

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

COVER CROP

(Ac.)

CODE 340

DEFINITION

Crops including grasses, legumes, and forbs for seasonal cover and other conservation purposes.

PURPOSE

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.

Increase biodiversity.

Pest suppression.

Provide supplemental forage.

Soil moisture management.

Reduce particulate emissions into the atmosphere.

Minimize and reduce soil compaction.

CONDITIONS WHERE PRACTICE APPLIES

On all lands requiring vegetative cover for natural resource protection and or improvement.

CRITERIA

General Criteria Applicable to All Purposes

Plant species, seedbed preparation, fertility requirements, and planting methods will be consistent with approved local criteria and site conditions.

The species selected will be compatible with the land user's objectives and other components of the crop management system. Plant species, seeding rates, seeding dates, and planting depth are listed in Table 1 at the end of this standard. The seeding rates in Table 1 represent the minimum seeding rates for proper seed placement with good seed to soil contact.

Select adapted crops and varieties listed in appropriate South Dakota State University (SDSU) publications. Please refer to SD Range Technical Note No. 4 or locally accepted University or Extension agronomy guides, or other accepted technical references for criteria to establish herbaceous vegetation.

In most cases, cover crop mixtures will provide more and greater functions than single species plantings. For example, oats and peas planted together tend to yield more than either species planted alone. Table 2 contains a list of resource concerns and suggested primary species for cover crop mixes in SD.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#), or visit the [electronic Field Office Technical Guide](#).

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Table 2.

Resource Concern	Primary Species
Grazing	turnips, lentils, rape, radish, rye, oat, triticale, sorghum-sudan
Compaction	radish, canola, sugar beet, sunflower, sorghum-sudan, turnip and turnip hybrids
Moisture	rape, clovers, W. wheat, rye, triticale
N-fixation	clovers, vetches, lentils, cowpeas, soybean, field pea
Residue Cycling	brassicas, mustards
Nutrient Cycling	sunflower, sugar beets, brassicas, small grains

If broadcasting seed, increase seeding rates by multiplying the listed pure live seed (PLS) seeding rate by 2.0. Cover crop species or mixes that consist of large seeded species (with the exception of cereal rye) will be drilled-not broadcasted. In addition, broadcasting will only be allowed prior to crop harvest or into a low residue crop.

The selected plant species should have a minimal potential to act as a host in pest cycles for adjacent crops, as well as, for the next crop in the rotation. Therefore, the cover crop species or majority of the cover crop species in the mixture should be the opposite crop type of the following year's cash crop. For example, a broadleaf cover crop is planted prior to a corn crop (warm season grass).

Cover crops will be terminated by harvest, frost, mowing, grazing, tillage, crimping, and/or herbicides in preparation for the following crop. Cover crop residue will not be burned.

Herbicides used with cover crops will be compatible with the following crop. Carefully

evaluate labels of those herbicides that will be used in the cash crop prior to seeding the cover crop for potential herbicide carryover. Most brassicas, legumes, and/or broadleaf cover crops are sensitive to herbicides used for broadleaf weed control.

The land user shall take reasonable measures to control or eradicate any noxious weeds in the field.

Additional Criteria to Reduce Erosion from Wind and Water

Cover crop establishment, in conjunction with other practices, will be timed so that the soil will be adequately protected during the critical erosion period(s).

Plants selected for cover crops will have the physical characteristics necessary to provide adequate protection.

The amount of surface and/or canopy cover needed from the cover crop shall be determined using current erosion prediction technology.

Additional Criteria to Increase Soil Organic Matter Content

Cover crop species will be selected on the basis of producing high volumes of organic material and or root mass to maintain or improve soil organic matter.

The Natural Resources Conservation Service (NRCS) Soil Conditioning Index (SCI) procedure will be used to determine the amount of biomass required to have a positive trend in the soil organic matter subfactor.

The cover crop will be terminated as late as feasible to maximize plant biomass production, considering the time needed to prepare the field for planting the next crop and soil moisture depletion.

Additional Criteria to Capture and Recycle Excess Nutrients in the Soil Profile

Cover crops will be established and actively growing before the expected period(s) of nutrient leaching.

Cover crop species will be selected for their ability to take up large amounts of nutrients from the rooting profile of the soil.

When used to redistribute nutrients from deeper in the profile up to the surface layer, the cover crop will be killed in relation to the planting date of the following crop. If the objective is to best synchronize the use of cover crop as a green manure to cycle nutrients, factors such as the carbon/nitrogen ratios may be considered to kill early and have a faster mineralization of nutrients to match release of nutrient with uptake by following cash crop. A late kill may be used if the objectives are to use as a biocontrol and maximize the addition of organic matter. The right moment to kill the cover crop will depend on the specific rotation, weather, and objectives.

Additional Criteria to Promote Biological Nitrogen Fixation

Only legumes or mixtures containing predominately legumes will be established as cover crops.

The specific Rhizobium bacteria for the selected legume will either be present in the soil or the seed will be inoculated at the time of planting.

Additional Criteria to Increase Biodiversity

Cover crop species shall be selected that are of different crop types (than those used in the current crop rotation), maturity dates, attract beneficial insects, increase soil biological diversity, serve as a trap crop for damaging insects, and/or provide food and cover for wildlife habitat management.

Additional Criteria for Pest Suppression

Species for the cover crop will be selected for their chemical or physical characteristics to compete with weeds and suppress disease or insects.

Cover crops residues will be left on the soil surface to maximize allelopathic (chemical) and mulching (physical) effects.

For long-term weed suppression, reseeding annuals and/or biennial species can be used.

Additional Criteria to Provide Supplemental Forage

Species selected will have desired forage traits, be palatable to livestock, and not interfere with the production of the subsequent crop.

Forage provided by the cover crop may be hayed or grazed, as long as, sufficient biomass is left for resource protection.

Additional Criteria for Soil Moisture Management

Terminate growth of the cover crop sufficiently early to conserve soil moisture for the subsequent crop. Cover crops established for moisture conservation shall be left on the soil surface.

In areas of potential excess soil moisture, allow the cover crop to grow, as long as, possible to maximize soil moisture removal.

Additional Criteria to Reduce Particulate Emissions into the Atmosphere

Manage cover crops and their residues so that at least 80 percent ground cover is maintained during planting operations for the following crop.

Additional Criteria to Minimize and Reduce Soil Compaction

Select and manage cover crop species that will produce deep roots and large amounts of surface or root biomass to increase soil organic matter, improve soil structure and increase soil moisture through better infiltration.

CONSIDERATIONS

Maintain an actively growing cover crop as late as feasible to maximize plant growth, allowing time to prepare the field for the next crop and moisture depletion.

Use deep-rooted species to maximize nutrient recovery.

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

For most purposes for which cover crops are established, the combined canopy and surface cover is at nearly 90 percent or greater, and the above ground (dry weight) biomass production is at least 4,000 lbs/acre.

Cover crops may be used to improve site conditions for establishment of perennial species.

Use plant species that enhance bio-fuels opportunities.

Use plant species that enhance forage opportunities for pollinators.

PLANS AND SPECIFICATIONS

Plans and specifications will be prepared for the practice site. Plans for the establishment of cover crops shall include:

Species or species of plants to be established.

Seeding rates.

Recommended seeding dates.

Establishment procedure.

Planned rates and timing of nutrient application.

Planned dates for destroying cover crop.

Other information pertinent to establishing and managing the cover crop.

Plans and specifications for the establishment and management of cover crops may be recorded in narrative form, on job sheets, or on other forms.

OPERATION AND MAINTENANCE

Control growth of the cover crop to reduce competition from volunteer plants and shading.

Control weeds in cover crops by mowing or by using other pest management techniques.

Control soil moisture depletion by selecting water efficient plant species and terminating the cover crop before excessive transpiration.

REFERENCES

Bowman, G., C. Cramer, and C. Shirley. A. Clark (ed.). 1998. Managing cover crops profitably. 2nd ed. Sustainable Agriculture Network Handbook Series; bk. 3. National Agriculture Library. Beltsville, MD.

Hargrove, W.L., ed. Cover crops for clean water. SWCS, 1991.

Magdoff, F. and H. van Es. Cover Crops. 2000. p. 87-96. In Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series; bk. 4. National Agriculture Library. Beltsville, MD.

Reeves, D.W. 1994. Cover crops and erosion. p. 125-172 In J.L. Hatfield and B.A. Stewart (eds.) Crops Residue Management. CRC Press, Boca Raton, FL.

Managing Cover Crops Profitably, Third Edition, Sustainable Agriculture Network <http://www.sare.org/publications/covercrops.htm>.

Overview of Cover Crops and Green Manures – www.attra.ncat.org.

Table 1: Cover Crop - Common Species and Properties

Cover Crop	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Erosion Reduction	Increase soil organic matter	Capture, recycle, redistribute nutrients in the soil profile	Promote biological nitrogen fixation	Weed suppression	Provide supplemental hay	Provide supplemental grazing	Rooting Depth / Plant Water Use	Minimize / reduce soil compaction	Seed size (Large or Fine)	Crop Type /2	Seeding rate, lbs/acre	Seeding depth, inches	Salinity tolerance	C:N Ratio	Attract Beneficial Insects	Mycorrhizal fungi association
alfalfa	1	G	G	Y	G	F	F	DH	G	F	CB	6.5	0.25 - 0.75	P	L	Y	M
alsike clover	1	F	G	Y	G	F	F	SL	P	F	CB	3	0.25 - 0.75	P	L	Y	M
annual oregon ryegrass	1	G	G	N	F	G	G	MM	P	L	CG	15	.5-1.5	F	M	Y	L
barley	1	G	F	N	G	F	F	MM	F	L	CG	50	0.75 - 2	G	M	Y	L
buckwheat	1	F	G	N	G	P	P	SL	P	F	WB	50	0.5 - 1.5	P	L	Y	N
canola	1	F	G	N	P-G**	F	F	MM	G	F	CB	5	0.25 - 0.75	G	L	Y	N
chickling vetch	1	F	G	Y	F	F	F	SL	F	L	CB	50	0.5 - 1.5	P	L	Y	M
common vetch	1	F	F	Y	P	F	F	SM	F	L	CB	16	0.5 - 1.5	P	L	Y	M
corn	1	G	G	N	P-G**	F	F	DH	G	L	WG	12*	1-1.5	P	H	N	H
cowpea	1	P	F	Y	G	F	F	SL	F	L	WB	30	1 - 1.5	P	L	Y	M
crimson clover	1	F	G	Y	G	G	G	SM	F	F	CB	15	0.25 - 0.75	P	L	Y	M
ethiopian cabbage	1	F	G	N	F	F	F	MM	G	F	CB	5	0.25 - 0.75	G	L	Y	N
flax	1	F	F	N	P	P	P	SM	P	F	CB	20	.25-.75	F	H	Y	H
grain and forage sorghum	1	G	G	N	G	G	F	MM	G	L	WG	10	0.5 - 1.5	F	M	Y	H
hairy vetch	1	F	F	Y	P	F	F	SM	F	L	CB	15	0.5 - 1.5	P	L	Y	M
kale	1	F	G	N	G	F	F	MM	G	F	CB	0.5	0.25 - 0.5	G	L	Y	N
lentil	1	P	F	Y	P	F	F	SL	P	F	CB	30	1-1.5	P	L	Y	M
millet	1	G	F	N	G	G	F	SL	F	L	WG	25	.25-.75	P	M	N	H
mustard, oriental or brown	1	F	F	N	G	F	F	MH	F	F	CB	6	0.25 - 0.75	P	M	Y	N
mustard, tame yellow	1	F	F	N	G	F	F	MH	F	F	CB	12	0.25 - 0.75	P	L	Y	N
oat	1	G	F	N	F	G	F	MM	F	L	CG	70	0.5 - 1.5	F	M	N	L
pea	1	P	P	Y	F	G	F	SL	P	L	CB	70	1.5 - 3	P	L	Y	M
radish	1	P	G	N	G	P	G	DH	G	F	CB	8	0.25 - 0.5	P	L	Y	N
rapeseed	1	F	G	N	F	F	G	MM	G	F	CB	5	0.25 - 0.75	G	L	Y	N
red clover	1	F	G	Y	G	F	F	SL	P	F	CB	5	0.25 - 0.75	P	L	Y	M
safflower	1	F	G	N	F	P	P	DM	F	L	WB	30	.5-1	F	M	Y	M
soybean	1	P	F	Y	P-G**	F	F	SM	P	L	WB	35	1-1.5	P	L	Y	M
spring rye or s. wheat	1	G	G	N	G	F	F	MH	F	L	CG	60	0.5 - 1.5	F	M	Y	L
sudangrass, sudan-sorghum hybrid	1	G	G	N	G	G	G	MM	G	L	WG	25*	0.5 - 1.5	F	M	Y	H
sugarbeet	1	P	G	N	F	P	G	DH	G	F	CB	4	0.25 - 0.5	G	L	N	N
sunflower	1	F	G	N	F	P	G	DM	F	L	WB	7	.5-1	F	M	Y	M
sweet clover	1	F	F	Y	F	P	F	MM	F	F	CB	4	0.25 - 1	F	L	Y	M
tall wheatgrass	1	G	G	N	G	G	G	DH	F	L	CG	13	0.25 - 1	G	H	N	L
teft grass	1	G	F	N	F	G	F	SM	P	F	WG	5	.125 - .25	P	M	N	N/A
triticale	1	G	G	N	G	F	F	MH	F	L	CG	60	.5-1.5	G	M	Y	L
turnip	1	P	G	N	G	P	G	DH	G	F	CB	4	.25-.5	P	L	Y	N
white clover	1	F	G	Y	G	F	F	SL	P	F	CB	1.5	0.25 - 0.75	P	L	Y	M
winter camelina	1	F	G	N	F	P	P	ML	G	F	CB	3	.25-.5	P	L	Y	N
winter rye or w. wheat	1	G	G	N	G	F	F	MH	F	L	CG	60	0.75 - 2	G	M	Y	L

1 **Rooting Depth/Water Use**

- SL= Shallow rooted/Low water use
- SM= Shallow rooted/Medium water use
- SH= Shallow rooted/High water use
- ML= Medium rooted/Low water use
- MM= Medium rooted/Medium water use
- MH= Medium rooted/High water use
- DL= Deep rooted/Low water use
- DM= Deep rooted/Medium water use
- DH= Deep rooted/High water use

2 **Crop types**

- CG= cool season grass
- CB= cool season broadleaf
- WB= warm season broadleaf
- WG= warm season grass

- Shallow 6-18 inches
- Medium 18 - 24 inches
- Deep 24+ inches

Ratings

- L= Low G= Good
- M= Medium F= Fair
- H= High P= Poor
- Y= Yes
- N = No or None
- N/A= Not Available

3 **Seeding Dates**

April 1 through May 15 – Predominantly cool season species
 May 15 through August 1 – Predominantly warm season species
 August 1 through October 1 – Predominantly cool season species
 Seeding dates fluctuate annually. The dates listed above are averages that may be changed 10 days in either direction depending on current climatic conditions.

4 "Full Seeding Rates" – should be multiplied by the percent desired if mixtures are used.

*Variable depending on seed size and row spacing.
 **Poor weed competitor, but herbicide-tolerant varieties are available.