



## Soil Health in Southeast Nebraska

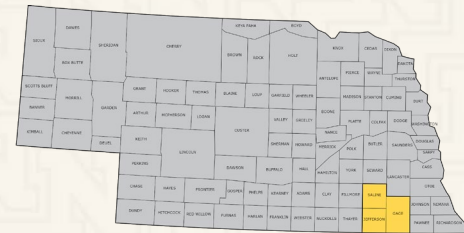


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# Overview

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- What is soil health?
- Soil health gap
- Four principles of soil health
- Getting started with cover crops in southeast Nebraska
- Winter Wheat Works Initiative
- Resources





# What is Soil Health?

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# What is Soil Health?

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1. “The continued capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans.” *USDA-NRCS*
2. “The suite of biological, chemical, and physical properties and which enable soils to function as a vital living ecosystem that sustains all life above and underneath the soil surface.” *Soil Health Nexus*
3. “The capacity of soil to function as a vital living system, within an ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health.” Doran et al (1996)
4. Others....

# Soil Health Questions

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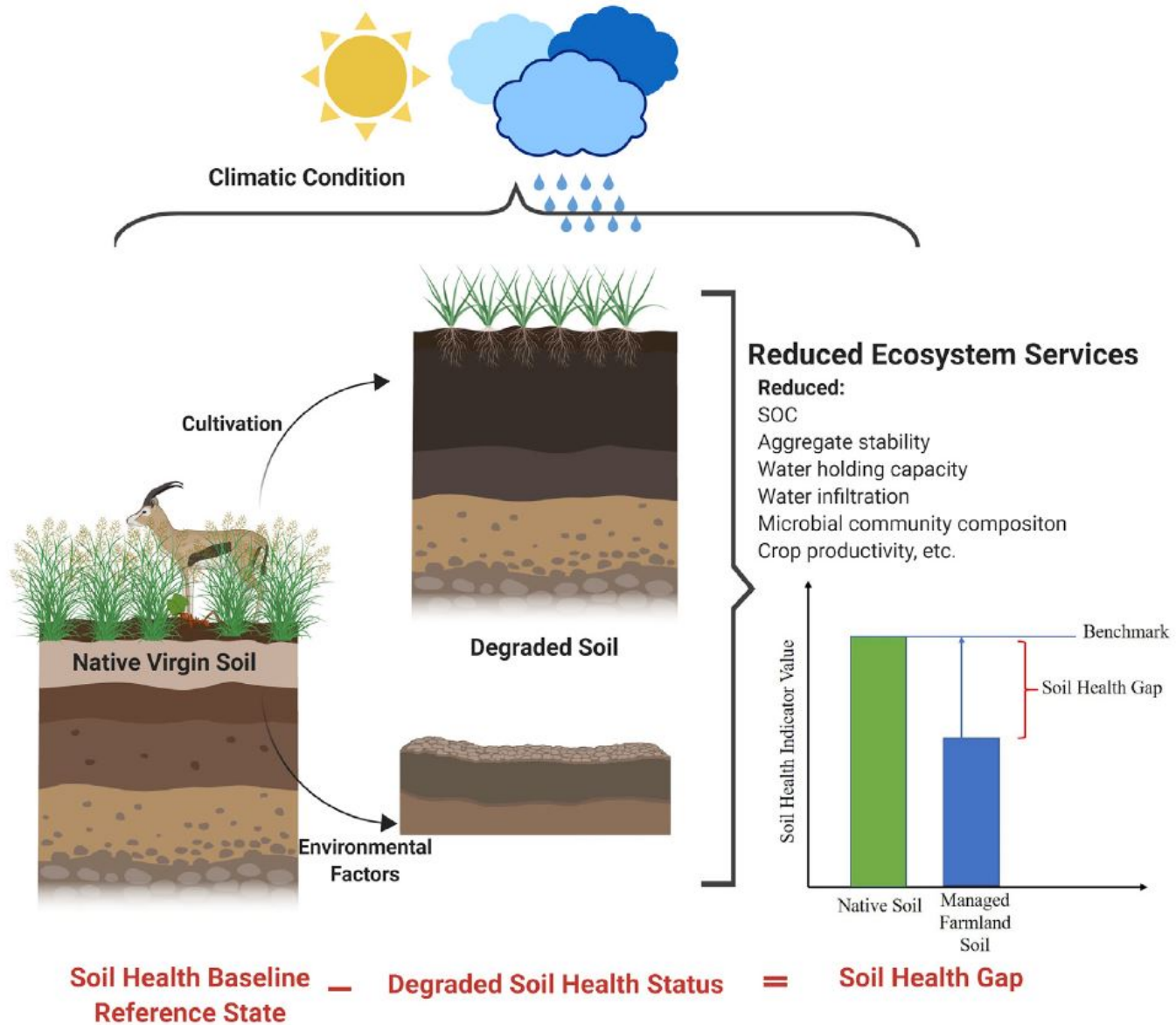
- What does a healthy soil do for our community?
- What does a healthy soil do for farm?
- How healthy is my soil and what is my goal?
- Other questions...



# Soil Health Gap

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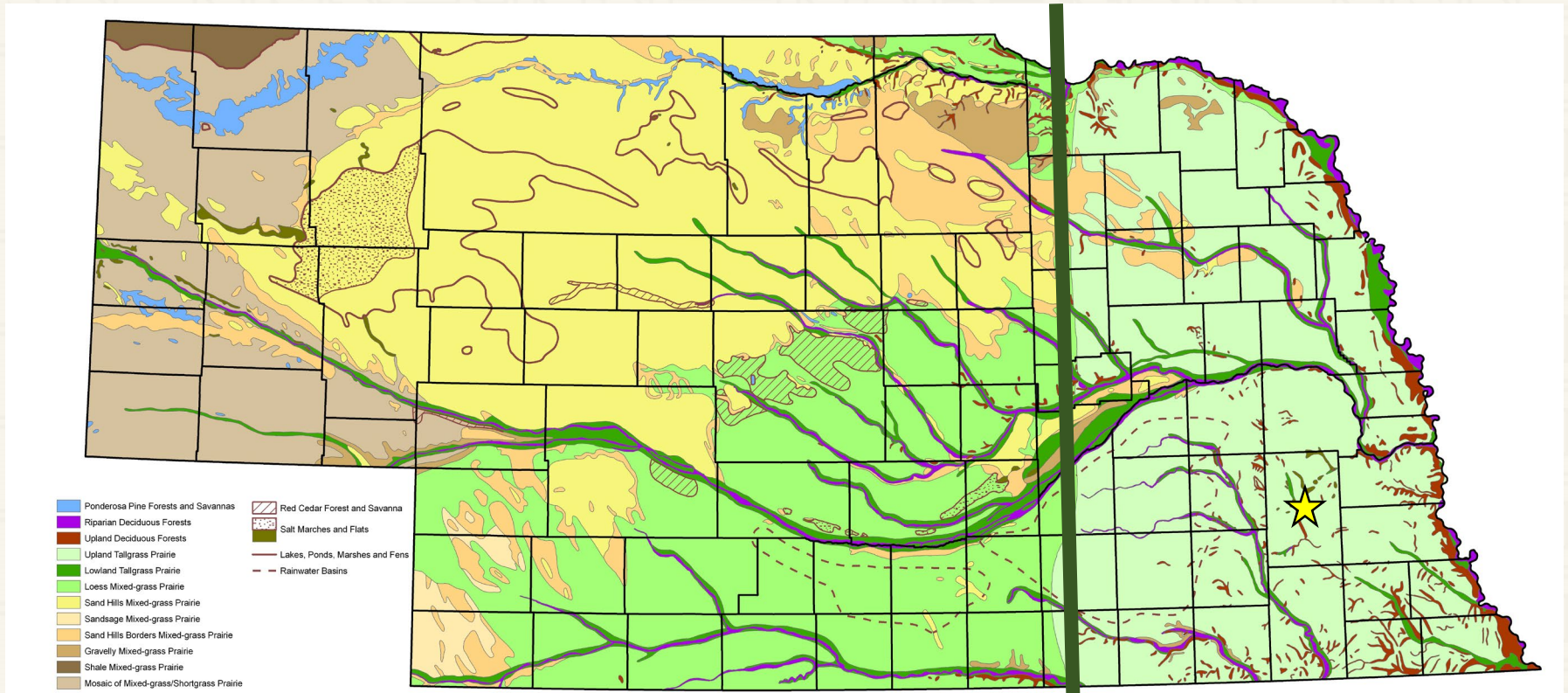




$$\text{Soil Health Gap (SHG)}_x = (\text{SH})_n - (\text{SH})_m$$

Fig. 1. Graphical abstract of *Soil Health Gap* concept.

# Soil Health, Climate, & Native Vegetation

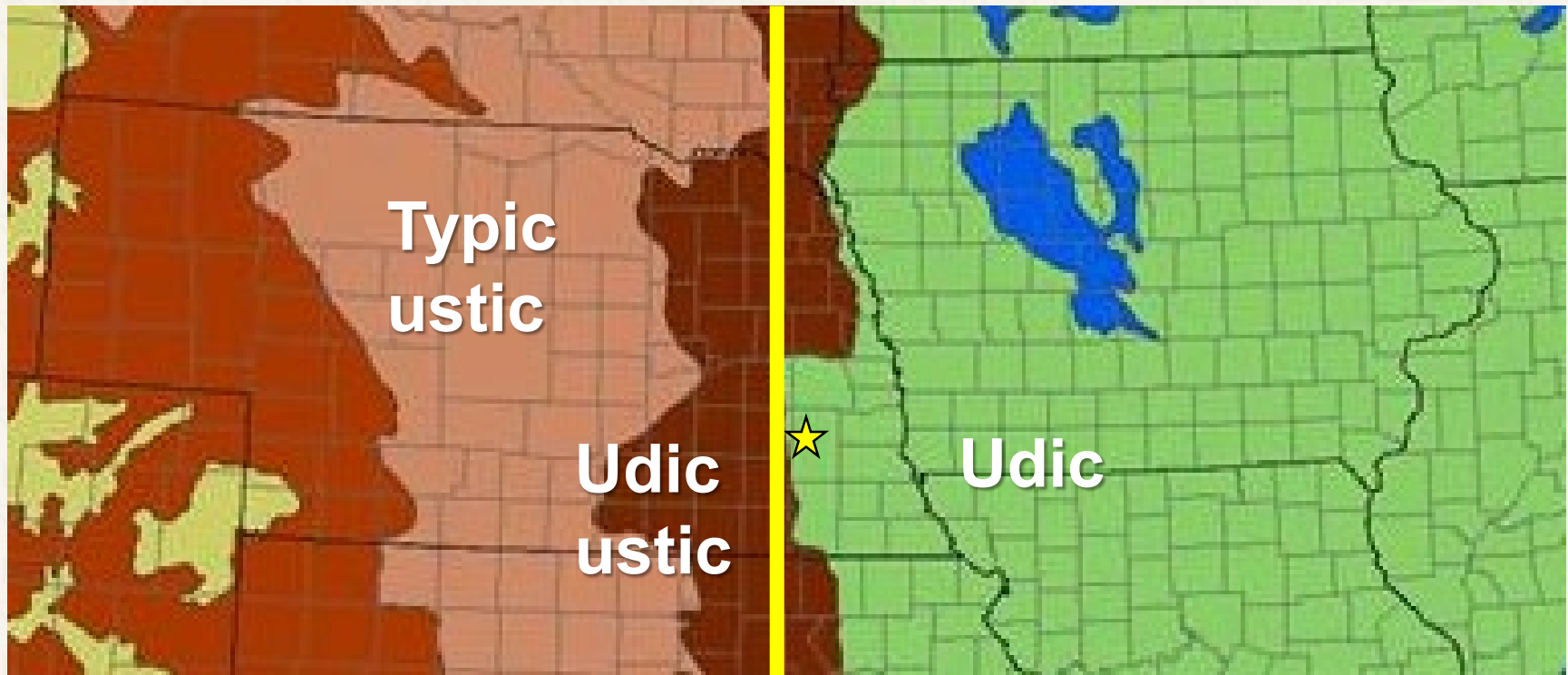


Hwy 14



# Soil Moisture Regime – USDA-NRCS

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97 degrees west longitude



## Nebraska Extension

Research-Based Information That You Can Use

G2283 · Index: Crops, Soil Management  
Issued February 2017

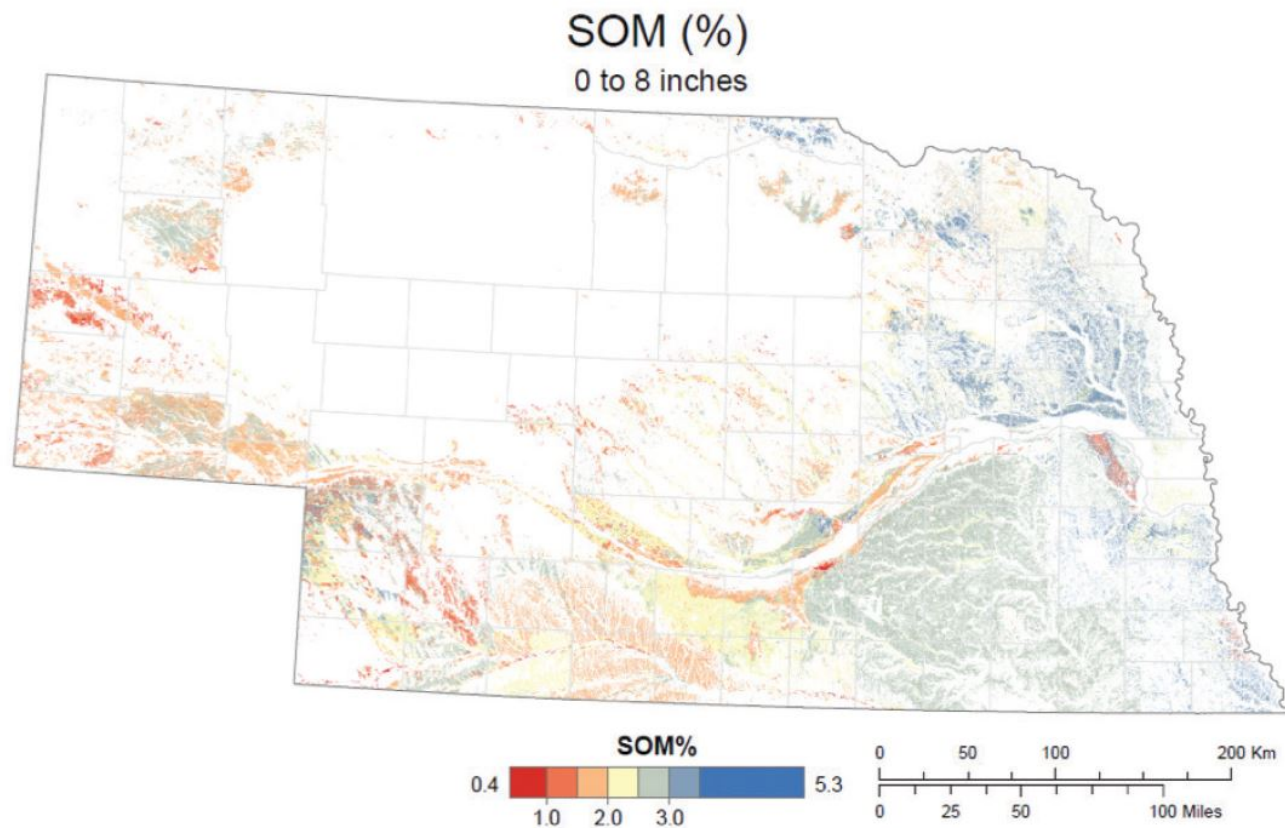


Figure 1. Soil organic matter (%) for non-eroded loamy soil crop-lands of Nebraska (developed from NRCS SSURGO data).

# Soil Organic Matter

- Annual crop steady state
  - Climate
  - Soil properties
  - Management

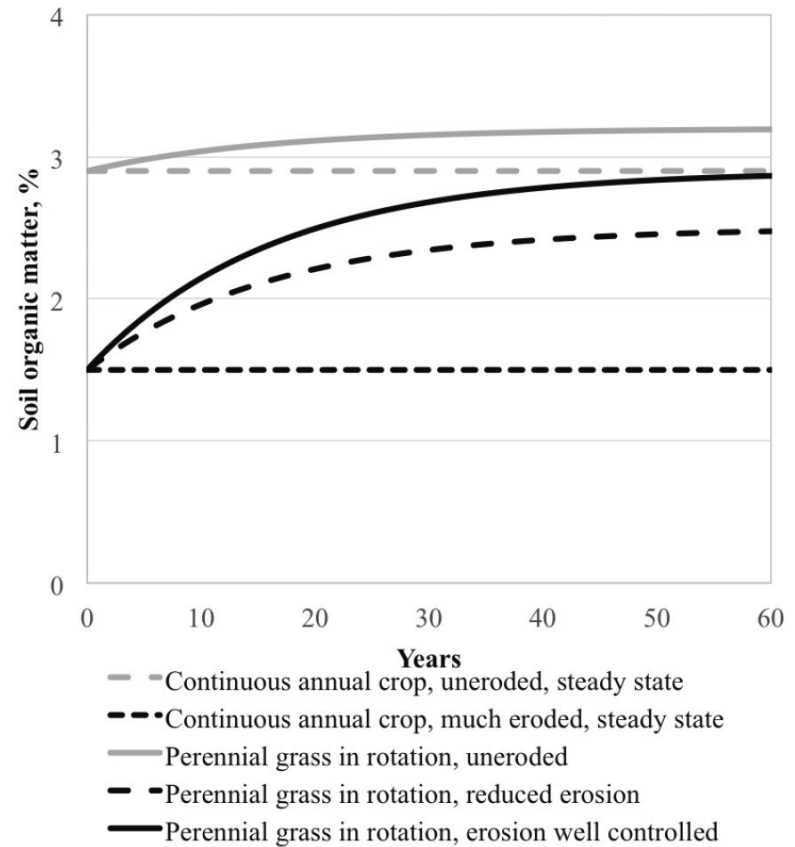


Figure 2. A hypothetical illustration of soil organic matter content and steady state for a silty clay loam soil of eastern Nebraska as affected by erosion and cropping system.

# Soil Health Gap – Reference Samples in 2021

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- New 2021 Extension project in Saline, Jefferson, and Gage counties
- Remnant native prairie references (why not fence lines?)
- Most dominant/common soil series in Jefferson County
  - Hobbs-Hord-Cass
  - Crete-Mayberry
  - Morrill-Burchard
  - Geary-Hastings
  - Geary-Jansen
  - Benfield-Kipson
  - Lancaster-Hedville
- Looking for locations to test in May and June
  - Talk to me after
  - Contact me - flyer



# Soil Health Testing Cost Share

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- Cost share through the Little Blue NRD
  - **Items Covered:**
    - Complete Soil-Health Test
    - Haney Test
  - **Cost-Share:** Up to \$60 per composite sample, up to \$240 per producer, per fiscal year
  - Talk with Little Blue NRD Staff for details
  - <https://littlebluenrd.org/cost-share/>



# NRCS Four Principles of Soil Health

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# NRCS Four Principles of Soil Health

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1. Use plant diversity to increase diversity in the soil
2. Manage soils more by disturbing them less
3. Keep the live root throughout the year to feed the soil
4. Keep the soils covered



# What farming practices help?

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No-till

Nutrient  
management

Integrate  
livestock

Cover crops

Retain crop  
residue

Irrigation  
management

Diverse crop rotation

Manure/amendments

IPM and Habitat

Add grazed/hayed  
perennial grass

Controlled  
traffic/reduce  
compaction





# Getting Started with Cover Crops

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# Post Soybean, Going to Corn



**N**  
EXTENSION

## NEBRASKA COVER CROP RECIPE

MCCC-108  
G2315

## Post Soybean, Going to Corn: Use a Mix of Oats/Wheat/Rapeseed or Wheat Only

*This publication is intended to provide a starting point for farmers who are new to growing cover crops. With experience, farmers may fine-tune the use of cover crops for their systems.*

### Introduction

The following recipe provides an introductory approach to integrating a cover crop into a soybean-corn rotation. Often the easiest place to begin is to plant a cover crop ahead of a soybean cash crop following corn, so consider starting with the companion recipe titled *Post Corn, Going to Soybean* (publication MCCC-107; see Resources).

### Planning and Preparation

- **Planning**—Educate yourself. Learn the pros and cons of cover crops through reading, attending field days and conferences, and talking with farmers who have used cover crops successfully. Start small. Be timely. Prioritize management based on your goal for using cover crops.
- **Soybean variety and planting**—If possible, plant the preceding soybean crop early and use an early maturity soybean cultivar. One strategy is to use your earliest-maturity-group soybeans on the fields where you plan to seed cover crops and plant those beans first.
- **Residual soybean herbicides**—Because oats/wheat are very tolerant of most soybean residual herbicides, few restrictions apply unless grazing is being considered. Rapeseed planted in this cover crop mix may be affected by residual soybean herbicides. Chlorimuron (Classic®, Canopy®, Cloak®, etc.), imazethapyr (Pursuit®), and fomesafen (Reflex®, etc.) could be a problem for fall-seeded legume or mustard covers.
- **Seed purchase**—Order cover crop seed early. Named oat and rapeseed varieties grow well but are more expensive than VNS (variety not stated) seed. Start with VNS seed with a good germination rate that has been cleaned, tested for germination, and has a seed tag even though it is VNS. North of Highway 30 or if not

seeding by September 15, use winter wheat only as oats will not grow enough to justify its use in the mix. Use certified, nontreated seed wheat varieties to reduce cost. Most wheat varieties have adequate winter hardiness for Nebraska for cover crop purposes.

### Fall Work

- **Soybean harvest**—Harvest fields where the cover crop mix is to be planted as early as possible.
- **Timing of planting**—Plant the cover crop mix immediately after harvest (by the third week in September for most of Nebraska). For wheat only, plant before two weeks after the 50% frost date. Use the Selector Tool (in Resources section) for more precise dates for your county.
- **Planting method**—Drill to a depth of 0.75–1.50 inches or broadcast. Incorporation of the seed, if any, should be light since excessive disturbance of soybean stubble may negate any benefit of the cover crop. See Resources for more details on seeding methods. All seeding rates are based on seed with germination rates of 85–98%.
- **Seeding rate for a mix**—Drilled: oats, 20 lbs./acre; wheat, 25 lbs./acre; rapeseed 1 lb./acre. Broadcast: oats, 25 lbs./acre; wheat, 35 lbs./acre; rapeseed 2 lbs./acre.
- **Seeding rate for wheat alone**—Drilled: 45–60 lbs./acre. Broadcast with shallow incorporation: 50–65 lbs./acre.
- **Aerial seeding or overseeding**—An alternative to seeding after harvest is to do aerial seeding with a plane or helicopter or overseeding with a ground-based vehicle. In most of Nebraska, seeding should take place in late August or by the first week of September and before 25% of the soybean leaves have yellowed and dropped. Rainfall after seeding is essential for establishment.
- **Seeding rate for overseeding**—For a mix: oats, 20 lbs./acre; wheat, 30 lbs./acre; rapeseed, 3 lbs./acre. For wheat alone: 50 lbs./acre.

### ■ Post Soybean, Going to Corn: Use a Mix of Oats/Wheat/Rapeseed or Wheat Only



Figure 1. Here, corn is being planted into recently terminated winter wheat that is 6 to 8 inches tall. (Nathan Mueller)

- **Tillage or no-tillage**—To allow for adequate cover crop growth, it is best if no full-width tillage takes place until spring in order to maintain surface cover to prevent erosion.
- **Fertility or liming**—If applying P, K, or lime, complete the application prior to the seeding operation or apply to the growing oats/wheat/rapeseed before the ground freezes. If it is necessary to inject N fertilizer or manure in the fall, a low-disturbance applicator should be used to minimize reduction in surface residues.

### Spring Work

- **Starter fertilizer**—Strongly consider equipping your corn planter with 2x2 starter fertilizer, and aim for a starter fertilizer rate between 30–50 pounds of actual N per acre.
- **Termination timing**—Terminate the wheat in the spring when plants are 6 to 12 inches tall and actively growing or about two weeks before planting corn—whichever comes first. Many growers will successfully plant corn into terminated wheat taller than 12 inches, especially if weed control is a primary purpose, but new cover crop users should terminate when the wheat is smaller.
- **Termination herbicide**—Wheat can be terminated with a full rate of glyphosate (minimum of 1 lb. acid equivalent [ae] per acre) after dormancy breaks in the spring. Effectiveness and rapidity of termination improves if wheat is rapidly growing and air temperatures are warmer. Larger wheat, wheat past the boot stage, or wheat sprayed during cooler weather can be more difficult to kill. Be careful of atrazine and atrazine premixes antagonizing glyphosate if weather is cool and cloudy near the application date.
- **Termination modifications for dry weather**—Watch the weather and be ready to modify your termination plans. In a dry spring, wheat has the potential to use moisture that the cash crop will need, so terminate cover crops sooner to allow rainfall to make up the deficit.
- **Termination modifications for wet weather**—In a wet spring, be ready to take advantage of any break in the weather

and/or use low axle weight sprayers. If projected corn planting is less than 10 days away and the wheat is tall, then it often works better to spray within a day or two of planting.

### Resources

**Cover Crop Selector Tool**, <http://mccc.msu.edu/selector-tool/>—available from the Midwest Cover Crops Council, [www.mccc.msu.edu](http://www.mccc.msu.edu)

**Post Corn, Going to Soybean: Use Cereal Rye** (Nebraska Cover Crop Recipe series, MCCC-107)—available from [www.mccc.msu.edu](http://www.mccc.msu.edu)

**Cover Crop Options after Corn or Soybean Harvest**, <https://cropwatch.unl.edu/cover-crop-options-after-corn-or-soybean-harvest>

**Managing Cover Crops: An Introduction to Integrating Cover Crops into a Corn-Soybean Rotation** (Purdue Extension publication AY-353-W)—[https://edustore.purdue.edu/item.asp?item\\_number=AY-353-W](https://edustore.purdue.edu/item.asp?item_number=AY-353-W)

**Residual Herbicides and Fall Cover Crop Establishment** (Purdue Extension Weed Science publication), <https://ag.purdue.edu/btny/weeds/cscience/Documents/covercroprapycrover.pdf>

**How Herbicide Labels Restrict Using Cover Crops as Forage**, <https://cropwatch.unl.edu/how-herbicide-labels-restrict-using-cover-crops-forage>

**Corn and Soybean Herbicide Options for Planting Cover Crops for Forage in Fall**, <https://cropwatch.unl.edu/corn-and-soybean-herbicide-options-planting-cover-crops-forage-fall>

**Terminating Cover Crops: Successful Cover Crop Termination with Herbicides** (Purdue Extension publication WS-50-W), [https://mdc.itap.purdue.edu/item.asp?Item\\_Number=WS-50-W](https://mdc.itap.purdue.edu/item.asp?Item_Number=WS-50-W)

### Authors

Gary Lesoing, University of Nebraska—Lincoln, and Katja Koehler-Cole, University of Nebraska—Lincoln (Note: This publication was adapted with consent from MCCC under a joint project to produce customized introductory guidance about cover crops for all member states/provinces.)

### Reviewers and Contributors

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Funding for this project was provided by McKnight Foundation.

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October 2019

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# Post Corn, Going to Soybeans:



**N**  
EXTENSION

## NEBRASKA COVER CROP RECIPE

MCCC-107  
G2314

## Post Corn, Going to Soybean: Use Cereal Rye

*This publication is intended to provide a starting point for farmers who are new to growing cover crops. With experience, farmers may fine-tune the use of cover crops for their systems.*

### Introduction

The following recipe provides an introductory approach to integrating a cover crop into a corn-soybean rotation. Planting a cover crop ahead of a soybean cash crop is often the easiest way to introduce cover crops into your rotation. Farmers who plan to grow wheat in a crop rotation should use cereal rye with caution. Cereal rye cannot be grown or used as a cover crop on fields where certified wheat will be grown in the next five years.

### Planning and Preparation

- **Planning**—Educate yourself. Learn the pros and cons of cover crops through reading, attending field days and conferences, and talking with farmers who have used cover crops successfully. Start small. Be timely. Prioritize management based on your goal for using cover crops.
- **Corn hybrid and planting**—If possible, plant the preceding corn crop early and use an early maturity corn hybrid. One strategy is to use cover crops on the field you usually harvest first, on sloping ground, or on a field where you can watch it regularly, and to plant your earliest maturity hybrid on that field.
- **Residual corn herbicides**—Cereal rye can be seeded and a successful stand will occur in the fall following most of the spring-applied residuals used in corn. However, if cereal rye will be grazed or fed to livestock, there are some restrictions (see Resources section).
- **Seed purchase**—Order cereal rye seed early. Named varieties can produce substantially more growth or more predictable growth and maturity, but they are more expensive than VNS (variety not stated) seed. Unless you are considering grazing or using the cereal rye as a harvested forage, start with VNS seed with a good germination rate purchased from a reputable seed dealer. Note that this means the seed has been cleaned, tested for germination, and has a seed tag even though it is VNS.

### Fall Work

- **Corn harvest**—Harvest fields where cereal rye is to be planted as early as possible.
- **Tillage or no-tillage**—To allow for adequate cover crop growth, it is best or easier if no full-width tillage is planned for after rye planting or before intended rye termination date. Thus, it is easier to integrate cover crops into no-till or strip-till systems.
- **Timing of planting**—Ideally, plant cereal rye as soon after harvest as possible and before two weeks after the 50% frost date. In northern Nebraska, this would be before Oct. 15; in southern Nebraska, before Nov. 1. Use the Selector Tool (in Resources section) for more precise dates for your county. These dates are guidelines; the sooner cereal rye is planted in the fall, the better, but later-planted cereal rye can also be successful.
- **Seeding rate**—Drilled seeding rate: 45–60 lbs./acre. Broadcast with shallow incorporation: 50–65 lbs./acre. These rates are based on high-quality seed with germination rates of 85–98%.
- **Planting method**—Drill to 0.75–1.50 inches deep or broadcast with shallow incorporation. An air-seeder mounted on a vertical tillage tool can also be used.
- **Fertility or liming**—If applying P, K, or lime, complete the application prior to the seeding operation or apply to the growing rye before the ground freezes. If it is necessary to inject manure, low-disturbance injectors are available that will cause minimal damage to the cereal rye. Surface application of liquid manure on top of the rye is not recommended. Surface broadcast of dry manure or litter should be done prior to seeding, but 4 tons or less can be applied to growing cereal rye with minimal damage by using modern spreading equipment that provides even distribution.

### Spring Work

- **Scouting**—In the spring, scout your cereal rye cover crop to determine how well it is growing and its coverage. But if rainfall is below normal, scout also to monitor soil

### Post Corn, Going to Soybean: Use Cereal Rye



Figure 1. Terminate cereal rye growth when approximately 6–12 inches in height (shown here). (Gary Lesong)

- moisture in case earlier termination is needed for the germination and growth of the desired row crop.
- **Termination timing**—Terminate the cereal rye in the spring when plants are 6 to 12 inches tall and actively growing or about two weeks before planting soybean—whichever comes first. Many growers will successfully plant soybean into terminated cereal rye much taller than 12 inches, especially if weed control is a primary purpose, but new cover crop users should terminate when the cereal rye is smaller (see Figure 1).
  - **Termination herbicide**—Cereal rye can easily be terminated with a full rate of glyphosate (minimum of 1 lb. acid equivalent [ae]/acre) after dormancy breaks in the spring. Be aware that there can be termination issues when urea-ammonium nitrate (UAN) liquid fertilizer is used as a carrier for the herbicide. Effectiveness and rapidity of termination improves if rye is rapidly growing and air temperatures are warmer. Larger rye, rye past the boot stage, or rye sprayed during cooler weather can be more difficult to kill or will die more slowly.
  - **Termination modifications for dry weather**—Watch the weather and be ready to modify your termination plans. In a dry spring, the cereal rye cover crop has the potential to use moisture that the cash crop will need, so terminate cover crops sooner to allow rainfall to make up the deficit.
  - **Termination modifications for wet weather**—In a wet spring, when it has been very difficult to get into the fields to spray, be ready to take advantage of any break in the weather and/or use low axle weight sprayers. If projected soybean planting is less than 10 days away and the rye is tall, then it often works better to spray within a day or two of planting.
  - **Soybean planting**—It is usually best to no-till plant soybean into the dead/dry or standing cereal rye cover

crop. Almost all modern planters and drills are fully capable of planting soybean into a cereal rye cover crop. Check planting depth and seed furrow closure shortly after beginning to plant into the cover crop residue as usually some adjustments are needed.

- **Scouting**—After soybean planting, scout for soybean emergence and population. Additionally, scout for weeds since substantial cereal rye residue can often delay emergence of annual weeds, which may delay the application of post-emergence herbicides.

### Resources

**Cover Crop Selector Tool**, <http://mccc.msu.edu/selector-tool/>—available from the Midwest Cover Crops Council, [www.mccc.msu.edu](http://www.mccc.msu.edu)

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October 2019

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# Adding Winter Wheat to a Crop Rotation

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# Improving Soil Health with Winter Wheat

- Aspects of soil health
  - Physical
  - Biological
  - Chemical

### Improving Soil Health with Winter Wheat



Figure 1. Slake test proxy for water stable aggregates. Left to right: Alfalfa, CCSW(rc)-NT, CCSW(rc)-CT, CCCC-CT, CCSS-NT, and CCSS-CT. NT=No-till, CT=Conventional till, C=corn, S=soybean, W=wheat, rc=red clover. Photo credit: Bill Deen, Univ. of Guelph

#### Current Issue

Soil health (biological, physical, and chemical) has been a popular focus with emphasis on utilizing no-till and cover crops in eastern Nebraska. However, a more diverse crop rotation is often left out of the discussion as a way to improve soil health. The corn-soybean rotation is the most widely utilized cropping systems in eastern Nebraska. Despite the potential benefits adding a third or fourth crop to this rotation to improve soil health, few farmers in eastern Nebraska have because of various adoption barriers.

#### Crop rotation benefits

The trifecta of soil health practices:

- No-till, cover crops, and diverse crop rotation

Two long-term (14 & 15 years) crop rotation studies in the Midwest have shown that including winter wheat into the corn-soybean rotation results in the following improvement in soil health:

1. Increase in water stable aggregates (most sensitive and best single indicator of soil physical health, example in Figure 1)
2. Higher total nitrogen (N), potentially mineralizable N in soil, and N use efficiency
3. Reduced N rates needed in corn for maximum economic return
4. Higher yields in corn and soybeans

These aspects of soil health were increased by adding wheat into the rotation regardless of the tillage system,

conventional and no-till. The dense fibrous root system of wheat and nitrogen derived from wheat root deposits is likely the cause of these measurable differences. These long-term crop rotation studies did not include cover crops.

#### Overcome barriers to adding wheat

Barriers producers share

- Economics of wheat grain yield only/input cost compared to corn and soybean production
- Logistics of planting and harvesting only 1 or 2 fields
- Concerns about the learning curve of growing a new crop

Overcoming these barriers

- Improve economics by capturing good basis (Lincoln & Fremont), selling straw, growing forage crop after wheat, higher corn and soybean yield in rotation, and USDA programs payments
- Improve logistics with custom drilling and harvesting and business opportunity
- Reduce learning curve through new website, grower group email list, and future peer-learning group, and working with cropping systems extension educators

#### Local grower quotes

*"It (wheat) breaks up our corn-bean rotation and it creates more organic matter, because of the root mass."*  
Local Farmer – Fremont Tribune

*"Winter wheat gives you an additional 45 to 60 days for the cover crop to grow, which results in more material to graze if you choose to, and more root mass to help build organic matter in the soil."* Local Farmer - Nebraska Farmer Magazine

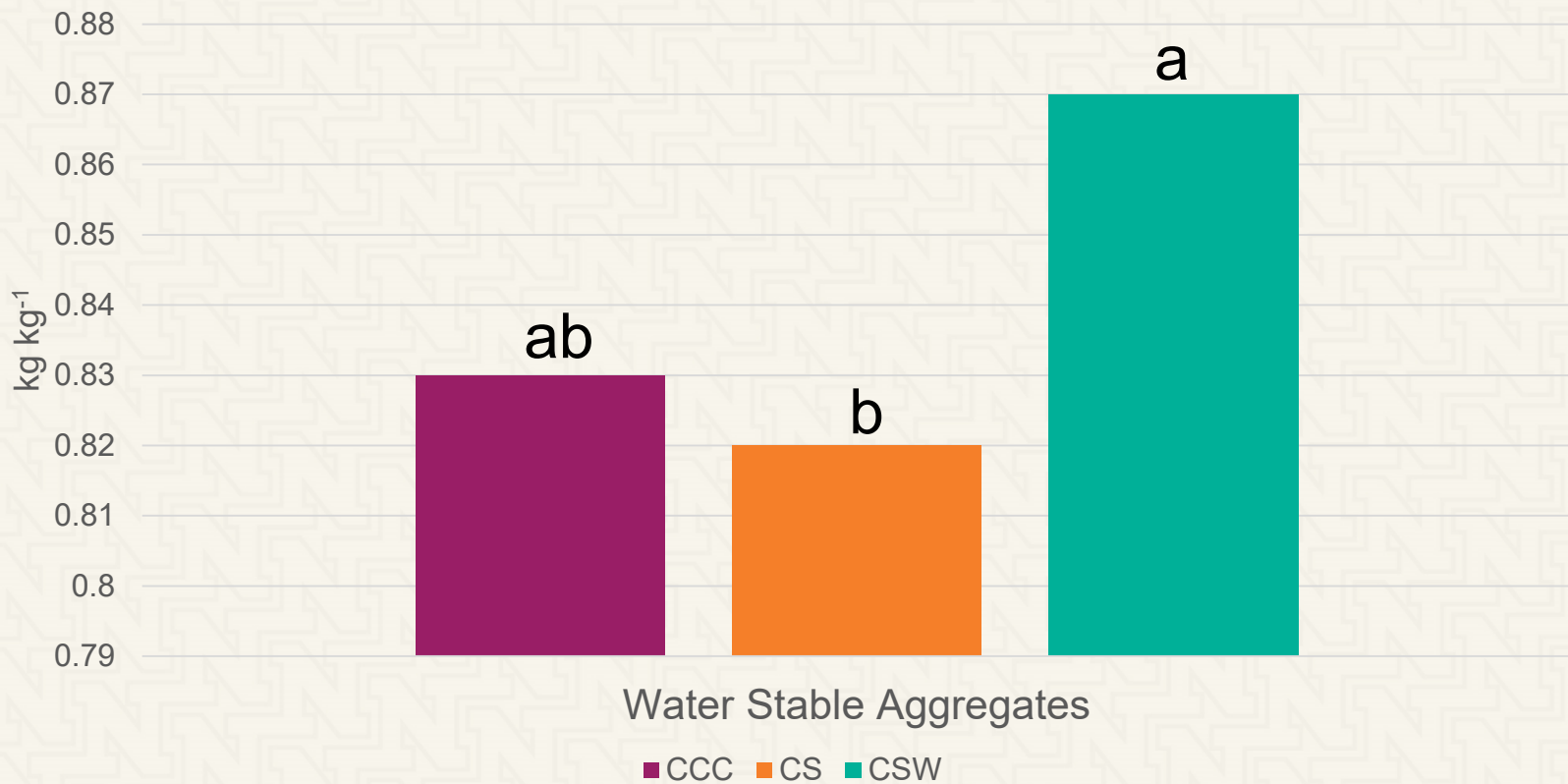
#### For more information

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402-821-2151 or [nathan.mueller@unl.edu](mailto:nathan.mueller@unl.edu)

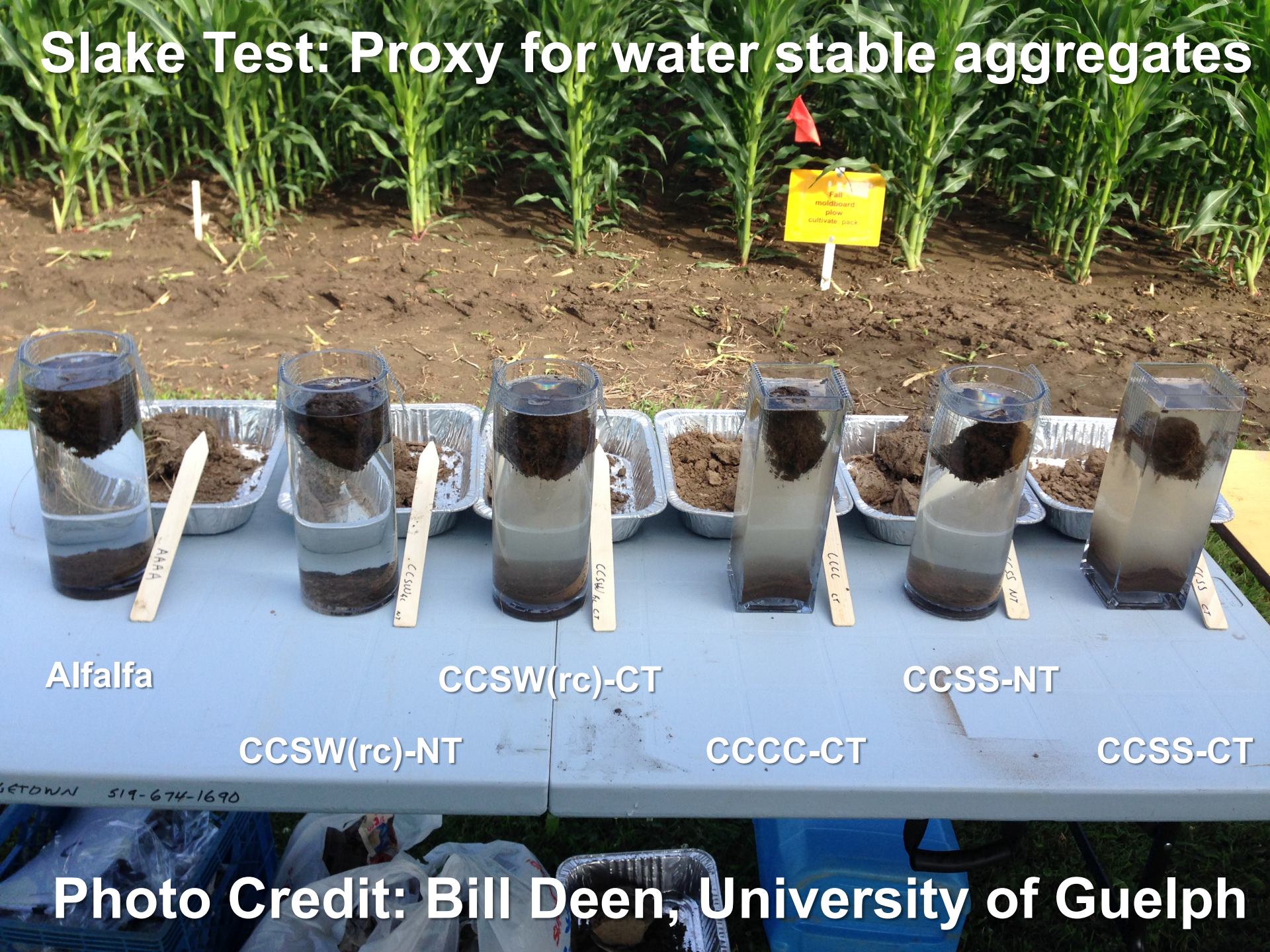
Wheat resources for eastern Nebraska at [croptechcafe.org/winterwheat](http://croptechcafe.org/winterwheat)

# Water Stable Aggregates

15-year rotation study – 0 to 8 inch depth



# Slake Test: Proxy for water stable aggregates



Fall  
moldboard  
plow  
cultivate pass

Alfalfa

CCSW(rc)-NT

CCSW(rc)-CT

CCCC-CT

CCSS-NT

CCSS-CT

Alfalfa

CCSW(rc)-CT

CCSS-NT

CCSW(rc)-NT

CCCC-CT

CCSS-CT

GETDOWN 519-674-1690

Photo Credit: Bill Deen, University of Guelph

# Four Components of Crop Diversity

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- Working with Dwayne Beck
  - Years separating the same type of crop
  - Utilizing both grass and broadleaf crops
  - Having both spring and fall planted crops
  - Presence of warm and cool-season crops
- Which of these components are we missing?



# Winter Wheat Cafe

## Crop Tech Cafe

*Know your crop, know your tech, know your bottom line... feeding you agronomic information for your farm in southeast Nebraska*

HOME CROP ▼ TECH ▼ BOTTOM LINE ▼ LOCAL PROGRAMS ▼ ABOUT ▼

Type and hit enter to Search

### Winter Wheat Cafe for East and South Central Nebraska



2020 Winter Wheat Variety Trial near Fairbury in Jefferson County

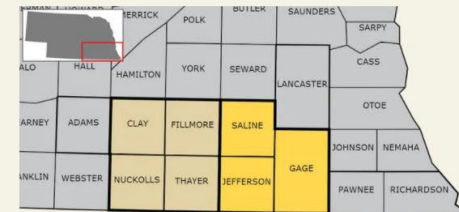
Positioning your farm to manage manure, control tough weeds, and improve soil health are just some of the advantages to growing winter wheat in east and south central Nebraska.

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View at [croptechcafe.org/winterwheat](http://croptechcafe.org/winterwheat)



# Eastern Nebraska Wheat Email Group

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- **194 current members**
- Weekly Email Update: What's Up This Wheat?
- Opportunity for members to email others with questions
- Opportunity to be aware of upcoming Extension events related to wheat

Sign up at [croptechcafe.org/winterwheat](https://croptechcafe.org/winterwheat)



# Resources and Wrap-Up

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# General Soil Health Resources

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- UNL/NRCS Soil Health Initiative - <https://cropwatch.unl.edu/soilhealth>
- UNL Cover Crops - <https://cropwatch.unl.edu/cover-crops>
- Midwest Cover Crops Council - <https://mccc.msu.edu/>
- Crop Tech Cafe (local Extension website) - <http://croptechcafe.org/soilhealth/>
- Soil Health Nexus – Soil Health Toolbox <https://soilhealthnexus.org/resources/>
- Contact Little Blue NRD, Local NRCS, Local Extension

# Upcoming Events on Soil Health

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- Nebraska Cover Crop and Soil Health Conference
  - Thursday, February 11
  - Online and multiple hosting locations (Beatrice)
  - Link to agenda and registration at: <http://croptechcafe.org/>
- Nebraska On-Farm Research Results Meetings
  - February 25 and 26
  - Online and multiple hosting locations (Beatrice and Wilber)
  - Link to agenda and registration at: <http://croptechcafe.org/>



[croptechcafe.org/winterwheat](http://croptechcafe.org/winterwheat)



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