



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

COVER CROP

CODE 340

(ac)

DEFINITION

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

PURPOSE

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

- Reduce erosion from wind and water
- Maintain or increase soil health and organic matter content
- Reduce water quality degradation by utilizing excessive soil nutrients
- Suppress excessive weed pressures and break pest cycles
- Improve soil moisture use efficiency
- Minimize soil compaction

CONDITIONS WHERE PRACTICE APPLIES

All lands requiring seasonal vegetative cover for natural resource protection 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 applicable local criteria and soil/site conditions.

Select species that are compatible with other components of the cropping system.

Ensure herbicides used with crops are compatible with cover crop selections and purpose(s).

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.

Determine the method and timing of termination to meet the grower's objective and the current NRCS Cover Crop Termination Guidelines. Current NRCS Cover Crop Termination Guidelines are posted in FOTG Sec IV in the 340 Cover Crop CPS folder. Click this link to open the NRCS Cover Crop Termination Guidelines. Current NRCS Cover Crop Termination Guidelines:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2_020.

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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When a cover crop will be grazed or hayed ensure that crop selection(s) comply with pesticide label rotational crop restrictions and that the planned management will not compromise the selected conservation purpose(s).

Do not harvest cover crops for seed.

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.

A determination of cover crop stand adequacy must be made to enable practice certification. This adequacy determination will be based on an evaluation concluding: (a) establishment specifications were followed by the producer as closely as possible; and (b) the stand at time of evaluation can be reasonably expected to reach a maturity level and density to address the identified resource concern(s), achieve the practice purpose(s) and associated standard criteria, and meet producer objective. Evaluate stand adequacy at a time after planting when it can be best determined that conditions (a) and (b) have been met. Documentation (photos, cover measurements, map location of evaluation, etc.) that supports stand adequacy determination must be retained in the case file.

Additional Criteria to Reduce Erosion from Wind and Water

Time the cover crop establishment in conjunction with other practices to adequately protect the soil during the critical erosion period(s). In NC, the 'critical erosion period' is when the production crop management system provides the least amount of soil cover.

Select cover crops that will have the physical characteristics necessary to provide adequate erosion protection. For cover crop single species selection for this purpose, varieties that have at least ½ circle filled in the Managing Cover Crops Profitably "Performance and Roles" Chart 2 (Appendix A of this standard) column "Erosion Fighter" or are sufficiently documented as locally effective per relevant resource information and/or collaboration with qualified professional agronomy resources are acceptable. For cover crop mix selection for this purpose, species determined to be effective for erosion control must be a substantial part of the mix. Click this link to open this practice standard's Appendix A through C: https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2020.

Use the current erosion prediction technology to determine the amount of surface and/or canopy cover needed from the cover crop to achieve the conservation and producer erosion reduction objectives.

Additional Criteria to Maintain or Increase Soil Health and Organic Matter Content

Cover crop species will be selected on the basis of producing higher volumes of organic material and root mass to maintain or increase soil organic matter. For cover crop single species selection for this purpose, varieties that have at least ½ circle filled in the Managing Cover Crops Profitably "Performance and Roles" Chart 2 (Appendix A) column "Soil Builder" or are sufficiently documented as locally effective per relevant resource information and/or collaboration with qualified professional agronomy resources are acceptable. For cover crop mix selection for this purpose, species determined to be effective soil builders must be a substantial part of the mix. Click this link to open this practice standard's Appendix A through C: https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2020.

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

The cover crop shall be planted as early as possible and be terminated as late as practical for the producer's cropping system to maximize plant biomass production, considering crop insurance criteria, the time needed to prepare the field for planting the next crop, and soil moisture depletion.

Soil Aggregate Instability and Soil Organism Habitat Loss or Degradation Resource Concerns

Maintaining/Increasing soil organic matter is associated with addressing soil aggregate instability and soil organism habitat loss or degradation (soil biology) resource concerns. Thus, planting and managing cover crops in a manner that will maintain/increase soil organic matter will also be presumed to enhance soil aggregate stability and the environment for soil biological activity.

When “Aggregate Instability” or “Soil Organism Habitat Loss or Degradation” are identified as soil resource concerns, cover crop species with at least ½ circle filled in the MCPP “Performance and Roles” Chart 2 (Appendix A) column “Soil Builder”, or are sufficiently documented as locally effective per relevant resource information and/or collaboration with qualified professional agronomy resources are acceptable to include in establishment specifications. Click this link to open this practice standard’s Appendix A through C:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2_020.

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

Establish cover crops as soon as practical prior to or after harvest of the production crop. (i.e. before or after harvest). Recent NCSU research indicates that cover crop seeding dates early in the date range windows indicated in the Specifications Development Tables provide better opportunities for sufficient plant growth to optimize nutrient (especially Nitrogen) uptake.

Select cover crop species for their ability to effectively utilize nutrients. For cover crop single species selection for this purpose, varieties that have at least ½ circle filled in the Managing Cover Crops Profitably “Performance and Roles” Chart 2 (Appendix A of this standard) column “N Scavenger” or are sufficiently documented as locally effective per relevant resource information and/or collaboration with qualified professional agronomy resources are acceptable. For cover crop mix selection for this purpose, species determined to be effective nutrient ‘scavengers’ must be a substantial part of the mix. Click this link to open this practice standard’s Appendix A through C:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2_020.

Terminate the cover crop as late as practical to maximize plant biomass production and nutrient uptake. Practical considerations for termination date may include crop insurance criteria, the amount of time needed to prepare the field for planting the next crop, weather conditions, and cover crop effects on soil moisture and nutrient availability to the following crop.

If the cover crop will be harvested for feed (hay/balage/etc.), choose species that are suitable for the planned livestock, and capable of removing the excess nutrients present.

Additional Criteria to Suppress Excessive Weed Pressures and Break Pest Cycles

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

- To suppress weeds, or compete with weeds.
- Break pest life cycles or suppress of plant pests or pathogens.
- Provide food or habitat for natural enemies of pests.
- Release compounds such as glucosinolates that suppress soil borne pathogens or pests.

For cover crop single species selection for this purpose, varieties that have at least ½ circle filled in the Managing Cover Crops Profitably “Potential Advantages” Chart 4A (Appendix B of this standard) “Soil Ecology” heading (or Performance and Roles Chart 2 “Weed Fighter” column for weed pressure) under the column specific to the pest concern or are sufficiently documented as locally effective per relevant resource information and/or collaboration with qualified professional agronomy resources are acceptable. For cover crop mix selection for this purpose, species determined to be effective in pest/weed suppression must be a substantial part of the mix. Click this link to open this practice standard’s Appendix A through C:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2020.

When nematodes are the pest concern, consult qualified NC CES, NCDA, or CCA agronomy resources to match cover crop species known to be effective for control/suppression to the specifically identified nematode types.

Select cover crop species that do not harbor pests or diseases of subsequent crops in the rotation. (See MCPP Chart 4B — Potential Disadvantages – Appendix C of this standard). Click this link to open this practice standard's Appendix A through C:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2020.

Additional Criteria to Improve Soil Moisture Use Efficiency

In areas of limited soil moisture, 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 Minimize Soil Compaction

Select cover crop species that have the ability to root deeply and the capacity to penetrate or prevent compacted layers.

For cover crop single species selection for this purpose, varieties that have at least ½ circle filled in the Managing Cover Crops Profitably “Potential Advantages” Chart 4A (Appendix B) “Soil Impact – Subsoiler” column or are sufficiently documented as locally effective per relevant resource information and/or collaboration with qualified professional agronomy resources are acceptable. For cover crop mix selection for this purpose, species determined to be effective in addressing soil compaction must be a substantial part of the mix. Click this link to open this practice standard's Appendix A through C:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCPPAppendicesA_B_C_2020.

CONSIDERATIONS

Plant cover crops in a timely matter and when there is adequate moisture to establish a good stand.

If a farmer elects to use bin run or farmer-saved seed, it should be tested prior to seeding for purity, germination and noxious weeds by a recognized seed laboratory. These tests are performed free of charge for North Carolina residents by the North Carolina Department of Agriculture & Consumer Services.

When developing seeding specifications to achieve practice purposes and meet producer objectives, consider using NRCS ENTSC Plant Material Technical Note 1; “A Tool for Selecting Cover Crops in Row Crop Rotations in the Southeast” as a planning companion to standard criteria and other resource information like “Managing Cover Crops Profitably (MCP)”. Species specific benefits, and seeding rates and dates from the tool are derived from MCP guidance. Click this link to open “A Tool for Selecting Cover Crops in Row Crop Rotations in the Southeast”:

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mspmctn13166.pdf. Click this link to open “Managing Cover Crops Profitably (MCP)”:

https://efotg.sc.egov.usda.gov/api/CPSFile/23475/340_NC_OTH_Cover_Crop-Managing_Cover_Crops_Profitably_3rd_Edition_Complete_2012.

Consider that NRCS Cover Crop Termination Guidelines align well in NC with 'late' termination dates that maximize maturity potential and biomass production, and minimize 'bare soil' periods during production crop establishment.

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

Select cover crops that are compatible with the production system, well adapted to the region's climate and soils, and resistant to prevalent pests, weeds, and diseases. Avoid cover crop species that harbor or carry over potentially damaging diseases or insects.

When cover crops are used for grazing, select species that will have desired forage traits, be palatable to livestock, and not interfere with the production of the subsequent crop.

Use plant species that enhance forage opportunities for pollinators by using diverse legumes and other forbs.

Cover crops may be selected to provide food or habitat for natural enemies of production crop pests.

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

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 weed- competitiveness.

Cover crops may be selected that release biofumigation compounds that inhibit soil-borne plant pests and pathogens.

Select a mixture of two or more cover crop species from different plant families to achieve one or more of the following: (1) species mix with different maturity dates, (2) attract beneficial insects, (3) attract pollinators, (4) increase soil biological diversity, (5) serve as a trap crop for insect pests, or (6) provide food and cover for wildlife habitat management.

Plant legumes or mixtures of legumes with grasses, crucifers, and/or other forbs to achieve biological nitrogen fixation. Select cover crop species or mixture, 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, C:N ratio of the cover crop at termination, and anticipated nitrogen needs of the subsequent crop. Use LGU- recommended nitrogen credits (NCSU estimated N credits available at: <https://content.ces.ncsu.edu/winter-annual-cover-crops>) from the legume and reduce nitrogen applications to the subsequent crop accordingly if recommended by qualified agronomy resources.

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

Allelopathic effects to the subsequent crop should be evaluated when selecting the appropriate cover crop.

Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom.

Additional Considerations to Reduce Erosion by Wind or Water

To reduce erosion, best results are achieved when the combined canopy and surface residue cover attains 90 percent or greater during the period of potentially erosive wind or rainfall.

Additional Considerations to Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

Use deep-rooted species to maximize nutrient recovery.

When appropriate for the crop production 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, thereby increasing their subsoiling and nutrient- recycling efficacy.

Additional Considerations to Increase Soil Health and Organic Matter Content

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

Plant legumes or mixtures of legumes with grasses, crucifers, and/or other forbs to provide nitrogen through biological nitrogen fixation.

Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom.

Additional Considerations for Reading and Understanding Key Concepts in “Managing Cover Crops Profitably” (MCCP) Resource Information

- MCCP is a resource meant to be consulted repeatedly when seeking information about cover crop management, purposes, benefits, and how they may fit into addressing resource concerns and achieving producer objectives. Key charts for assistance in planning cover crops to meet standard criteria and practice purposes are posted in FOTG Sec IV with this standard. Reading the book in its entirety is neither necessary nor practical. MCCP may be opened or downloaded by clicking this link: https://efotg.sc.egov.usda.gov/api/CPSFile/23475/340_NC_OTH_Cover_Crop_Managing_Cover_Crops_Profitably_3rd_Edition_Complete_2012.
- To gain a better understanding of key general concepts for cover crops use and management, and known effective functions and their alignment with conservation purposes, planners should focus on specific articles and charts:
 - “Benefits of Cover Crops”
 - “Building Soil Fertility and Tillage”
 - Chart 2, “Performance and Roles”
 - Chart 4A, “Potential Advantages”
 - Species summary descriptions for cover crop varieties commonly prescribed in the local area—such as cereal rye, crimson clover, and brassicas. MCCP pages numbers species that have available summary descriptions are noted in Specifications Development Table 1.

PLANS AND SPECIFICATIONS

During development of site-specific producer specifications for establishment and management, complete the conservation planning process to associate identified resource concerns with practice purpose(s). Utilize technical resource materials provided with this standard (Appendices A-C), and process noted in standard criteria and Specifications Development Tables 1-3 to recommend cover crop species determined effective to achieve practice purpose(s). Appendices A through C may be opened by clicking this link:

https://efotg.sc.egov.usda.gov/api/CPSFile/26740/340_NC_GD_Cover_Crop_MCCPAppendicesA_B_C_2020. The Specifications Development Tables 1-3 may be opened by clicking this link: https://efotg.sc.egov.usda.gov/api/CPSFile/26741/340_NC_GD_Cover_Crop_Specification_Development_Tables_2020.

Prepare plans and specifications for each field or treatment unit according to the planning criteria and operation and maintenance requirements of this standard. Specifications shall describe the requirements to apply the practice to achieve the intended purpose for the practice site. Plans for the establishment of cover crops shall, as a minimum, include the following specification components in an approved Cover Crop, 340, Implementation Requirements document:

- Field number and acres
- Species of plant(s) to be established.
- Seeding rates.
- Seeding dates.
- Establishment procedure.
- 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 e.g., if haying or grazing is planned specify the planned management for haying or grazing.

The approved Cover Crop, 340, Implementation Requirements document may be opened or downloaded by clicking this link: https://efotg.sc.egov.usda.gov/api/CPSFile/23474/340_NC_IR_Cover_Crop_2019.

OPERATION AND MAINTENANCE

Evaluate the cover crop to determine if the cover crop is meeting the planned purpose(s) and producer objective. If the cover crop is not meeting the purpose(s) and objectives, adjust the management, change the species of cover crop, or choose a different technology.

REFERENCES

A. Clark (ed.). 2007. Managing Cover Crops Profitably. 3 ed. Sustainable Agriculture Network Handbook Series. Handbook 9 <https://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition>

NC State University, NC State Extension Publications; Soil Facts Publication AG-439- 85; "Soil Health: What Does it Mean in North Carolina?", November 2018. <https://content.ces.ncsu.edu/soil-health-what-does-it-mean-in-north-carolina>

Southern Sustainable Agricultural Research & Education (Southern SARE); Cover Crop Research Across the Southern Region (web site): <https://www.southernsare.org/SARE-in-Your-State/North-Carolina/State-News/Cover-Crops-Research-Across-the-Southern-Region>

USDA NRCS East National Technology Support Center, Plant Materials Program Technical Note 1; A Tool for Selecting Cover Crops for Row Crop Rotations in the Southeast, 2017; https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mspmctn13166.pdf

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.

NRCS Cover Crop Termination Guidelines:

https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1466429&ext=pdf

USDA, Natural Resources Conservation Service, National Agronomy Manual, 4th Edition, Feb. 2011. Website: <http://directives.sc.egov.usda.gov/> Under Manuals and Title 190