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1. Agricultural practices for soil carbon sequestration

There are several agricultural and forestry practices that can increase carbon sequestration.

* **Continuous no-till.**

What it is: Producing crops without tilling the soil. There are variations on this (such as strip-till, reduced tillage, and ridge-till), but the research data on whether those variations can sequester carbon is mixed.

How it works: When soil is tilled, air is mixed into the soil and organic matter is oxidized by soil microbes, releasing a portion of the stored soil carbon. By avoiding all tillage, no-till production avoids oxidizing organic matter. As a result, more of the plant organic carbon remains in the soil every year. Tillage also makes the soil more susceptible to water and wind erosion, and the organic fraction of the soil is especially vulnerable to these losses. Also, no-till farming reduces fuel use, which results in lower CO_2 emissions.

* **Increased crop biomass production.**

What it is: Producing more biomass per acre per year. Examples include the production of higher crop or forage yields, more intensive rotations, cover crop production, elimination of unplanted fallow periods, and the use of higher residue crops, such as corn, grain sorghum, and wheat.

How it works: More plant production leads to more carbon being fixed by the plants into organic materials in roots, stems, leaves, and seed. Part of this organic carbon remains in the soil, and eventually becomes incorporated into soil organic carbon. When fields are fallowed, no crop is produced and this reduces the amount of plant material entering the soil system. Continuous cropping, or using cover crops to replace fallow, keeps plant material production at the highest possible level, increasing soil carbon levels.

* **New grass plantings.**

What it is: Any new perennial grass plantings, such as Conservation Reserve Program ground, new pasture ground, reclaimed land, grass waterways, and buffer strips.

How it works: Perennial grass plantings establish long-term areas of plant material on soil that is undisturbed by tillage. Grasses incorporate considerable carbon into the soil through photosynthesis, and the production of roots and stems in the soil. This organic material eventually decomposes and adds to the soil organic carbon pool in the soil. As grass stands mature over a period of 20 to 30 years, they reach a natural equilibrium in which carbon input through photosynthesis is balanced by carbon emissions through respiration.

* **Soil conservation practices.**

What it is: Terraces, grass waterways, buffer strips, and any other soil erosion prevention measure.

How it works: Soil conservation doesn't sequester new soil carbon. Rather, it prevents the loss of existing soil organic carbon. Soil erosion, both water erosion and wind erosion, exposes organic materials in the soil to oxygen. This can result in oxidization of the organic material, and the release of CO_2 into the atmosphere.

*** Improved grazing land management methods.**

What it is: Regular use of proper grazing methods and properly timed prescribed burning for certain grass species to increase forage production.

How it works: The goal is to increase forage production, which will increase the amount of plant organic carbon production and result in an increase in soil organic carbon. Another practice grazing land managers can do is to improve grazing distribution if there are areas of the grazing land that are eroded by animals. This will help protect existing soil carbon levels by reducing soil erosion.

-- Chuck Rice, Soil Microbiology
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2. Soil salinity problems in Kansas

(Note: There have been an increasing number of reports of alkali spots and other salinity-related soil problems in Kansas in recent years. The following article written by Dave Whitney, professor emeritus of Agronomy at K-State, was originally published in the February 10, 2006 issue, e-Update No. 19. The principles remain valid, and offer a good explanation of the problem. – Steve Watson, e-Update Editor)

Of all the soil-related problems for crop production in Kansas, one of the most potentially damaging for crops is high salinity. Fortunately, salinity problems affect a relatively small percentage of the total acres. The Arkansas River floodplain has the greatest concentration of salt-affected soils in Kansas.

In some cases, salinity problems occur because of a shallow water table and poor quality of the river water, as is the case with the Arkansas River floodplain. Other causes include soil formation from parent material high in soluble salts, poor quality irrigation water, excessive application rates of manure or other waste products, and spillage of brine water associated with oil production.

Some degree of salinity in the soil is normal, and even necessary because essential nutrients exist in the soil as part of the soluble salts. If soluble salt levels are too high, however, salt can reduce seed germination and plant growth. At this point, the soil is termed a "saline soil." This is sometimes confused with "sodic" soils. Sodic soils are those with excessive levels of exchangeable sodium, but low levels of total salts. Saline-sodic soils have both high salt levels and high exchangeable sodium.

Saline and saline-sodic soils often have a white crust on the soil surface. Sodic soils usually have a brownish-black crust from the dispersion of organic matter.

When salt levels in the soil become too high, the osmotic pressure within the soil is increased to the point that soil water is held too tightly for plant roots to be able to absorb it. Most plants become stressed or die from lack of water uptake in a saline soil. Plant species vary markedly in their tolerance to salinity levels. Some species are quite tolerant, such as salt marsh grasses. Unfortunately, the major agronomic crops grown in Kansas are only moderately tolerant to salinity. Soybeans are slightly more sensitive than sorghum, corn, and wheat to salinity.

Measurement of soluble salt concentrations is normally made on a saturation paste by mixing just enough distilled water with the soil to totally saturate it. The specific conductance is then measured on the mixture directly or on a vacuum extraction of the mixture. A specific conductance of 4 millimhos per centimeter (mmhos/cm) or greater is defined as saline or saline-sodic. You also may see results reported as deciseimens per meter (ds/m). One mmhos/cm is equal to one ds/m, so these numeric values are equivalent.

Soil testing labs typically evaluate EC (electrical conductivity) as part of a routine analysis. Because saturation pastes are labor intensive to prepare and hard to duplicate among technicians without considerable experience, many soil test laboratories use an alternative method of sample preparation, which yields excellent results. An equal amount of distilled water and soil are mixed as a slurry and the specific conductance is determined on the mix. This is the same slurry mix used by the lab for determination of soil water pH. Results obtained by this alternative method cannot be interpreted using published salinity levels in most soils textbooks or handbooks which reference the saturated paste method. Conductivity values for this mix will be roughly half those found for a saturation paste on a medium-textured soil.

Reclamation of salt-affected soils is possible. The first step is to assess the situation through a salt-alkali soil test to verify that a salinity problem exists. Find out whether it is only a salinity problem, or if excess exchangeable sodium also is present.

The second step is to identify the source of the excess soluble salts and, if possible, eliminate the source. This may be a simple as stopping the manure application, or correcting drainage problems. In some cases, such as where the water table is high, it may not be possible to eliminate the source of the problem.

If excess sodium is found by the salt-alkali test, then a chemical amendment, such as gypsum, needs to be applied.

The final step is to leach out the excess salt from the root zone. Under natural rainfall conditions, leaching may be relatively slow. Practices that improve water retention and movement into the soil, such as enhanced residue cover, will be beneficial.

For more detailed information on saline and sodic soils, see K-State Extension publication MF-1022.

-- David Whitney, Professor Emeritus, Soil Fertility Specialist

3. Canola Field Tour coming up April 23

K-State will sponsor a Canola Field Tour April 23. The tour will begin at 9 a.m. at the Clark Woodworth Farm near Sterling, Kan., and after three presentations there, at 10 a.m. will move to the Redd Foundation Field near Partridge, Kan.

"This is an opportunity for producers who are growing canola, or who are considering trying it, to learn more about this important crop and current K-State and Oklahoma State University research aimed at increasing our ability to produce it profitably in the central Great Plains," said Vic Martin, K-State Research and Extension agronomist.

Presentation topics and speakers will include:

* Clark Woodworth Farm – Sterling, Kan.
- Experiences growing winter canola and how it has benefitted a crop rotation – Clark Woodworth, producer;
- Information on a multi-site research project funded by U.S. Department of Agriculture Risk Management Agency and tillage research – Vic Martin, K-State; and
- Preliminary results of a canola establishment study – Kraig Roozeboom, K-State.

* Redd Foundation Field - Partridge, Kan.
- Discussion about the past year's weather – Bill Heer, K-State;
- Soil fertility issues in canola production – Dave Mengel, K-State;
- Overview of canola as a dual-purpose forage and grain crop – Vic Martin, K-State;
- Update on canola variety development and yield trials – Mike Stamm, K-State/Oklahoma State.

A canola question and answer period will follow the program.

More information is available by contacting Martin at 620-921-0786 or vmartin@ksu.edu.

-- Mary Lou Peter, Communications News Coordinator
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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