United States Department of Agriculture

## CONSERVATION ENHANCEMENT ACTIVITY

## E340E

CONSERVATION STEWARDSHIP PROGRAM

# Use of soil health assessment to assist with development of cover crop mix to improve soil health

### Conservation Practice 340: Cover Crop

**APPLICABLE LAND USE: Crop (Annual & Mixed)**

**RESOURCE CONCERN: Soil**

**ENHANCEMENT LIFE SPAN: 1 Year**

**Enhancement Description**

Soil health assessment (year 1) to evaluate current crop rotation in addressing soil organic matter depletion. Results are utilized to select a multi-species cover crop mix to add to the current crop rotation. Follow up assessment completed (year 3).

**Criteria**

- Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with applicable local criteria and soil/site conditions (**REFER TO STATE SPECIFIC LISTS**).
- Determine the method and timing of termination to meet the grower's objective and the current NRCS Cover Crop Termination Guidelines.
- Select species that are compatible with other components of the cropping system.
- Ensure herbicides used with crops are compatible with cover crop selections.

- Cover crops may be established between successive production crops, or companion-planted or relay-planted into production crops. Select species and planting dates that will not compete with the production crop yield or harvest.
- Do not burn cover crop residue. Do not harvest the cover crop.
- If the specific rhizobium bacteria for the selected legume are not present in the soil, treat the seed with the appropriate inoculum at the time of planting.
- Cover crop must provide soil coverage during all non-crop production periods to the maximum extent possible considering the cropping system, climate, and soils in the annual crop rotation. (**STATES SHALL PREPARE GUIDANCE FOR THEIR LOCAL CLIMATES AND CROPPING SYSTEMS**)
- Soil health assessment will be used to evaluate impact of current conservation crop rotation in addressing soil organic matter depletion, as well as additional soil health objectives of the individual grower (primary assessment made in Year 1). During Year 3, a follow up assessment will be completed to allow time for the addition of a cover crop and other management activities to have an impact on soil health. No specific soil health assessment type is required or recommended by NRCS, but at a minimum the assessment must account for soil organic matter. The specific assessment selected should provide the grower information based on their soil health objectives.
- Minimum 4 species cover crop mix will be selected based on producing higher volumes of organic material and root mass to maintain or increase soil organic matter. The cover crop mix must be compatible with the local soil, climate, and cropping systems.
- Planned crop rotation including cover crops, biomass produced, and associated management activities must achieve a management soil conditioning index (SCI) of zero or higher and results in a positive trend in the Organic Matter (OM) sub factor value over the life of the rotation.

**Additional criteria when livestock are included in the system:**

*Cover Crops may only be grazed in a manner that retains or enhances the purpose of increasing soil organic matter.*

- Grazing plan must be developed to document livestock management. Plan must include at a minimum a forage estimate and livestock inventory for all fields implementing this enhancement that will be grazed. For soil health benefits, utilization by livestock must be less than 50% of available cover crop forage.

- Before cover crops are grazed, they must have produced enough biomass to allow for grazing while maintaining soil health benefits. Cover crops planted in late fall will not typically be well enough established, however if stands are adequate cover crops may be grazed in the spring prior to termination.

- Different cover crop species have varying tolerances to grazing; this should be taken into consideration when developing cover crop seeding specifications.

- Grazing shall not occur during wet soil conditions.

- Some pesticides have restrictions on grazing following application (up to 18 months). Refer to pesticide labels.

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**Documentation and Implementation Requirements**

**Participant will:**

- ☐ Prior to implementation, provide NRCS with the current and planned crop rotation and field operation(s) used for each crop.

**Current Management Rotation**

| Field | Planned Crops/Cover Crop (in sequence) | Planting Date | Harvest/Termination Date |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

**Current Field Operations for each crop**

| Field | Crop | Field Operation | Timing of Field Operation (month/year) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Planned Management Rotation Including Cover Crop**

| Field | Planned Crops/Cover Crop (in sequence) | Planting Date | Harvest/Termination Date |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

**Cover Crop Mix *(minimum of 4 species)* and Seeding Rate**

| Species | Variety | Seed Size | Typical Seeding Depth | Seeding Rate (PLS lbs/acre) | Percent of Mix (%) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Establishment and Management Considerations:**

| Task | Provide information and details |
|---|---|
| Seedbed Preparation | |
| Seeding Date | |
| Seeding Depth | |
| Seeding Method | |
| Fertilizer, as needed | |
| Weed Management, as needed | |
| Grazing Management, as needed | |
| Termination Date (window) | |
| Termination Method | |

**Soil Health Assessment:**

| Producer Objective | Year 1 Assessment Value | Year 3 Assessment Value |
|---|---|---|
| Soil Organic Matter (required) | | |
| | | |
| | | |

☐ Prior to implementation, read and follow current NRCS Cover Crop Termination Guidelines.

☐ Prior to implementation, if livestock are included in the system consider cover crop species tolerant to grazing.

- ☐ Prior to implementation, if livestock are included in the system develop a grazing plan which must document livestock management. Plan must include at a minimum a forage estimate and livestock inventory for all fields implementing this enhancement that will be grazed. For soil health benefits, utilization by livestock must be less than 50% of available cover crop forage.
- ☐ During implementation, cover crops must not be burned or harvested.
- ☐ During implementation, if livestock are included in the system maintain records of forage utilization.
- ☐ During implementation, notify NRCS of any planned changes in crops, crop rotation, or unharvested areas to verify the planned system meets the enhancement criteria.
- ☐ After implementation, if changes to the cover crop and crop rotation were made, complete the tables above to document the applied Cover Crop for the contract period and provide to NRCS.
- ☐ After implementation, if livestock are included in the system provide grazing plan and forage utilization records to NRCS for review to verify additional criteria of the enhancement were met.
- ☐ After implementation, provide soil health assessment results and any documentation of changes made to NRCS for review to verify implementation of the enhancement.

**NRCS will:**

- ☐ As needed, provide technical assistance in selecting cover crop mixes for the crop rotations or substitute species that would meet the criteria of the enhancement.
- ☐ As needed, provide additional assistance to the participant as requested.
- ☐ Prior to implementation, provide and explain the current NRCS Cover Crop Termination Guidelines.
- ☐ Prior to implementation, use information provided from the participant to calculate the management Soil Conditioning Index (SCI) and Organic Matter (OM) sub factor value over the life of the rotation using current NRCS Soil Conditioning Index (SCI) procedure. Cover crop must increase SCI and OM sub factor from the current/benchmark condition and SCI value must be 0 or greater and have a positive trend in OM sub factor over the life of the rotation.

  **Benchmark Management SCI = _____, Benchmark Management OM sub factor = _____**

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**Planned Management SCI = _____,**

**Planned Management OM sub factor = _____**

- ☐ Prior to implementation, <u>if livestock are included in the system</u> verify a grazing plan has been developed.

- ☐ During implementation, evaluate planned adjustments in cover crop selected, timing in crop rotation, management, or field operations to verify the new system meets the enhancement criteria.
- ☐ After implementation, evaluate the applied crop rotation or management using information provided from the participant, if any variation to planned evaluation, then calculate SCI values to document that the applied rotation met the enhancement criteria.

  **Applied Management SCI = _____, Applied Management OM sub factor = _____**
- ☐ After implementation, <u>if livestock are included in the system</u> review grazing plan and forage utilization records to verify additional criteria of the enhancement were met.
- ☐ After implementation, review soil health assessment results and any documentation of changes made to verify implementation of the enhancement.

**<u>NRCS Documentation Review:</u>**

I have reviewed all required participant documentation and have determined the participant has implemented the enhancement and met all criteria and requirements.

Participant Name _____ Contract Number _____

Total Amount Applied _____ Fiscal Year Completed _____

_____ _____

NRCS Technical Adequacy Signature Date

# SOUTH DAKOTA (SD) SUPPLEMENT TO CONSERVATION ENHANCEMENT ACTIVITY

CONSERVATION STEWARDSHIP PROGRAM

## E340E

**Additional Criteria for SD**

In addition to the criteria specified in the national job sheet E340E, the following additional criteria apply in SD:

- Ninety percent (90%) of the mix will be rated Good (G) or Fair (F) for Increase Soil Organic Matter or have a rating of Medium (M) or High (H) for Mycorrhizal Fungi Association on the attached Cover Crop Table 1.

- A Soil Health Assessment at a minimum must include **organic matter**. Laboratories in and around SD include but are not limited to the following:

AgLab Express
3600 S. Minnesota Avenue; Suite 200
Sioux Falls, SD 57105
Phone: (605) 271-9237
Fax: (605) 271-9238

Agvise Laboratories, Inc.
902 13th Street N; P.O. Box 187
Benson, MN 56215
Phone: (320) 843-4109
Fax: (320) 843-2074

Agvise Laboratories, Inc.
604 Hwy 15 West
P.O. Box 510
Northwood, ND 58267
Phone: (701) 587-6010
Fax: (701) 587-6013

East Prairie Laboratories
48598 234th St.
Flandreau, SD 57028
Phone: (605) 633-0005

Midwest Laboratories
13611 B St.
Omaha, NE 68144
Phone: (402) 334-7770

Minnesota Valley Testing Laboratory
326 Center Street
New Ulm, MN 56073
Phone: (800) 782-3557

Next Level Ag, LLC
617 Pine Avenue N
Alpena, SD 57312
Phone: (605) 849-5227
Fax: (605) 849-3463

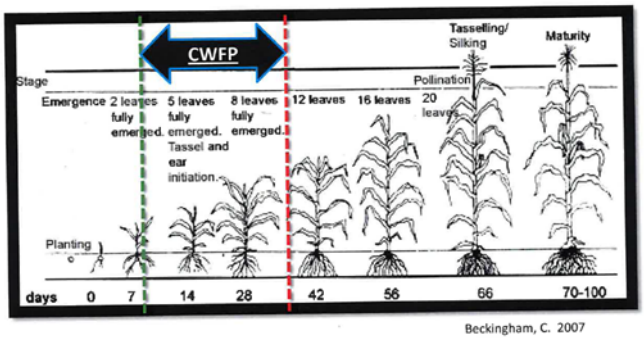
SGS North America Inc.
1405 32nd Ave.
Brookings, SD 57006
Phone: (605) 692-7611

Ward Laboratories
4007 Cherry Avenue
P.O. Box 788
Kearney, NE 68847
Phone: (800) 887-7645

## SD guidance to maximize soil coverage during non-crop production periods:

- **Guidelines for aerial applying cover crops into standing corn:**
  - Aerial apply cover crops when corn plant is dried approximately to the ear and when 50% of the sunlight can reach the ground between the rows.
  - A forecasted rain event within two to three days of cover crop seeding improves germination success.

- **Guidelines for interseeding cover crops into corn:**
  - Critical Weed Free Period (CWFP): The period in the corn growth cycle which weeds must be controlled to prevent yield losses (Mahmoodi, S. And Rahimi, A. 2009).
  - Corn CWFP: 3rd to 8th leaf (34 days after planting (DAP))(Ontario 2010).



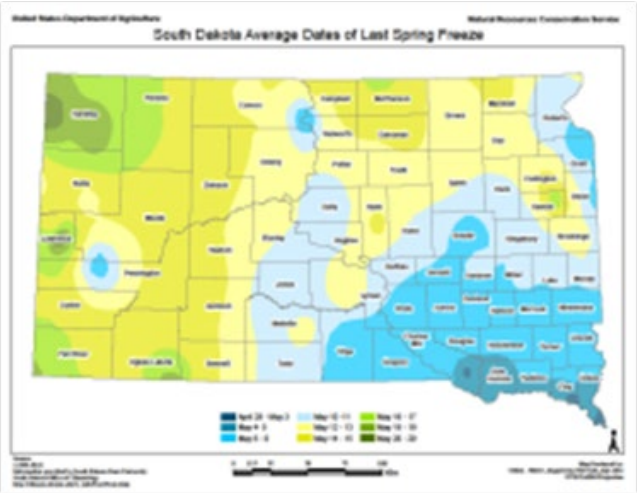

Source: https://www.ag.ndsu.edu/carringtonrec/cover-crops-forum/Possible%20Advantages%20of%20Cover%20Crops%20Interseeded%20at%20V5-V6%20Corn%20in%20SD%20No-Till%20Production%20Systems%20A.%20Bich.pdf

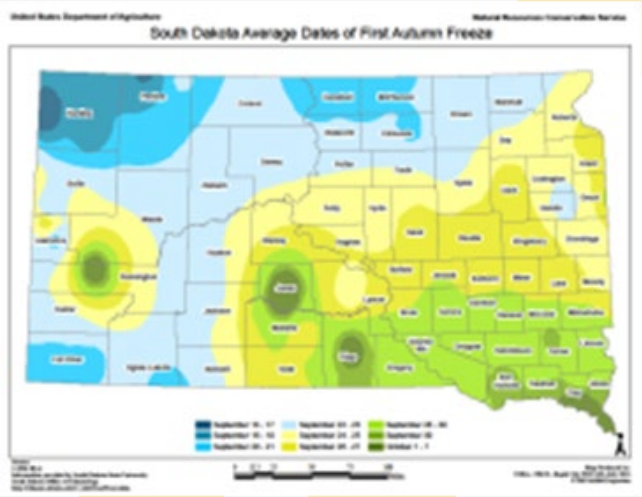
- **Guidelines for aerial applying cover crops into standing soybeans:**
    - Start aerial application of cover crops when the soybean plant is showing 25-50% yellowing of leaves and 40-50% of the sunlight can reach the ground between rows.

- **Guidelines for seeding cover crops into small grains:**
    - Grain harvest through August 5 – warm-season species
    - Grain harvest through August 20 - cool-season winter-kill species
    - August 1 through Winter – species that do not winter kill

- **Average Frost Dates for SD:**

  Maps identifying SD Average Dates of First Autumn Freeze and Last Spring Freeze are located in the Field Office Tech Guide (FOTG) under Section I/Maps/1. General/SD Average Dates of First Autumn Freeze and SD Dates of Last Spring Freeze.




- **Cover Crop Species Selection for Grazing:**
  - Cover crops may only be grazed in a manner that retains or enhances the purpose of increasing soil organic matter.
  - Utilize SD-FS-56 Cover Crop Species Selection for Grazing to estimate forage production of Warm- or Cool-Season Cover Crops. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_036211.pdf

## Table 1: Cover Crop - Common Species and Properties

| Cover Crop | Full seeding rate lbs/acre/4 | Seeding depth, inches | Reduce erosion | Increase soil organic matter | Scavenge nutrients | Biological N fixation | Suppress weeds | Provide supplemental hay | Provide supplemental grazing | Rooting depth / Plant water use /1 | Minimize / Reduce surface soil compaction | Minimize/ Reduce subsoil compaction | Seed size (Large or Fine) | Crop type and seeding dates /2 /3 | Winter Survival | Salinity Tolerance | C:N Ratio | Mycorrhizal fungi association | Seeds/lb | Shade Toler-ance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alfalfa | 6.5 | .25 - .75 | G | G | G | Y | G | G | F | DH | G | G | F | CB | Y | P | L | M | 210,000 | F |
| Barley | 50 | .75 - 2.0 | G | G | G | N | G | G | G | MM | G | F | L | CG | N | G | M | M | 14,000 | F |
| Brassica hybrids | 7 | .25 - .5 | F | F | G | N | G | F | G | MM | G | G | F | CB | N | G | L | N | 180,000 | P |
| Buckwheat /5 | 50 | .5 - 1.5 | P | P | F | N | F | P | P | SL | F | P | L | WB | N | P | L | N | 19,000 | G |
| Cabbage, African | 5 | .25 - .75 | F | F | G | N | F | F | F | MM | G | G | F | CB | N | G | L | N | 180,000 | F |
| Camelina, Winter | 3 | .25 - .5 | F | F | F | N | P | P | P | ML | P | F | F | CB | S | P | L | N | 400,000 | P |
| Canola | 5 | .25 - .75 | F | F | G | N | G | F | F | MM | G | G | F | CB | S | G | L | N | 140,000 | F |
| Clover, Balansa | 5 | .25 - .75 | F | P | F | Y | P | P | F | SL | P | P | F | CB | N | P | L | M | 500,000 | F |
| Clover, Crimson | 15 | .25 - .75 | F | F | F | Y | P | F | F | SM | P | P | F | CB | S | P | L | M | 150,000 | F |
| Clover, Red | 5 | .25 - .75 | G | F | F | Y | F | F | F | SL | F | F | F | CB | Y | P | L | M | 275,000 | G |
| Clover, Sweet | 4 | .25 - 1.0 | G | G | F | Y | G | F | F | MM | G | G | F | CB | Y | F | L | M | 260,000 | G |
| Collards or Kale | 5 | .25 - .5 | F | F | G | N | G | F | G | MM | G | G | F | CB | N | G | L | N | 175,000 | F |
| Corn | 12 | 1 - 1.5 | G | G | G | N | G | F | G | DH | G | G | L | WG | N | P | H | H | 2,500 | F |
| Cowpeas or Dry Beans | 30 | 1 - 1.5 | P | F | F | Y | P | P | F | SL | F | F | L | WB | N | P | L | M | 4,000 | F |
| Fava beans | 75 | 1 - 1.5 | F | F | F | Y | F | G | G | DM | F | F | L | CB | N | F | L | P | 2,500 | P |
| Flax | 30 | .25 - .75 | F | F | F | N | P | P | P | SM | F | P | F | CB | N | P | H | H | 80,000 | P |
| Lentils | 30 | 1 - 1.5 | P | P | P | Y | P | P | P | SL | P | P | F | CB | N | P | L | M | 20,000 | P |
| Millet, hay | 15 | .5 - 1.0 | G | G | G | N | G | G | G | SL | G | F | F | WG | N | P | M | H | 180,000 | P |
| Millet, proso | 25 | .5 - 1.0 | G | G | G | N | G | G | G | SL | G | F | F | WG | N | P | M | H | 80,000 | P |
| Mustard | 6 | .25 - .75 | F | F | F | N | G | F | P | MH | G | F | F | CB | N | P | L | N | 140,000 | P |
| Oats | 70 | .5 - 1.5 | G | G | G | N | G | G | G | MM | G | F | L | CG | N | F | M | H | 16,000 | F |
| Peas | 70 | 1.5 - 3.0 | F | P | P | Y | F | G | G | SL | F | F | L | CB | N | P | L | M | 3,500 | F |
| Phacelia | 4 | .25 - .5 | F | F | F | N | P | P | P | DH | F | P | F | CB | N | P | L | M | 225,000 | F |
| Radishes | 8 | .25 - .75 | F | F | G | N | G | P | G | DH | G | G | F | CB | N | P | L | N | 25,000 | P |
| Rapeseed | 5 | .25 - .75 | F | F | G | N | G | F | G | MM | G | G | F | CB | Y | G | L | N | 140,000 | F |
| Rye, Cereal | 60 | .75 - 2.0 | G | G | G | N | G | G | G | MH | G | G | L | CG | Y | G | H | M | 18,000 | G |
| Ryegrass, Annual | 15 | .5 - 1.5 | G | G | G | N | F | G | G | MM | G | F | F | CG | S | F | M | M | 190,000 | G |
| Safflowers | 30 | .5 - 1.0 | F | F | G | N | F | P | P | DM | F | G | L | WB | N | F | M | M | 15,000 | P |
| Sorghum, Forage and Sudan Hybrids | 15 | .5 - 1.5 | G | G | G | N | G | G | G | MM | G | G | L | WG | N | F | M | H | 17,000 | P |
| Sorghum, Grain | 5 | .5 - 1.5 | G | G | G | N | G | G | G | MM | G | G | L | WG | N | F | M | H | 17,000 | P |
| Soybeans | 35 | 1 - 1.5 | F | P | F | Y | F | F | F | SM | F | F | L | WB | N | P | L | M | 3,000 | F |
| Sudangrass | 20 | .5 - 1.5 | G | G | G | N | G | G | G | MM | G | G | L | WG | N | F | M | H | 25,000 | P |
| Sugar beets | 4 | .25 - .5 | F | P | G | N | F | P | G | DH | G | G | F | CB | N | G | L | N | 22,000 | P |
| Sunflowers | 7 | .5 - 1.0 | F | F | G | N | F | P | G | DM | F | G | L | WB | N | F | M | M | 8,000 | P |
| Sunn hemp | 15 | 1.5 - 2.0 | F | F | F | Y | F | P | F | DM | F | F | L | WB | N | P | L | M | 15,000 | P |
| Teff grass | 5 | .13 - .25 | G | G | F | N | F | G | G | SM | G | F | F | WG | N | P | M | H | 1M | N |
| Triticale | 60 | .5 - 1.5 | G | G | G | N | G | G | G | MH | G | F | L | CG | Y | G | M | M | 15,000 | F |
| Turnips | 4 | .25 - .5 | F | P | G | N | G | P | G | DH | G | G | F | CB | S | P | L | N | 175,000 | P |
| Vetch, Chickling | 50 | .5 - 1.5 | F | F | F | Y | F | F | P | SL | F | F | L | CB | N | P | L | M | 2,500 | F |
| Vetch, Common | 25 | .5 - 1.5 | F | F | F | Y | F | F | G | SM | F | F | L | CB | N | P | L | M | 8,000 | F |
| Vetch, Hairy | 15 | .5 - 1.5 | G | F | F | Y | F | F | F | SM | G | F | L | CB | Y | P | L | M | 14,000 | G |
| Wheat, Spring | 60 | .5 - 1.5 | G | G | G | N | G | G | G | MH | G | F | L | CG | N | G | M | M | 15,000 | F |
| Wheat, Winter | 60 | .75 - 2.0 | G | G | G | N | G | G | G | MH | G | F | L | CG | Y | G | M | M | 15,000 | F |