



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

COVER CROP

CODE 340

(ac)

DEFINITION

Grasses, legumes, and other forbs planted for seasonal vegetative cover.

PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce sheet, rill, and wind erosion.
- Maintain or increase soil organic matter.
- Improve soil aggregate stability.
- Improve habitat for soil organisms.
- Reduce water quality degradation by utilizing excess soil nutrients.
- Reduce weed and plant pest pressure.
- Improve moisture management.
- Reduce soil compaction.
- Supply nitrogen to the subsequent crop.
- Improve habitat for pollinators, beneficial organisms, or natural enemies of crop pests.

CONDITIONS WHERE PRACTICE APPLIES

All lands requiring seasonal vegetative cover for natural resource protection or improvement.

CRITERIA

General Criteria Applicable to All Purposes

Cover crops are established as part of a cropping system between production crops in rotation. Cover crops may be interseeded into production crops or planted in the alleyways of perennial trees or vine crops. Select species and planting dates that will not adversely affect crop yield or interfere with the harvest process.

Plant species selection, seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with applicable local criteria and soil/site conditions.

Determine the method and timing of termination to meet the grower's objective and the current NRCS Cover Crop Termination Guidelines.

Where applicable for crop insurance, refer to the Risk Management Agency Good Farming Practice Handbook to determine the request process when an exception to the NRCS Cover Crop Termination Guidelines is supported as a good farming practice.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at <https://www.nrcs.usda.gov/> and type FOTG in the search field.

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Cover crops must be compatible with other components of the cropping system such as crops, available equipment, and timing of operations.

Avoid selection of cover crop species with the potential to contaminate production crops (e.g., buckwheat cover crop in wheat production fields).

Ensure chemical applications used with previous crops and for the establishment of the cover crop are compatible with cover crop selections and purposes.

Do not burn cover crop residue.

Do not harvest cover crops for seed.

Time termination and method of termination to enable the cover crop to meet the specified purpose(s).

If the specific rhizobium bacteria for a selected legume is not expected to be sufficiently present in the soil, treat the seed with the appropriate inoculum.

Seed will be free of noxious weed seed.

For organic and transitioning to organic systems, comply with the National Organic Program (NOP) rules.

Additional Criteria to Reduce Sheet, Rill, and Wind Erosion

Time the cover crop establishment in conjunction with other practices to adequately protect the soil during the critical erosion periods.

Select cover crops that will have the physical characteristics necessary to provide adequate erosion protection.

Use the current erosion prediction technology to determine the amount of surface and canopy cover needed from the cover crop to achieve the predicted erosion reduction.

Additional Criteria to Maintain or Increase Soil Organic Matter Quantity

Select cover crop species that produce high volumes of aboveground biomass and root mass to maintain or increase soil organic matter.

The planned crop rotation including the cover crop and associated management activities will score a Soil Conditioning Index (SCI) value > 0 , and be higher than the benchmark system, as determined, using the current approved NRCS SCI procedure, with appropriate adjustments for additions to and subtractions from plant biomass.

Plant the cover crop as early as possible and terminate as late as practical (late vegetative stage or later) to maximize plant biomass production, while considering the time needed to prepare the field for planting the next crop, and soil moisture depletion.

Do not mechanically harvest cover crop biomass. Allow residues to remain on the surface following termination.

When integrating livestock as part of a soil health management system, control the frequency, intensity, and duration of grazing to maintain cover crop above ground vegetation.

Plan grazing events at later stages of maturity in order to maximize root biomass and to allow for at least 50% of the total above ground vegetation to remain with the majority to be flattened onto the soil surface.

Additional Criteria to Improve Soil Aggregate Stability

Select cover crops that contain at least one fibrous rooted grass in conjunction with other practices in a soil health management system to bind aggregates and support aggregate-building soil organisms.

Terminate the cover crop with a method that is consistent with maintaining the aggregate stability achieved by the growth of the cover crop and meets producer objectives.

Additional Criteria to Improve Habitat for Soil Organisms

Seed a minimum of 3 species of plants that includes 2 or 3 plant families to provide diverse soil organism food supply in conjunction with other practices in a soil health management system.

Do not mechanically harvest cover crop biomass. Allow residues to remain on the surface following termination.

Terminate cover crop in the late vegetative stage or later to maximize biomass production.

Additional Criteria to Reduce Water Quality Degradation by Utilizing Excess Soil Nutrients

Establish cover crops as soon as practical prior to or after harvest of the production crop.

Select cover crop species for their ability to effectively utilize nutrients.

Terminate the cover crop as late as practical to maximize plant biomass production and nutrient uptake.

Additional Criteria to Reduce Weed Pressures and Break Pest Cycles

Select cover crop species for their life cycles, growth habits, and other biological, chemical, and physical characteristics to provide one or more of the following:

- Suppress or compete with weeds.
- Break pest life cycles or suppress pests, including pathogens.
- Provide food or habitat for natural enemies of pests.
- Release compounds such as glucosinolates that suppress soilborne pathogens or pests.

Select cover crop species that do not harbor unmanageable pests or diseases of subsequent crops.

For weed suppression, leave terminated cover crop residue on the soil surface when appropriate.

Additional Criteria to Improve Moisture Management

In areas of limited soil moisture, terminate growth of the cover crop sufficiently early to conserve soil moisture for the production crop. Leave residues of cover crops 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 Soil Compaction

Select cover crop species that can penetrate or prevent compacted layers.

Depending on characteristics of selected cover crops, plant cover crops early enough or terminate late enough to achieve potential increased root biomass or depth.

For near surface compaction or crusting issues, leave terminated cover crop residue on the surface.

Additional Criteria to Supply Nitrogen to Subsequent Crop

Legumes (with appropriate inoculants where necessary), either alone or in a seed mix, are used to improve fertility by providing the subsequent crop with a minimum of 20% but not more than 100% of the crop's estimated nitrogen requirement.

Use land grant university (LGU's) publications or cover crops analysis to estimate the amount of nitrogen in the cover crop. The nitrogen supplied by the cover crop must be credited in the nutrient budget for the subsequent crop.

Use LGU publications or field data to determine the effects of termination timing and termination methods (which may include incorporation, grazing, crimping, mowing or agrichemicals) on the amount of estimated available nitrogen for the subsequent crop.

Do not mechanically harvest biomass.

Additional Criteria to Improve Habitat for Pollinators, Beneficial Organisms, or Natural Enemies of Crop Pest

Use cover crop mixes that contain at least 50% forbs of known habitat, pollen, or nectar value to targeted pollinators or other beneficial organisms. Allow these forbs to achieve at least 50% bloom before termination.

Cover crop seeds must not be treated with systemic insecticide coatings that may pose a risk to beneficial organisms. Cover crops must not be exposed to pesticide sprays, seed coatings, or drift that can negatively impact the targeted pollinators or beneficial organisms. [See Agronomy Technical Note 9 for determining potential impacts.]

CONSIDERATIONS

General Considerations

Plant cover crops in a timely manner and when there is adequate moisture to establish a good stand. If soil moisture is insufficient and irrigation is available, irrigate newly seeded cover crops to ensure timely establishment and ground coverage.

Avoid cover crop species that harbor or carry over potentially damaging diseases or insects that can affect subsequent crops.

Cover crops may be used to improve site conditions for establishment of perennial species by providing early cover for emerging perennial seedlings. In such cases, meeting a primary purpose still applies.

Cover crops may be used (grazed, mowed, or harvested for silage) for emergency livestock forage needs when extreme weather conditions negatively affect the planned forage production.

Cover crops residues should be left on the soil surface to maximize mulching (physical) effects.

Cover crops, flattened to the soil surface can moderate soil temperatures, keeping soils cooler during hotter periods and warmer during cooler periods.

Cover crops can be selected and managed for allelopathic effects. Evaluate potential allelopathic effects to the subsequent crop.

Cover crops may be selected that release biofumigation compounds that inhibit soilborne plant pests and pathogens.

Seed a higher density cover crop stand to promote rapid canopy closure and greater weed suppression. Increased seeding rates (1.5 to 2 times normal) can improve the cover crop competitiveness with weed species.

Species can be selected to serve as trap crops to divert pests from production crops.

For wildlife plantings, select a mixture of two or more cover crop species from different plant families to increase soil biological diversity or to provide food and cover.

Select cover crop species or mixtures, and timing and method of termination that will maximize efficiency of nitrogen utilization by the following crop, considering soil type and conditions, season and weather conditions, cropping system, carbon (C) to nitrogen (N) ratio of the cover crop at termination, and anticipated nitrogen needs of the subsequent crop.

To ensure timely seeding of cover crops, employ planting methods that allow for early season growth such as interseeding or broadcast overseeding into standing crops.

Time the termination of cover crops to meet nutrient release goals. Termination at early vegetative stages may cause a more rapid release compared to termination at a more mature stage.

Both residue decomposition rates and soil fertility can affect nutrient availability following termination of cover crops. As an example, higher C to N plant residues in conjunction with lower soil fertility could slow the availability of N to growing plants.

Use diverse cover crop species mixtures with various C:N ratios or maturity that upon decomposition would allow nutrients to be released throughout the growing season of the next crop, enhancing nutrient cycling and nutrient retention.

Legumes add the most plant-available N if terminated when about 30 - 50 percent of the crop is in bloom (depending on species).

Cover crops can reduce pesticide losses by reducing erosion and adding organic matter.

Cover crop species selected for their ability to effectively utilize potential water quality degrading nutrients may also be used to conserve and cycle other nutrients as well.

When appropriate, refer to crop insurance criteria when deciding the timing of cover crop termination.

Considerations to Reduce Sheet, Rill, and Wind Erosion

Maximize the combined canopy and surface residue cover to attain a minimum of 90-percent cover during the period of potentially erosive wind or rainfall.

Considerations to Maintain or Increase Soil Organic Matter Quantity

Increase the diversity of cover crops (e.g., mixtures of several plant species or functional groups) to promote a wider diversity of soil organisms, and possibly promote increased soil organic matter.

Plant legumes or mixtures of legumes with grasses, brassicas, and other forbs to provide N through biological N fixation and to achieve a balanced C:N ratio which can maximize formation of stable soil organic matter.

Considerations to Improve Soil Health

In semiarid regions, where seasonal fallow is used, consider leaving sufficient residues to protect the soil surface during the fallow period, or growing a shallow-rooted cover crop that allows deep moisture storage. Reduce the intensity of tillage and increase soil surface coverage with vegetation and crop residues.

When applying agrichemicals, consider the potential impact on the soil organisms and consult with a pesticide professional to develop alternative application techniques or alternative agrichemicals that have lower adverse impacts on soil organisms.

Select diverse cover crops that have shallow, medium, and deep roots to maximize aggregate stability, to increase organic matter, and to improve water infiltration and improve soil structure.

The effects of this practice can be enhanced by being integrated into a soil health management system. Refer to Technical Note 450-4 for more information.

With increasing water infiltration due to improved soil health, ephemeral gully occurrences can be minimized.

The effects of this practice can be enhanced by utilizing animal wastes, or applying nonsynthetic mulches to supplement the biomass produced by cover crops.

Considerations to Reduce Water Quality Degradation by Utilizing Excess Soil Nutrients

Use deep-rooted species to maximize nutrient recovery.

When appropriate for the cropping system, mowing certain grass cover crops (e.g., sorghum-sudangrass, pearl millet) prior to heading and allowing the cover crop to regrow can enhance rooting depth and density.

PLANS AND SPECIFICATIONS

Develop implementation requirements for each field or treatment unit according to the criteria and operation and maintenance requirements of this standard. Specifications must describe the requirements to apply the practice to achieve the intended purpose. Record the following specification components in an approved CPS Cover Crop (Code 340) implementation requirements document:

- Field number and acres.
- Species of plants to be established.
- Contingency plan with specie options for substitution to achieve the intended purpose.
- Seeding rates.
- Seeding dates.
- Seeding depth.
- Establishment procedure including planting method.
- Rates, timing, and forms of nutrient application (if needed).
- Dates and method to terminate the cover crop.
- Other information pertinent to establishing and managing the cover crop.

OPERATION AND MAINTENANCE

Evaluate the cover crop to determine if the cover crop is meeting planned purposes. If the cover crop is not meeting the purposes, adjust the management.

REFERENCES

Chessman, D., B.N. Moebius-Clune, B.R. Smith, B. Fisher. 2019. The Basics of Addressing Resource Concerns with Conservation Practices within Integrated Soil Health Management Systems on Cropland. Soil Health Technical Note No. 450-04. USDA NRCS.

Clark, A. (ed.). 2007. Managing cover crops profitably. 3rd ed. Sustainable Agriculture Network Handbook Series; bk 9.

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

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

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

Revised Universal Soil Loss Equation Version 2 (RUSLE2) Website:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/tools/rusle2/>

USDA NRCS Cover Crop Termination Guidelines. <https://www.nrcs.usda.gov/sites/default/files/2023-03/cover-crops-termination-guidelines-designed-v4-2019-updated.pdf>

USDA NRCS Organic Farming Handbook and other resources: [Organic Agriculture | NRCS \(usda.gov\)](#)

USDA, NRCS National Agronomy Manual, 4th Edition, Feb. 2011.

Website: <https://directives.sc.egov.usda.gov/landingpage/15836>

Wind Erosion Prediction System (WEPS) Website:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/tools/weps/>