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 used to accomplish 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

This practice applies on all lands requiring seasonal vegetative cover for natural resource protection and/or improvement.

A cover crop may also be used to provide temporary cover before establishing a permanent planting.

CRITERIA

General Criteria Applicable to All Purposes

Select a cover crop to accomplish the intended purpose of the practice and the objectives of the client. The species selected must be compatible with provisions of nutrient management and pest management plans, as applicable.

Cover crops may be established between successive production crops, companion-planted, or relayplanted (interplanted) into production crops. Select species and planting dates that will not compete with the production crop yield or harvest. Selection shall be based upon time of year, availability and cost of seed, and geographic location. Adjust the seeding rate as appropriate based on the method of planting.

If legumes are used, treat the seed with the appropriate Rhizobium inoculant at the time of planting if the appropriate bacteria are not likely to be present in the soil.

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

Determine the method and timing of termination to meet the client's objectives and the current NRCS guidelines. The cover crop termination must be at or before the time periods specified in the NRCS Cover

Crop Termination Guidelines located in the FOTG, Section IV, Conservation Practice Standards, Cover Crop.

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

Do not harvest cover crops for seed or burn cover crop residue.

For additional criteria concerning species selection and plant characteristics, seeding methods and rates, seeding depths, planting dates, and termination methods, refer to the Maryland conservation practice Specifications for Cover Crop (340).

Additional Criteria to Reduce Erosion from Wind and Water

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

Plants selected for cover crops shall 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. The cover crop shall be killed as late as feasible to maintain soil surface coverage and prepare the seedbed for the following crop.

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

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

The species selected, or at least a portion of the cover crop mix, shall be a different crop type than the previous crop (i.e., cool-season grass, warm-season grass, cool-season forb, warm-season forb).

The planned crop rotation including the cover crop and associated management activities will score a NRCS Soil Conditioning Index (SCI) value >0, as determined using the current approved NRCS 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.

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.

Select cover crop species for their ability to effectively utilize nutrients from the root zone of the soil and that have appropriate planting dates so that cover crops will be actively growing during the leaching period.

When nutrients will not be recycled through a following crop, the above-ground biomass of the cover crop shall be removed from the field if maximum nutrient removal is planned.

Additional Criteria to Suppress Excessive Weed Pressures and Break Pest Cycles

Species for the cover crop shall be selected for their life cycles, growth habits, and other biological, chemical, and/or physical characteristics to provide one or more of the following:

- Suppress weeds, or compete with weeds;
- Break pest life cycles or suppress 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.

Select cover crop species that do not harbor pests or diseases of subsequent crops in the rotation.

Use a mixture of two or more cover crop species from different plant families to serve as a trap crop for insect pests, increase soil biological diversity, attract beneficial insects, and/or provide food and cover for wildlife and pollinators.

For long-term weed suppression, perennial and/or biennial species may be used.

Additional Criteria to Improve Soil Moisture Use Efficiency

Terminate growth of the cover crop sufficiently early to conserve soil moisture for the next crop, and leave cover crop residues on the soil surface to reduce evaporation and increase infiltration.

On soils with excess soil moisture, allow the cover crop to grow as long as possible to optimize removal of soil moisture.

Additional Criteria to Minimize 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.

Note: Specific programs may dictate criteria in addition to, or more restrictive than, those specified in this standard.

CONSIDERATIONS

General

Consider the amount of time needed for germination and sufficient growth of a cover crop before dormancy. Annuals generally germinate more rapidly than perennials, and grasses usually germinate more rapidly than legumes. Rapidly establishing cool-season grass species include annual ryegrass and spring oats, followed by winter wheat and rye. Foxtail millet, pearl millet, and sudangrass are rapidly establishing warm-season species.

Also consider cover crop termination methods and dates, including the need to meet crop insurance requirements for a following crop.

For seasonal cover crops, consider the use of annual grasses, including cereal grains. These plants provide satisfactory results at a reasonable cost. In the summer, a warm-season annual grass (such as foxtail millet or pearl millet) can be used as a “half-season” cover crop after an early vegetable crop, before a late crop, and to control weeds while land is out of production for a short period of time.

Plant disease and insect problems can be increased by the use of cover crops. Rotations in which grasses are alternated with legume crops should help to avoid this problem. For example, corn or wheat should follow legume cover crops, while soybeans are better following small grains.

Consider cover crops that are compatible with the production system, well adapted to the climate and soils, and resistant to prevalent pests, weeds, and diseases. If planting cereal grains as cover crops, consider the need for pest management of Hessian fly, powdery mildew, and other pests common to these crops. Avoid cover crop species that harbor or carry over potentially damaging diseases or insects.

Some cover crops may present a weed problem by volunteer seeding when or where they are not wanted. The vetches and annual ryegrass have this tendency. It is usually not a serious problem and in most cases can be handled through normal weed control practices.

Use plant species that enhance forage opportunities for pollinators by selecting diverse legumes and other forbs. Flowering species such as legumes and brassicas are ideal for pollinators.

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.

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.

Close-seeded high biomass crops such as oats, rye, wheat, sorghum or sudangrass are ideal for protecting the soil surface, controlling soil erosion, and increasing soil organic matter content. This is especially important following crops that provide little residue cover, such as soybeans or corn silage. A minimum of 6-8 inches of growth is usually needed for erosion control, but 12 inches or more is optimal. To maximize erosion control and biomass production, maintain an actively growing cover crop as long as feasible to maximize plant growth.

Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

Deep-rooted and high biomass species provide maximum nutrient uptake.

When appropriate for the crop production system, mowing certain grass cover crops (e.g., sorghumsudangrass, 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.

If residual nutrients in the soil are a concern, consider species that will provide sufficient uptake of the target nutrients. Grasses utilize more soil nitrogen than legumes, and legumes utilize both nitrogen and phosphorus.

Winter annual grasses, especially cereal grains, can immobilize significant quantities of residual nitrogen left from the previous crop and can reduce the potential for nitrate leaching to the groundwater. The efficiency of these grasses for using residual nitrogen in the fall is (in decreasing order): rye, wheat, barley, oats. The earlier the planting in the fall, the more growth and nutrient uptake will occur before winter dormancy.

Forage radishes and turnips are also good nutrient scavengers and will recycle nutrients more quickly than the grass cover crops.

Suppress Excessive Weed Pressures and Break Pest Cycles

Consider cover crops that will provide food or habitat for natural enemies of production crop pests.

Consider selecting cover crops that release biofumigation compounds that inhibit soil-borne plant pests and pathogens. Species can be selected to serve as trap crops to divert pests from production crops.

Leaving cover crop residues on the soil surface can maximize allelopathic (chemical) and mulching (physical) effects.

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

Increasing 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.

All cover crops can provide nutrients and organic matter to the soil. Grasses planted alone generally produce more dry matter than legumes alone, but they also decompose more slowly and are less efficient

in conserving soil moisture. Grass/legume mixtures produce more dry matter overall, better early ground cover, and eventually more mulch for soil moisture conservation than either component grown alone.

Promote Biological Nitrogen Fixation

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

The timing of cover crop termination for nutrient cycling depends on the type of cover crop and the method of termination. Cover crops with a low carbon to nitrogen (C:N) ratio, such as legumes and other forbs, decompose and release nutrients more rapidly than cover crops with high C:N ratios, such as grass cover crops, especially if the grasses are allowed to grow beyond boot stage.

Incorporating the cover crop with tillage generally speeds decomposition and nutrient release but if the decomposition occurs too rapidly the nutrients may be lost to leaching or the soil organisms may temporarily tie up nutrients in the soil resulting in early season nutrient deficiencies. Cover crops that are left on the surface generally decompose more slowly and release nutrients to the growing crop throughout the growing season. Avoid cover crop species that harbor or carryover potentially damaging diseases or insects.

Winter annual legume crops that provide significant amounts of nitrogen for the next crop are (in decreasing order): hairy vetch, Austrian winter peas, and crimson clover. Other legumes may be used, but most supply smaller quantities of nitrogen. Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom

However, while annual legumes can supply large amounts of nitrogen to the summer crop, they provide minimum protection for nitrate leaching from the root zone when compared to cereal grains and other grasses.

Biennial and perennial legumes, although useful for supplying nitrogen and providing ground cover protection for the soil, are best suited as permanent pasture and hay crops in long-term rotations and should not be planted and utilized as annual cover crops.

Credit for nitrogen contributions from legume cover crops must be consistent with current University of Maryland Extension recommendations, and must be accounted for in the nutrient management plan. Credit is taken only for pure stands of legumes, not for mixes of legumes with grasses and/or forbs.

Terminate legumes as late as feasible to maximize nitrogen fixation.

PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for the specific fields that will be treated according to the planning criteria and operation and maintenance requirements of this practice. The plans and specifications should identify the requirements for establishing and maintaining this practice. Appropriate Implementation Requirements (IR) sheet(s) can serve as the planting plan and specifications for the practice.

Supporting Data and Documentation

- Extent of the planting in acres, field number where the practice is located, and the location of the practice marked on the conservation plan map;
- Assistance notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom;
- Completed copy of the appropriate Implementation Requirements sheet(s), or other specifications and management plans. Specify the following for each field, or groups of fields:
    - Purpose of the planting;
    - Soil loss calculations, if erosion control is a purpose;

- Plant species, varieties (if applicable), seeding rate and method, and planting dates;
- Rates, timing, and forms of nutrient application (if applicable);
- Dates and method to terminate the cover crop;
- Other management requirements or 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).

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be prepared for each management unit. Appropriate Implementation Requirement sheets, fact sheets, or other information sheets may be used to serve as the management plan as well as supporting documentation, and shall be provided to the client. These sheets shall be referenced in the conservation plan narrative.

At a minimum, the following components shall be addressed in the O&M plan, as applicable:

- Describe the extent of management needed to manage the cover crop for the desired period of time. Management may consist of mowing, mechanical harvesting, prescribed grazing, nutrient management, pest management, or other actions, as appropriate;
- Control weeds as needed by mowing or by spraying with an appropriate herbicide. To the extent feasible, “spot” spray or mow to control weeds so that desirable cover is not destroyed unnecessarily. Noxious weeds must be controlled as required by state law. Weed control must be part of a pest management plan;
- If forage use is desired, green-chop or graze the cover crop in the late boot to early head stages when optimal nutritional content and yield is available;
- For all purposes other than supplemental forage, terminate a grass cover crop no later than the late joint to early boot stage, or no later than 2 to 4 weeks prior to planting the next crop. Termination should be early enough that the crop does reach the flowering stage. The timing of the termination date permits maximum growth of the cover and maximum uptake of residual nutrients while allowing sufficient time for the decomposition of the vegetation, release of nutrients, and recharge of soil moisture;
- Legumes killed while succulent decompose more rapidly than grasses, so killing a legume cover crop 1 to 2 weeks before planting the next crop is usually sufficient;
- When optimum wildlife habitat is desired, do not mow or mechanically harvest fields during the nesting season of the desired wildlife species. For Maryland, the primary nesting season is generally from April 15 through August 15;
- Describe the acceptable uses (e.g., grazing, haying) and time of year/frequency of use restrictions, if any.

REFERENCES

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Revised Universal Soil Loss Equation Version 2 (RUSLE2) website:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/tools/rusle2/