Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

SOIL CARBON AMENDMENT

CODE 808

(ac)

DEFINITION

Using carbon-based amendments to increase soil carbon and improve the physical, chemical, and biological properties of the soil.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Maintain, increase, or improve soil organic matter quantity and quality
- Maintain or improve soil aggregate stability
- Maintain or improve habitat for soil organisms
- Improve plant productivity and health
- Improve the efficient use of irrigation water

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land where carbon amendment applications will improve soil conditions.

CRITERIA

General Criteria Applicable to All Purposes

Evaluate soils following the In-field Soil Health Assessment Worksheet to determine where soil carbon amendments will improve the soil condition.

Plan, design, and implement carbon amendment applications to meet all federal, state, and local laws and regulations. The owner or operator is responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations.

Physical and chemical amendment analysis is the responsibility of the provider of the material. In cases where the amendment is produced on-farm or on-site, the producer must have the material tested by a laboratory that participates in the North American Proficiency Testing Program.

Compost: Use compost that is analyzed for the following parameters according to the Test Methods for the Examination of Composting and Compost (TMECC), or by other Land Grant University (LGU) recognized methods:

- Maturity index rating of “mature” or “very mature”
- Carbon to nitrogen ratio (C:N) between 15:1 and 30:1 at maturity
- 40-60% moisture (60-40% solids) at maturity

Compost analysis must also report the carbon and nitrogen content, phosphorus, potassium, pH, soluble salts (electroconductivity), organic matter, and bulk density.

Biochar: Use biochar that is produced by heating biomass to a temperature in excess of 350°C under conditions of controlled and limited oxidant concentrations to prevent combustion (pyrolysis or gasification).

Biochar analysis must report carbon, nitrogen, phosphorus, potassium, and pH.

Do not create biochar from crop residues that could otherwise be left on the field to provide soil protection and improve soil organism habitat.

Other Carbon Amendments: Use regionally appropriate carbon-based materials, such as wood chips, sawdust, pulverized paper, bagasse, or distillation residue to meet the conservation objective.

Ensure that materials are tested as appropriate to identify any contaminants and applied judiciously to avoid nutrient imbalances (*e.g.* nitrogen immobilization).

Conduct whole orchard recycling only with new (replanting) tree crops. Chip orchards in place and do not export chips off site. Distribute chips evenly and incorporate to at least 6 inches deep.

All Amendments: On fields adjacent to surface water, follow all setbacks and spreading restrictions referenced in state-specific Conservation Practice Standard Nutrient Management (590). Apply at a rate that will improve soil organic matter and organism habitat without creating unacceptable risk of N or P loss. Spread amendment no more than 2 inches deep on the soil surface.

Do not apply **compost** when phosphorus risk assessments indicate a **high** or **very high** risk for phosphorus transport. Do not apply at rates that exceed the plant N or P requirements for the current crop.

Avoid use of heavy equipment during wet soil conditions or sensitive times of year.

Do not apply amendments:

- During peak wind erosion periods, unless anchored, incorporated or protected so as not to contribute to particulate air emissions
- To native grasslands
- To frozen or snow-covered fields, or when the top 2 inches of soil are saturated
- To slopes greater than 15%
- To sensitive areas, such as: wetlands, karst sinkholes, vernal pools, hydric soils, or naturally low fertility sites (*e.g.* serpentine soils, sage steppe, alkali sink or chaparral)
- To fields where a crop will not be able to utilize nutrients (*e.g.* to fallow land, or to a field without an existing or planned cover crop or cash crop)

Do not use this practice for minimal surface mulching using crop residues.

Do not use this practice for the exclusive application of biosolids that are not part of a compost or biochar mixture made from different feedstocks. Follow USEPA 40 CFR Part 503 pollutant limits and crop/site restrictions if amendments contain biosolids or sewage sludge. This regulation provides safe standards for pathogen reduction and heavy metal content.

Do not mix amendments with raw or uncomposted manure or use amendments pre-blended with soil.

Carbon amendments with C:N greater than 30:1 can immobilize other nutrients, especially nitrogen, and may necessitate supplemental nitrogen applications for plant growth. Time land application of amendments and crop planting dates to allow any mineralization and immobilization of nutrients at a less critical crop stage.

Additional Criteria to Maintain, Increase, or Improve Soil Organic Matter Quantity and Quality

Keep the soil surface covered with or incorporate plant-based mulching materials of suitable quantity and quality to add organic matter, provide food and shelter for soil biota, and protect the soil surface from raindrop impact and crusting, while allowing for adequate soil aeration.

Additional Criteria to Maintain or Improve Habitat for Soil Organisms

Use plant-based mulching materials of suitable quantity and quality to add organic matter, provide food and shelter for soil biota, and protect the soil surface from raindrop impact and crusting, while allowing for adequate soil aeration.

Additional Criteria to Improve the Efficient Use of Irrigation Water

Ensure amendments will not introduce excessive salts and will not negatively affect soil water dynamics.

CONSIDERATIONS

General Considerations

Mix biochar and compost together prior to application to supply nutrients to nutrient-poor biochars and equilibrate nutrient interactions in the soil.

Using compost or biochar with the US Composting Council's Seal of Testing Assurance Program (STA) or the International Biochar Institute (IBI) Seal, respectively, may serve an expedient alternative for amendment validation.

Apply biochar that contains more than 60% carbon to reduce phosphorus losses. Test the product on small acreage prior to widespread use.

Consider using set maintenance application rates that would meet the conservation objective, avoid any negative nutrient interactions, and reduce planning time.

Take appropriate measures to prevent soil erosion and compaction.

Where material is trucked onto land, timing of traffic must minimize potential soil compaction, and traffic routes must be closely examined to ensure that erosion is not caused. Disturbed areas should be appropriately treated to minimize potential erosion.

Carbon loss is directly related to the volume of soil disturbed, intensity of the disturbance, and the soil moisture content and soil temperature at the time the disturbance occurs. To make this practice more effective at reducing carbon loss:

- Perform any deep soil disturbance, such as subsoiling or fertilizer injection, so the vertical slot created by the implements is closed at the surface.
- Plant with a single disk or slot opener no-till drill to release less carbon dioxide (CO_2) and reduce oxidation of organic matter compared to wide-point hoe/chisel opener seeder drill.
- Perform soil disturbance when soil temperatures are below 50° F to oxidize less organic matter and release less CO_2 than operations done when the soil is warmer.

PLANS AND SPECIFICATIONS

In the soil carbon amendment plan, document:

- Purpose of practice
- In-field Soil Health Assessment Worksheet completed for each conservation management unit.
- Planned fields receiving amendments and their planned rotations aerial photos, including location of sensitive areas and setbacks
- Soil maps, including soil type, slope, drainage class

- Amendment analysis or certification
- Application rate, method, timing, and method of incorporation (when applicable)
- Soil test results before application
- Evaluation of carbon input effectiveness for the purpose(s) using the In-field Soil Health Assessment Worksheet to interpret positive trends.

OPERATION AND MAINTENANCE

Monitor fields in accordance with Land Grant University guidance and State law. A follow-up soil analysis should be taken at least a year after application to determine the effectiveness of the application.

Inspect and evaluate after the first heavy precipitation event to assure that material is stable and not impacting non-target areas.

Calibrate application equipment to ensure accurate distribution of material at planned rates.

Evaluate the effectiveness of the amendment (application, amount of cover provided, durability, etc.) and adjust future management or type of compost to better meet the intended purpose(s).

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