



Central KS Soil Health Projects

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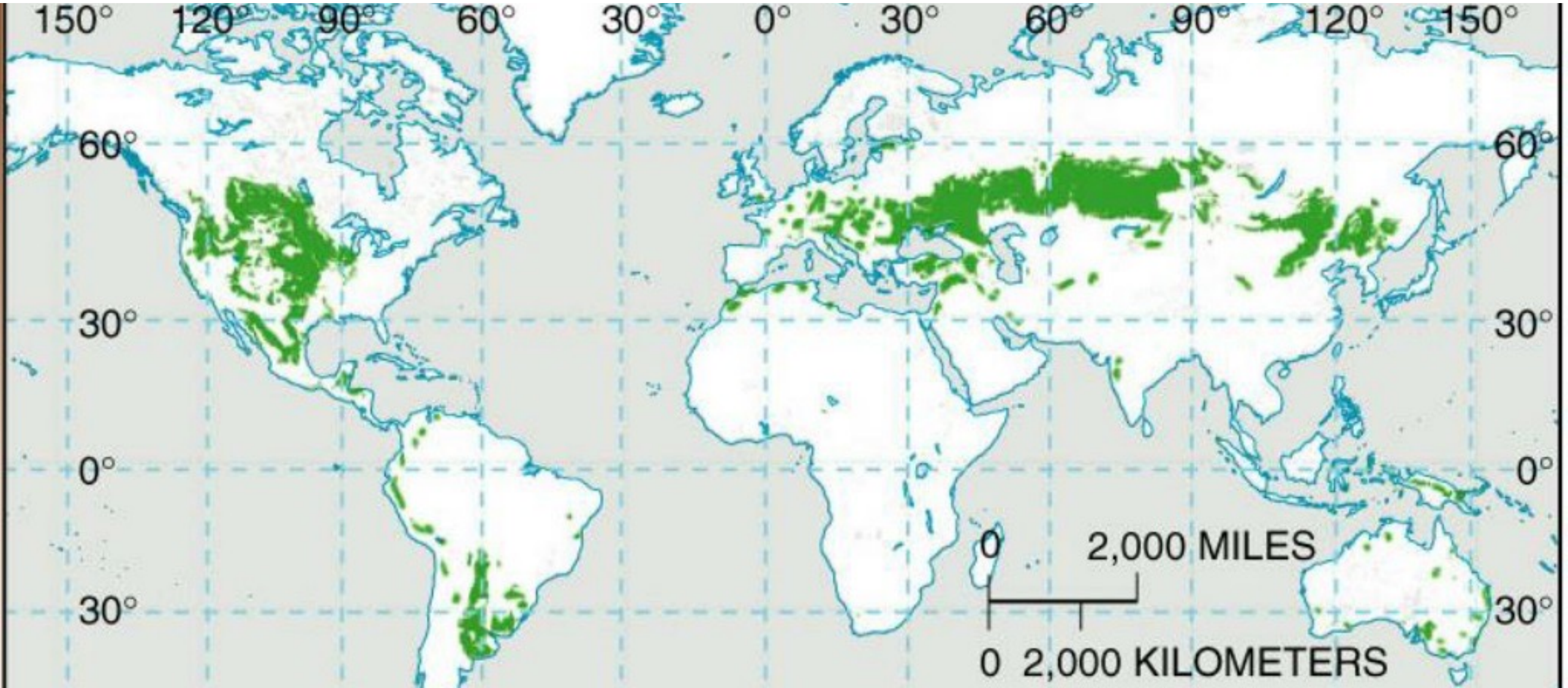
Department of
Agronomy

What does sustainability mean to you?

To me, sustainability is....

- A safe and abundant food supply (yield)
- An income for farm families (money)
- Not having to use as many inputs to get the same advantage?
- Clean water and clear air (environment)
- Doesn't deplete resources (fossil fuels, mined products)
- Best soils = productivity = stable economy

Soil health is a result of the inherited soil properties and the way a soil is managed.
How well does it function?



Let's get the bad news over with....

- Reducing soil disturbance
- Covering the soil surface
- Increasing the diversity of the cropping system
- Adding carbon to the system: more plants, manure, compost, etc



We've been hard on soils, and it shows

Definition of cover crops

- “Close growing crop, that provides soil protection and soil improvement between periods of normal crop production, or between trees in orchards or vines in vineyards.”
- If you harvest it, it’s not a cover crop
- Source: Soil Science Society of America glossary



Obligatory photo of crimson clover, shown in every cover crop PowerPoint, ever, and a cool-season legume.

Purposes of cover crops, continued

- **Soil improvement** and protection from erosion
- Reduce compaction
- Weed control
- Break disease and pest cycles
- Cycle plant nutrients
- Legumes fix N



Sunn hemp, a warm-season legume

Purposes of cover crops, continued



Phacelia, warm season, non-legume
Bees account for \$15 billion in crop value.
<http://www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm309134.htm>

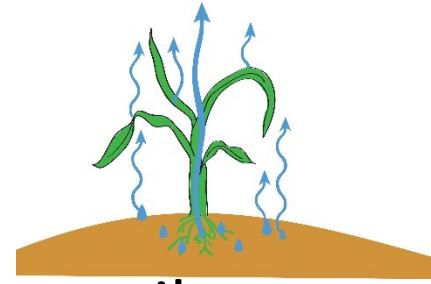


Self-propelled manure spreaders
University of Nebraska study:
<http://extensionpublications.unl.edu/assets/pdf/g2264.pdf>





“A temperature of 80 to 100° F is found most favorable to the production of a maximum fermentative activity.”
Soil: Ferments important in agriculture, Yearbook of the USDA, 1895, p. 73.

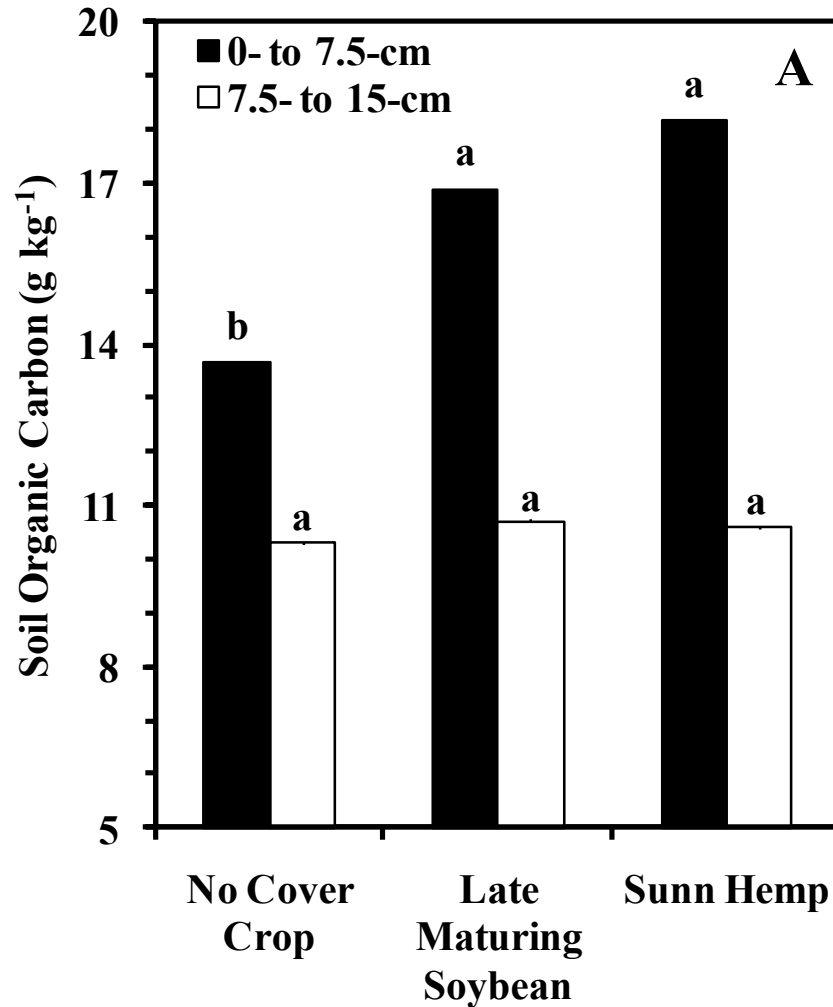


Roller-crimped rye: Reduces soil temperature, which aids in reducing E



Covers improve soils

Blanco-Canqui, H., Claassen, M. M., & Presley, D. R. (2012). Summer cover crops fix nitrogen, increase crop yield and improve soil-crop relationships. *Agronomy Journal*, 104(1), 137-147.



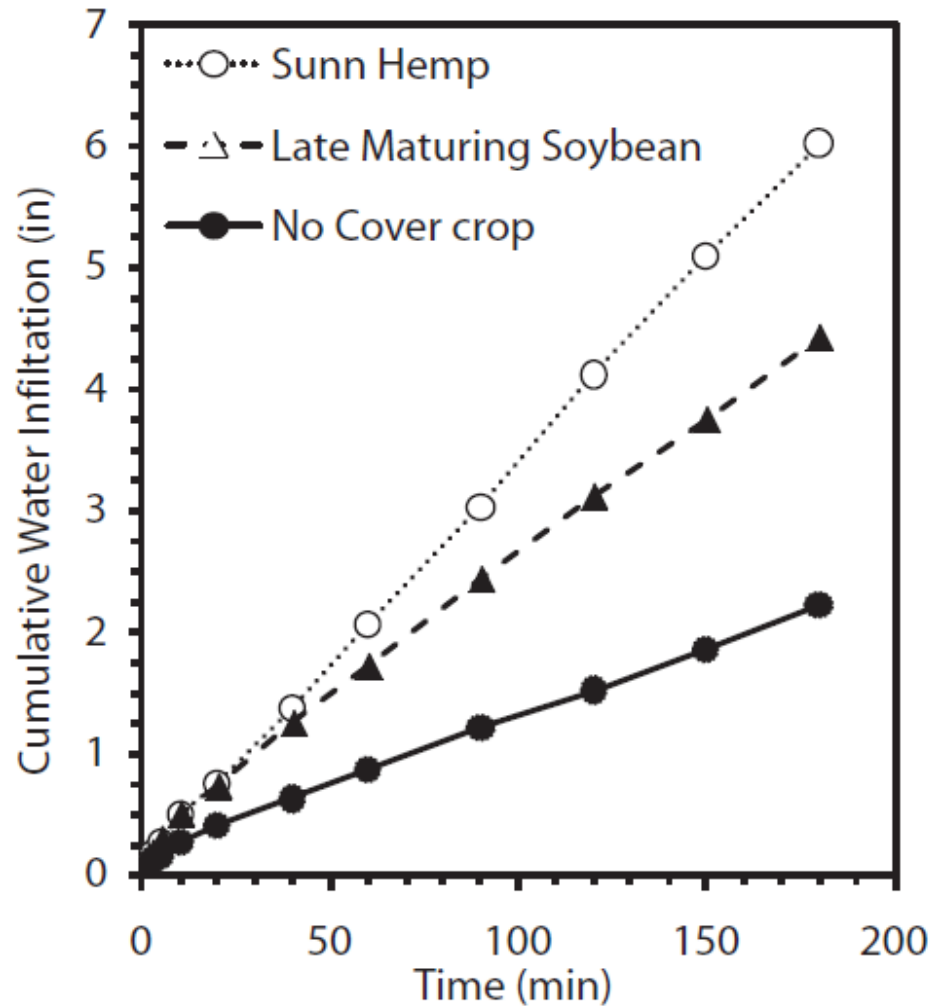
Raising soil organic matter can be done by:

1. Eliminating tillage
2. Diversifying a crop rotation
3. Adding more days when plants are growing
4. Adding manure
5. Over time (>5 years)

Happens faster with:

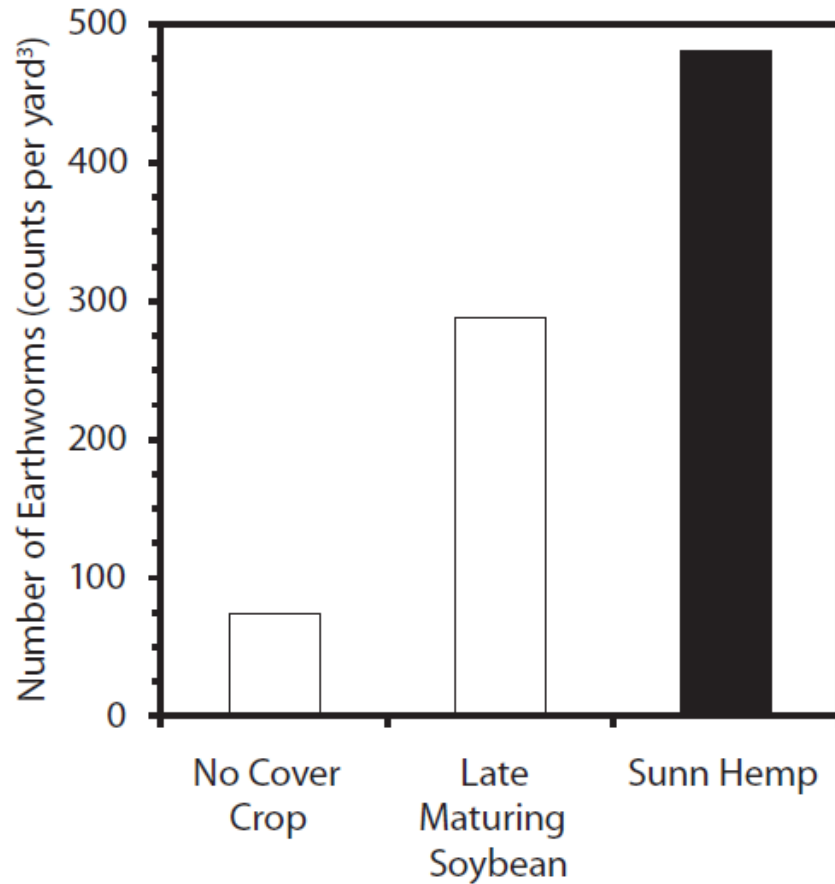
1. Clayey soils vs. Sandy soils
2. Wetter soils vs. drier soils

Infiltration



- Infiltration: Movement of water through the surface: Precipitation capture
- In this no-till experiment, cover crops increased infiltration
- Cover crops planted every other year

Build it and they will come



- Measured worms by digging up soil in December 2009 in grain sorghum stalks.
- How long had it been since the covers were green and living?
- About 13-14 months. Worms *still* preferred the cover crop plots.

“Worms prepare the ground in an excellent manner for the growth of fibrous-rooted plants and for seedlings of all kinds.”
Charles Darwin, 1881

Earthworm specifics

- Stimulate microbial activity.
- Earthworms consume microbes, many more microorganisms are present in their feces or casts than what they consume (gut)
- They fragment and inoculate with microorganisms
- Available plant nutrients (N, P, & K) tend to be higher in fresh earthworm casts than soil
(Edwards et al., 1995)



Sunn hemp, a warm-season legume

Earthworms, continued

- Earthworms increase mineral N in soil,
- and also readily exchangeable phosphorus (P) (Suarez et al., 2004),
- potassium, calcium and magnesium (Adejuyigbe et al., 2006).
- Productivity and earthworms: very positive relationship, and they must be fed.

Overview

- Flickner Innovation Farm
 - 2021 and 2022, strips of cover vs. no-cover, continuing in 2023
 - End of 2023 will sample for soil health
 - Crop yields, cover crop biomass, soil moisture dynamics 2021-2023
- Survey of soil health
 - 100 pedons sampled fall 2022 in McPherson and Harvey County, KS
- Since 2009, assessing tillage practices along a survey route in McPherson and Harvey Counties, 450 fields per county per year
 - NASA Harvest Project: Does tillage practice affect crop yields?

On-farm cover crop trials

- 4 locations per year in KS, Flickner farm is one site
- Report by Alexis Correira

<https://www.precisionsustainableag.org/>



Precision
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Soil Health Assessment: 100 pedons in McPherson and Harvey Counties

M.S. student: Adam Petty

DeAnn Presley, Peter Tomlinson

Funded by NRCS, KS Corn, and Foundation for Food and Ag Research



Type	Indicator/Property	Method (general)
Lab 1	Soil organic C	How much is stored in soil?
Lab 2-5	Aggregation	More aggregation, better structure
Lab 6	Bulk Density	More dense = less porous
Lab 7	Soil Respiration	How much CO ₂ is respired by all living organisms, more respiration, more organisms, theoretically more nutrient cycling
Lab 8	Permanganate Oxidizable C (POX C)	The labile carbon in the soil, flows between living organisms
Lab 9	ACE-Protein	Indicates how much nitrogen can potentially be mineralized by the soil microbial community and made available to plants.
Lab 10	Community Structure	Phospholipid Fatty Acid (PLFA)

Progress

- Samples collected August-November 2022
- Land use data collected (tillage, crop rotation, cover crops, etc.)
- Lab analyses January 2023-June 2023

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