



Extension Agronomy

eUpdate

08/29/2014

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 cthompso@ksu.edu.

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1. Fungicide seed treatments for wheat

Fungicide seed treatments may help with wheat stand establishment in certain situations. For seed production fields, a systemic seed treatment is highly recommended to help keep seedborne pathogens such as bunt and loose smut out of seed stocks. Due to the high value of the seed produced, even small yield increases can justify the use of seed treatments.

For grain production fields, seed treatment economics are less certain. Conditions favoring use of standard seed treatments in grain production fields include: 1) high yield potential field, 2) seed saved from field with loose smut, common bunt, or Fusarium head blight last year, 3) expensive seed, 4) low planting rates, or 5) planting under poor germination conditions, especially very early or late planting

If planting that late or into heavy residue, it's probably a good idea to use a fungicide seed treatment, even on seed that has high test weight and good germination. Planting wheat late into cool wet soils often delays emergence, reduces tillering capacity and lowers yield potential of the crop. Seed treatment fungicides can help prevent stand losses and maintain yield potential.

There are many different seed treatments available for wheat. Although most seed treatment ingredients are fungicides, some will also contain lindane and imidacloprid as insecticides. Each ingredient has certain strengths and weaknesses which may depend on the particular rates used. Many commercial formulations are complementary combinations of ingredients in order to provide a broader spectrum of protection.

The most important use of seed treatments is for the control of seed-borne diseases such as smuts and bunts. Loose smut control requires a systemic fungicide like carboxin, tebuconazole or difenoconazole. Common bunt, sometimes called, "stinking smut", can be controlled, very effectively, with most commercial treatments. Some elevators around the district have reported affected wheat with common bunt in recent years. If you are planning to keep your seed that has been confirmed with common bunt, seed treatment is critical.

Most treatments do at least a fair job of controlling seed rots and seedling blights. Scab and black point are two seed-borne diseases that can reduce seed germination. If a seed lot has either of these, it should be cleaned to remove all light test weight seeds and then tested for germination rate. If the germination rate is low (less than 90%), a seed treatment could help increase the germination rate. Several products are available if wireworms are expected to be a problem in stand establishment.

Some seed treatments also offer limited control of fall-season foliar diseases. Tebuconazole and difenoconazole provide some protection against fall infections of powdery mildew, leaf rust, and Stagonospora nodorum leaf blotch. A seed treatment will not prevent the disease from becoming reestablished in the spring.

Triadimenol, tebuconazole, and imazalil can shorten the coleoptile, so avoid deep planting when using these treatments.

Producers must balance the possible benefits against the cost and the possibility of having leftover treated seed. Leftover treated seed can be avoided by using hopper box treatments. If seed is treated on-farm, pay close attention to thorough coverage of the seed.

For more information, see K-State publication MF2955, *Seed Treatment Fungicide Wheat Disease Management* at: <http://www.ksre.ksu.edu/bookstore/pubs/MF2955.pdf>

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2. Wheat seeding tips for good stand establishment

Whatever the soil moisture conditions at wheat planting time, there are a few important steps producers can take to improve their chances of getting a good stand of wheat:

- Proper tractor speed. It is best to use a tractor speed of between 5 and 6 miles per hour in most cases when drilling wheat, depending on the amount of down pressure on the openers. If higher speeds are used, the openers can tend to “ride up” in the soil every now and then if down pressure is insufficient.
- Proper, uniform seeding depth. The ideal planting depth for wheat in most cases is about 1.5 inches. When planting early into very warm soils, it is especially important not to plant too deeply since coleoptile lengths are shorter than normal under warm conditions. On the other extreme, producers should also be especially careful not to plant too deeply when planting later than the recommended time into very cool soils. Getting a uniform seeding depth is also important. Where producers are planting into fields with heavy residue, or where there is uneven distribution of chaff from the previous crop, uneven planting depth can be a serious problem. In those situations, it is common to end up with poor stand establishment in areas of the field where the drill opener rode up over the residue or chaff, and was unable to penetrate the soil to the same depth as in other areas of the field.
- Firm seedbed. Planting into loose, fluffy soils can be a problem where soils have been tilled repeatedly during the summer. When seeds are planted into loose soils, rains in the fall will settle the soil and leave the crowns of the seedlings too close to the soil surface. Having a good closing system behind the drill openers, with adequate down pressure, should help.
- Plant during the optimum time. In general, wheat should be planted somewhere around the Hessian fly-free date. There may be good reasons to plant some wheat before the fly-free date, such as planting for pasture or time pressures from having considerable acreage to plant. But stand establishment and ultimate grain yields are usually best when wheat is planted after the fly-free date and before deadlines set by crop insurance. Planting more than three weeks after the fly-free date can be risky. Late-planted wheat often does not develop an adequate root system before winter, and forms fewer productive fall tillers. When planting late, seeding rates should be increased by 25 to 50 percent (up to a maximum of 120 lbs/acre) to help ensure an adequate stand and compensate for the lack of tillering.
- Adequate soil fertility. In general, producers should apply at least part of their nitrogen before or at planting time to get the plants off to a strong start. Nitrogen rates of 20-30 lbs can help with fall establishment and tillering. If the soil is low or very low in phosphorus or potassium, these nutrients should be applied at planting time as well so that the plants benefit early in their development. Starter phosphorus with the seed or band-applied close to the seed can also help with fall early growth and establishment, particularly in low-testing soils. Low soil pH can be a concern particularly early in the season when root systems are mostly near the surface, which is often an area of lower pH. Soil tests will determine the need for pH adjustment, and potential for aluminum toxicity. Variety selection and phosphorus application with the seed are potential management strategies for low pH and aluminum toxicity issues if it is too late to apply lime before seeding.
- Make adjustments for planting into row crop stubble. When planting wheat into grain sorghum stubble, producers will need an extra 30 lbs N per acre over their normal N rate. Also, it is important to make sure the sorghum is dead before planting wheat. When planting wheat into soybean stubble, producers should not reduce their N rates since the N credit from soybeans doesn't take effect until the following spring. If the wheat is being planted no-till after row crop harvest, N rates should be increased by 20 lbs N per acre over the normal N

rate. Seeding rates should be increased when planting wheat late after row crop harvest. It's best to use a seeding rate of 90 to 120 lbs per acre in central and eastern Kansas, and 75 to 100 lbs per acre in western Kansas. When planting more than three weeks after the Hessian fly-free date, producers should use a seeding rate of 120 lbs per acre.

- Watch out for potential disease issues when planting into corn residue. The risk of some diseases may be higher when wheat is planted into fields with large amounts of corn residue left on the soil surface. Fusarium head blight (scab) of wheat, for example, is caused by a fungus that is known to cause a stalk rot of corn.
- Using a seed treatment (see the article "Fungicide seed treatments for wheat" in this issue of the Agronomy eUpdate).

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3. Sudden Death Syndrome in soybeans

Soybean Sudden Death Syndrome (SDS) is epidemic in Doniphan and Atchison counties this year and is at record levels in many other counties in northeast Kansas. The heavy rains following planting in early June combined with continued rain events in the northeast part of the state in recent weeks have provided ideal conditions for the disease to develop.

SDS is a disease caused by the soilborne fungus *Fusarium virguliforme*. This fungus prefers wet conditions and thus is usually most severe in irrigated fields. In 2014, however, it is equally bad in non-irrigated fields including not only bottomland fields but upland fields as well. SDS tends to be most severe on well-managed soybeans with a high yield potential. It also tends to be more prevalent on fields that are:

- Infested with soybean cyst nematode
- Planted early when soils are wet and cool
- Compacted

This year, SDS disease is severe in the Kansas River Valley from Geary County to the Missouri border and northeast Kansas in the Missouri River basin area. The disease can also be found in irrigated fields in the Republican River Valley northeast of Clay Center. SDS is even showing up in some areas of southeast Kansas.

Historical yield losses from this disease are generally in the range of 1 to 25 percent but it would not be surprising to see losses in the 50% range in the most severely affected fields this year. If yields on SDS-free fields are in the range of 60 bushels per acre, that means up to 15 - 30 bushels per acre could be lost to the disease on the most severely affected fields.

Symptoms of SDS are fairly easy to recognize. SDS begins as small, bright, pale green to yellow circular spots on the leaves during late vegetative or early reproductive growth stages. As the disease progresses, the tissue in these spots starts to die and enlarges to form brown streaks between the veins. Symptoms are more pronounced on top leaves.



Figure 1. Scattered yellow spots on some of the greener leaves in the lower right in this photo are the early leaf symptoms of SDS. The leaves in the center foreground have more advanced symptoms of SDS. Photo by Stu Duncan, K-State Research and Extension.



Figure 2. A soybean field in Franklin County with SDS. Photo by Eric Adey, K-State Research and Extension.

Flowers and pods may abort or not fill. Another key symptom of SDS is substantial amounts of root decay and discoloration of roots and crown.



Figure 3. Root rot occurs on plants infected with the SDS pathogen. This symptom distinguishes SDS from brown stem rot and stem canker. Left image by Jim Shroyer, K-State Research and Extension; right image courtesy of Iowa State University.

Diseased plants are easily pulled out of the ground because the taproots and lateral roots have deteriorated. Symptoms present on both the leaves and roots are diagnostic for SDS.

Soybean yield losses from SDS depend on variety and stage of crop development when the symptoms first appear. Appearance of the disorder at early pod fill is more damaging than its appearance at a later stage of plant development. Yield reduction is the result of reduced photosynthetic area, defoliation, flower and pod abortion, and reduced seed size.

Effective management of SDS requires an integrated approach. Management starts with the planting of SDS resistant varieties. At K-State, we have been evaluating soybean varieties for SDS resistance in our performance test for the past several years. Most varieties are susceptible to some degree, and very few have good resistance. The most susceptible varieties yield 40 to 50 percent less than the resistant varieties at locations where SDS is present and yield levels are in the range of 60+ bushels per acre.



Figure 4. The variety on the right in a recent K-State performance test was susceptible to SDS. The foliage was completely dead by early pod fill. Photo by Bill Schapaugh, K-State Research and Extension.

Seed companies also have SDS ratings for most of their varieties, and there is typically a wide variation in ratings. There is little or no correlation between the maturity of a variety and its SDS resistance rating.

The presence of SDS is strongly correlated with the presence of soybean cyst nematode. Therefore, where SDS is present, soil samples should be taken to determine the level of soybean cyst nematode present and it will need to be managed along with the SDS. Producers cannot manage SDS simply by selecting varieties that have soybean cyst nematode resistance, however. Some varieties with resistance to soybean cyst nematode are susceptible to SDS. And some varieties that are susceptible to soybean cyst nematode are resistant to SDS. Ideally, producers should select varieties that are resistant to SDS and multiple races of soybean cyst nematode.

Cultural management practices that can reduce the risk of SDS infection include delaying planting until soil temperatures are warmer, avoiding planting into overly wet soils, and reducing compaction problems within a field. Producers who have fields with compaction problems should make every effort to correct that problem before planting soybeans next season.

Crop rotation also seems to have some positive effect on SDS, but only if the field is not planted to soybeans for four years or more.

Recent research with seed treatments on soybeans has shown some promising results. A study with seed treatments applied to soybean was conducted at the Kansas River Valley Experiment Field in 2013, with treatments applied to three soybean varieties of with different levels of tolerance to SDS. The study was irrigated earlier and more often than normal for soybean to promote the disease. The most severely infested plots had more than 80% of the leaf area expressing symptoms of SDS by the R6 growth stage. Treatments with the experimental product ILeVO from Bayer CropScience reduced the amount of foliar disease in all varieties and increased yields up to 16 bu/acre, or more than 40% (Table 1). ILeVO is not yet on the market.

Table 1. Influence of soybean variety and seed treatment on Sudden Death Syndrome, Kansas River Valley Experiment Field-Rossville, 2013						
	Soybean varieties					
	Most resistant	Moderately resistant	Susceptible	Most resistant	Moderately resistant	Susceptible
Seed treatment	Yield (bu/acre)			% Leaf area with SDS at R6		
None	28.6	29.2	21.3	18%	44%	63%
ILeVO* at 0.25 mg/seed	41.6	39.7	37.4	4%	28%	45%
ILeVO at 0.15 mg/seed	42.9	41.0	26.2	5%	28%	72%
LSD 0.05	8.3			17.4		

* Fluopyram 600 FS, Bayer CropScience

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4. Planting spring oats and turnips to extend the grazing season

Most producers plant spring oats in spring. However, spring oats can be planted in late summer as well for fall and early winter grazing. Spring oats will die out after the first hard freeze in the mid 20's.

Oats are a high-quality forage, almost as good as wheat. Since oats do not have awns, cattle can graze them easily.

Is it possible to plant oats and turnip at the same time? The answer is yes. Some wildlife hunters plant oats and turnips for their deer food plots in the fall. Producers can use the same concept for beef grazing in the fall.

Forage turnip is one of the forage brassicas (others include forage rape, turnip, and kale) and has very high nutritive value with 24 - 25% crude protein in leaves and 16-18% crude protein in the roots. Forage turnip has high moisture content, so it's not suitable for hay. The low fiber and high moisture content of forage turnip can cause diarrhea in livestock, so it is recommended that animals have free choice of dry hay or dry forage along with the turnips. Oats can provide some fiber in the growing mix, but not much when the oats are very young.

Oats and turnip can be planted at the same time using a grain drill with a second, small seed box for turnip seed. If a small seed box isn't available, the turnips can be broadcast ahead of oat drilling. The soil disturbance from the drill is generally enough to get the turnip started after a rain. The seeding rate for oats is 120 pounds per acre. For turnip, the seeding rate is 2 pounds per acre.

The ideal planting depth for oats is 1 to 1 ½ inch. The ideal planting depth for turnips is ½ inch. A mixture of oats and turnips should be planted ½-inch deep.

Turnip is more winterhardy than spring oats, and can continue to grow into winter while maintaining its greenness even under snow cover. To have more growth, about 50 lbs nitrogen per acre can be applied at planting. Both oats and turnips can accumulate high nitrates so forage should be tested prior to grazing. Having dry roughage available can help dilute the nitrate levels in fresh, grazed oat/turnip forage. Samples can be submitted for analysis through the local county Extension office.

Potential yield for a fall-planted oats and turnip mixture might be 2 to 3 tons dry matter tons per acre. For spring oats alone, it would be about 1 to 2 tons dry matter per acre. Depending on the soil moisture condition, producers can start grazing about 6 to 8 weeks after oats and turnips are planted.



Figure 1. Oats and turnip pasture. Photo by Doug Shoup, K-State Research and Extension.

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5. Sulfur fertilizer for wheat on fields with a history of sulfur deficiency

In recent years, sulfur (S) deficiency in wheat has become common in many areas of Kansas, particularly in no-till wheat. Classic S deficiency symptoms, confirmed by soil and plant analysis, have been observed in many no-till wheat fields during periods of rapid growth in the spring. These observed deficiencies generally occur during periods of rapid growth prior to jointing, or during stem elongation.

There are two likely reasons for this: a reduction in sulfur additions to the crop from atmospheric deposition and phosphorus fertilizer applications, and cooler soil temperatures as a result of no-till planting, which slows S mineralization in the soil. The net effect of these factors is a significant reduction in the crop available S.

The photo below is a good representation of the problem. Generally the S-deficient wheat is yellow and stunted, and the problem is found in patches in the field, especially in areas where there has been previous soil erosion or soil movement. Sulfur deficiency on growing crops is often mistaken for nitrogen (N) deficiency. However, unlike N where the older leaves show firing and yellowing, with S deficiency, the pale yellow symptoms of S deficiency often appear first on the younger or uppermost leaves. Wheat plants with S deficiency often eventually become uniformly chlorotic. The patchy S-deficient areas of the field are often found on hilltops or sideslopes where erosion has occurred and soil organic matter is reduced, or where leaching is more pronounced. In terraced or leveled fields, wheat in areas where topsoil was removed or significant cuts were made also commonly shows symptoms.



Figure 1. Sulfur deficiency in wheat. Photo by Dave Mengel, K-State Research and Extension.

Sulfur deficiencies in wheat have been showing up early in the spring, shortly after greenup, before organic S is mineralized from soil organic matter, and before wheat roots can grow into the subsoil to utilize sulfate accumulated there. Deficiencies of S are often difficult to identify because the paling in crop color is not always obvious. Crops lacking S also may be stunted, thin-stemmed, and spindly. In the case of wheat and other cereal grains, maturity is delayed. Due to the slower growth and lack of good tillering, winter annual weed competition is also enhanced.

The majority of S in soils is present in organic forms in surface soils and as sulfate. Sulfate is relatively soluble, so it tends to leach down from the surface soil into the subsoil. In many of our Kansas soils it will accumulate in the B horizon in two forms. Some will be sorbed to clay surfaces and coatings similar to the processes whereby phosphates are sorbed, though sulfate will not be adsorbed as strongly. Sulfate will also be present in the subsoil of many Kansas soils as gypsum. Traditionally, S deficiency was most common on high-yielding crops grown on irrigated sandy soils low in organic matter and subject to leaching. However, due to the reduced additions from the atmosphere (there is less S in the air now) and continued crop removal, an increasing number of finer-textured soils have shown S deficiency in recent years.

A soil test for available sulfate-S in the soil profile is available. For proper interpretation of this test, soil organic matter, soil texture, the crop to be grown, and the expected yield level all need to be factored in. Since sulfate-S is mobile, sampling to a 24-inch depth is important. Accurate estimates of S needs cannot be made from a surface sample alone. However, due to the relatively high demand

for S during the rapid vegetative growth phase of wheat growth, and relatively shallow rooting by the wheat crop at this time, the S measured in the deeper, subsoil levels by the test may not be available to wheat in the early spring, especially where soils are cold.

Many fields in North Central and Northeast Kansas now have an established history of S deficiency for wheat. In this situation rather than waiting for symptoms to appear, farmers may want to consider a fall application of S as a preventive measure.

There are many S-containing fertilizer materials. Several dry materials are available that can be blended with dry phosphorus or nitrogen fertilizers for preplant or winter/spring topdressing.

Elemental S (typically 90-95 percent S) is a dry material marketed by several manufacturers. Before it becomes available for plant uptake, elemental S must first be oxidized by soil microorganisms to sulfate-S and this can be a slow process when surface-applied. As a result, this material is well suited for preplant applications. Elemental S is not well suited for corrective applications to S-deficient wheat in the spring, however, due to the time requirement for oxidation to sulfate.

Ammonium sulfate, AMS (21-0-0-24S) is a dry material that is a good source of both N and S. It has high acid-forming potential, however, and soil pH should be monitored. Ammonium sulfate is a good source to consider for both preplant or topdressing to correct existing sulfur deficiencies.

Gypsum (analysis varies) is calcium sulfate, and is commonly available in a hydrated form containing 18.6 percent S. This material is commonly available in a granulated form that can be blended with other materials. Since it is a sulfate source, it would be immediately available, and is another good source for spring topdressing. But gypsum is not as water soluble as many fertilizer materials, such as ammonium sulfate.

New N-P-S products such as Microessentials or Anchor D are ammonium phosphate materials formulated with sulfur, and in some cases micronutrients such as zinc. In most of these products the sulfur is present as a combination of elemental-S and sulfate-S. These are also good choices for preplant applications.

There are also liquid sources of sulfur fertilizers available.

Ammonium thiosulfate (12-0-0-26S) is the most popular S-containing product used in the fluid fertilizer industry, as it is compatible with N solutions and other complete liquid products.

Potassium thiosulfate (KTS, 0-0-17-17S) is a clear liquid product that can be mixed with other liquid fertilizers.

Application guidelines supplied by the manufacturers of both these liquid products caution that these products should not be applied directly to seed, by in-furrow or pop-up application, due to germination and seedling injury concerns. They also caution that these products should not be applied in a foliar application or as foliar sprays to actively growing plants. Topdressing with thiosulfate and UAN can be done early, before Feekes 5, and at temperatures below 70 degrees. But some burn can be expected, especially with KTS. These products would be good sources for preplant application, however.

In-furrow application of dry products at seeding is another potential way to address S needs in fields

with a history of S deficiency. Care needs to be taken when applying any sulfur product in the row at seeding due to the potential for seedling injury, however. Due to the large number of products being sold, make sure to check with your supplier that a product selected is recommended for direct in row or on the seed application.

For more information see *Sulfur in Kansas*, K-State publication MF-2264,
<http://www.ksre.ksu.edu/bookstore/pubs/MF2264.pdf>

For estimations of required application rates of S see *Soil Test Interpretation and Fertilizer Recommendations*, K-State publication MF-2586
<http://www.ksre.ksu.edu/bookstore/pubs/mf2586.pdf>

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6. Northwest Research-Extension Center Centennial Celebration, September 4

K-State's Northwest Research-Extension Center in Colby will be celebrating its Centennial Celebration at its Fall Field Day on Thursday, September 4. The theme is "Looking Back, Moving Forward 1914-2014."

The Centennial Celebration and Field Day will begin with registration at 2 p.m. at the NWREC, 105 Experiment Farm Road. Field tours will be held from 2:30 until 5 p.m.

Field tour presentations include:

- Water Use and Productivity of Dryland Corn and Grain Sorghum – Rob Aiken, NWREC Crops Research Scientist
- Water Use of Corn: Historical and Current Perspectives – Freddie Lamm, NWREC Irrigation Engineer
- Crop Weed Management, Then and Now – Phil Stahlman, K-State Agricultural Research Center-Hays Weed Scientist
- Ogallala Aquifer Declines at the NWREC and Monitoring the Declines Going Forward – Danny Rogers, K-State Irrigation Engineer
- Grain Market and Crop Profitability Prospects for 2014-2015 – Dan O'Brien, Northwest Area Extension Agricultural Economist

After the field tours, a meal will be served from 5:30 to 6:30 p.m. There is no charge for the meal, but preregistration is required. The meal and evening program will be at the Cooper Barn, Prairie Museum of Art and History, 1905 S. Franklin in Colby.

The evening program will be held from 6:30 until 8 p.m. Presentations include:

- The First Century: The Legacy of the Northwest Research-Extension Center – Bob Gillen, Head, Western Kansas Agricultural Research Centers
- A Century of Climate Variability in Northwest Kansas – John Harrington, Professor, K-State Department of Geography
- Grand Challenges for the Next Century – John Floros, Dean of the College of Agriculture and Director of K-State Research and Extension

To register or for more information, call 785-462-6281 or visit www.northwest.ksu.edu

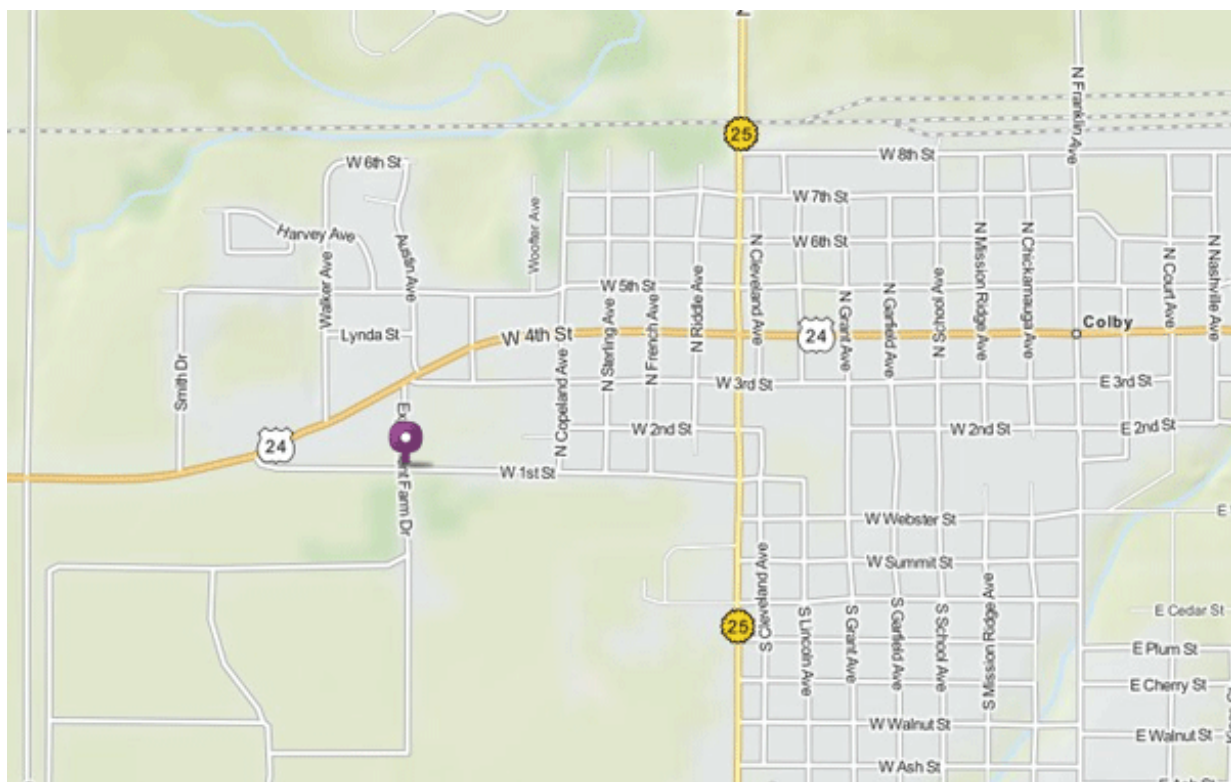


Figure 1. Map to K-State's Northwest Research and Extension Center in Colby.

7. Comparative Vegetation Condition Report: August 12 - 25

K-State's Ecology and Agriculture Spatial Analysis Laboratory (EASAL) produces weekly Vegetation Condition Report maps. These maps can be a valuable tool for making crop selection and marketing decisions.

Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:

<http://www.youtube.com/watch?v=CRP3Y5Nlggw>

<http://www.youtube.com/watch?v=tUdOK94efxc>

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 25-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.

NOTE TO READERS: The maps below represent a subset of the maps available from the EASAL group. If you'd like digital copies of the entire map series please contact Nan An at nanan@ksu.edu and we can place you on our email list to receive the entire dataset each week as they are produced. The maps are normally first available on Wednesday of each week, unless there is a delay in the posting of the data by EROS Data Center where we obtain the raw data used to make the maps. These maps are provided for free as a service of the Department of Agronomy and K-State Research and Extension.

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

Kansas Vegetation Condition

Period 34: 08/12/2014 - 08/25/2014

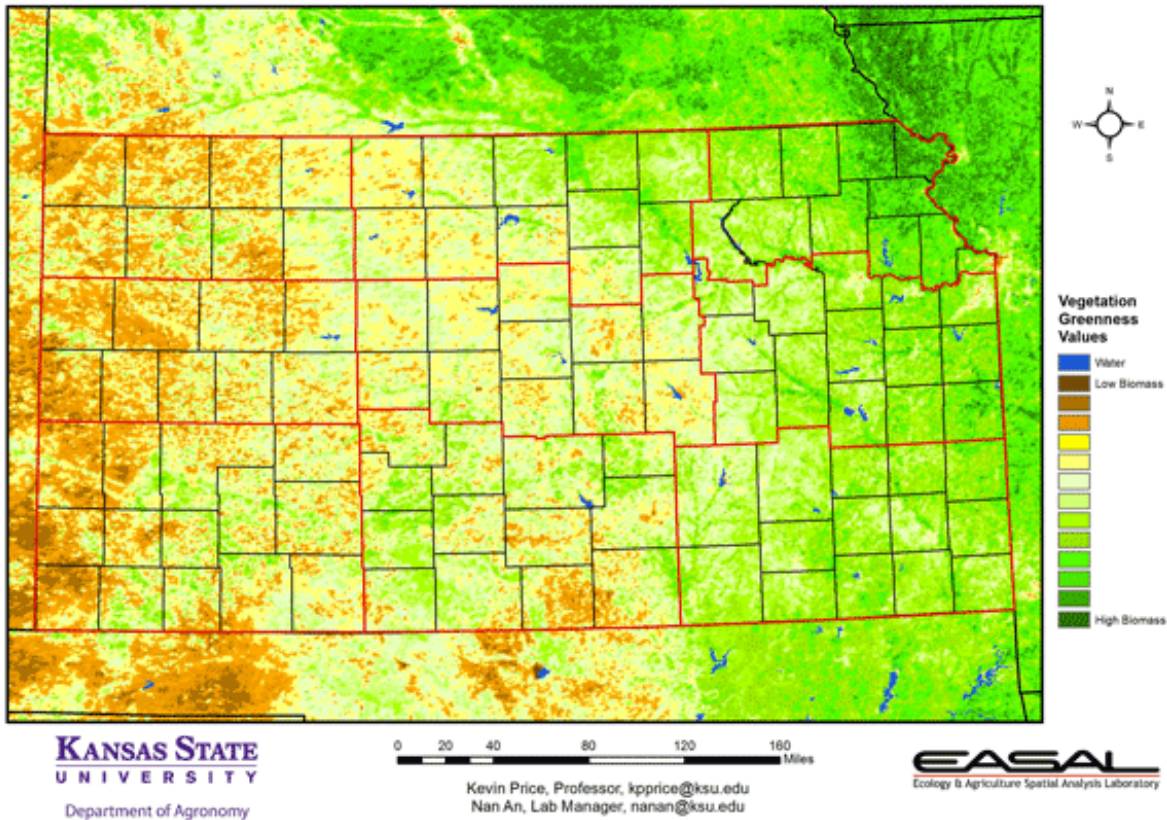


Figure 1. The Vegetation Condition Report for Kansas for August 12 – 25 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that highest NDVI values are confined to the extreme northeastern portion of the state. This region continues to see the greatest moisture, and very favorable temperatures. Some lower NDVI values are beginning to appear in southeast and east central Kansas, which has missed much of the recent moisture.

Kansas Vegetation Condition Comparison

Mid-August 2014 compared to the Mid-August 2013

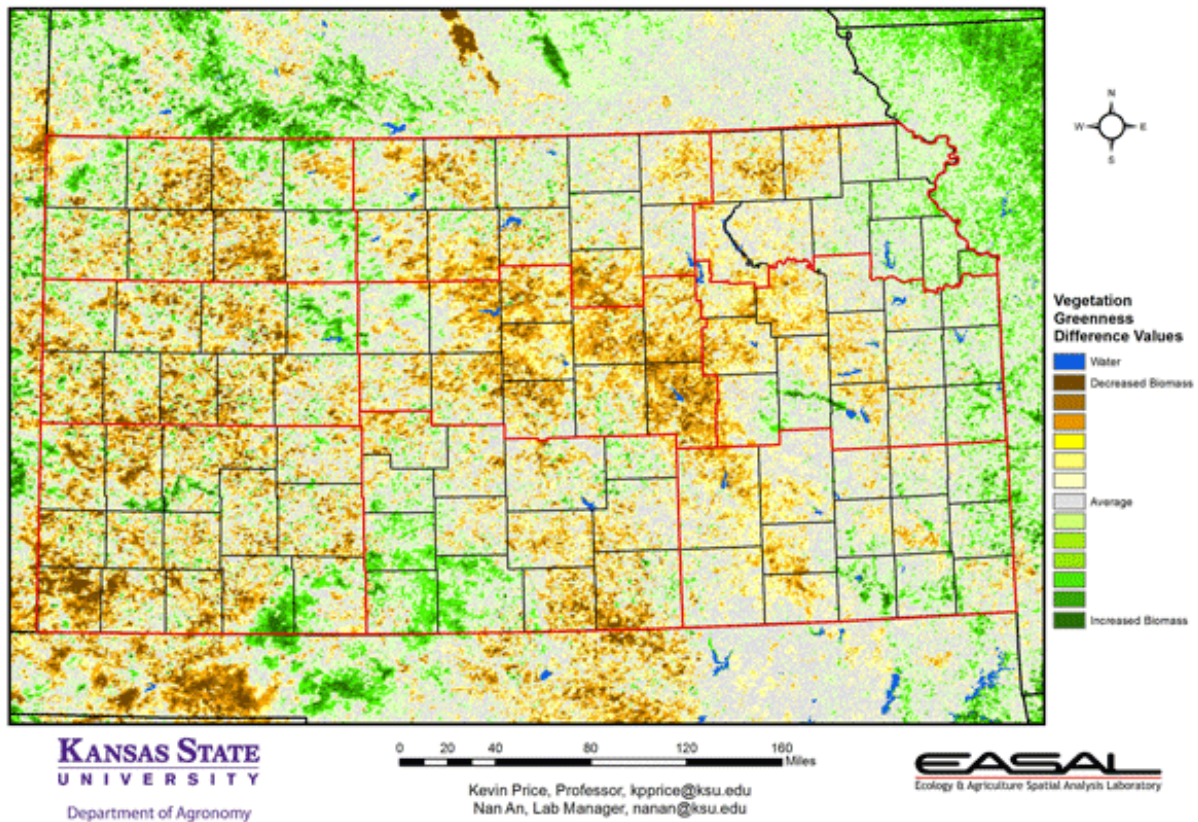


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for August 12 – 25 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that much of the state has lower NDVI values this year. The biggest departure is in central Kansas, while some portions of south central Kansas have higher biomass production this year.

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Kansas Vegetation Condition Comparison
Mid-August 2014 compared to the 25-Year Average for Mid-August

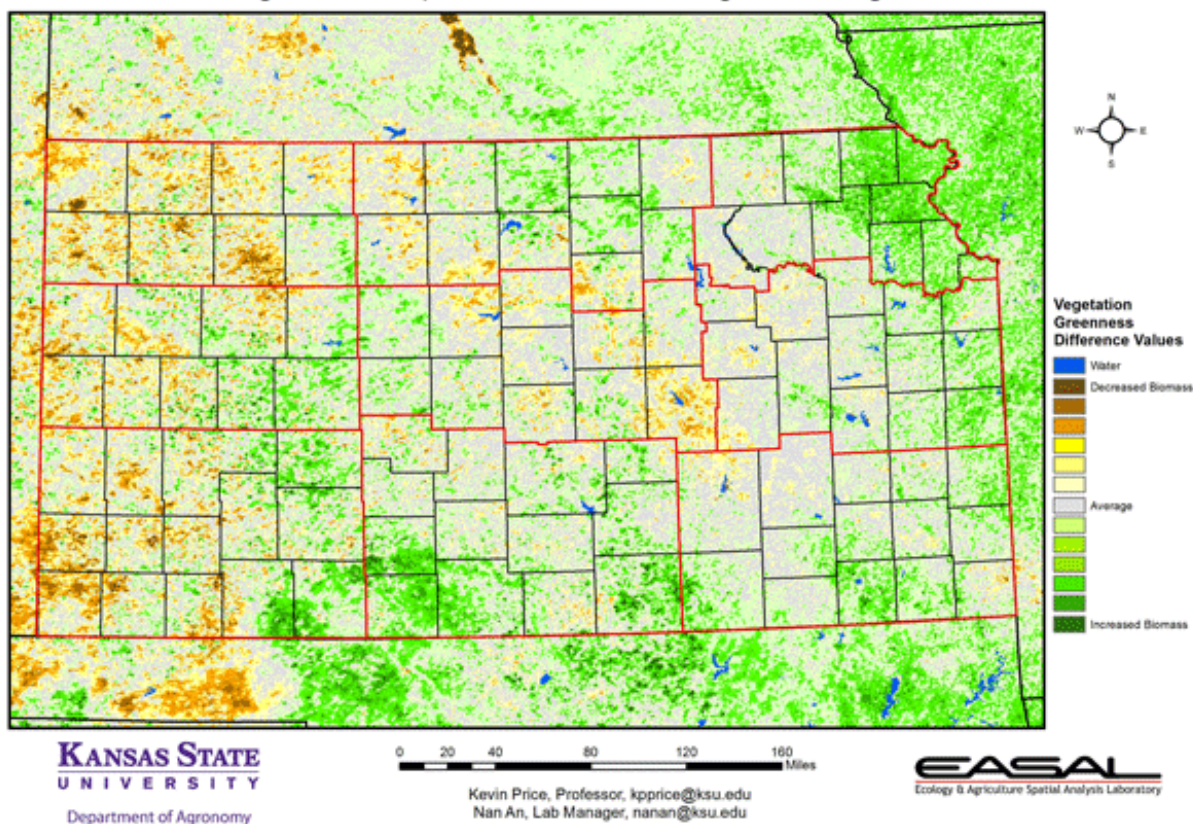


Figure 3. Compared to the 25-year average at this time for Kansas, this year's Vegetation Condition Report for August 12 – 25 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows the western third of the state continues to have below-average NDVI values. Marion County also is showing below-average biomass productivity.

U.S. Corn Belt Vegetation Condition

Period 34: 08/12/2014 - 08/25/2014

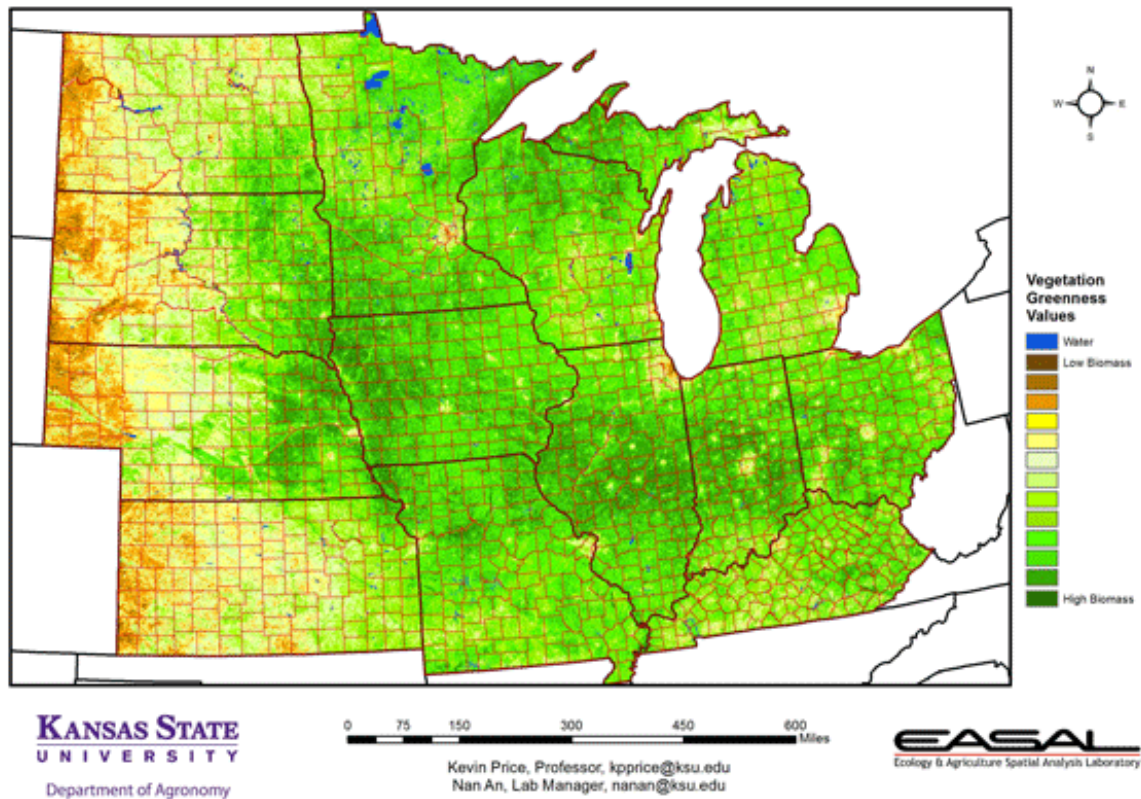


Figure 4. The Vegetation Condition Report for the Corn Belt for August 12 – 25 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the central portion of the region continues to have very high NDVI values. These areas of high NDVI values continue along the Missouri River Basin in Nebraska and Iowa, where temperatures and precipitation have continued to be favorable for plant development.

U.S. Corn Belt Vegetation Condition Comparison
 Mid-August 2014 Compared to Mid-August 2013

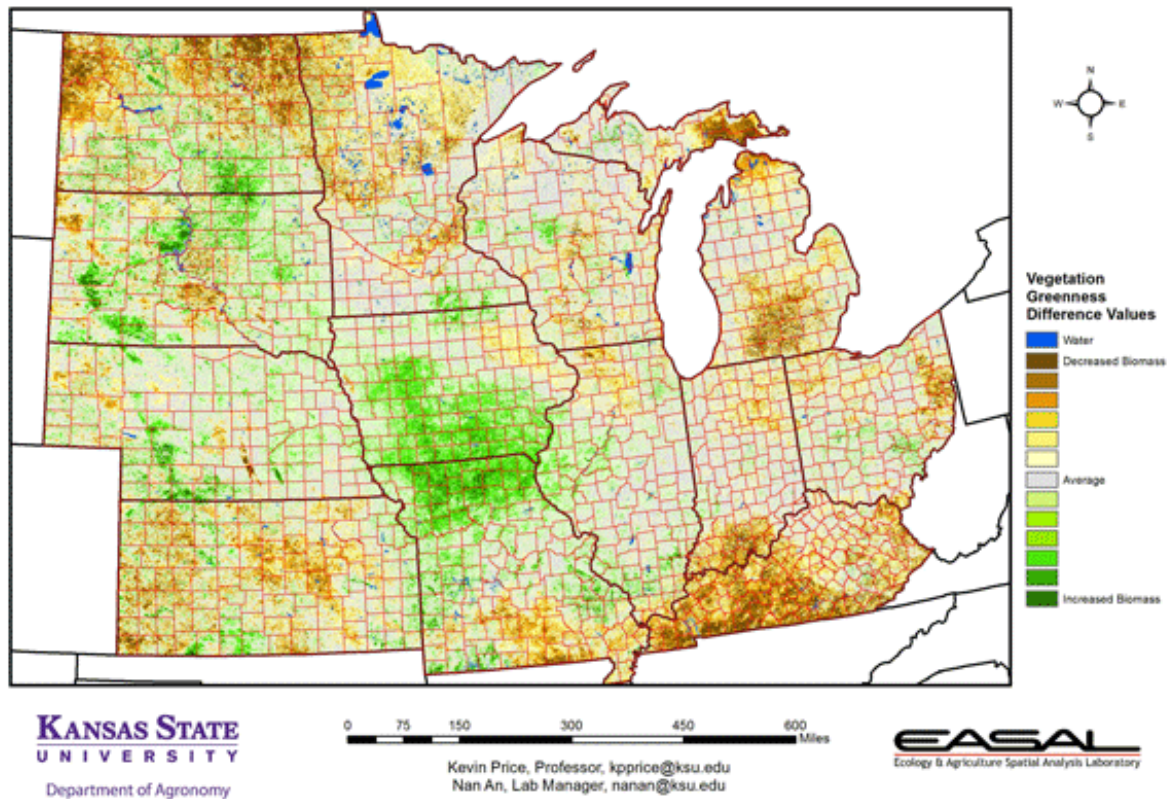


Figure 5. The comparison to last year in the Corn Belt for the period August 12 – 25 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that with more favorable growing conditions, northern Missouri and southern Iowa have higher biomass production. In contrast, North Dakota and western Kentucky have much lower NDVI values.

U.S. Corn Belt Vegetation Condition Comparison
Mid-August 2014 Compared to the 25-Year Average for Mid-August

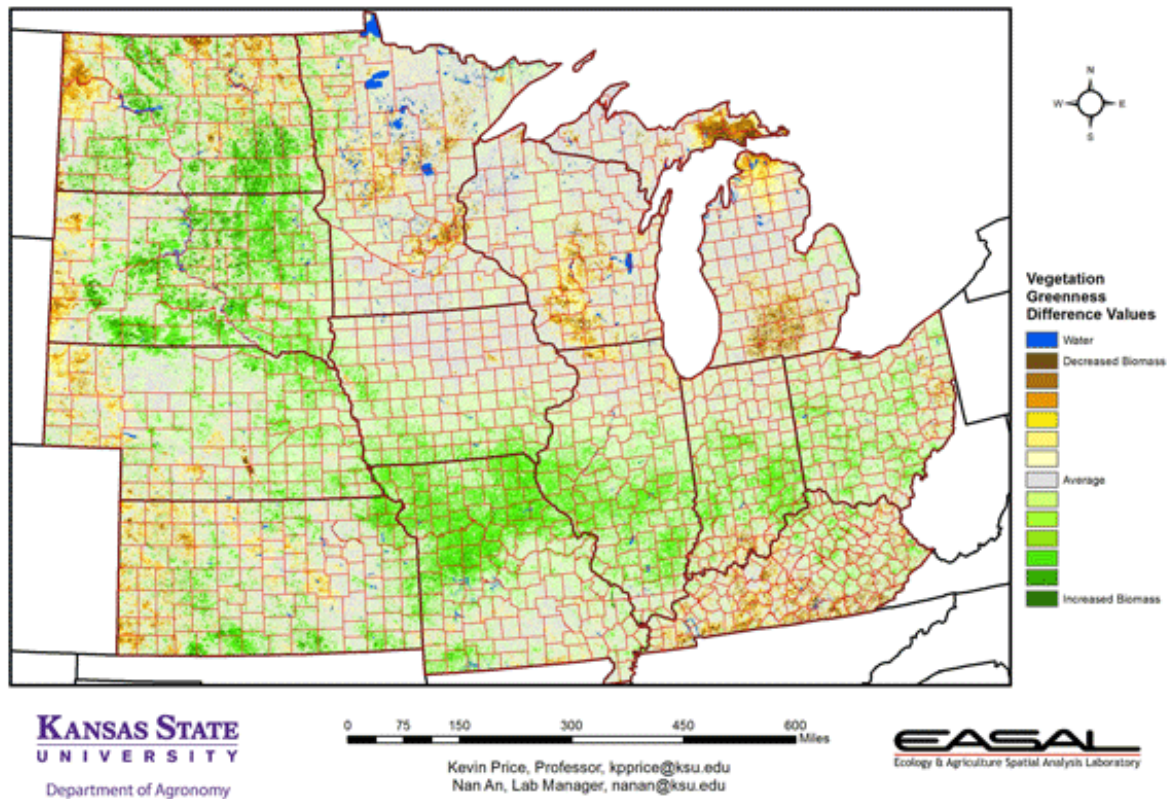


Figure 6. Compared to the 25-year average at this time for the Corn Belt, this year's Vegetation Condition Report for August 12 – 25 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the Dakotas and northern Missouri have above-average biomass production. Most of the remainder of the region is close to the long-term average. The biggest area of below-average biomass production is in the Upper Peninsula of Michigan.

Continental U.S. Vegetation Condition

Period 34: 08/12/2014 - 08/25/2014

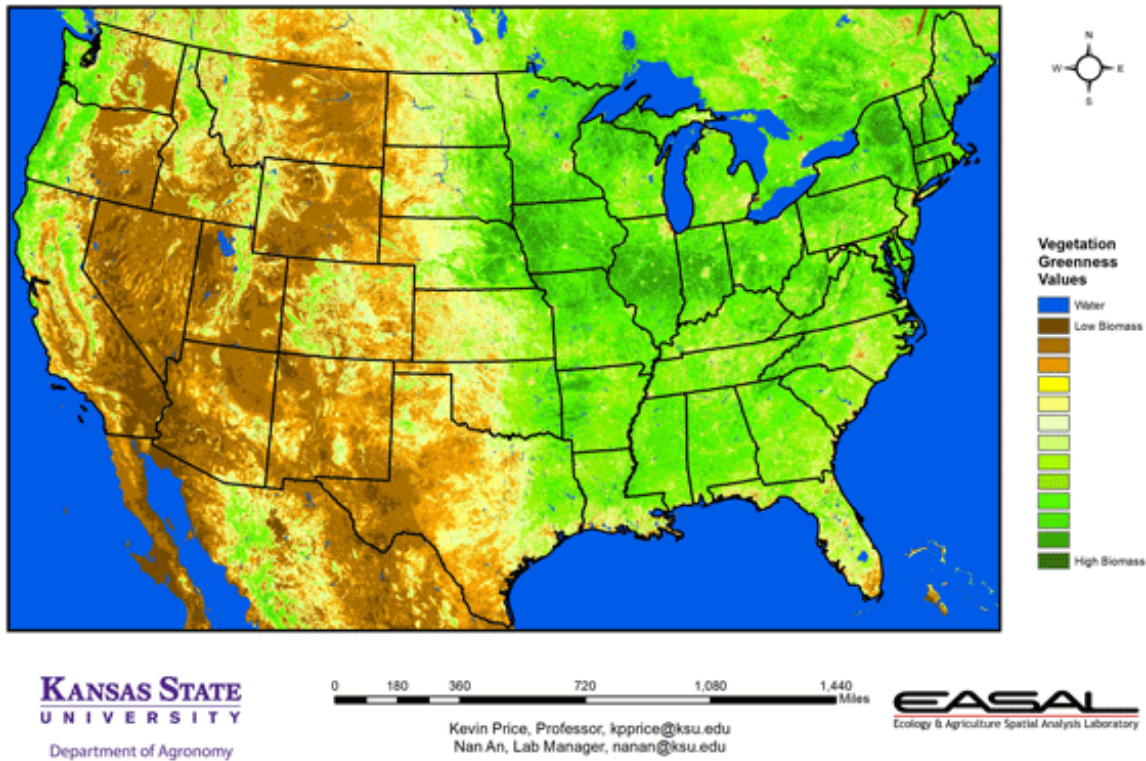


Figure 7. The Vegetation Condition Report for the U.S. for August 12 – 25 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the areas of highest biomass production are along the upper Missouri River across the Corn Belt and into northern New England.

Continental U.S. Vegetation Condition Comparison
Mid-August 2014 Compared to Mid-August 2013

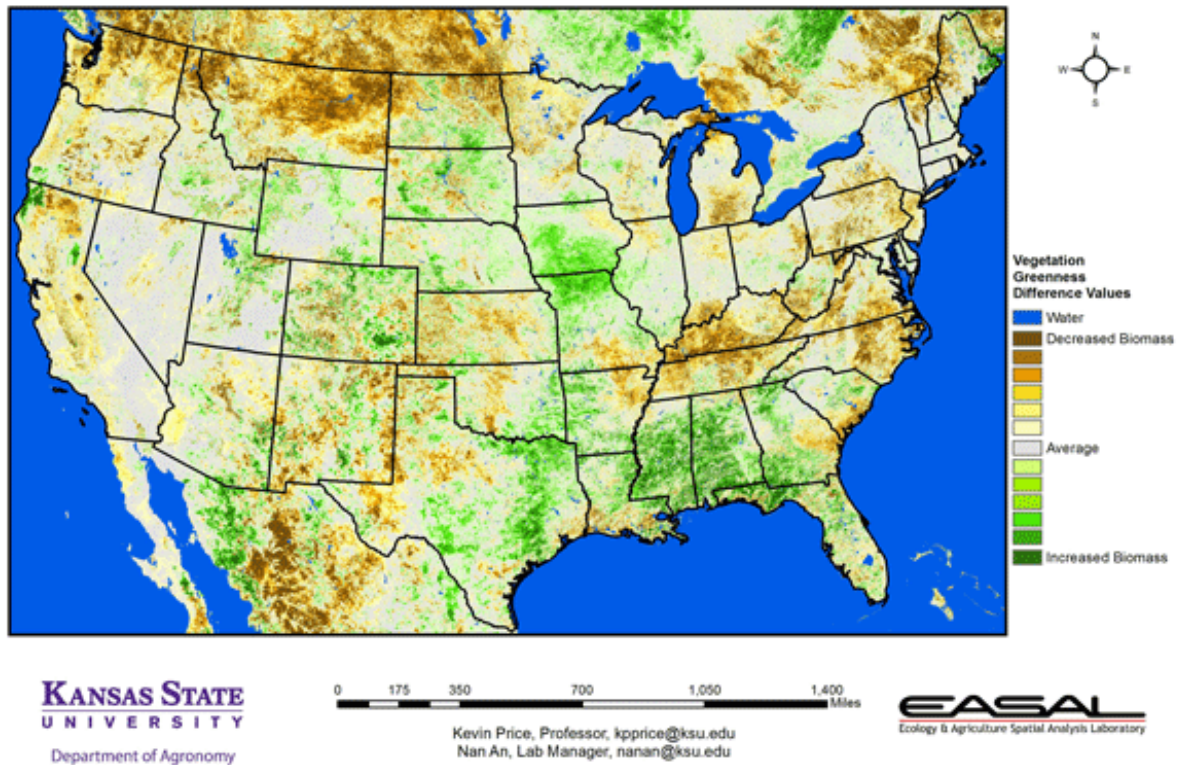


Figure 8. The U.S. comparison to last year at this time for the period August 12 – 25 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that Washington and Montana have much lower NDVI values while Louisiana and Alabama have much higher values. In Montana, heavy rains created problems with flooding.

Continental U.S. Vegetation Condition Comparison
Mid-August 2014 Compared to 25-year Average for Mid-August

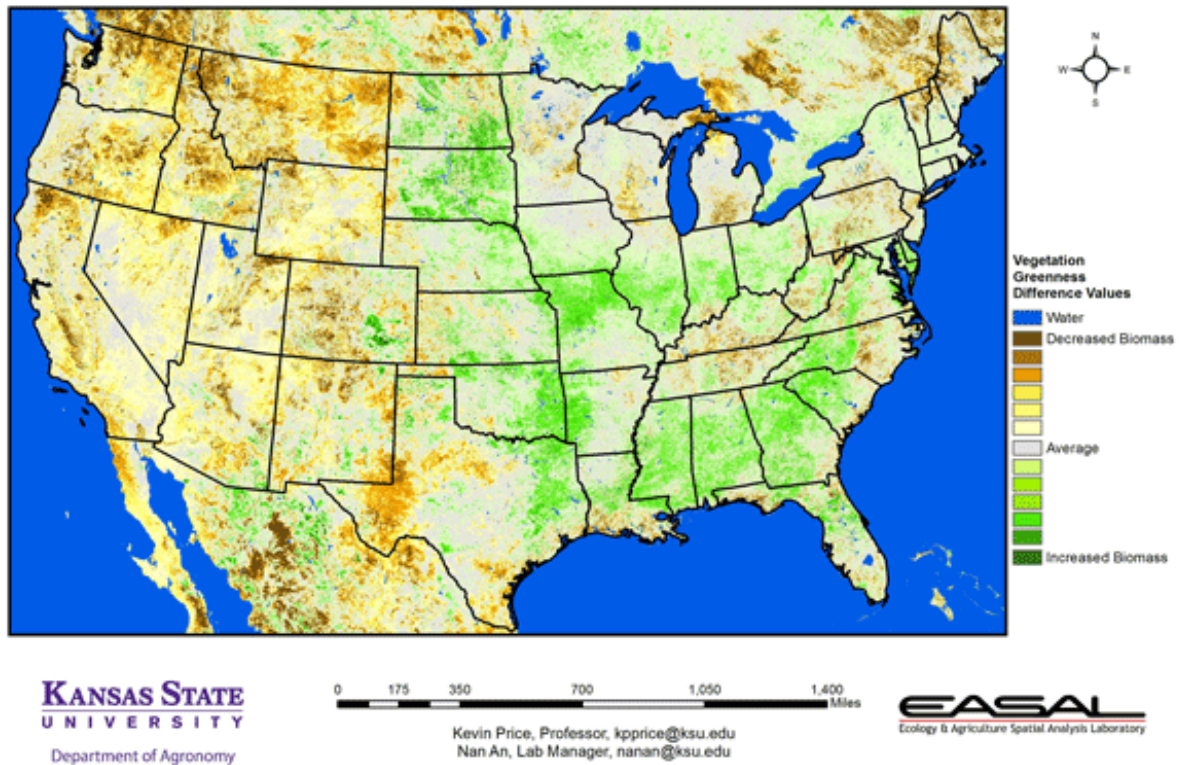


Figure 9. The U.S. comparison to the 25-year average for the period August 12 – 25 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the greatest departure is in the Northwest. In Montana, while range conditions are poorer than last year, it is reported in better condition than the 5-year average.

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