k-state extension AGRONOMY e-Updates

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1. Cover crops improve no-till performance

Cover crops can have several potential benefits in a no-till rotation. Greater biomass input from cover crops can potentially increase soil organic carbon (C) concentration, enhance nutrient cycling, regulate soil temperature, and help protect the soil from water and wind erosion. In short, cover crops may improve soil physical properties by increasing soil organic C concentration.

But there is surprisingly little scientific documentation of these effects. Because changes in soil properties are often measurable in the long term, data from long-term cover crop experiments can provide insights into the potential of cover crops for improving soil functions. In spring 2010, we measured the effects of cover crops on soil physical properties and studied relationships between crop-induced changes in soil organic C concentration and soil physical properties on a long-term cover crop experiment at the former Harvey County Experiment Field in Hesston (Figure 1).

Figure 1. Cover crop experiment at the former Harvey County Experiment Field in Hesston (*Photo by Dr. Mark M. Claassen, K-State Research and Extension*)

The experiment was initially established in 1995 with hairy vetch as a winter cover crop following winter wheat in a wheat/grain sorghum rotation compared to the same rotation without a cover crop. Management involved reduced-tillage and four levels of N fertilizer at 0, 30, 60, and 90 lb/acre. This system was tested through 2000. Starting in 2002, sunn hemp and late-maturing soybean as summer cover crops replaced hairy vetch, with all phases of the experiment managed exclusively under no-till. Other treatments (N rates and the no-cover-crop check) were kept the same. Sunn hemp and late-maturing soybean were planted after wheat in early summer, terminated in September or October, and grain sorghum was planted in June of the following year.

Soil Organic Carbon

Sunn hemp and late-maturing soybean cover crops increased soil organic C concentration relative to plots without cover crops. Averaged across N rates, soil organic C concentration in the 0 to 3 inch soil depth was 30% greater in sunn hemp and 20% greater in late-maturing soybean plots than in plots without cover crops (Fig. 2). Cover crops did not, however, affect organic C concentration in the 3 to 6 inch depth.

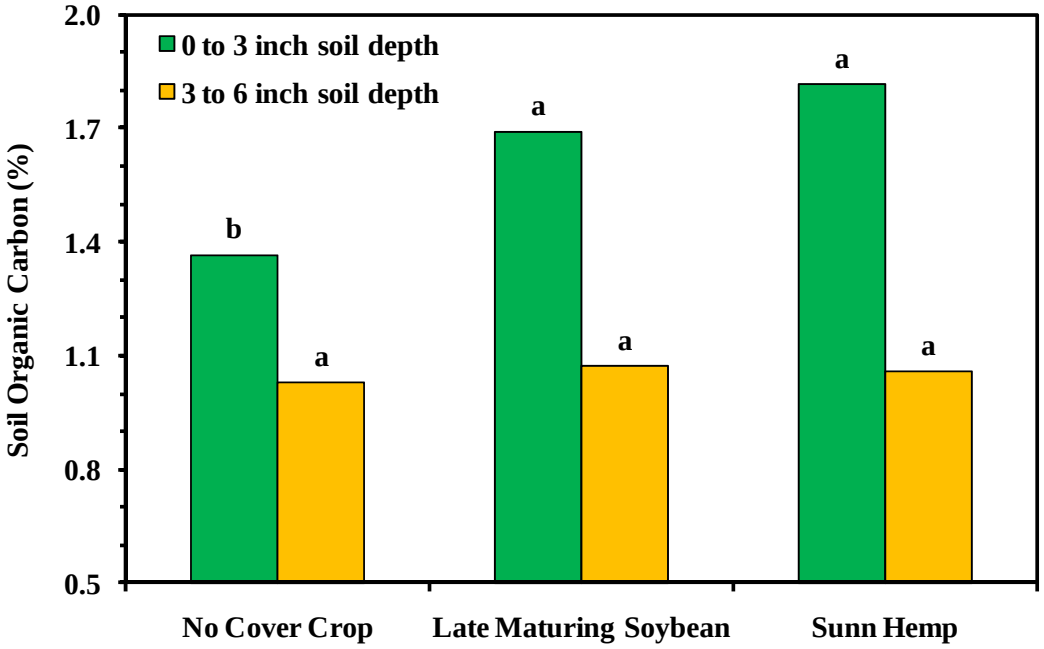

Figure 2. Effects of cover crops on soil organic C concentration at two soil depths. Bars with the same letter within the same depth are not significantly different.

Aggregate Stability and Organic Carbon

Cover crops improved soil wet aggregate stability in the 0 to 3 inch depth (Fig. 3A). The proportion of macroaggregates was greater in cover crop plots than in plots with no cover crops. The increase in soil organic C concentration with cover crops was partly responsible for the improved aggregate stability (Fig. 3B).

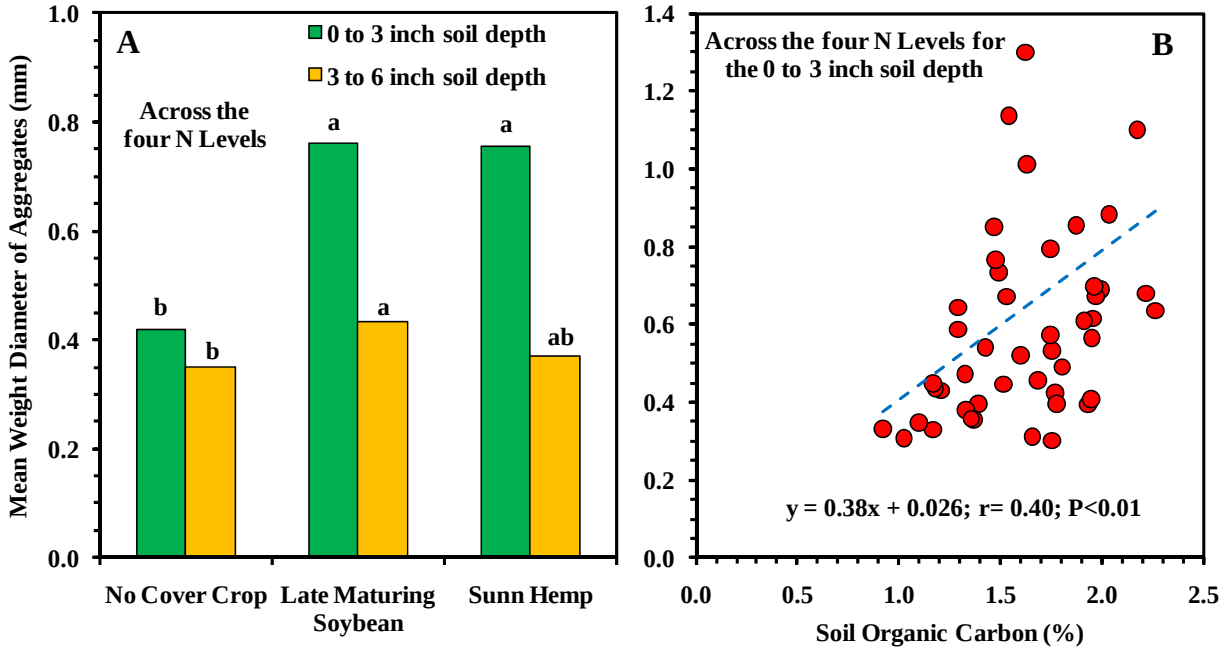

Figure 3. Wet aggregate stability expressed as mean weight diameter of aggregates (A) and relationship between aggregate stability and cover crop-induced increase in soil organic C concentration (B). Bars with the same letter within the same depth are not significantly different.

Water Infiltration and Organic Carbon

Sunn hemp increased water infiltration by about three times when compared with plots without cover crops. Cumulative water infiltration was greater in sunn hemp than in no-cover crop plots by about 3 times (Fig. 4). Late-maturing soybeans had less effect on water infiltration than sunn hemp. Water infiltration rate was positively correlated with an increase in soil organic C concentration.

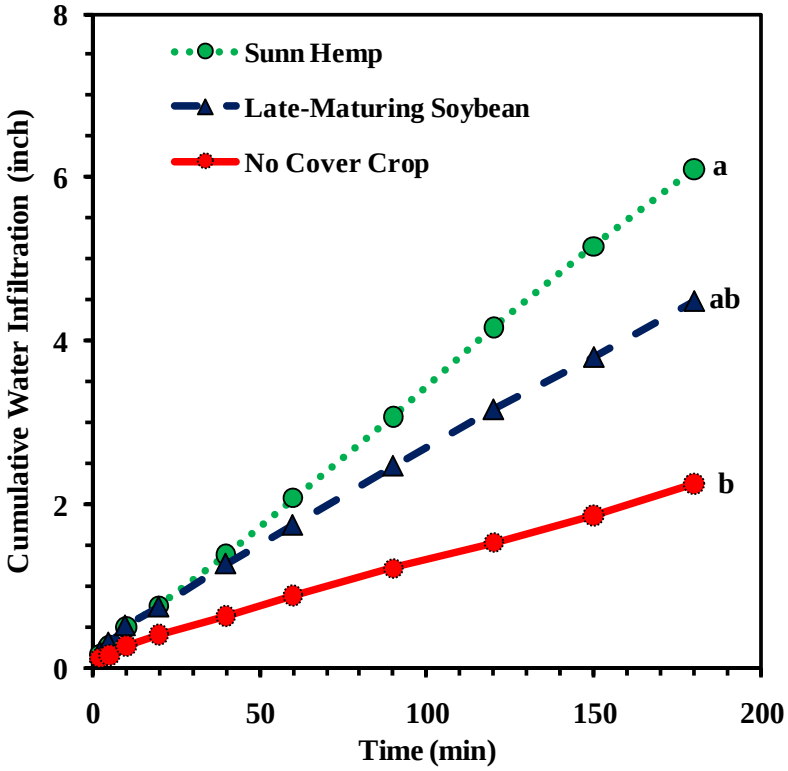

Figure 4. Cumulative water infiltration for the three cover crop treatments. Means with the same letter are not significantly different.

Soil Compactability and Organic Carbon

Soils with cover crops were less compactable in the 0 to 3 inch depth than soils without cover crops. At 0 lb/acre of N, maximum soil compactability was about 5% lower under cover crops than under plots without cover crops. At 60 lb/acre of N, soil compactability was not, however, affected by cover crops. Maximum soil compactability was negatively correlated with soil organic C concentration. This indicates that the increase in soil organic C concentration from the use of cover crop plots was partly responsible for the reduced soil compactability in plots with cover crops.

Cover Crop Residues

Sunn hemp produced more residue than late-maturing soybean. Averaged across the three previous rotation cycles and N rates, sunn hemp produced 3.13 tons/acre of residues while late-maturing soybean produced 2.37 tons/acre. Thus, the greater benefits of sunn hemp than late-maturing soybean for increasing water infiltration may be due to the greater residue input with

sunn hemp. Both cover crops, however, had significant benefits on reducing soil compactability, improving aggregate stability, and increasing soil organic C concentration.

Nitrogen Fertilization

Nitrogen application did not affect aggregate stability, but it did help reduce soil compactability and increase organic C concentration in the 0 to 3 inch depth. When averaged across the four N rates, aggregate stability was positively correlated with organic C concentration, which indicates that cover crops can indeed improve aggregate stability by increasing organic C concentration. Looking at the specific N rates, the same effects occurred at the 0 lb/acre N rate. At 30, 60, and 90 lb/acre of N, however, aggregate stability was not significantly correlated with organic C concentration. This suggests that the increase in organic C concentration from the use of cover crops possibly diminished, to some degree, with N fertilization.

Summary

Addition of cover crops enhanced no-till performance. It improved soil physical and hydraulic properties, and increased soil organic C concentration near the soil surface. Results suggest cover crops may reduce some risks of excessive near-surface soil compaction and help improve soil structure in no-till systems. Cover crops, particularly sunn hemp, may reduce runoff and soil loss by increasing water infiltration. The improvements in soil physical properties are directly related to increases in soil organic C concentration. Results suggest cover crops should be used as companion to no-till systems to enhance the potential of no-till technology for improving soil properties.

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2. Winter/spring options for winter annual broadleaf control in wheat

There are several herbicide options for controlling winter annual broadleaf weeds in wheat. Generally, fall applications will provide the best control of winter annual weeds with any herbicide, as long as the weeds have emerged. The majority of winter annual weeds usually will emerge in the fall, although you can still have some emergence in the spring, especially if precipitation after planting is limited in the fall. However, winter annual weeds that emerge in the spring often are not very competitive with the crop, assuming that you have a decent crop.

Some herbicides can work well even when applied during the dormant part of the season, while others perform best if the crop and weeds are actively growing. The key difference relates to the degree of soil activity provided by the herbicide. Herbicides that have good residual activity,

such as Glean, Finesse, Amber, and Rave can generally be applied in January and February when plants aren't actively growing and still provide good weed control, assuming you have proper conditions for the application. Most other herbicides, which depend more on foliar uptake, will not work nearly as well during the mid-winter months, when the wheat and weeds aren't actively growing, as compared to a fall or early spring application.

Spring herbicide applications can be effective for winter annual broadleaf weed control as well, but timing and weather conditions are critical to achieve good control. Spring applications generally are most effective soon after green-up when weeds are still in the rosette stage of growth, and during periods of mild weather. Once weeds begin to bolt and wheat starts to develop more canopy, herbicide performance often decreases dramatically.

Huskie is a relatively new herbicide that can provide good control of a variety of broadleaf weeds with excellent crop safety from the 2-leaf to boot stage of growth. Huskie is a premix herbicide of pyrasulfatole and bromoxynil. Pyrasulfatole is an "hppd" herbicide, and can be effective to control ALS-resistant broadleaf weeds. Because Huskie has limited residual activity, it works best when applied when weeds and wheat are actively growing and with milder weather.

Another important consideration with herbicide application timing is crop tolerance at different application timings. For example, 2,4-D should not be applied in the fall or until wheat is fully tillered in the spring. On the other hand, any herbicide containing dicamba can be applied after wheat has 2 leaves, but should not be applied once the wheat gets close to jointing in the spring, Herbicides containing dicamba include Banvel, Clarity, Rave, Pulsar, and Agility SG.

There has been some discussion about wheat tolerance to herbicides, especially when applied with fertilizer carrier. The best advice regarding crop safety with herbicide-fertilizer combinations and application timing is to follow the label guidelines. We generally see very minimal crop injury and no yield loss from topdress fertilizer/residual herbicide applications during the winter months. However, these combinations can often cause considerable burn to the wheat if applied when the crop is actively growing and with warmer weather. The foliar burn is generally temporary in nature and wheat usually will recover if good growing conditions persist.

Research at Hays several years ago found as much as 47% injury to the wheat 4 days after treatment following a late March treatment of Amber plus 2,4-D, but wheat recovered and yields were not reduced. However, research in Nebraska did show some yield loss from Ally plus 2,4-D applications with fertilizer applied in late April to more advanced wheat and with moisture stress conditions. Crop injury with herbicide-fertilizer combinations will depend on the total amount of fertilizer applied, dilution with water, and the addition of surfactant. Again the herbicide label provides the best guidelines regarding if, when, and how herbicides can be applied with fertilizer.

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3. Kansas Flint Hills Smoke Management Plan: Impact on Kansas Ranchers

The following is a slightly edited transcript of the second in a series of K-State's Agriculture Today radio broadcasts on the Kansas Flint Hills Smoke Management Plan. This is an interview

with Jeff Davidson, Greenwood County Extension Agent, conducted by Eric Atkinson of the K-State Radio Network. Podcasts of all Agriculture Today interviews on the Flint Hills Smoke Management Plan can be found at:
http://www.ksre.ksu.edu/news/DesktopDefault.aspx?tabid=197

Q: The new Flint Hills Smoke Management Plan will be implemented in full on a pilot basis during the spring of 2011 in two Flint Hills counties. One of those is Greenwood County and the other is Chase County. How will this plan actually play out at the farm and ranch level?

A: K-State Research and Extension, both on campus and a couple of county Extension agents in the Flint Hills, were involved with the small group that put together this plan. We tried to develop a plan that we thought would be workable for our local ranchers as well as accomplish the air quality goals that were needed.

Q: A lot of stakeholders were involved in putting this plan together. Was this a successful formula?

A: Yes, I think so. Seems like once we sat down and started talking about it, everybody described what they thought needed to happen. Once we sat around the table and had some dialogue, the plan began to fall into place. It took some time, but I think everybody on that committee will say that we accomplished some things and met some goals. We think we've put together a plan we can all live with, and that will help mitigate the air quality situations in our metropolitan areas.

Q: And hopefully for the landowner in the Flint Hills, this plan will help avoid far more stringent regulations in the future, correct?

A: Exactly. That was really the goal of our plan, was to reduce the problems with air quality in the metropolitan areas in a way that would prevent more stringent regulations from coming down the pike.

Q: How do you see this being implemented at the ground level?

A: I'm planning to visit at a lot of public meetings, and I started doing that just this last week. A synopsis of the plan will be handed out. I've visited with various groups in the county already. The communications effort is going to involve the sheriff's dispatch office as well as the county fire marshal. They will be involved when people call in to state that they are planning to burn on a particular day. Then they'll make a return call when the fire is out, which we're already doing. We will just fine-tune that a bit and try to get a better count of the acreages involved that have had prescribed fire on them. And I also have a check sheet or survey that I'll send out after the fire season is over. That will be asking the fire practitioners if the plan was helpful to them, and whether they think they put up a little less smoke or if they were more aware of whether their smoke avoided going toward Kansas City. K-State is working on developing a web site as well that's going to have quite a lot of information.

Q: Do you think this will be a management system for your landowners? It's a little out of the ordinary, but is it cumbersome at all?

A: Well, there is a little hassle to it so I suppose you could say it's a little cumbersome. But I think they can manage that, at least as they plan is today. It's not the biggest hurdle they've had to jump.

Q: Part of the goal is to help spread out burns over a longer time period so there isn't that two- to three-day concentration of smoke. From the grass management point of view in Greenwood County, will that be a workable option for the producers?

A: Yes, at least to some degree. Unfortunately, when we talk about spreading fires out, weather comes into play big time. A good day to burn is a good day for me, and also my neighbor, and right on down the line. If it's raining or extremely windy then we can't burn, but that's going to be the same for everyone in the area. So when we talk about spreading the burning out -- yes, the plan will encourage that. I think that will happen to the degree that it is possible.

Q: You've talked about this informally with producers already. What's been their response?

A: Actually, pretty positive. The fellows I've talked to understand they don't want to smoke out, so to speak, Kansas City or Wichita. A lot of our Flint Hills ranchers have kids and grandkids that live in and around these metropolitan areas, so they're aware of the situation. No matter where we live, we all share some common things and this is a common problem to both of us. So they're fairly positive about it and want to see what they can do. They still want to be able to burn because they need to in order to maintain the prairie.

Q: In addition to the web site, K-State Research and Extension has come out with a handy little publication on fire management that will give still more information, and information is the key to making this work.

A: Correct. We've got a nice little pamphlet available at the local Extension offices. And there's also the full smoke management plan that can be downloaded off the KDHE web site: http://www.kdheks.gov/bar/air-monitor/flinthillsinfo/SMP_v10FINAL.pdf

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4. South Central Experiment Field Update

The South Central Experiment Field Advisory Committee met on January 13, 2011 to discuss field activities and plans for future research and field days. In addition to the field staff of Bill Heer, Mike Seyb, and Lowell Stucky, five faculty from the Department of Agronomy, seven Extension agents from surrounding counties, and two representatives from the Farmer's Coop at Nickerson attended and contributed to the discussion.

The major items of discussion included:

Small Grains - Winter wheat in particular and small grains in general have been a focus at the field for many years. Activity ranges from foundation seed production, variety tests, winter wheat breeding and genetics, winter wheat planting management, and nitrogen fertilization and

tillage comparisons. The group expressed an interest in continuing spring wheat grain performance tests as well as forage work with spring and winter small grains.

Diversified Cropping Systems - Another historical focus of work at the field has related to diversifying cropping systems for south central Kansas. This work has included:

* Evaluating the impact of cover crops in rotations
* Comparing no-till crop rotations with wheat
* Exploring potential alternative crops:
    -- A significant amount of work continues with canola, including breeding nurseries and management experiments.
    -- Sesame has emerged as another summer annual broadleaf alternative with a potential fit in south central Kansas. Experiments at the field have evaluated varieties, fertilizer rates, and seeding rates in an effort to optimize management of this crop in south-central Kansas.
    -- Cotton and sunflower are crops that have been around for some time, but occupy a relatively small acreage relative to the major crops. Both crops have a fit in south-central Kansas, justifying continued research on varieties and crop management.
    -- Non-irrigated corn acres continue to increase in the area, justifying increased activity with this crop.

Forages - Forages are an important component of cropping systems in the south central area. Continued work with perennial and summer annual forages was identified as an ongoing priority. A new alfalfa variety test was planted in spring of 2010 to further this work.

The addition of the Redd Foundation Land, consisting of two quarters west of Partridge, has facilitated additional research in recent years. Some projects that have been located there include:

* Soil fertility work with wheat, sorghum, and canola
* Biofuel cropping systems
* Evaluation of biochar (a potential byproduct of some bioenergy processing technology) as a soil amendment to improve soil structure
* Over-seeding poor wheat stands, one of several locations
* Evaluating wheat variety performance in no-till rotations
* Non-irrigated soybean variety comparisons, in cooperation with the Nickerson Coop
* Drought-tolerant corn management, in cooperation with Monsanto

Watch for future e-Updates that will discuss results from specific research projects in each of these areas.

Field Days are scheduled for May 24 and August 30 in 2011. Both will be held in the evening with supper provided courtesy of sponsor support.

Much of the May 24 Field Day will likely be devoted to winter wheat production, varieties, and disease management, but other potential topics might include a GPS demonstration and a discussion of foliar feeding and tissue sampling.
The program for the August 30 field day will depend on what issues arise during the growing season and how specific research progresses, but may include discussions of skip-row cotton and center-pivot irrigation uniformity.

The South Central Experiment Field strives to meet the applied crop production research needs of south central Kansas. Please contact Bill Heer, Agronomist-in-Charge, or Kraig Roozeboom, Field Co-chair, if you have ideas for how the field can better meet that goal.

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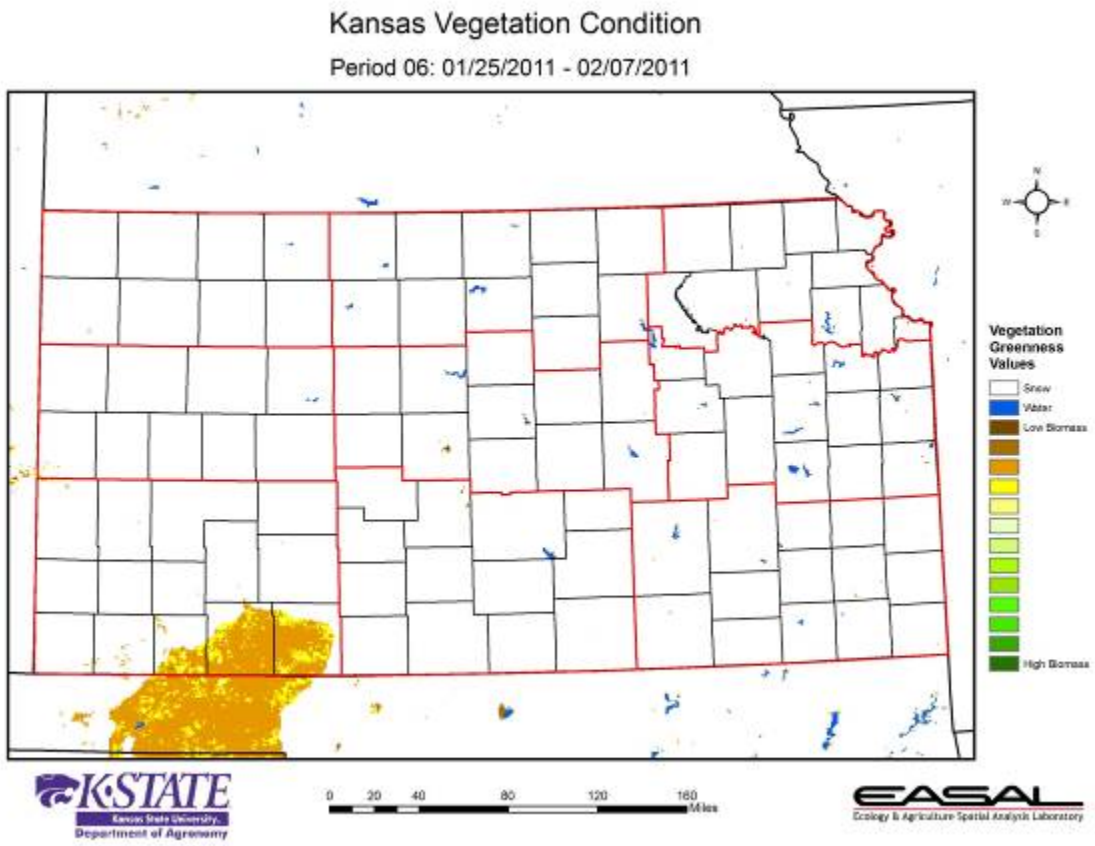
5. Comparative Vegetation Condition Report: January 25 – February 7

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.

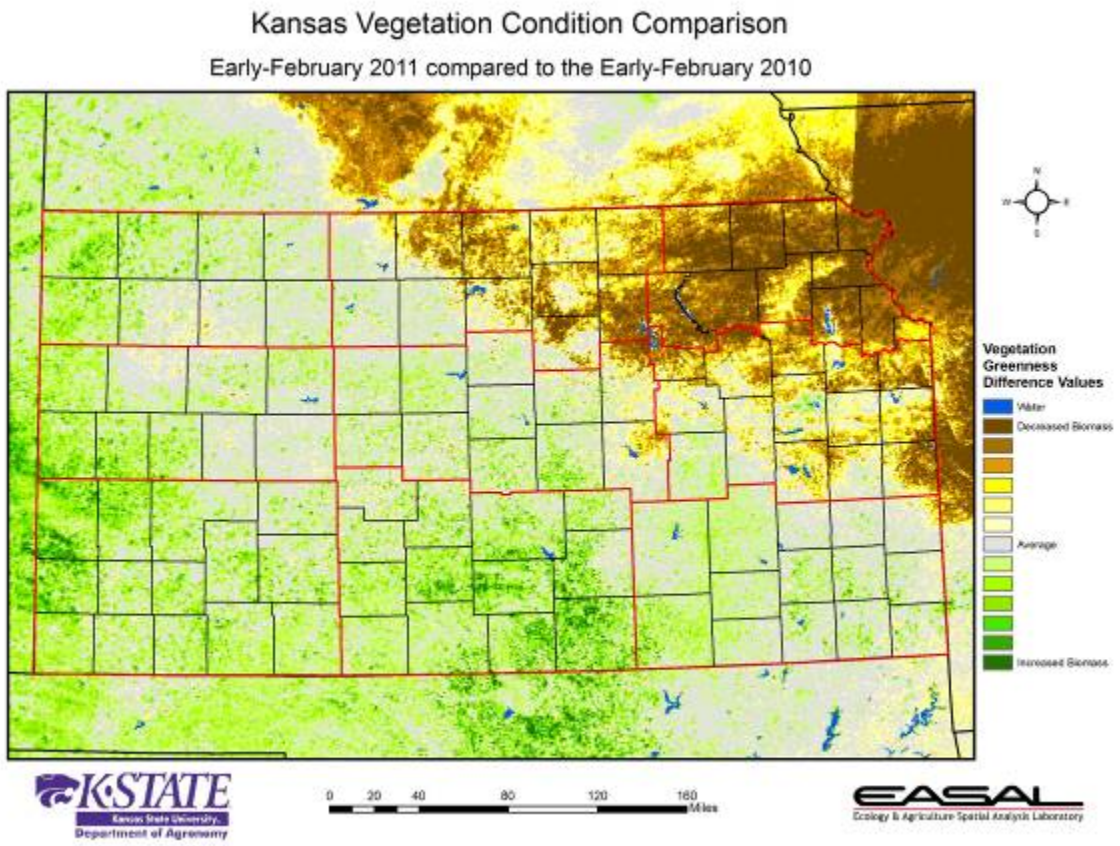
Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:
http://www.youtube.com/watch?v=CRP3Y5NIggw
http://www.youtube.com/watch?v=tUdOK94efxc

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 21-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.

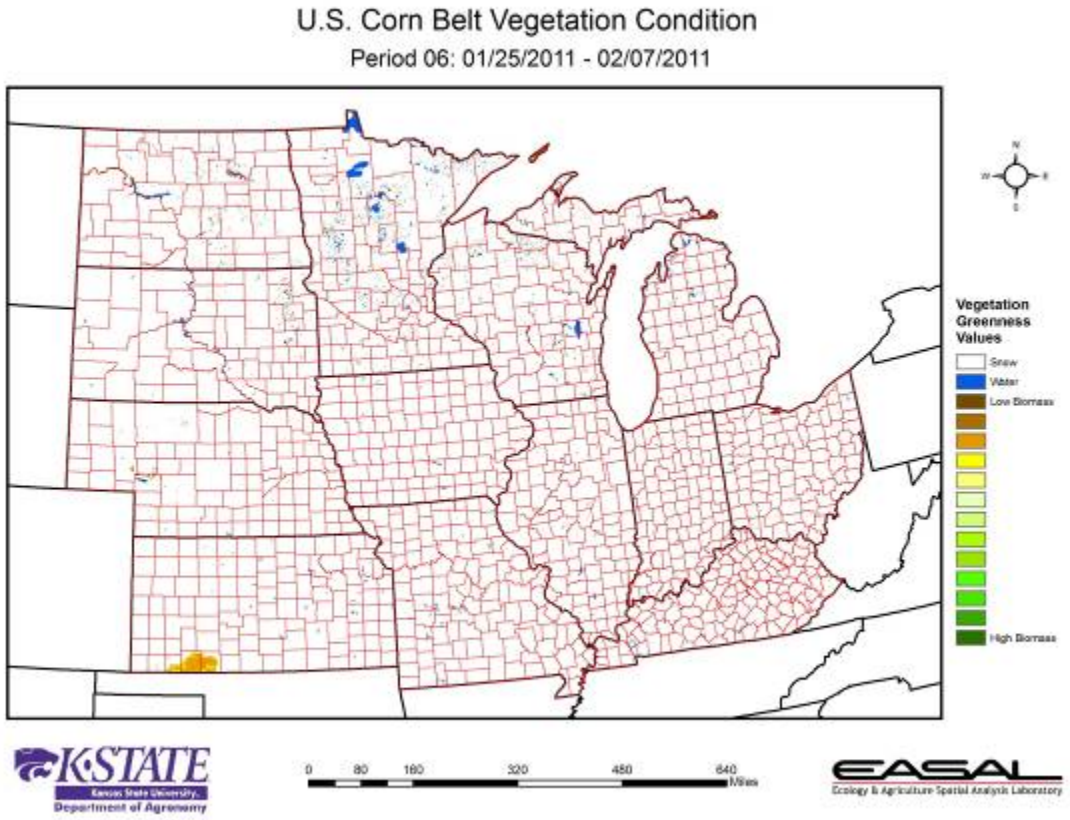
The maps below show the current vegetation conditions in Kansas, the Corn Belt, and the continental U.S, with comments from Mary Knapp, state climatologist:



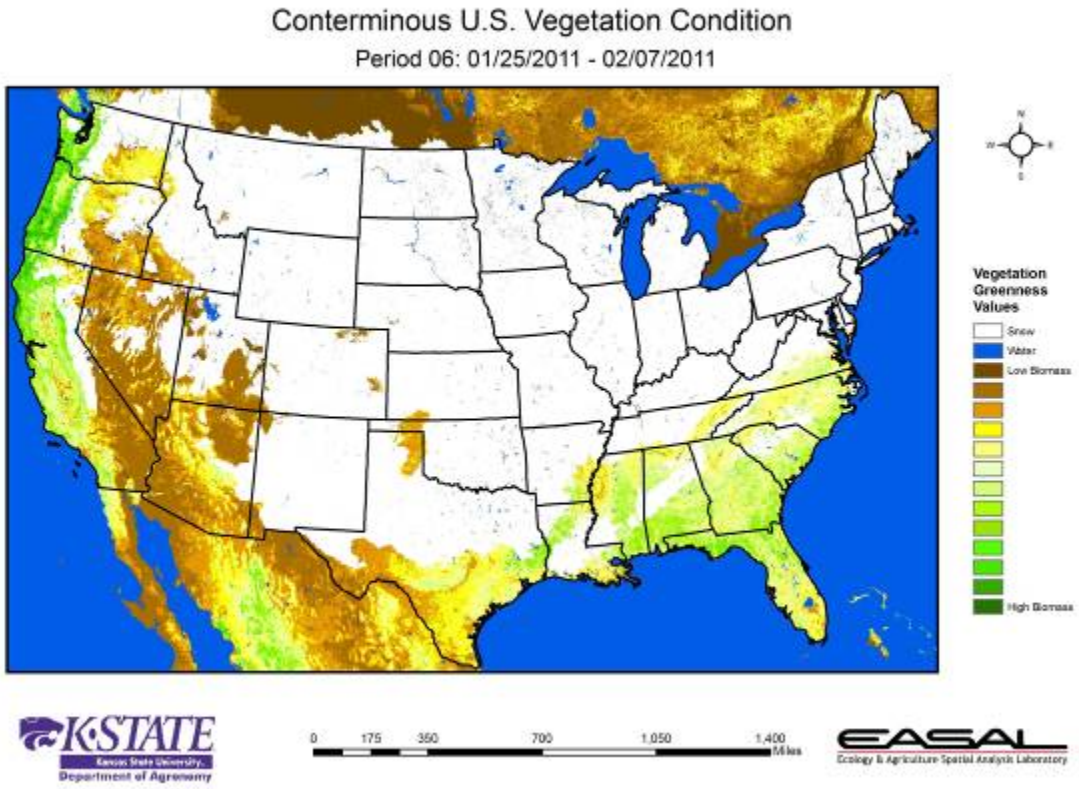
Map 1. The Vegetation Condition Report for Kansas for January 25 – February 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows again that snow cover is the major feature of the period. As with the previous snow events, the liquid equivalent of the snowfall as been less than typical. Average values have been 0.08 inches of liquid to an inch of snow. In Crawford County, where snowfall amounts averaged 18 inches, the liquid equivalent values averaged 1.51 inches.



Map 2. Compared to last year at this time, this year's Vegetation Condition Report for January 25 – February 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows more photosynthetically active vegetation can be seen in south central and far western Kansas. In south central Kansas part of this can be attributed to more winter wheat planted this year versus last year. In north central and northeast Kansas the reduction in photosynthetically active vegetation can be attributed to the earlier arrival of cold weather in this region. Colder-than-normal conditions started in this part of the state in December this winter, whereas it didn't reach the rest of the state until January.



Map 3. The Vegetation Condition Report for the Corn Belt for January 25 – February 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows only a small three-county area of southwest Kansas missed the overall snowy pattern for the period.



Map 4. The Vegetation Condition Report for the U.S. for January 25 – February 7 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that only small areas of southwest Kansas into the Texas and Oklahoma Panhandles missed the snowy weather. Particularly interesting are the snows in Louisiana, Central Alabama, and parts of the Carolinas.

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These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu