Issue 542

K-STATE
Research and Extension

Extension Agronomy

eUpdate

12/23/2015

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.

eUpdate Table of Contents | 12/23/2015 | Issue 542

1. UAS Registration: Positive implications for precision agriculture

As of December 21, the Federal Aviation Administration (FAA) is requiring individuals who own Unmanned Aerial Systems (UAS) to register their craft with the FAA. The implementation of this regulation has spurred many questions and concerns: How will this impact my farm? I don't use my UAS for commercial purposes, so do I need to register? Is this just more regulation that will restrict UAS use in agriculture?

If you have a UAS, will it require registration? The FAA provides very concise guidelines to help individuals determine if their UAS needs to be registered and what registration process should be used:

Which unmanned aircraft must be registered?

Owners must register their UAS **online** if it meets the following guidelines:

- Weighs more than 0.55 lbs. (250 g) and less than 55 lbs. (25 kg). Unmanned Aircraft weighing more than 55 lbs. **cannot** use this registration process and must register using the Aircraft Registry process.

Owners must register their UAS by paper if it meets any one of the following guidelines:

- Your aircraft is used for commercial purposes.
- Your aircraft is used for other than hobby and recreation.
- Your aircraft is greater than 55 lbs.
- You intend to operate your aircraft outside of the United States.

Source: FAA, http://www.faa.gov/uas/registration/

Most UAS owners that do not use their craft for commercial purposes will be able to register online. All that is needed to register is an email address, physical address and mailing address, and a credit card for the five-dollar registration fee. However, if individuals register before January 20, 2016, the five-dollar registration fee will be refunded. The online registration process has been well implemented and is easy to do. We highly encourage individuals to take advantage of the free registration opportunity.

How will UAS registration affect UAS operations in agriculture?

The UAS registration should be considered a step in the right direction for safe UAS operations on the farm. The registration of UAS helps draw attention to very important protocols for conducting safe flight operations. Just as important as it is for owners of vehicles to know driving protocols that emphasize the motto "share the road," UAS operators should also recognize we need to "share the sky." The FAA is providing valuable resources, guidance, and regulations to help ensure the positive impacts and experiences of UAS on agriculture as interest in this use continues to grow.

In addition, UAS has been clearly identified to be under the domain of the FAA for regulation, which will also be beneficial to agriculture. Had it been determined that UAS would be regulated at the state level, regulations for UAS would then be different depending upon the state in which the pilot in command was located, or UAS use could have been potentially outlawed at each state's discretion. However, with UAS regulated by the FAA, UAS operators will have greater stability and consistency in the regulations for UAS operations in agriculture across state lines.

We highly encourage all UAS owners in agriculture to register their craft with the FAA and enroll in workshops that cover UAS flight safety. K-State Polytechnic will be offering a UAS Multirotor Hobby course January 23, 2016. Additional details about this course can be found at: http://polytechnic.k-state.edu/profed/uashobby

Ray Asebedo, Precision Agriculture
ara4747@ksu.edu

Kurt Caraway, Acting UAS Manager, KSU Polytechnic
kcarraway@ksu.edu

The Environmental Protection Agency's Oil Spill Prevention, Control, and Countermeasure (SPCC) Program was initiated in 2013. It establishes reporting requirements on certain farms related to on-farm oil storage. There have been some important revisions in 2015 to the SPCC program.

The goal of the SPCC program is to prevent oil spills into waters of the United States and adjoining shorelines. Oil spills can cause injuries to people and damage to the environment. A key element of this program requires farmers and other facilities that exceed the SPCC oil storage requirements to have an oil spill prevention plan, called an SPCC Plan. These Plans can help farmers contain potential oil spills which could damage water resources needed for farming operations.

Revisions to the original SPCC program

1. A Farm is not required to have an SPCC Plan if it has:

- Aggregated storage capacity less than 2,500 gallons
- Aggregated storage capacity greater than 2,500 gallons and less than 6,000** gallons and no reportable discharge history

2. A farmer can self-certify the SPCC Plan if the farm has:

- An aggregate aboveground storage capacity greater than 6,000** gallons but less than 20,000 gallons
- No individual tank with a capacity greater than 10,000 gallons
- No reportable discharge history

**The 6,000-gallon threshold may be adjusted by EPA, following a study to determine the appropriate exemption.

3. The following **do not count** when calculating aggregate aboveground oil storage capacity:

- All containers on separate parcels that have a capacity of 1,000 gallons or less
- Containers storing heating oil used solely at a single-family residence (e.g., your personal residence as the farm owner or operator)
- Pesticide application equipment or related mix containers (with adjuvant oil)
- Any milk and milk product container and associated piping and equipment
- Completely buried oil tanks (underground storage tanks or USTs) and associated piping and equipment that are subject to all of the technical requirements under EPA's underground storage tank regulations at 40 CFR part 280 or 281
- Containers holding animal feed ingredients approved for use in livestock feed by the Commissioner of the Food and Drug Administration (FDA).

Summary of the SPCC program

What is considered a farm under the SPCC program?

Under SPCC, a farm is: "a facility on a tract of land devoted to the production of crops or raising of animals, including fish, which produced and sold, or normally would have produced and sold, $1,000 or more of agricultural products during a year."

Does my farm have to meet requirements of the SPCC program?

The SPCC program applies to a farm that meets **ALL THREE** (**3)** of the following:

1. Stores, transfers, uses, or consumes oil or oil products, such as diesel fuel, gasoline, lube oil, hydraulic oil, adjuvant oil, crop oil, vegetable oil, or animal fat.
2. Stores more than 2,500 gallons of oil or oil products in aboveground containers.
3. Could reasonably be expected to discharge oil to waters of the US or adjoining shorelines, such as interstate waters, intrastate lakes, rivers, and streams. The environment and flow properties of oil when combined with a rain event must be considered.

Farms that meet all three criteria are covered by SPCC and need to review the "SPCC Program: Farms and the Water Resources Reform and Development Act (WRRDA)"fact sheet found at the following website:
http://www.epa.gov/oil-spills-prevention-and-preparedness-regulations/farms-fact-sheet-explaining-impact-water

Sample plans and plan templates are available at the following website (these have not been updated to reflect the new guidelines):
http://www.epa.gov/emergencies/content/spcc/tier1temp.htm

What do I do with my SPCC plan?

The plan should be maintained at your facility if you are usually present at least 4 hours per day or at your nearest office if the facility is not staffed. Your SPCC plan must be updated when any changes are made to your storage and/or containment. Additionally the plan must be reviewed every five years.

Peter Tomlinson, Environmental Quality Specialist, Agronomy
ptomlin@ksu.edu

Aleksey Sheshukov, Watershed Assessment Specialist, Biological and Agricultural Engineering
ashesh@ksu.edu

Kerri Ebert, Extension Assistant, Ag Safety and Health Program, Biological and Agricultural Engineering
kebert@ksu.edu

3. Cover crops improve soil quality, crop yields in central Kansas research

Cover crops can have several potential benefits for soil quality 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 tend to happen very gradually, data from long-term cover crop experiments can provide insights into the potential of cover crops for improving soil functions. A few years ago, K-State agronomists 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 Mark M. Claassen, professor emeritus, 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.

Crop yields

In 6 site-years during the period 2002 through 2008, soybean and sunn hemp produced dry matter yields of 2.42 and 3.43 ton/acre with total N contents of 111 and 134 lb/acre, respectively. Overall, both cover crops had a positive impact on grain sorghum yield, particularly at N rates of 60 lb/acre or less. At the highest N rate of 90 lb/acre, the soybean cover crop did not increase sorghum yields. However, sunn hemp tended to result in a sorghum yield benefit even at the highest N rate, over the 6-year average. Averaged over N rates, soybean and sunn hemp resulted in 6-year average grain sorghum yield increases of 8.8 and 14.9 bu/acre, respectively.

Positive residual effects of soybean and sunn hemp cover crops on the yield of wheat after sorghum were small and mostly observed at N rates of 60 lb/acre or less. Five-year mean wheat yields combined from the two sites and averaged over N rate indicated increases of 2.2 and 2.9 bu/acre in rotations with soybean and sunn hemp vs. no cover crop.

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 (Figure 2). Cover crops did not, however, affect organic C concentration in the 3 to 6 inch depth.

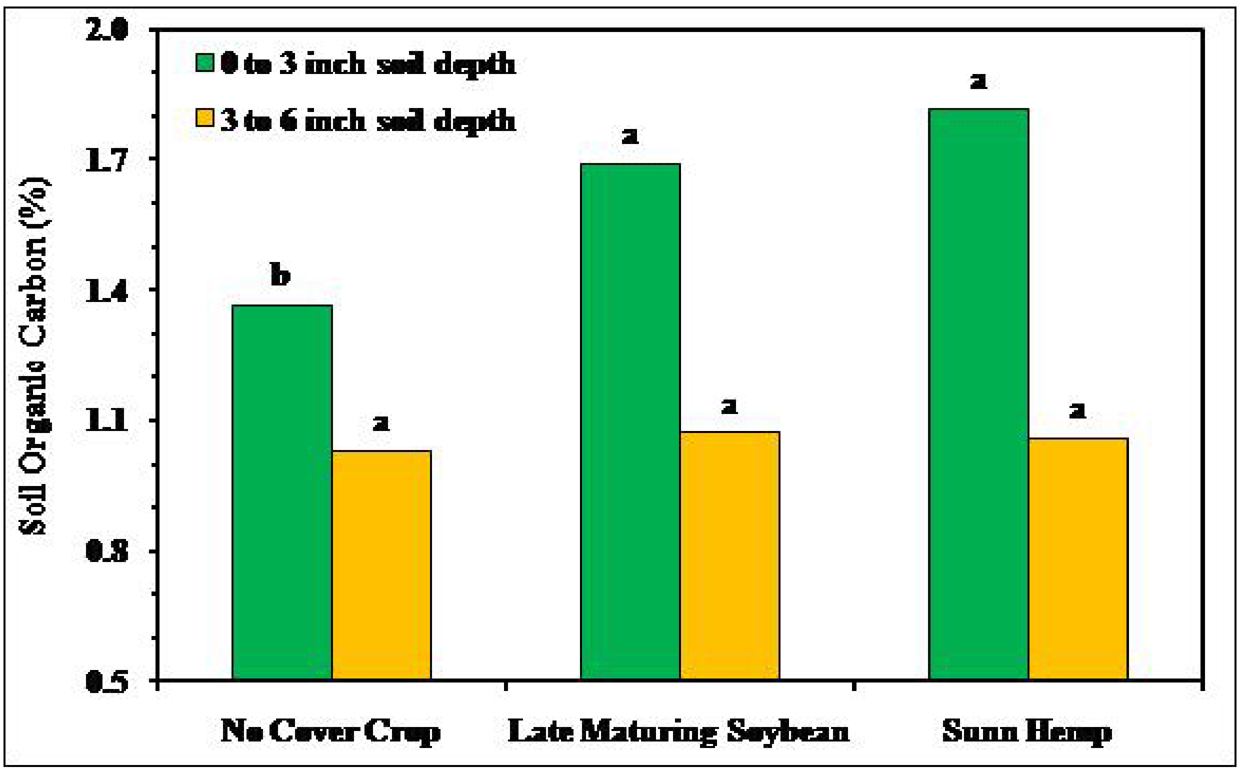


Figure 2. Effects of cover crops on soil organic C concentration at two soil depths. Bars with the same letter within the same depth are not significantly different.

Aggregate stability and organic carbon

Cover crops improved soil wet aggregate stability in the 0 to 3 inch depth (Figure 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 (Figure 3B).

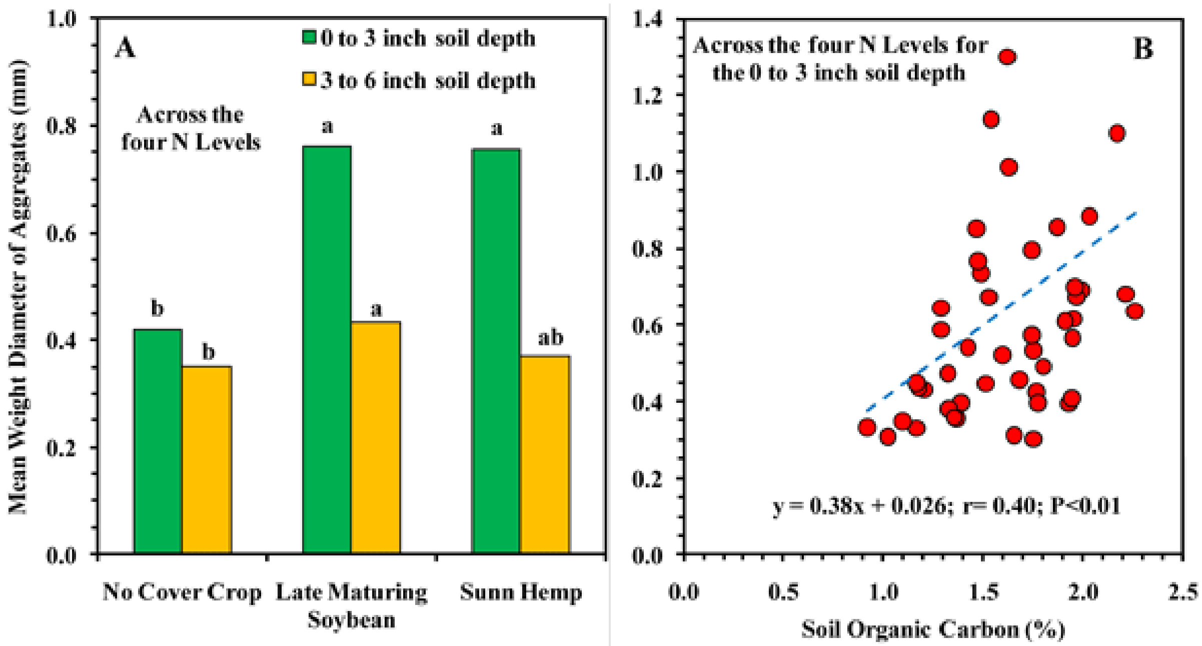


Figure 3. Wet aggregate stability expressed as mean weight diameter of aggregates (A) and relationship between aggregate stability and cover crop-induced increase in soil organic C concentration (B). Bars with the same letter within the same depth are not significantly different.

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.

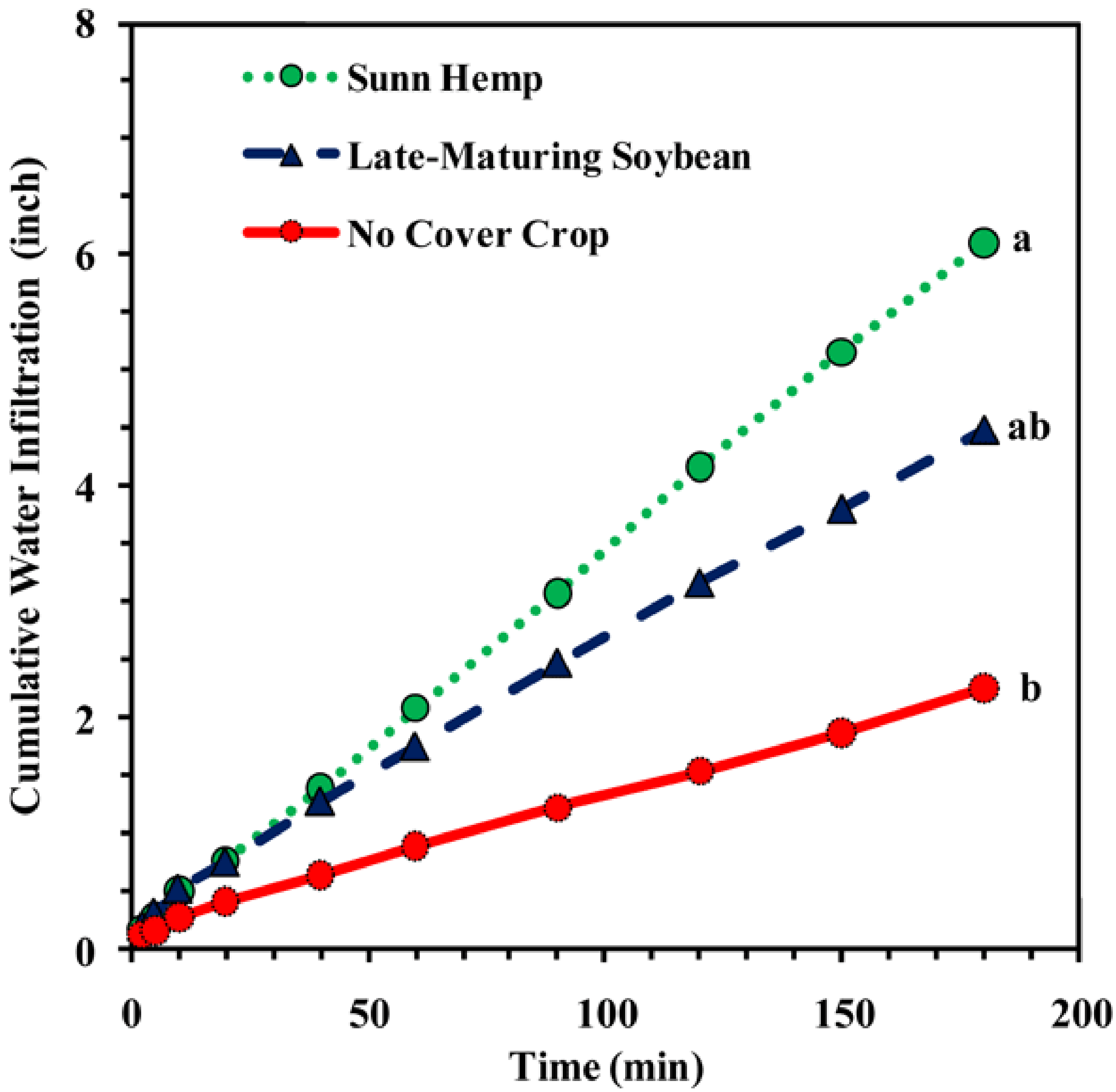


Figure 4. Cumulative water infiltration for the three cover crop treatments. Means with the same letter are not significantly different.

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.

Earthworm abundance

Averaged across all N rates, sunn hemp led to higher total earthworm numbers, followed by soybeans and no cover. A separate article in this issue of the Agronomy eUpdate (No. 542) addresses this in detail. The eUpdates are available at: https://webapp.agron.ksu.edu/agr_social/eu.throck

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. The same is true for cash crop yields; the benefits of cover crops decrease as N fertilization rate decreased.

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.

DeAnn Presley, Soil Management Specialist
deann@ksu.edu

4. Earthworms: One of many indicators of soil health

Earthworms play an important role in soil as they redistribute organic matter, influence soil fertility, and affect soil physical properties. While earthworms are not essential for the formation of well-aggregated soil, their presence can contribute significantly to the formation and stabilization of aggregates and improve soil structure. Earthworm casts -- the excreted mixture of soil and organic matter -- can develop into stable soil aggregates. Depending on the species the cast material may be deposited in the burrow or on the soil surface.

Earthworm-driven improvements in soil structure (Figure 1) can result in positive changes in soil porosity, aeration, water holding capacity, and the rate of water infiltration.

Figure 1. An earthworm and earthworm burrow in a clod of soil in a no-till cover crop research study. Photo by DeAnn Presley, K-State Research and Extension.

The activity of earthworms accelerates decomposition of plant material and mineralization of soil organic matter, increasing the availability of plant available nutrients. A complex relationship exists between earthworms and microorganisms. Bacteria have been found to proliferate in the earthworm gut and be excreted in cast material. Thus, enhanced microbial decomposition of organic matter fueled by the presence of nutrient rich secretions begins in the earthworm gut and continues in earthworm casts.

What effects do cultivation and soil health practices have on earthworm populations?

Earthworm populations generally become reduced in cultivated agricultural fields. Several explanations for the decline and loss of earthworms have been proposed:

1) Tillage implements cause physical injury to earthworms resulting in mortality.

2) Reductions in residue and soil organic matter associated with long-term tillage restrict food supplies.

3) A change in soil temperature resulting from the loss of insulation provided by the vegetation.

4) Increased predation from birds when the soil is turned over.

It is likely a combination of these factors that leads to reduced earthworm populations.

When tillage practices are reduced or eliminated as a result of conversion to a minimal or no-till system, earthworm populations generally begin to increase. Earthworms play an important role in no-till systems as they redistribute organic matter. Earthworms are important in soil fertility, and their burrows play an important role in soil aeration and drainage.

The addition of cover crops can further benefit earthworm populations. In a long-term cover crop study conducted at the former K-State Harvey County Experiment Field in Hesston from 2002 to 2008, more earthworms were counted in the plots with either late-maturing soybean or sunn hemp cover crops (Figure 2).

Improved cumulative water infiltration (Figure 3) was also observed in the cover crop treatments of the study and followed the same pattern as the earthworm populations. The greatest levels of cumulative water infiltration and earthworm populations were in the sunn hemp treatment while the "no cover crop" treatment had the lowest cumulative water infiltration and earthworm populations.

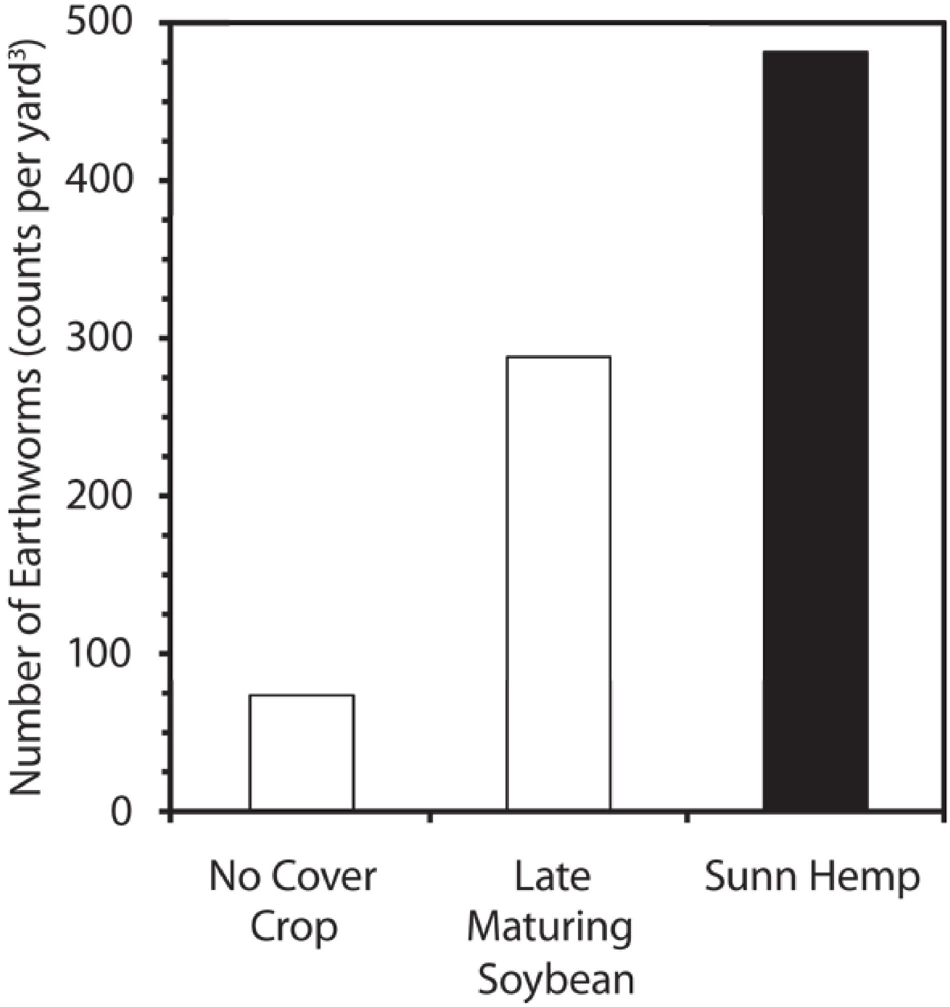


Fig. 2. Earthworm densities in a cropping system with and without cover crops in the rotation.

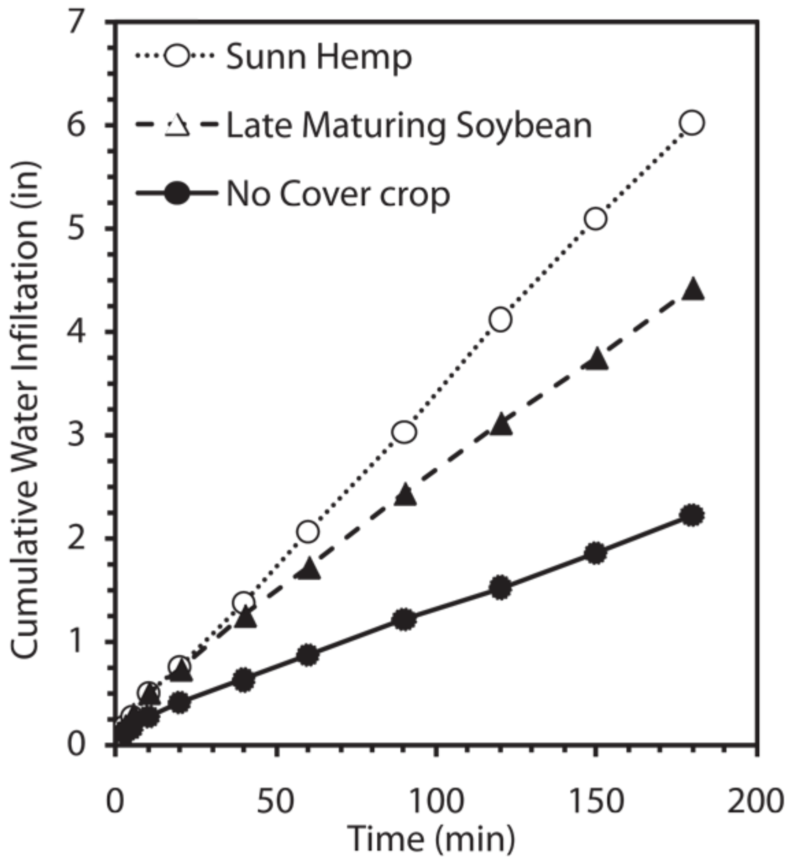


Fig. 3. Cumulative water infiltration in a cropping system with and without cover crops in the rotation.

How do you assess earthworms as an indicator of changing soil health?

It is important to understand that you will not see changes in earthworm populations immediately after a change in management practices. In fact it will likely take many years to observe a change in earthworm populations. The key is to collect base line population information before you make a management change and then repeat the measurements every few years, being consistent in your sampling date.

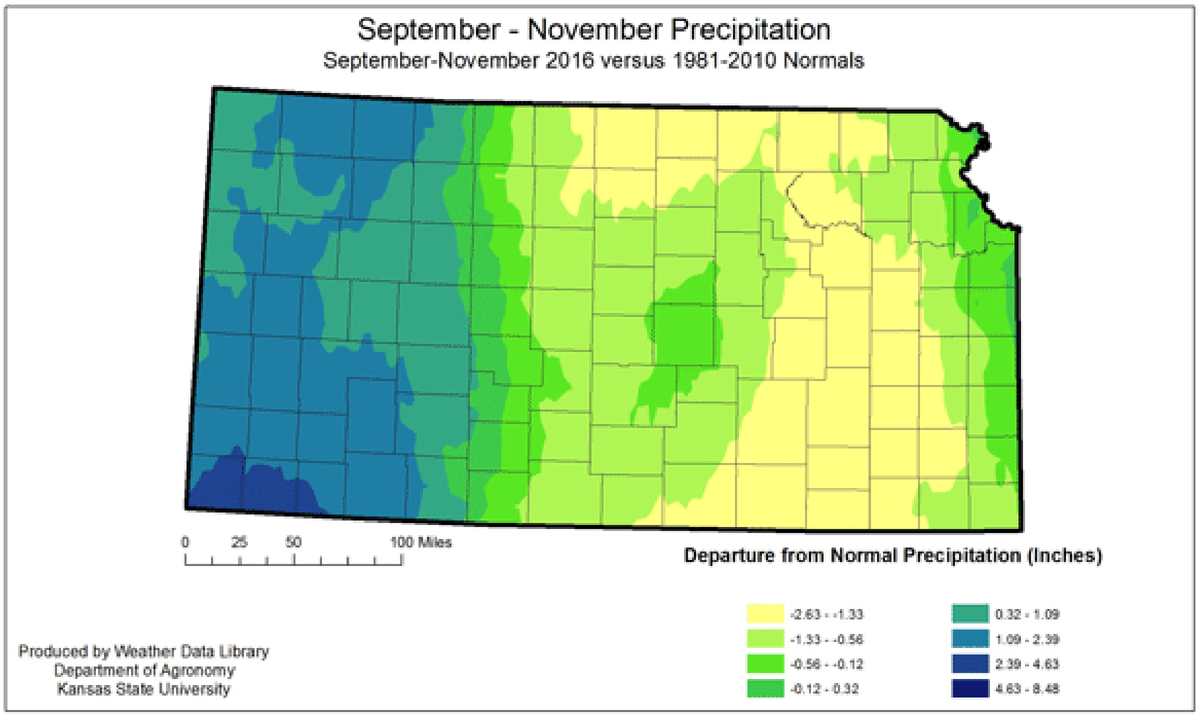
The recommended time of year to count earthworms is the late spring (April-May) or mid-fall (Oct-Nov). It is best to identify at least four locations that are representative of the field and which will provide an indication of the spatial variability of the earthworms. Over time you will want to be able to go back to the same general sampling location.

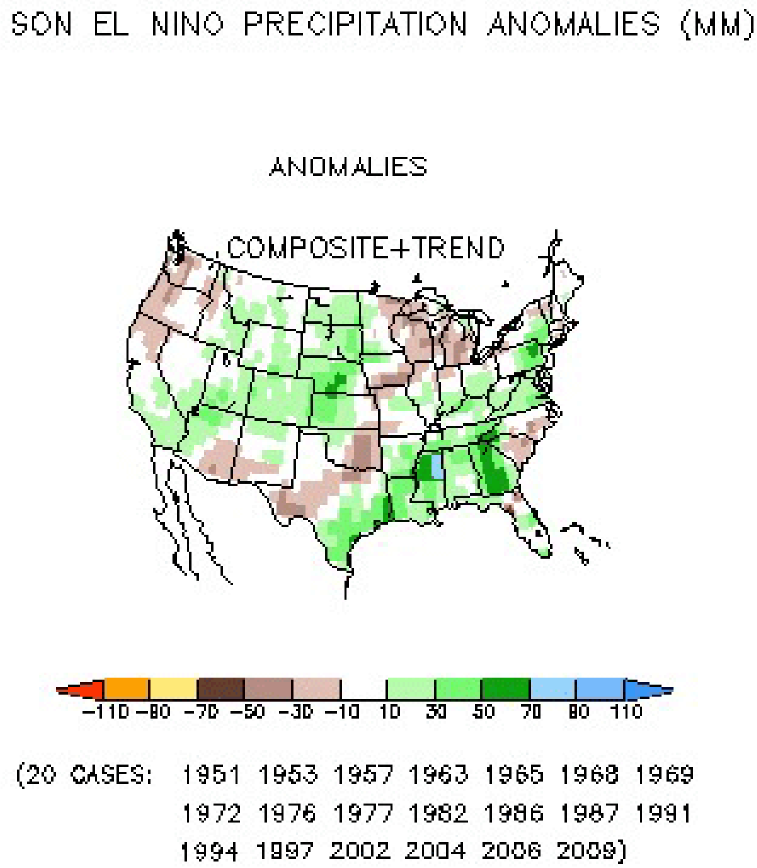
To assess your earthworm population, dig a cubic foot of soil and hand sort the soil, keeping track of how many earthworms you find. The typical range for earthworm numbers in a cubic foot of soil in an agricultural field is 5 to 30 but may be higher depending on tillage and soil organic matter.

Peter Tomlinson, Environmental Quality Specialist
ptomlin@ksu.edu

The current El Niño has strengthened. The most recent ONI (Oceanic Niño Index) for the September, October, November (SON) period is +2.0 degrees Celsius. This is the second strongest reading for the season since 1950. In 1997, the SON period was recorded at +2.2 degrees Celsius, while 1982 ranked third at +1.9 degrees Celsius.

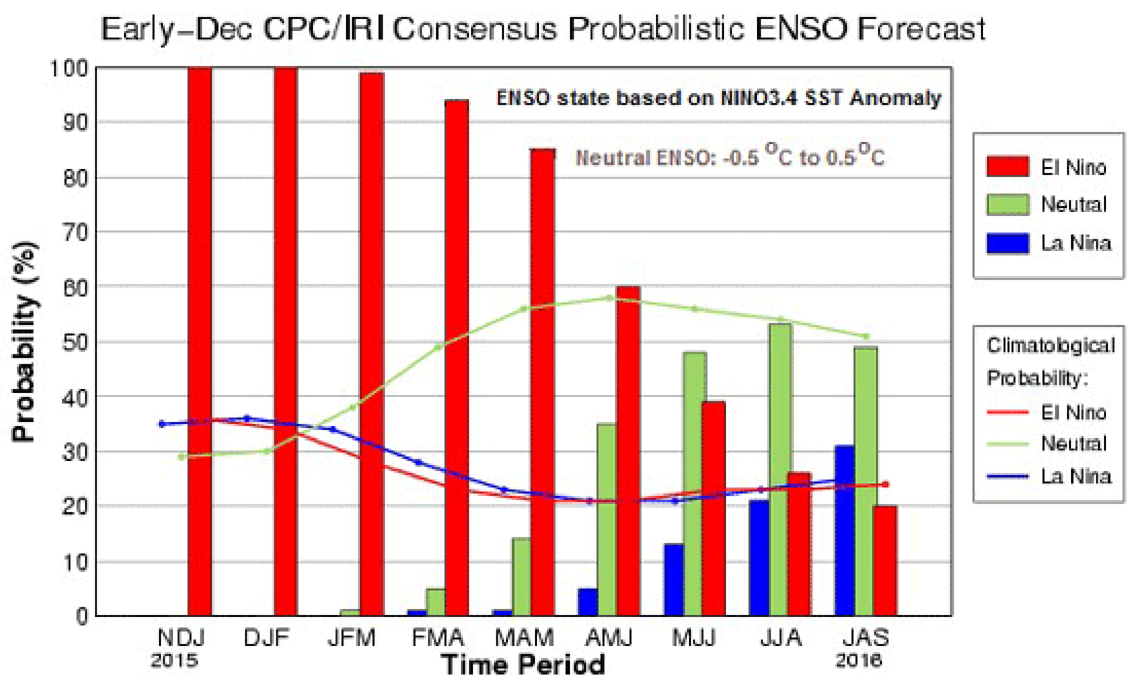
An El Niño event typically brings wetter-than-normal conditions to the Plains. The first map below shows the departures from normal precipitation in Kansas for the September through November period, while the second shows previous SON precipitation anomalies:





SOURCE: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ENSO/composites

December, through Dec. 21, extends the wet pattern. The outlook for the January through March period continues with a higher probability of wetter-than-normal conditions, and a neutral temperature outlook. The current question being discussed is how long the current El Niño will persist. At this point, the National Oceanic and Atmospheric Administration's Climate Prediction Center outlook shows a continued El Niño favored through the spring, with neutral conditions likely as we head into summer.



http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.ppt

The Climate Prediction Center's long-lead outlooks have the greatest skill when the ENSO is strongly in one phase or another. The outlooks are least reliable when the ENSO is in the neutral phase, as other global circulation features battle for dominance.

Mary Knapp, Weather Data Library
mknapp@ksu.edu

Christopher Redmond, Weather Data Library
christopherredmond@ksu.edu