

# NEBRASKA SOIL CARBON PROJECT

Fall 2021 Informational Packet



## CONTENTS

|                                                                           |    |
|---------------------------------------------------------------------------|----|
| Introduction .....                                                        | 1  |
| Betting on soil, shifting carbon markets may mean money in the bank ..... | 2  |
| Impact of Agricultural Practices on Soil Health .....                     | 3  |
| ESMC Pilot Projects .....                                                 | 6  |
| Meeting Caroline Wade, ESMC Deputy Director .....                         | 7  |
| Cover Crops through NRCS the lens .....                                   | 8  |
| References .....                                                          | 15 |

## INTRODUCTION

As part of enrolling in the Nebraska Soil Carbon Project, farmers will have access to quarterly educational events. Usually, we host a large lunch and invite guest speakers from around Nebraska. Due to meeting restrictions at The Nature Conservancy and NRCS this fall, we're using this document as a stand in for our normal lunches (which we hope to resume in 2022).

This document contains information gathered from various expert sources. We hope you find it useful. If there are any additional topics you'd like to have covered in one of these newsletters or at an in person event next year, please let us know!

For any questions or comments, please e-mail Florencia Abram at [florencia.abram@tnc.org](mailto:florencia.abram@tnc.org).

# BETTING ON SOIL, SHIFTING CARBON MARKETS MAY MEAN MONEY IN THE BANK

Florencia Abram,

*Agronomist and Agriculture Program Manager for  
The Nature Conservancy in Nebraska*

Newsletter - nebrasokasoybeans.org | Summer 2021

As nations and private companies around the world set ambitious greenhouse gas emissions reduction goals, there is growing interest in the role of farmers and the carbon they store in their soils.

At The Nature Conservancy, we're working with private companies in the agricultural supply chain to pay farmers for storing carbon in their soils through practices like no-till, cover crops, and diversified crop rotations. The companies eventually hope to use those carbon removals to account for greenhouse gas reductions in their own supply chains.

## DOLLARS AND SENSE

Many Nebraska farmers have been implementing carbon storing practices for years and taking on the initial uncertainty themselves, motivated by economic and productivity benefits as well as by a land stewardship ethic. While agricultural carbon markets are still coming online (and generating a lot of confusion and discussion in the process!), the main objective of these programs is to accelerate the adoption rate by helping farmers overcome any financial risks and rewarding them for the generated ecosystem benefits.

## The Challenge

Since the dawn of agriculture over 10,000 years ago, farmers and scientists have always found innovative ways to grow more crops. Over the past 30 years especially, new technologies have allowed farmers to intensify production to unprecedented levels. But some of that progress has come with a cost to our soil and water resources. As any farmer knows, the top few inches of soil contain most of its carbon, which plays a critical role in retaining nutrients, preserving soil life, and preventing erosion. Tillage and

annual cropping cycles disturb the soil structure, impacting the porosity that allows water and oxygen to be available for crops. The effects of soil structure loss may be hard to detect as improved crop genetics have likely masked the effect of soil degradation on yields. Fortunately, practices like reduced tillage, cover crops, and diversified rotations can reverse this loss of soil health.

## GOOD SOIL FOR THE GOOD LIFE

As natural stewards of their lands, Nebraska farmers are poised to prove that farming is not incompatible with healthy soils and water. We already know that they are conserving their soils and protecting freshwater ecosystems: close to 50% of Nebraska cropland acres are managed under no-till. And while just an estimated 3% of Nebraska acres have winter cover crops, we see a (pardon the pun) fertile opportunity for its expansion!

Public funds are a great resource to support the expansion of new soil health practices, but they are often insufficient on their own to scale practices to every Nebraska farm. Private support from carbon markets for soil health practices could be an important supplement to those existing resources.

**Nebraska farmers continue to lead the world in food, fuel, and fiber production. Now they have an opportunity to lead the world in soil and water conservation.**



# IMPACT OF AGRICULTURAL PRACTICES ON SOIL HEALTH

Alori et al.

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*Adapted version*

A healthy soil is physically, nutritionally, biologically balanced, productive, and stable, and can withstand environmental impacts without loss of fertility, structure, and biological activity. A healthy soil is one that has continued capacity to function as a vital living ecosystem for sustaining plants, animals, and humans. **However, these soil-based biological processes may become disturbed or altered by factors such as addition of agricultural inputs, tillage, and irrigation.** More specifically, underuse, overuse, and adequate use of crop production inputs influence the health of any soil.



## IMPORTANCE OF A HEALTHY SOIL

The soil is an ecosystem containing living organisms that require the basic necessities of life (food, shelter, water) to produce food, shelter, and fibre for humans. Healthy soil provides nutrients for plant growth, absorbs and holds rainwater for use during drier periods, filters and buffers potential pollutants from leaving our fields, and serves as a firm foundation for agricultural activities. A healthy soil gives us clean air and water, bountiful crops and forests, productive grazing lands, diverse wildlife, and beautiful landscapes

For a soil to be healthy, it must comply with the following characteristics:

1. It must be able to effectively and efficiently accommodate active and diverse populations of **beneficial organisms**, with minimum populations of plant pests and pathogens.
2. It must contain high levels of relatively **fresh residues** that provide beneficial organisms with food. The **decomposed organic matter** content of a healthy soil must be very high as this will help to retain both water and readily leachable nutrients.
3. The soil should contain low levels of **toxic compounds** such as soluble aluminum and only low to moderate concentrations of salt.
4. A healthy soil can only support adequate **levels of nutrients** because excessive nutrients can make the crop more attractive to insect pests or can increase the threat of surface or subsurface water pollution.
5. It must have a sufficiently **porous surface**, with many pores connected to subsoil to permit easy entry by rainfall or irrigation water.



6. It has good tilth to allow plant roots to easily penetrate large volumes of soil.
7. A healthy soil will provide **physical stability** and support for plants and regulate water; the soil helps control where rain, snowmelt, and irrigation water go. Water and dissolved solutes flow over the land or into and through the soil.
8. A good soil sustains **plant and animal life** and filters and buffers potential pollutants.

## STRATEGIES FOR IMPROVED SOIL HEALTH

Soil health can be maintained or improved by engaging in agricultural practices that are based on the principles of:

- **minimizing soil disturbances,**
- **keeping the soil covered,**
- **maximizing plant diversity, and**
- **maximizing the period of living root growth.**

Managing soil for improved health demands a long-term commitment to using combinations of soil-enhancing practices, keeping in mind the soil natural characteristics such as texture, natural drainage class, and slope.

The following agricultural practices can enhance improved soil health:

### Cover Cropping.

The practice of cover cropping could include the use of living vegetation or crop residue. **Cover crop roots improve soil aggregation and reduce erosion.** Cover crop residue also reduces the impact of raindrops on the soil surface and serves as a habitat and food source for soil microbes. As organisms decompose the residue, nutrients are released back into the soil. The residue protects soils from moisture and temperature extremes and allows earthworms to adjust gradually to decreasing temperatures, reducing their mortality.

Intensive use of cover crops supplies nitrogen to the succeeding crops, soaks up leftover soil nitrates, increases soil organisms, and improves crop health as it reduces runoff, erosion, and soil compaction..

### Crop Rotation

The practice of crop rotation can help to manage soil and soil fertility, reduce soil loss, increase nutrients available for crop use, improve the workability of the soil, reduce soil crusting, increase water available for plants, reduce erosion and sedimentation, and recycle nutrients in the soil, hence improving soil health. However, a strong strategy for long-term resiliency is to increase plant diversity in the rotation system.

### Conservation Tillage

Reducing tillage to either no-till or strip-till minimizes disruptions to soil aggregates by not constantly breaking them up. **Minimal tillage maintains natural aggregates and helps prevent loose soil particles from washing or blowing away easily.** Residue decomposes more slowly under a reduced tillage system because fewer aggregates are broken up with less intensive tillage and less organic matter is therefore exposed to decomposition.

More reduced tillage also can make soil temperatures slightly cooler, and the lower temperatures help organic matter accumulate because the residue is not broken down as quickly. **Reducing tillage can increase soil organism diversity and activity.** Reduced tillage does not disrupt earthworm burrowing and helps protect the network created by mycorrhizal fungi that connects them to their host plant.

Leaving residue on the soil surface also acts as a barrier against raindrops and wind that could cause erosion.

Full article access using this link  
<https://link.springer.com/content/pdf/10.1007%2F978-3-030-44364-1.pdf>



# ESMC PILOT PROJECT

## A LOW-RISK CARBON MARKET OPPORTUNITY FOR FARMERS

Farmers participating in the Nebraska Carbon Project, or just interested in trying out the "carbon market" experience, have an opportunity to be part of an **Ecosystem Services Market Consortium (ESMC) pilot project**. Unlike other carbon payment programs, project farmers will be paid on an acreage basis and not based on the amount of carbon stored.

THIS GUARANTEED BY-ACRE RATE INTENDS TO **DE-RISK THE ADOPTION OF NEW PRACTICES** FOR OUR FARMER COOPERATORS AND ALLOWS PRODUCERS TO BETTER UNDERSTAND THEIR **SOILS' CARBON STORAGE POTENTIAL** AND THE **DATA REQUIREMENTS** OF PARTICIPATING IN A CARBON MARKET.

While there are many carbon programs available to producers, we are working with ESMC on this project because:

1. **The contract for this pilot project is non-binding**, meaning farmers will sign year-by-year annual contracts. If they choose to not renew their contract, they can leave the program without penalty from ESMC. This allows farmers to try out a program without a binding, multi-year contract.
2. **The payments are non-variable**. Other carbon payments are variable year to year and based on actual carbon storage rates. This pilot will pay farmers a flat-rate of \$3 per acre per year regardless of current market payment rates or the amount of carbon stored per year. This is intended to give farmers certainty around the level of revenue they'll generate through this project while learning the real potential of their soils to store carbon.
3. **Simplified data collection**. ESMC is piloting multiple data collection methods, including remote imaging, to reduce the data burden placed on farmers.
4. **"Stacked" payments**. ESMC is developing ways to compensate farmers for multiple benefits from the same practice on the same acres. In addition to soil carbon storage, benefits include water quality improvements and biodiversity.
5. **ESMC is a not for profit**. ESMC's non-profit structure minimizes transaction costs and maximizes value for farmers. They are a private-public partnership, with backing from Foundation for Food and Agriculture Research.

For more information about ESMC you can reach out to the project coordinators or visit the ESMC website at [ecosystems-services-market.org](https://ecosystems-services-market.org).



## MEETING CAROLINE WADE

### ESMC DEPUTY DIRECTOR



*Caroline, how did you end up at ES&MC?*

My professional pathway to a career in agricultural sustainability and to my role at ES&MC was not a pre-planned or straight-line trajectory, and in both cases involved some serendipitous aligning of the stars! I started my career focused primarily on water quality from a point source and environmental health perspective.

After completing my undergraduate degree in Environmental Health, I got involved with the agriculture field when accepting a position as ag director for the ISU ag research lab. Eventually, I completed a master's degree in agriculture. It has been a very productive combination of disciplines and has positioned me well to engage in the ag sustainability space. My path to ES&MC also happened by chance. I had worked with ES&MC's founders, Debbie Reed and Bruce Knight, in different contexts in past roles with the Illinois Corn Growers Association and The Nature Conservancy during my time in Illinois. In 2019, I relocated to Virginia to be closer to family. By chance, I met in DC with Bruce and Debbie while exploring other work opportunities with a mutual colleague. At that meeting, I learned that they were looking to hire a Project Manager. I signed a contract with ES&MC the following week! The most important lesson I've learned in my career is to be open to all opportunities and expect the unexpected. It helps to have a career plan but don't let it restrict your options!

*What makes you excited about ecosystem (including soil carbon) markets?*

Having worked directly with producers for many years to encourage and incentivize the adoption of conservation practices with varying degrees of success, I'm excited about ES&MC's stacked ecosystems market approach because it is designed to be a streamlined, efficient mechanism that resonates with producers from a business perspective. In the market program, producers will be paid for the outcomes that they are generating which is more in line with their current business model of being paid to produce a product. Programs that use a market mechanism to maximize the return to producers for the ecosystem services they are providing will clearly connect producers with the value of those services and will reinforce an understanding of the benefits for their communities and society more broadly.

*What is the role of pilot projects like this one in helping ES&MC develop their market?*

These on-the ground pilot projects are critical for refining and pressure testing our program and our implementation strategies. We are building the program while simultaneously working with standard-setting bodies to determine the rules and requirements and working with asset buyers to understand their asset reporting needs. Gathering producer participant input and feedback on proposed changes and needed adjustments to the program as it is being built is the only way ES&MC will be successful in establishing a market program that both producers and buyers will embrace and scale up. We really appreciate the innovative, flexible, and curious attitudes of the producer participants and pilot partners in our research program! You all are vital to the work that ES&MC is doing!



# COVER CROPS THROUGH THE NRCS LENS

Natural Resources Conservation Service | September 2007

## WHAT ARE COVER CROPS?

Cover crops are non-harvested crops including grasses, legumes, or forbs, planted for seasonal cover and other conservation purposes.

## WHAT CAN COVER CROPS DO FOR FARMERS?

Cover crops are planted to fulfill any of these objectives:

- Reduce erosion from wind and water
- Increase soil organic matter content
- Capture and recycle or redistribute nutrients in the soil profile
- Promote biological nitrogen fixation and reduce energy use
- Increase biodiversity
- Suppress Weeds
- Manage soil moisture
- Minimize and reduce soil compaction.



## WHAT IS THE NRCS CRITERIA FOR A COVER CROP?

- Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with approved local criteria including all Federal, state and local laws, and site conditions.
- The species selected will be compatible with other components of the cropping system, including the nutrient and pest management provisions of the conservation plan.
- Avoid using plants that are on the state's noxious weed or invasive species lists.
- Cover crops will be terminated by frost, tillage, mowing, crimping, and/or herbicides in preparation for the following crop.
- Ensure herbicides used with cover crops are compatible with the following crop.
- Cover crop residue will not be burned.



# IMPORTANT CONSIDERATIONS

Cover crops may be used for various purposes and conditions. Refer to **Table 1 and Table 2** for uses and recommendations.

Cover crops are especially beneficial after harvesting early crops such as soybeans, seed corn, and corn silage. At this time, the soil has little residue cover, exposing it to wind and water erosion.

**Hairy vetch** is an excellent legume cover crop in no-till cropping systems that will produce nitrogen for next year's crop.

**Oats** are a good choice for fall forage, because it has the greatest forage yield potential of small grains planted in the fall. Another advantage of oats is that it will die over winter and not interfere with next year's crop. Oat residue, however, is not very durable and provides less effective soil protection for a shorter time. Turnips can also be a good choice for fall forage in field with high residue levels and can be planted with oats.

**Rye** provides the best soil protection, among the small grains. Rye also provides abundant early spring growth that can be used for forage. Fall growth is a little better than wheat or triticale, but not as good as oats. It also provides allelopathic effects for weed suppression if it is allowed to mature.



Triticale is the best to maximize **late spring forage** yield and quality, especially as hay or silage. While more expensive to plant and less winter hardy than rye, it can't be beat for late spring forage.

**Winter wheat** is a good choice by providing a dual option of grain production and/or winter soil protection.

During **wet years**, fall planted cover crops can help dry the surface, which allows earlier spring planting.

To **maximize erosion control, biomass and other soil quality parameters**, maintain an actively growing cover crop as late as feasible to maximize plant growth. Use deep-rooted species such as rye for winter annual or sorghums for summer annuals to maximize nutrient recovery.

Use **annual grasses** to utilize more soil nitrogen, and legumes to utilize both nitrogen and phosphorus.

**Avoid using the same cover crop species year after year. This can lead to more diseases or insect problems.**

**Grazing livestock** on annuals allows longer rest periods for pastures. This results in more forage, and in turn, reduces feed requirements. This practice also increases biological activity because of all the added flora of the rumen and returns nutrients back to the soil in the form of manure. The grazing of slightly more mature material mixed with a lower carbon to nitrogen (C:N) ratio species can help increase soil organic matter and get the nutrients in a more available form for the next crop.

**These reasons can be positive as long as the primary purpose of the cover crop is not compromised.**



**TABLE 1.** TYPE OF COVER, RATE OF PLANTING, WHEN TO PLANT AND WINTER HARDINESS

| Cover Crop Type           | Rate of Seeding             | Time of Planting                                    | Winter Hardy              |
|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------|
| Alfalfa                   | 8-12 lbs/ac                 | Jan 4-May 15 or Aug 15-Sept 15                      | Yes                       |
| Barley                    | 50-55 lbs/ac                | Mar 15-May 15 or Aug 1-Sept 15                      | Spring barley: No         |
| Buckwheat                 | 40-50 lbs/ac                | Jul 1 - Aug 1                                       | No                        |
| Chickpea                  | 95-100 lbs/ac               | Apr 15 - May 15                                     | No                        |
| Clover, Persian           | 8 lbs/ac                    | Mar 15-May 15 or Jul 15-Sept 15                     | to 10-15° F               |
| Corn (BMR)                | 34 lbs/ac                   | May 15 - Aug 15                                     | No                        |
| Cowpeas                   | 20-30 lbs/ac                | Jun 1-Aug 15 (VZ I,II) or May 15-Aug 15 (VZ III,IV) | No                        |
| Field Pea                 | 80-100 lbs/ac               | Mar 15 - Apr 15.                                    | No                        |
| Flax                      | 30-40 lbs/ac                | Apr 20 - May 10                                     | No                        |
| Foxtail Millet            | 15-25 lbs/ac                | May 15 - Aug 15                                     | No                        |
| Mustard (Brown)           | 3-6 lbs/ac                  | Mar 15 - Apr 1                                      | No                        |
| Oats, spring              | 45-50 lbs/ac                | Mar 15-May 1 or Aug 1-Sept 1                        | to -25°F                  |
| Oats, winter              | 40-45 lbs/ac                | Mar 15-May 15 or Aug 1-Sept 15                      | to -5°F                   |
| Pearl Millet              | 10-15 lbs/ac                | May 15 - Aug 15                                     | No                        |
| Proso Millet              | 8-16 lbs/ac                 | May 15 - Aug 15                                     | No                        |
| Radish                    | 4-6 lbs/ac                  | Mar 15-May 15 or Jul 15-Aug 8                       | to 15-20°F                |
| Rapeseed/Canola           | 4-6 lbs/ac                  | Mar 15-Apr 15 or Aug 22-Sept 12                     | to -20°F                  |
| Red Clover                | 6-8 lbs/ac                  | Aug 15-Sept 15 or Mar 15-May 15                     | to -20°F                  |
| Rye, cereal (VZ* I, II)   | 35-50 lbs/ac                | Aug 01-Oct 15 or Nov 15-Mar 15                      | Yes (-30°F)               |
| Rye, Cereal (VZ III, IV)  | 35-50 lbs/ac                | Aug 01-Nov 1 or Nov 15-Mar 15                       | Yes (-30°F)               |
| Rye & Vetch               | 50-60 lbs/ac & 15-20 lbs/ac | Mar 15-May 15 or Aug 1-Sept 15                      | Refer to individual crops |
| Ryegrass (Annual)         | 20-25 lbs/ac                | Mar 15-May 15 or Aug 1-Sept 15                      | to 0°F                    |
| Safflower                 | 20-25 lbs/ac                | Apr 20 - May 10                                     | No                        |
| Sorghum or Forage Sorghum | 10-15 lbs/ac                | May 15 - Aug 15                                     | No                        |
| Sorghum Sudan             | 15-25 lbs/ac                | May 15 - Aug 15                                     | No                        |
| Soybeans                  | 30-45 lbs/ac                | Jun 1 - Jul 15                                      | No                        |
| Sudangrass                | 15-25 lbs/ac                | May 15 - Aug 15                                     | No                        |
| Sunflower                 | 3 lbs/ac                    | May 15 - Aug 15                                     | No                        |

\*VZ = Vegetative Zone



| Cover Crop Type                | Rate of Seeding | Time of Planting                | Winter Hardy |
|--------------------------------|-----------------|---------------------------------|--------------|
| Sweet Clover                   | 8-10 lbs/ac     | Aug 01-Sept 15 or Nov 1-May 15  | to -20°F     |
| Triticale, winter (VZ I, II)   | 45-50 lbs/ac    | Aug 1 - Sept 15                 | to -20°F     |
| Triticale, winter (VZ III, IV) | 45-50 lbs/ac    | Aug 1 - Oct 15                  | to -20°F     |
| Turnips (VZ I, II)             | 2-6 lbs/ac      | Jul 15 - Sept 1                 | to -20°F     |
| Turnips (VZ III, IV)           | 2-6 lbs/ac      | Jul 1 - Sept 1                  | to -20°F     |
| Vetch (Hairy)                  | 15-20 lbs/ac    | Aug 01-Sept 15 or Nov 1-May 15  | to -20°F     |
| Vetch (Common)                 | 20 lbs/ac       | Jul 15-Sept 15 or Mar 15-Apr 15 | to 10-15°F   |
| Wheat, winter (VZ I, II)       | 45-50 lbs/ac    | Aug 15-Sept 15 or Mar 15-May 15 | to -20°F     |
| Wheat, winter (VZ III, IV)     | 45-50 lbs/ac    | Aug 15-Oct 15 or Mar 15-May 15  | to -20°F     |

We recommend the utilization of **NRCS's Cover Crop Design Worksheet** to find the best suited species, rates, and planting dates.

You can access this tool through this website: <https://efotg.sc.egov.usda.gov/#/state/NE> (Click on Document Search and then type in "Cover Crops Design Worksheet").



**TABLE 2.** MANAGEMENT AND USE OF COVER CROPS

| Use of Cover                         | Cover Type                                                                                                                                | Management of CC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Biodiversity</b>                  | All appropriate types                                                                                                                     | Select cover type based on the management objective: increase plant diversity, to attract beneficial insects, trap damaging insects, provide food and cover for wildlife. Cover crop types include warm season/cool season grass cover crops and warm season/cool season broadleaf cover crops. Select a cover crop with varying growth cycles to maximize bio-diversity benefits. Carbon is the largest element used by plants, and managing carbon through crop rotations and cover crops provides both diversity and intensity, and along with no till will have the greatest impact on crop production and soil health. |
| <b>Companion Cover Crop</b>          | Oats or other spring small grains                                                                                                         | Plant at the same time as cool season grasses or legume seedings. Avoid planting high rates or allowing oats to mature as it will compete too much with grass/legume seeding.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Forage</b>                        | Oats, Triticale and all small grains, Pearl Millet, Rye, Forage Sorghum, Sorghum-Sudan, Sudangrass, Triticale, Wheat, Oats, Rape, Turnips | Select species based on supplemental feed needs and palatability. Haying and grazing will be managed to provide/retain adequate cover for resource protection. For fall forage, oats is a good choice because it has the greatest forage yield potential of small grains planted in the fall. Turnips can also be a good choice for fall forage in field with high residue levels and can be planted with oats. To maximize late spring forage yield and quality, especially as hay or silage, triticale is best. For summer forage sorghum sudan or other warm season grasses with high yield potential are best.          |
| <b>Nitrogen Fixation Cover Crops</b> | All appropriate legume cover crops listed in Table 1                                                                                      | Plant early enough to ensure adequate growth and fixation prior to planting the crop that will utilize the fixed Nitrogen (i.e. Corn, Sorghum, Small Grains, etc.)                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



| Use of Cover                            | Cover Type                                                                           | Management of CC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ground Cover for Erosion Control</b> | All Types, depending on the amount of biomass, and timing of growth needed           | Whenever temporary cover crops are needed for erosion control or weed control (construction sites, vineyards, orchards, windbreaks, etc.) Cover crops should be reseeded annually as needed. Select cover crop that best fits the timing and amount of cover needed. For example, oats can be used for spring seedings; wheat, rye or annual ryegrass for fall seedings.                                                                                                                                            |
| <b>Native Grass Planting</b>            | Corn, Sorghum, Sorghum-Sudan Cross, Millet, Sudan, Forage Sorghum, Late Planted Oats | Plant cover crop in July through Mid-August to achieve 12-18 inches of growth prior to killing frost, otherwise plant earlier and plan to harvest and allow for 12-18 inches of re-growth prior to a killing frost. Manage cover crops so they do not over- grow or go to seed. Remove excess growth if necessary. Refer to Herbaceous Vegetation Design Procedures (550DP)                                                                                                                                         |
| <b>Soil Compaction</b>                  | Sudangrass, Sweet clover, Sorghums                                                   | Select species that will produce deep tap roots and large amounts of root biomass.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>No-till cover crops</b>              | All appropriate types based on the crop to be no-tilled                              | Plant directly into dead residue. Be aware of allelopathic effects. Select cover crops with based on growth cycle, erosion control, ability to kill cover crop with burn-down herbicides and amount of biomass desired. The goal for cover crops is to increase biological diversity and to keep live growing crops in place as much of the year as possible as well as providing cover. Hairy vetch is an excellent legume cover crop in no-till cropping systems that will produce nitrogen for next year's crop. |



| Use of Cover                                            | Cover Type                                                                                                                                                         | Management of CC                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Nutrient Utilization/ tie-up of excess nutrients</b> | All appropriate types                                                                                                                                              | Select cover crops based on the time of year that nutrient tie-up/uptake is desired and those that maximize nutrient uptake (i.e. Forage Sorghum or Sudan cut for forage during the summer). Refer to the National Engineering Handbook, Ag Waste Management Field Handbook, Chapter 6 for the amount of nutrients tied up or used. Use Rye, Wheat or Rye/Vetch for fall seeding immediately following harvest of spring seeded crops. |
| <b>Soil Organic Matter Content</b>                      | All Types                                                                                                                                                          | Utilize the Soil Conditioning Index (RUSLE2) to determine the amount of biomass and type of cover required to result in a positive value. Plant as early as possible (Table 1) and terminate as late as possible except where soil moisture depletion is a concern. Cover crops with the highest amount of biomass (root and above ground) will improve organic matter the fastest.                                                    |
| <b>Wind or Water Erosion Control</b>                    | Rye, Rye/Vetch, Oats, Wheat, Triticale, Annual Ryegrass, Italian Ryegrass, Summer annual cover crops should be used when cover is needed during the summer months. | Plant as early as possible in the fall to maximize growth and residue production needed. Burn back growth with chemical or undercut after April 15th or later to maximize growth before planting. A minimum of 12 inches of growth is optimal to achieve best results for erosion control. Refer to Nebraska Agronomy Technical Note No. 109.                                                                                          |
| <b>Weed suppression (allelopathic)</b>                  | Rye (best), and other small grains, Sweetclover (best) and other legumes (refer to table 1)                                                                        | For maximum benefits allow Rye (other small grains) to reseed itself over several years. Rye and other small grains must be allowed to go to maturity and residue must be retained.                                                                                                                                                                                                                                                    |



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IF YOU WANT TO LEARN MORE ABOUT THE

# NEBRASKA SOIL CARBON PROJECT

**PLEASE CONTACT:**

**Jacob Fritton**

Email: [jfritton@tnc.org](mailto:jfritton@tnc.org)

Phone: (308) 529-2636

*or*

**Florencia Abram**

Email: [florencia.abram@tnc.org](mailto:florencia.abram@tnc.org)

Phone: (979) 922-0960

