

**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.
- Weed 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, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with Oklahoma State University fact sheets and publications. Refer to the

Oklahoma NRCS Nutrient Management (590) standard for guidance on applying nutrients.

The species selected will be compatible with other components of the cropping system.

Cover crops will be terminated by harvest, frost, mowing, tillage, crimping, and/or herbicides in preparation for the following crop.

When viable seed produced by the cover crop is undesirable, the cover crop will be terminated prior to seed maturity or by selecting varieties that produce sterile seed.

Herbicides used with cover crops will be compatible with the following crop. Refer to the Oklahoma NRCS Pest Management (595) standard for guidance.

Avoid using plants that are on the state's noxious weed or invasive species lists.

Cover crop residue will not be burned.

**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 such as those listed in **Table 1**. Other crops meeting the above criteria may also be used.

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

Cover crops used to protect germinating or seedling crops or forages will provide wind

erosion protection for blowing soil to the estimated crop tolerance listed in **Table 2**.

**Cover Crops for Establishing Grasses, Forbs, and Legumes**

**Seedbed Preparation:** A seedbed will be prepared by any method that results in a friable, firm seedbed without weed competition.

Hardpans or plowpans will be destroyed prior to planting. The Oklahoma NRCS Deep Tillage (324) standard will be used as guidance.

The cover crop species listed in **Table 1** will be used for grass/legume plantings when required. Refer to **Table 1** for species selection, planting dates, rates, and additional information for establishment. Seed will be drilled providing good soil to seed contact. Seed may be broadcast only in locations where drills can not be used due to topography.

Soil test analysis for nutrient recommendation will not be required for cover crops used for grass establishment based on local technical determinations.

**Management of Cover Crop:** If tillage is used to terminate the cover crop, additional time may be needed for the soil to consolidate and the seedbed to become firm enough for planting.

Periodically, moisture conditions exist that will allow excess growth to be produced by the cover crop. This can occur with forage sorghums or sudangrasses. Excessive top growth can inhibit proper seed to soil contact at planting time and impair grass seeding operations. When excessive top growth occurs, it should be removed by grazing, haying or mowing with a shredder to chop up the residue. Using grain sorghums or delayed planting can help alleviate this condition.

If the cover crop is to be harvested, maintain a minimum stubble height of 12 inches.

Control weeds as needed in the cover crop during the fallow period. This is best done with herbicides but may be done with tillage as long as an adequate cover of residue remains and the proper firmness of the seedbed can be achieved by grass seeding time.

Volunteer small grains shall be destroyed to break pest cycles such as those that cause wheat streak mosaic.

**Required Cover Crops:** Cover crops used to protect grass/legume seedlings from wind and blowing soil will be required for the following conditions:

- "I" values  $\geq 134$  (statewide)
- "I" values  $\geq 86$  and "C" values  $\geq 35$
- "I" values  $\geq 56$  and "C" values  $\geq 45$
- "I" values  $\geq 38$  and "C" values  $\geq 55$

All residues from the cover crop will be retained on soils having "I" values of 310 or 220 with C factors  $\geq 25$ .

Soil loss from wind erosion will not exceed the soil loss tolerance for the field during the establishment period of the seedlings.

**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.

The NRCS Soil Conditioning Index (SCI) in RUSLE2 will be used to determine the amount of biomass required to have a positive trend in the 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. The cover crop will remain in the field and not harvested. The biomass produced by the cover crop will be incorporated into the soil or remain on the soil surface for recycling of nutrients by the next crop.

Cover crops used to capture nutrients from deeper in the soil profile and redistribute to the soil surface will be terminated in relation to the planting date of the following crop and the desired result of the nutrients being recycled.

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Cover crops with Carbon to Nitrogen ratios (C:N) of 30:1 or less will generally not use nitrogen from the soil (immobilize nitrogen) to decompose residues and will generally release nitrogen from decayed residues in 2 to 4 weeks. Legumes as well as other crops terminated before maturity used as green manure crops generally have C:N ratios of less than 30:1. Crops with C:N ratios above 30:1 will tie up nitrogen from the soil and will take as long as 4 to 8 weeks to release nitrogen from decayed residues. Annual non-legume crops that are near or have reached maturity such as small grains and sorghums will have C:N ratios well over 30:1. The proper time to kill the cover crop will depend on the specific rotation, weather and objectives desired.

Cover crop species will be selected for their ability to take up large amounts of nutrients from the rooting profile of the soil. Refer to the NRCS *Agricultural Waste Management Field Handbook, Chapter 6, Table 6-6* for estimated nutrient removal rates of crops and forages. Refer to the NRCS *National Agronomy Manual, Table 504-4, pg. 504-11* for rooting depths of crops and forages.

#### **Additional Criteria to Promote Biological Nitrogen Fixation**

Only legumes or legume-grass mixtures 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.

Legumes are capable of fixing large amounts of atmospheric nitrogen. Most of the nitrogen fixed by the legume plant is also used by the plant (approximately 75%). Only if the legume plant is left unharvested and returned to the soil will the full nitrogen benefit be realized.

Refer to **Table 3** for a list of legumes and the amount of nitrogen available for the next crop.

#### **Additional Criteria to Increase Biodiversity**

Cover crop species shall be selected that have different 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.

Most legumes such as vetch, sweet clovers, red clovers, etc. provide food and habitat for beneficial insects and animals when incorporated into a monoculture cropping system. Non-legumes such as rye, oats and wheat incorporated into summer annual crop systems will also provide diversity, food, and habitat.

#### **Additional Criteria for Weed Suppression**

Species for the cover crop will be selected for their chemical (allelopathic) or physical (shading, mulching, competitive growth) characteristics to suppress weeds.

Cover crops will be terminated by means in which all residues will be left on the soil surface to maximize chemical and 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**

In areas where conserving soil moisture is needed, cover crops which produce large amounts of residue and dense stubble should be selected for this purpose. The cover crop will provide a minimum of 60% surface cover at termination. Growth of the cover crop should be terminated sufficiently early to conserve soil moisture for the subsequent crop. The residues from cover crops shall be left on the soil surface for shade and mulch.

In areas of potential excess soil moisture, allow the cover crop to grow as long as possible to maximize soil moisture removal. Refer to the **Oklahoma Irrigation Guide, Chapter 4, Tables OK-4-1 through OK-4-11** for crop water use.

**Additional Criteria to Reduce Particulate Emissions into the Atmosphere**

Manage cover crops and their residues so that at least 80% 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. Refer to the NRCS **National Agronomy Manual, Table 504-4, pg. 504-11** for rooting depths of crops and forages.

**CONSIDERATIONS**

Use deep-rooted species to maximize nutrient recovery.

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

Avoid cover crop species that harbor or carryover potentially damaging diseases or insects.

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.

Use plant species that enhance bio-fuels opportunities.

Use plant species that enhance forage opportunities for pollinators.

Some plant species are known to have allelopathic effects on other plants which can reduce seed germination. Rye, alfalfa, oats and wheat have been known to effect seed germination of grasses if not destroyed at the proper plant stage of growth.

**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.

**TABLE 1**  
**Cover Crops for Establishing Grasses, Forbs, and Legumes**

Cover Crop	Optimum Planting Date	Seeding Rate	*Comments
Forage Sorghums	4/15 – 6/15	6 – 12 lbs./ac	Row spacing will be $\leq 20"$ . With adequate moisture, planting may be done until 60 days prior to the average killing frost date for the location.
Sudangrass	4/15 – 6/15	25 – 30 lbs./ac	Row spacing will be $\leq 20"$ . With adequate moisture, planting may be done until 60 days prior to the average killing frost date for the location.
Grain Sorghum	4/15 – 6/15	3 – 8 lbs./ac	Row spacing will be $\leq 30"$ . With adequate moisture, planting may be done until 60 days prior to the average killing frost date for the location. Excluded on soils with an "I" $\geq 134$ in the Panhandle
Wheat	9/1/ - 11/30	40 – 60 lbs./ac	Excluded on soils with an "I" $\geq 134$ Wheat may be used on "I" 134 soils when planting Weeping Lovegrass. All wheat residues will be retained until late spring. Combined residue from harvested wheat will be uniformly distributed on the soil surface. Growing wheat will be destroyed at or just prior to the boot stage but no later than the soft dough stage. Wheat may be used under graze out conditions when planting Old World Bluestems

\* Cover crops will be planted using drills to ensure proper seed to soil contact. Cover crops may be broadcast only in locations where drills can not be used due to topography.

**TABLE 2**  
**Estimate Crop Tolerances to Blowing Soil**

<b>*Crop</b>	<b>*Tolerance (Tons/Ac/Yr)</b>
Alfalfa (seedlings)	<0.5
Asparagus	<0.5
Cantaloupe	<0.5
Carrots	<0.5
Celery	<0.5
Eggplant	<0.5
Lettuce	<0.5
Muskmelons	<0.5
Onions (seedlings <30 day old)	<0.5
Peppers	<0.5
Spinach	<0.5
Squash	<0.5
Strawberries	<0.5
Sugar, Table Beets	<0.5
Tomatoes	<0.5
Watermelons	<0.5
Broccoli	1.0
Cabbage	1.0
Cotton	1.0
Cucumbers	1.0
Garlic	1.0
Green, Snap Lima Beans	1.0
Peanuts	1.0
Peas	1.0
Potatoes	1.0
Tobacco	1.0
Alfalfa (mature)	2.0
Field, Sweet Corn	2.0
Onions (>30 days old)	2.0
Soybeans	2.0
Sunflowers	2.0
Barley	5.0 **
Buckwheat	5.0 **
Flax	5.0 **
Millet	5.0 **
Oats	5.0 **
Rye	5.0 **
Grain Sorghum	5.0 **
Wheat	5.0 **

\* Reference – NRCS National Agronomy Manual, 3<sup>rd</sup> Edition, Table 502-5 pg. 502-19

\*\* Crops will tolerate wind erosion equal to or greater than 5 tons/ac/yr.

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**TABLE 3****Estimated Amount of Nitrogen Remaining in Soil After Legume Crop**

<b>Legume</b>	<b>*Legume Harvested and Removed from Field (Nitrogen for Next Crop) (lbs/ac)</b>	<b>**Legume Crop Unharvested (Nitrogen for Next Crop) (lbs/ac)</b>
Alfalfa	80	200
Ladino Clover	60	180
Sweet Clover	60	120
Red Clover	40	115
White Clover	20	100
Soybeans	20	60
Cowpeas	30	90
Vetch	40	80
Lespedeza (annual)	20	85
Peas	40	70
Peanuts	20	40
Beans	20	40

\* These numbers are derived from crops that are harvested and have the remaining crop residues returned to the soil by tillage. (Reference – Oklahoma State University, Oklahoma Soil Fertility Handbook, 2006 Edition, Table 2.2, pg. 18)

\*\* The legume is treated as a green manure crop and is not harvested or grazed and is returned to the soil just prior to maturity. These numbers reflect the amount of nitrogen available for the next crop. The numbers are adjusted to account for 30% nitrogen loss due to volatilization, leaching, and microbial action. (Reference – Soil Fertility and Fertilizers, Tidsdale and Nelson, pg. 128 and 566)