this year if the soil profile is drier than normal is a little like the famous line in the movie Dirty Harry: "How lucky do you feel?" If you think weather conditions will be more favorable for corn this year than the past years, stay about in the middle to upper part of the range of seeding rates in the table below. If you do not think growing conditions will improve enough to make up for dry subsoils, you might want to consider going toward the lower end of the range of recommended seeding rates, with the caveat that if growing conditions improve you will have limited your top-end yield potential.

Optimal seeding rates may need to be adjusted for irrigated corn if fertilizer or irrigation rates are sharply increased or decreased. For example, research at the Irrigation Experiment Field near Scandia has shown that if fertilizer rates are increased, seeding rates also have to be increased to realize the maximum yield benefit. Consult seed company recommendations to determine if seeding rates for specific hybrids should be at the lower or upper end of the recommended ranges for a given environment.

### Recommended planting rates

The recommended planting rates in the following table attempt to factor in these types of questions for the typical corn growing environments found in Kansas. Adjust within the recommended ranges depending on the specific conditions you expect to face and the hybrid you plan to use.

The following recommend planting rates are from the K-State Corn Production Handbook.

<b>Suggested Dryland Corn Final Populations and Seeding Rates</b>			
Area	Environment	Final Plant Population (plants per acre)	Seeding Rate*
Northeast	100-150 bu/a potential	22,000-25,000	26,000-29,500
	150+ potential	24,000-28,000	28,000-33,000
Southeast	Short-season, upland, shallow soils	20,000-22,000	23,500-26,000
	Full-season bottomground	24,000-26,000	28,000-30,500
Northcentral	All dryland environments	20,000-22,500	23,500-26,500
Southcentral	All dryland environments	18,000-22,000	21,000-26,000
Northwest	All dryland environments	16,000-20,000	19,000-23,500
Southwest	All dryland environments	14,000-20,000	16,500-23,500

<b>Suggested Irrigated Corn Final Populations and Seeding Rates</b>			
Environment	Hybrid Maturity	Final Plant Population (plants per acre)	Seeding Rate*
Full irrigation	Full-season	28,000-34,000	33,000-40,000
	Shorter-season	30,000-36,000	35,000-42,500
Limited irrigation	All	24,000-28,000	28,000-33,000

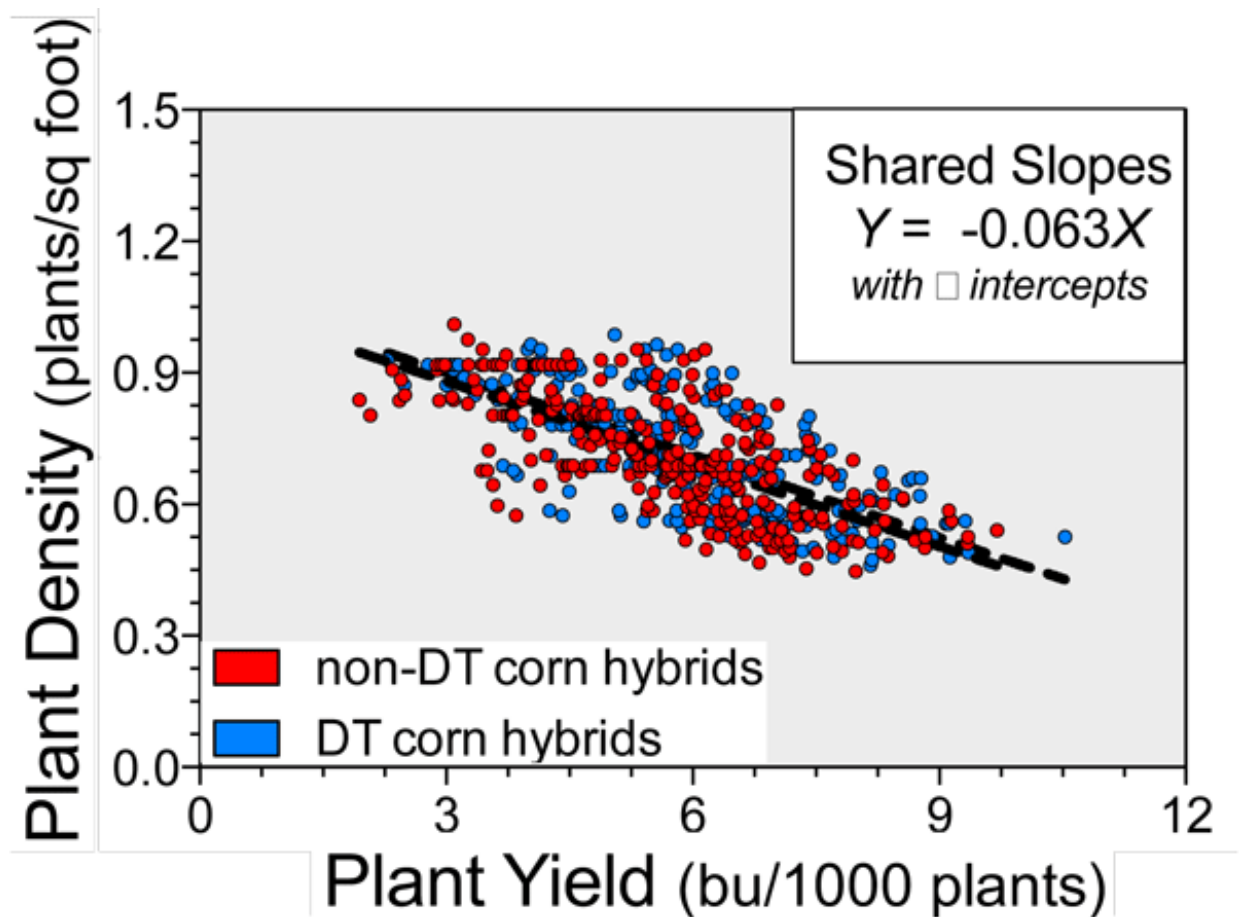
**\* Assumes high germination and that 85 percent of seeds produce plants. Seeding rates can be reduced if field germination is expected to be more than 85%.**

For more information, see the K-State Corn Production Handbook, C-560:

<http://www.ksre.ksu.edu/library/crpsl2/c560.pdf>

### Drought-tolerant hybrids

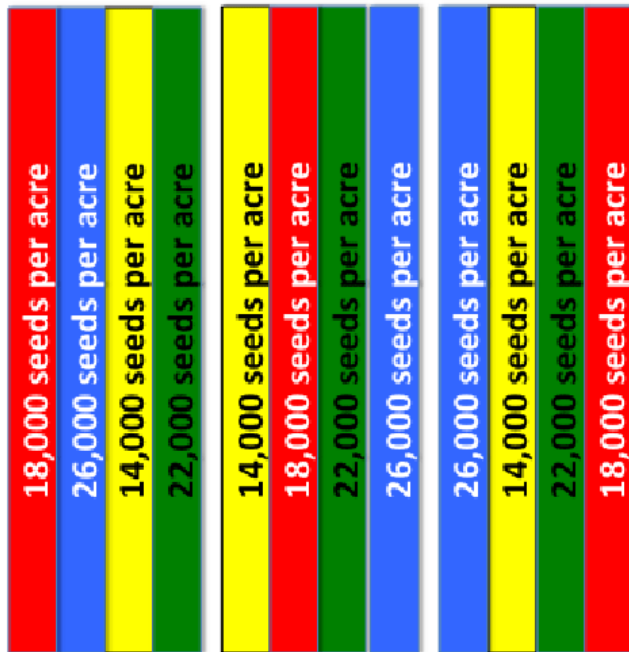
As a final note, for the new corn genetics technology, the drought-tolerant (DT) hybrids have arrived on the market recently and questions about whether changes in seeding rates are needed when using these new hybrids are becoming more frequent. A summary of information is in preparation as regarding the evaluation of DT vs. non-DT corn hybrids at different site-years around the state of Kansas (western, north central, and eastern locations). From the evaluation performed in these site-years evaluating diverse seeding rates, hybrids, and water usage, differences in yield were observed when DT corn hybrids were compared with non-DT materials. Still, the most important point, as presented in the below figure, is that the yield response at plant-scale to plant population is similar for DT vs. non-DT corn hybrids (share equal slope). Thus, a change in plant population doesn't seem to be needed when this new corn hybrid technology is employed.



**Figure 1. Plant-scale association between plant density or plant population (plants per square foot) and the plant yield (in bu per 1,000 plants) [Adee, Balboa, Roozeboom, Schlegel, and Ciampitti].**

## On-farm corn seeding rate studies: 2015 season – Central Kansas

During the last growing season, four on-farm research studies were established in collaboration with Tom Maxwell (Central Kansas District Agriculture Extension Agent) and corn farmers around the area (Justin Knopf, Mark Pettijohn, Dwight Conley and Matt Everhart, and Karbers' Farm). The experimental layout for those studies is presented in the below scheme.



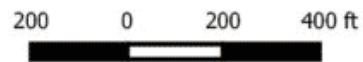
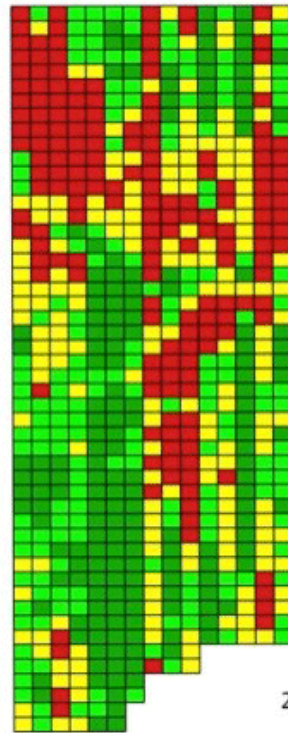
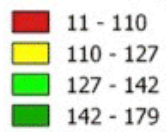
Field Variability: An example of the field variability was clearly reflected by yield monitor information collected at harvest time at two locations. Each of the strips in the maps represents a different plant population. Taking a close look we can see different response to population across the field within the same strip. This shows the need for more detailed studies that take in account different potential yields within the field. A combination of Precision Ag and proper assessment from an agronomist with geostatistics skills can help farmers better understand the complex nature of these interactions and to be more efficient when they select the optimal plant population, considering the entire field variability. The Extension Crop Production team is willing to collaborate with farmers who want to start doing strip trials across the field to generate on-farm data.

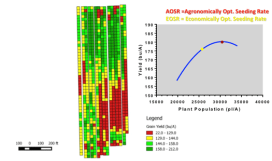
If you are interested please see: <http://bit.ly/KSUONFARMPROJECT>

In addition, if you want to share yield monitor data with us, please don't hesitate to reach us out and we can discuss how to coordinate and organize a meeting for discussing your needs and providing an interpretation of your field variability for improving the use of the on-farm Precision Ag tools (e.g. yield monitor).

Legend

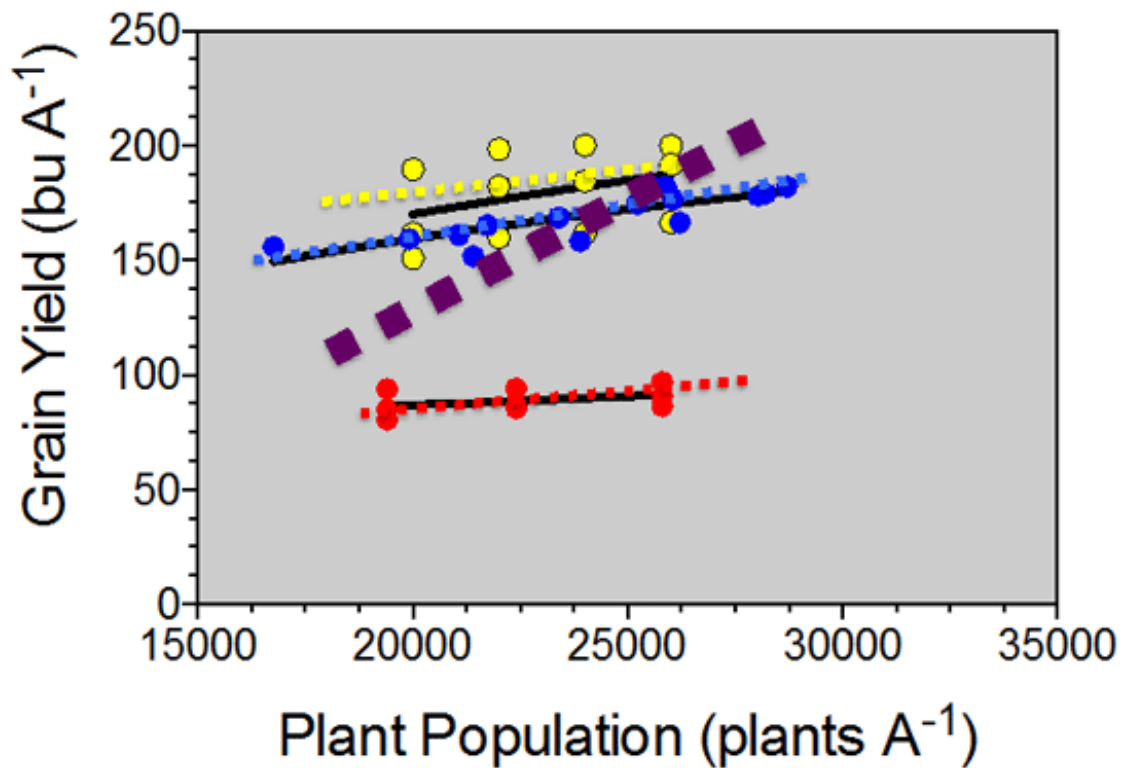
Grain Yield (bu/A)





A summary of corn plant population response to all four on-farm locations allowed us to visualize the complexity yield response to plant population and how essential is to continue the on-farm research efforts for properly identifying optimal corn plant population and providing a better guidance to producers and key-stakeholders in the seeding rate decision making process.





The agronomically optimum populations for all these on-farm corn population studies was different, even when environmental conditions and planting time was very similar. The economically optimal population ranged from 20,000 to 24,000 seeds per acre. The agronomically optimum did not coincide with economically optimum population, with the economic optimum population being lower in most of the situations evaluated.

More information on the on-farm studies will be summarized in upcoming issues of the Agronomy eUpdate. Stay tuned.

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## 6. Agricultural Mobile Apps: A review and update of irrigation apps

This article provides a review and update of some of the current “irrigation apps” for agriculture. These apps can assist farmers in the decision-making process of irrigating crops, including calculation of total irrigation water applied and the cost of the irrigation practice, estimation of soil water status (water used), and management of remotely controlled irrigation equipment, among several other features.

While these apps can often help you make decisions, always make sure to check with your crop consultants, Extension agents, and Extension specialists.

Stay tuned for more in this series of annual reviews and updates on Ag-Apps from our KSUCROPS Crop Production team (led by Dr. Ciampitti) and the K-State Department of Agronomy. More updated lists of Ag-Apps will be included in the next several editions of the Agronomy eUpdates.

NOTE: These apps are all available as of the time this article is published. Alterations or changes in availability could occur, affecting the ability to access these apps.

For this series of articles, we have grouped Ag-Apps into the following 10 classifications:

- **ID Apps:** For identification purposes (weeds, insects, diseases, and nutrients)
- **CALC Apps:** For calculating purposes (nutrient removal calculations, tank mixes, volume to spray, etc.)
- **SCOUT Apps:** For scouting purposes or for geo-positioning (soil sampling, recording notes, soil types, etc.).
- **ECON Apps:** For checking grain prices, market evolutions, fertilizer price trends, news and finances.
- **FIELD GUIDE Apps:** For diagnosing crop production issues in the field, primarily related to field guides (crop management: insect, disease, weed, and more).
- **LIVESTOCK Apps:** Apps related to the animal side, nutrition, health, and information on markets.
- **IRRIGATION Apps:** Apps related to field crop irrigation and water application.
- **MACHINERY Apps:** Apps for associated with agricultural equipment preparation, inventory, providing information of the machine.
- **GENERAL AG Apps:** GAG (general Ag-Apps) for general use, weather-related, for meetings, for reading magazines, among several other Apps' properties.
- **NON-AG Apps:** For general use from e-readers to calculators, email, calendar, picture editing, and more.

### 6. Irrigation Apps

Apps for field crop irrigation and estimation of water needs.

MOBILE AGRICULTURAL APPS – REVIEW from KSUCROPS ©Kansas State University



**Irrigation Apps**

Name of App and Source	Picture	Brief description and cost
<p>Irr. Pumping Plant Efficiency Calc.</p>  <p>University of Nebraska-Lincoln</p>		<p>This app provides assistance in calculating the efficiency and savings related to more efficient irrigation systems.</p> <p>\$3.99</p>
<p>Crop Water</p>  <p>University of Nebraska-Lincoln</p>		<p>This app provides an estimation of water status based on Watermark sensors installed at different soil depths. The app estimates water</p> <p>FREE</p>
<p>Water Meter Calculator</p>  <p>University of Nebraska-Lincoln</p>		<p>This app provides an estimation of total amount of inches of water applied by irrigation over time.</p> <p>\$2.99</p>

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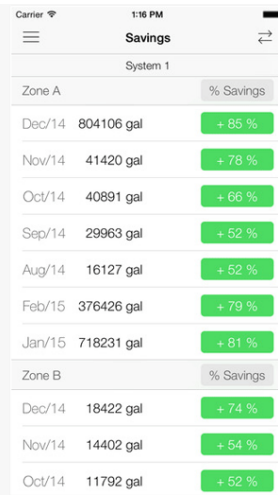
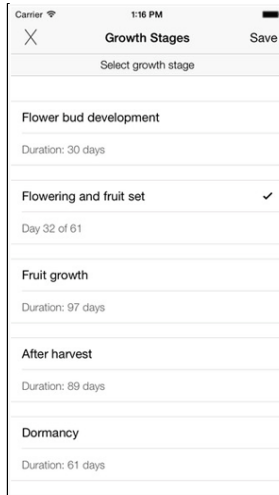
**MOBILE AGRICULTURAL APPS – REVIEW from KSUCROPS ©Kansas State University**

**Irrigation Apps**

Name of App and Source	Picture	Brief description and	cost
<p>Agriculture Irrigation Costs</p>  <p>University of Nebraska-Lincoln</p>		<p>This app provides information on irrigation costs for the most common used systems. It also compares costs of various alternatives.</p> <p>\$3.99</p>	
<p>FieldNET Mobile</p>  <p>Lindsay Sales &amp; Service LLC</p>		<p>This app can be utilized to remotely manage your pivots, laterals, drip/micro-irrigation systems, and pumps. Users can quickly monitor irrigation equipment.</p> <p>FREE</p>	
<p>Smartirrigation Avacado</p>		<p>This app is designed to help avocados</p>	



AgroClimate

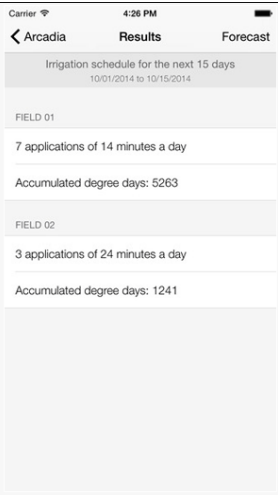
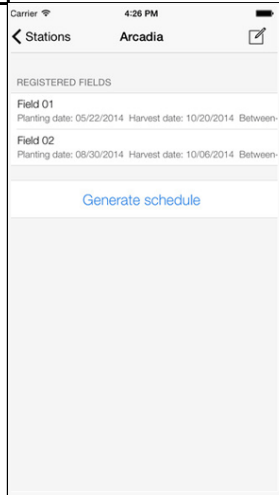


growers in Florida generate irrigation schedule recommendations based on real-time weather and short-term forecasted data.

FREE



Smartirrigation Strawberry

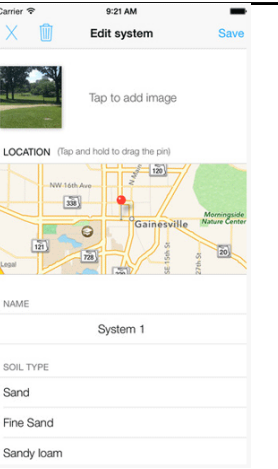
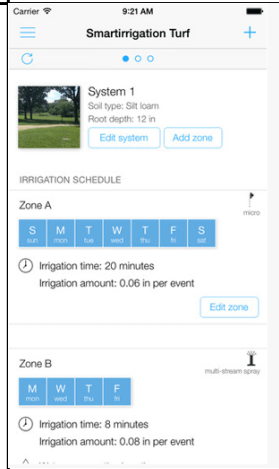


This app is designed to help strawberry growers in Florida generate irrigation schedule recommendations based on real-time weather and short-term data.

FREE



Smartirrigation Turf



This app is designed to help urban turf irrigators in Florida and Georgia generate irrigation schedule recommendations based on real-time weather.

FREE

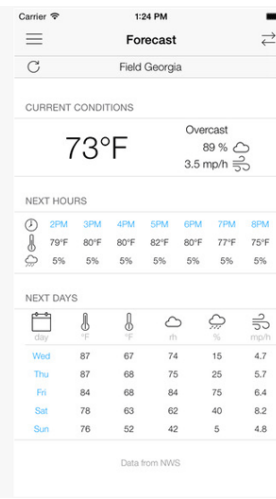
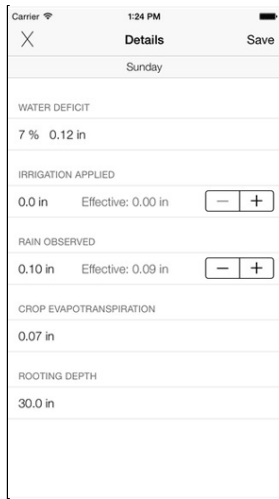
Smartirrigation Cotton

This app is designed to assist cotton producers in Florida and Georgia irrigate cotton more efficiently.

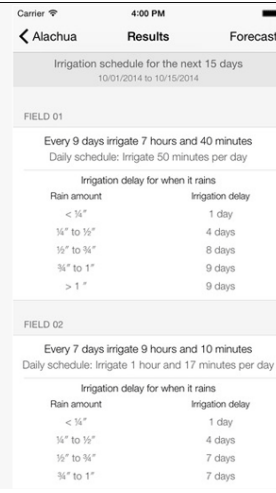
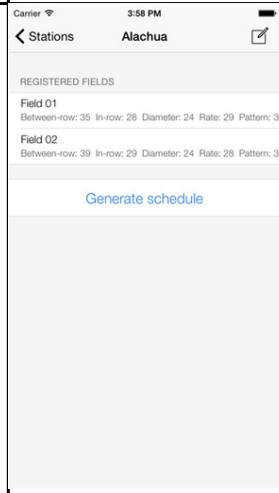
FREE



AgroClimate



Smartirrigation Citrus



This app is designed to help citrus producers in Florida to generate irrigation schedule recommendations

FREE

Each of the next three issues of the eUpdate will feature another classification of Ag-Apps from our KSUCROPS Crop Production team and the K-State Department of Agronomy!

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## 7. Ultra-high density grazing is topic of March 29 webinar



Ultra-high stock density grazing is the management tool of grazing livestock in much higher-than-normal concentrations to achieve landscape-focused objectives. The long-term goal is to enhance soils, forages and livestock production.

Such grazing is usually expressed in pounds of live-weight per acre at a given moment in time. Depending on the environment and forages, ultra-high stock densities are usually in excess of 100,000 pounds of animal live-weight per acre with some graziers exceeding 1 million pounds per acre thus requiring multiple moves to fresh pasture daily.

Great Plains Grazing team member and Samuel Roberts Noble Foundation consultant, Hugh Aljoe, will present "Ultra-High Stock Density Grazing: Five Precautions Before Implementation," a free webinar at 1:30 p.m. (CDT) on Tuesday, March 29. The webinar is open to anyone interested in gaining a better understanding of a practice known as "mob grazing." It is hosted by Great Plains Grazing, a U.S. Department of Agriculture-Agriculture and Food Research Initiative-Coordinated Agricultural Project (USDA-AFRI-CAP) grant.

Webinar participants can expect to learn:

- Infrastructure needs
- Setting production goals and measuring them
- Differences between stocking density and grazing intensity

Aljoe serves as a pasture and range consultant in the foundation's agricultural division consultation program. He serves as the consultation program manager, coordinating the efforts of the division's agricultural consultants across its 47-county service area, in both Oklahoma and Texas.

Before joining the Noble Foundation in 1995, Aljoe was the ranch manager of Belvedere Land & Cattle Corp. for 10 years. He supervised the growth of the ranch from a small 450-acre, 150-head purebred ranch into an extensive 3,900-acre, 1,500-head purebred and commercial cow-calf operation. Forage resources were predominantly introduced bermudagrass pastures (overseeded to ryegrass) that were operated in modified short-duration grazing systems.

This webinar is part of a monthly series hosted by Great Plains Grazing. The webinar series aims to provide research-based information, and is targeted for producers and extension agents. Previous webinars are archived and available for viewing on the [Great Plains Grazing website](#).

Due to Zoom's space limitations, this webinar is only available to the first 100 participants.

Register at [Great Plains Grazing March Webinar Registration](#).

Lana Barkman, Great Plains Grazing Project Manager  
[laneann@ksu.edu](mailto:laneann@ksu.edu)



## 8. Comparative Vegetation Condition Report: March 8 - 14

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.

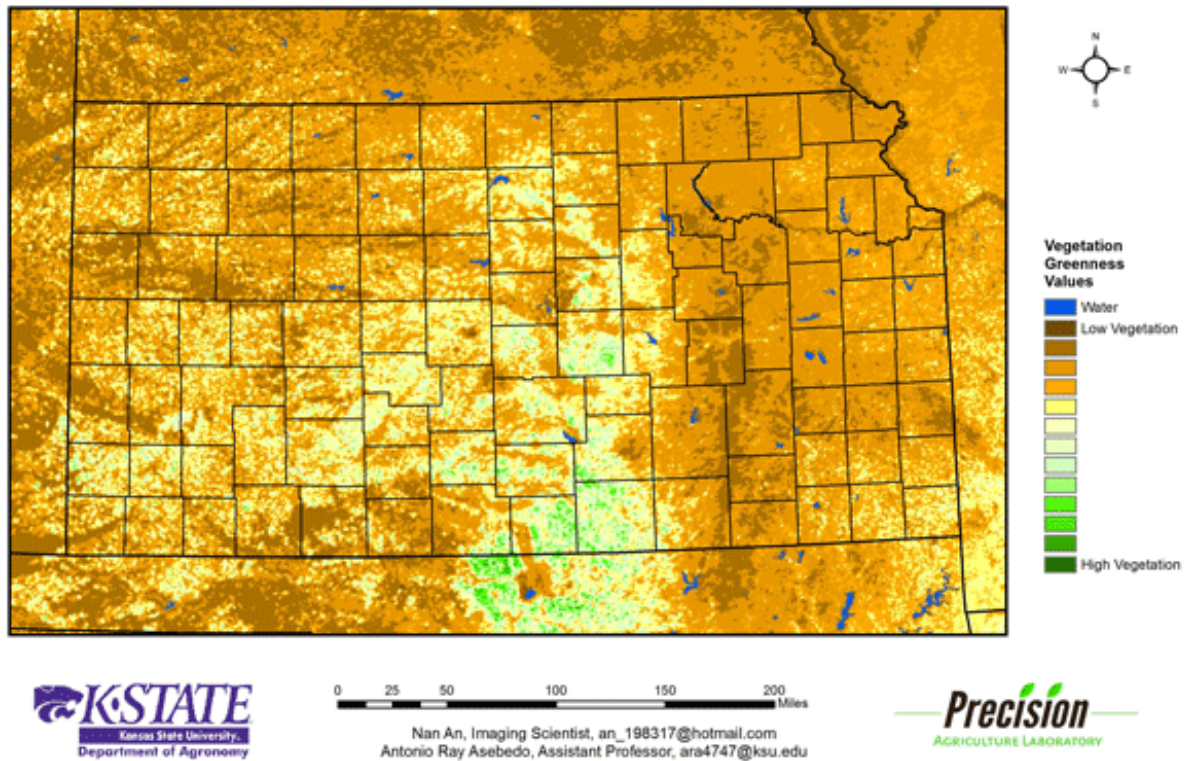
The maps have recently been revised, using newer technology and enhanced sources of data. Dr. Nan An, Imaging Scientist, collaborated with Dr. Antonio Ray Asebedo, assistant professor and lab director of the Precision Agriculture Lab in the Department of Agronomy at Kansas State University, on the new 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 11: 03/08/2016 - 03/14/2016



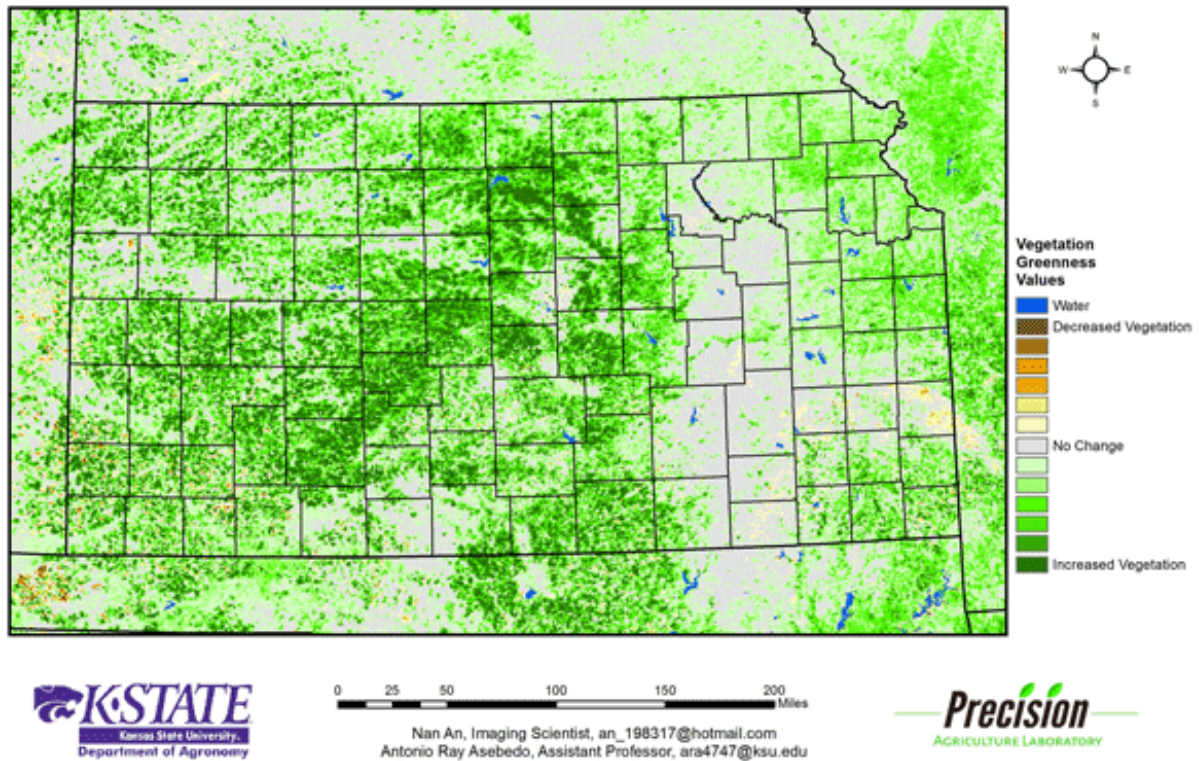
**Figure 1. The Vegetation Condition Report for Kansas for March 8 – 14 from K-State’s Precision Agriculture Laboratory shows that while overall production is still low, there continues to be high vegetative activity in the south central and central areas of the state. The highest NDVI values are still in Sumner and Harper counties. Some higher activity is also visible in the Arkansas River Valley in southwest Kansas. In the Northwest Division, the area of very low vegetative activity has been eliminated, as the impact from the early February snow is replaced by warmer soil temperatures.**

Kansas State University Department of Agronomy

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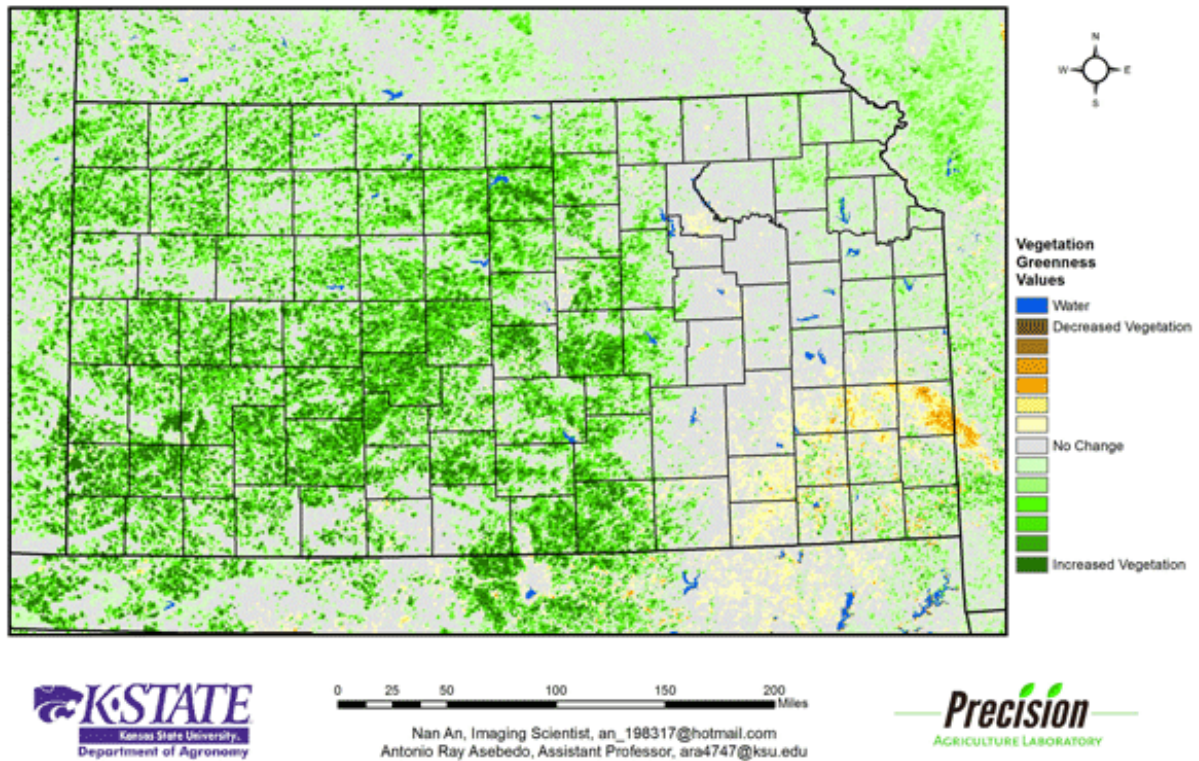
[www.agronomy.ksu.edu](http://www.agronomy.ksu.edu) | [www.facebook.com/KState.Agron](https://www.facebook.com/KState.Agron) | [www.twitter.com/KStateAgron](https://www.twitter.com/KStateAgron)

## Kansas Vegetation Condition Comparison Mid-March 2016 compared to the Mid-March 2015



**Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for March 8 – 14 from K-State’s Precision Agriculture Laboratory shows much higher photosynthetic activity in the western two thirds of the state. There is also a pocket of higher NDVI values in southeast Kansas where warm temperatures and recent rains have favored plant development.**

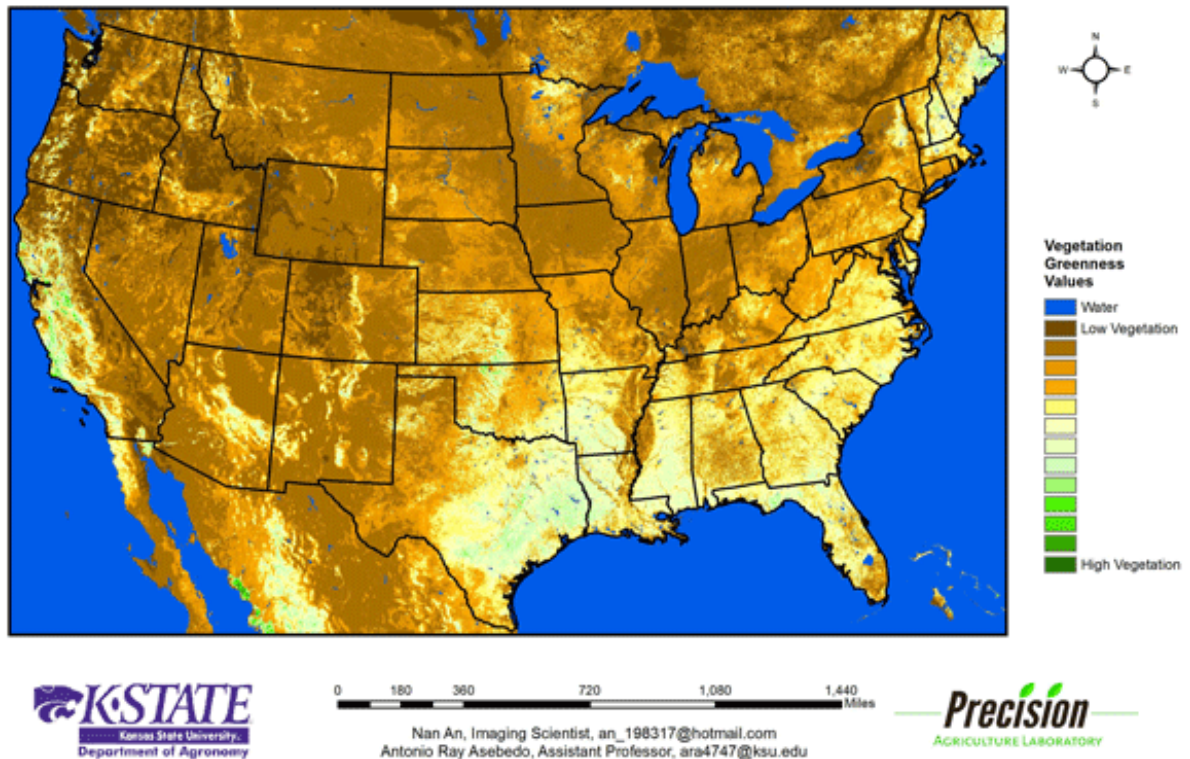
Kansas Vegetation Condition Comparison  
Mid-March 2016 compared to the 27-Year Average for Mid-March



**Figure 3. Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for March 8 – 14 from K-State's Precision Agriculture Laboratory shows that the area of above-average photosynthetic activity continues to increase. The largest areas with the greatest increase are in central and south central Kansas. Temperatures continue above normal across the state, with the warmest departures in the southwest. We will be watching for the impact of the current freezing temperatures across these areas.**

## Continental U.S. Vegetation Condition

Period 11: 03/08/2016 - 03/14/2016



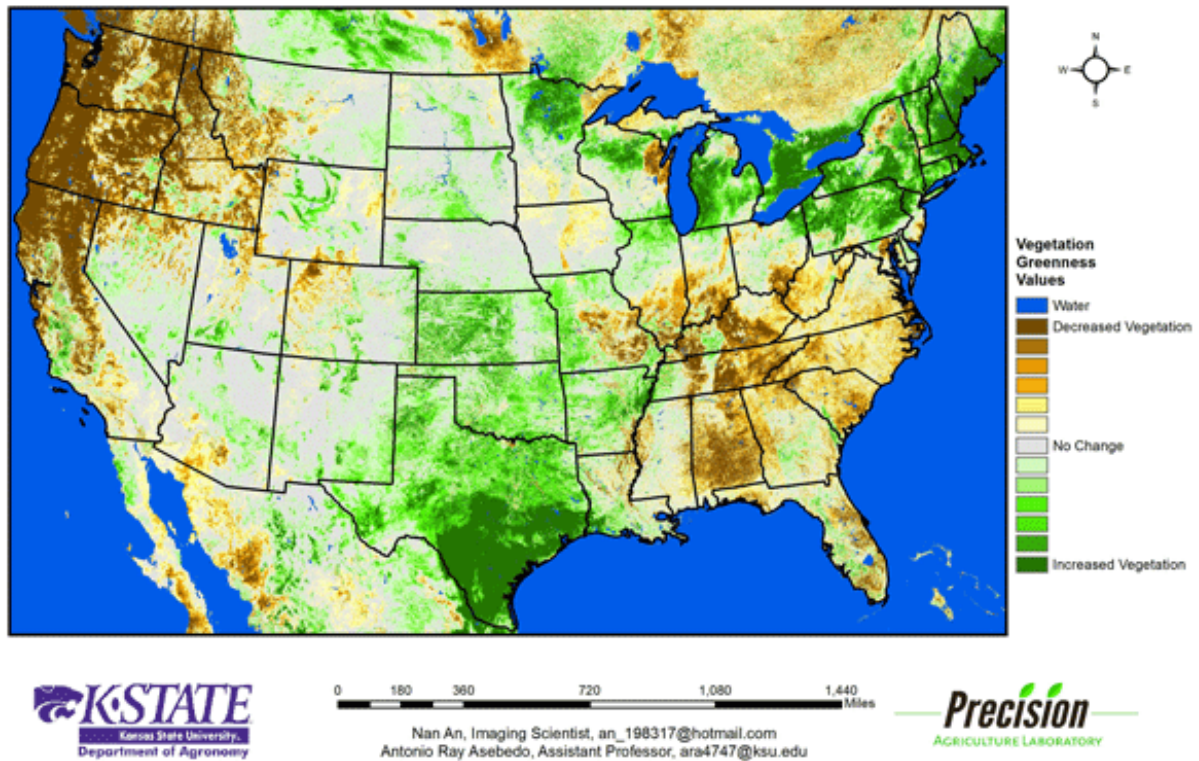
**Figure 4. The Vegetation Condition Report for the U.S for March 8 – 14 from K-State’s Precision Agriculture Laboratory shows higher NDVI values across central California, where recent rains have been plentiful. For the rest of the continental U.S. it shows that the highest photosynthetic activity is in east Texas through central Oklahoma and south central Kansas. Lingering impacts of the December flooding, as well as the heavy rains last week, have reduced vegetative activity in the lower Mississippi River Valley. Impacts of this week’s precipitation won’t be visible yet in these maps.**

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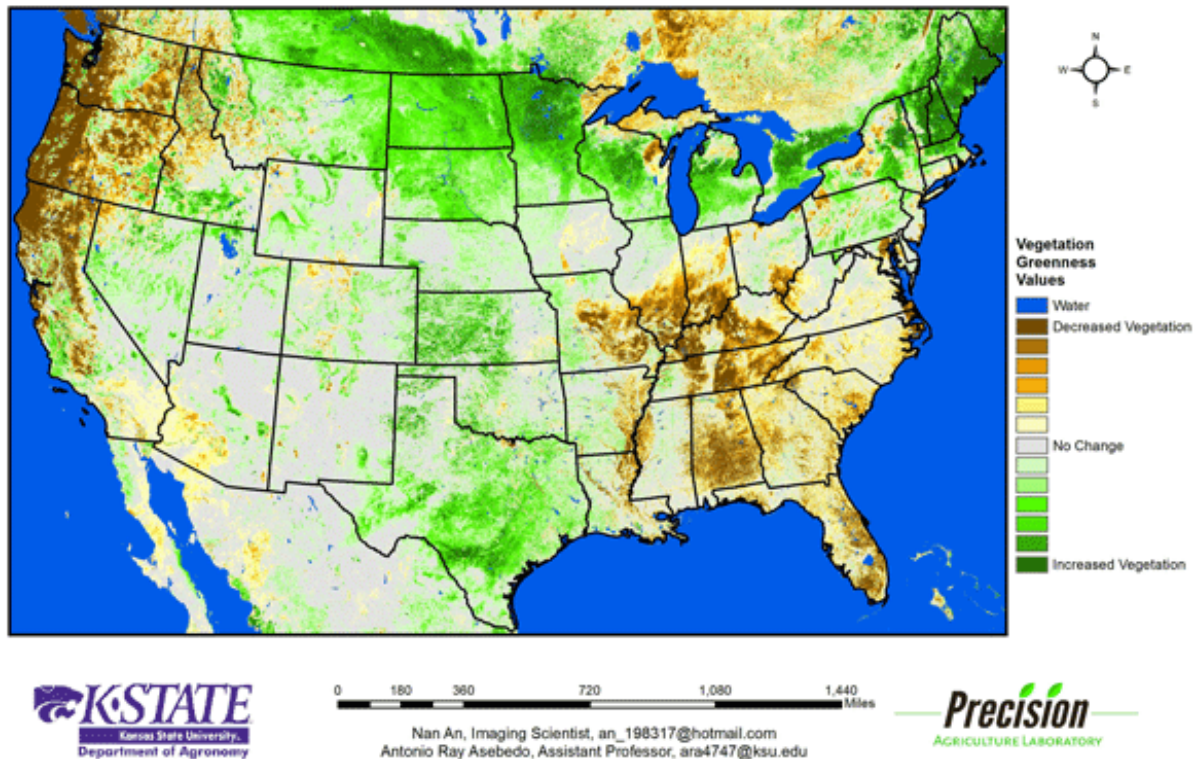
[www.agronomy.ksu.edu](http://www.agronomy.ksu.edu) | [www.facebook.com/KState.Agron](https://www.facebook.com/KState.Agron) | [www.twitter.com/KStateAgron](https://www.twitter.com/KStateAgron)

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



**Figure 5. The U.S. comparison to last year at this time for the period March 8 – 14 from K-State’s Precision Agriculture Laboratory shows that lower NDVI values are most evident along the Pacific Northwest while much higher NDVI values are visible from the Great Lakes to New England, and in the Central and Southern Plains. In the northern tier, snow continues to be the major influence on both. The Northeast continues to see a low-snow season, while the Pacific Northwest has a higher snow pack than last year. In the Plains, warmer and wetter conditions have fueled early progress in the vegetation.**

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



**Figure 6. The U.S. comparison to the 27-year average for the period March 8 – 14 from K-State’s Precision Agriculture Laboratory shows much higher photosynthetic activity across the Plains. The increased vegetative activity in eastern Montana and North Dakota is of particular concern. Snow pack in these areas is below average and abnormally dry conditions continue to expand in the region. Warmer-than-average winter temperatures across the Northern Plains is also spurring plant development. The below-average vegetative activity in the Southeast is largely due to last week’s heavy rainfall, while the lower NDVI values in the Pacific Northwest are indicative of the current snowpack conditions.**

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