United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT, REDUCED TILL

CODE 345

(ac)

DEFINITION

Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round while limiting soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.

PURPOSE

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

- Reduce sheet, rill, and wind erosion and excessive sediment in surface water - (Soil Erosion)
- Reduce tillage-induced particulate emissions - (Air Quality Impacts)
- Improve soil health and maintain or increase organic matter content - (Soil Quality Degradation)
- Reduce energy use - (Inefficient Energy Use)

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

CRITERIA

General Criteria Applicable to All Purposes

This practice includes tillage methods commonly referred to as reduced (conservation/mulch) tillage where the entire soil surface is disturbed by tillage operations such as chisel plowing, field cultivating, tandem disking, or vertical tillage. It also includes tillage/planting systems with few tillage operations such as ridge till, hoe drills, air seeders, and certain “no till” drills that do not meet the STIR criteria for WI NRCS Conservation Practice Standard (WI NRCS CPS), Residue and Tillage Management, No Till (Code 329).

Residue shall not be burned.

Residues shall be uniformly distributed over the entire field. Removing residue from the row area prior to or as part of the planting operation is acceptable.

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.

USDA is an equal opportunity provider, employer, and lender.

Minimum planned residue levels will be maintained from harvest until after planting of the next crop. Removing residue from the row area prior to or as part of the planting operation is acceptable.

The Soil Tillage Intensity Rating (STIR) value shall include all field operations that are performed during the crop interval between harvest of the previous crop and harvest or termination of the current crop (includes fallow periods).

The annual STIR value rating shall be no greater than 80, and no primary inversion tillage implements such as a moldboard plow shall be used.

Additional Criteria to Reduce Sheet/Rill and Wind Erosion and Excessive Sediment in Surface Wa- ters

Soil loss estimates shall be calculated for the dominate critical soil map units using the current erosion prediction technology.

Use the current water and/or wind erosion prediction model to document/determine:

- Minimum amount of randomly distributed surface residue required,
- Time of year the residue needs to be present on the field,
- The amount of surface soil disturbance allowed to reduce erosion to the desired level. All practices on the management system will be reflected,
- For ridge-till systems, plan ridge height and ridge orientation to manage runoff and to minimize erosion, ridges shall have a maximum row grade of 4 percent.

Additional Criteria to Reduce Tillage Induced Particulate Emissions

Reduce or modify tillage operations that create dust, especially during critical air

quality periods. Avoid tillage activities during periods when the soil is most vulnerable

to wind erosion.

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

Ensure the Soil Conditioning Index (SCI) for the cropping system results in a rating of greater than zero.

Additional Criteria to Reduce Energy Use

Reduce the total energy consumption associated with field operations by at least 25 percent compared to the benchmark condition. Use the current approved NRCS tool for determining energy use to document energy use reductions

CONSIDERATIONS

General Considerations

Removal of crop residue, such as baling or grazing, can have a negative impact. These activities should not be performed without full evaluation of impacts on soil, water, animal, plant, and air resources.

Reduced till may be practiced continuously throughout the crop sequence, or may be managed as part of a residue management system that includes other tillage methods such as no till.

Production of adequate amounts of crop residue necessary for the proper functioning of this practice can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops and adjustment of plant populations and row spacing.

When providing technical assistance to organic producers, ensure residue and tillage management activities are consistent with the USDA - Agricultural Marketing Service National Organic Program Regulations.

Considerations for Maintaining or Improving Soil Organic Matter Content and Soil Health

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

- When deep soil disturbance is performed, such as by sub-soiling or fertilizer injection, make sure the vertical tillage slot created by these implements is closed at the surface.
- Minimize soil disturbance by planting with a single-disk opener, planter or no-till drill.
- Soil disturbance that occurs when soil temperatures are below 50° F release less CO2 than

  operations done on warmer soils, thus reducing organic matter losses.
- Use a diverse crop rotation, incorporating multiple crop types (cool-season grass, cool-season legume/forb, warm-season grass, warm-season legume/forb) into the crop rotation.
- Maximizing year round coverage of the soil with living vegetation and/or crop residues builds organic matter and reduces soil temperature there by slowing organic matter depletion by oxidation.
- Plant a cover crop after every annually tilled crop in the rotation to increase the time the roots are actively growing in the soil. Multi-species cover crop mixes provide greater benefits than singlespecie cover crops.
- Use undercutting tillage tools rather than burying tillage tools to enhance accumulation of organic material in the surface layer.
- Conduct soil-disturbing field operation when soil moisture is optimal, in order to maintain soil tilth, and reduce the need for additional tillage in the future.

Additional Considerations for Wildlife Food and Cover

Avoid tillage and other soil and residue/stubble disturbing operations during the nesting season and brood-rearing period for ground-nesting species.

Leave crop residues undisturbed after harvest (do no shred, bale, or till) to maximize the cover and food source benefits to wildlife during critical winter months.

Leaving rows of un-harvested crops standing at intervals across the field or adjacent to permanent cover will enhance the value of residues for wildlife food and cover. Leaving un-harvested crop rows for two growing seasons will further enhance the value of these areas for wildlife.

Use approved habitat evaluation procedure to determine the appropriate time and amount of residue and stubble needed to provide adequate food and cover for target wildlife species.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit. Record the following as documentation:

1. Resource concern to be treated or the purpose for applying the practice.
2. Location map with planned crops identified.
3. Summary of all field operations or activities that affect:
   - Amount of residue produced for each crop
   - Amount of residue cover with all field operations reflected
   - Residue orientation
   - Disturbance of the soil surface including all disturbances
4. The amount of residue (pounds/acre or percent surface cover) required to accomplish the planned purpose, and the time of year it must be present.
5. The maximum STIR value allowed to accomplish the planned purpose, and the time of year soil disturbance is allowed.
6. The minimum Soil Conditioning Index (SCI) value required to accomplish the purpose.
7. Erosion rate.
8. Benchmark and planned energy consumption.

OPERATION AND MAINTENANCE

Evaluate/measure the crop residues cover and orientation for each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to achieve planned residue amount and orientation. Adjust planting, tillage or harvesting equipment.

If there are areas of heavy residue accumulation as a result of harvest equipment or movement by water or wind in the field, spread the residue prior to planting so it does not interfere with planter operation.

Federal, Tribal, State and Local Laws

Users of this standard shall be aware of potentially applicable federal, tribal, state and local laws, rules, regulations or permit requirements governing residue management. This standard does not contain the text of federal, tribal, state, or local laws.

REFERENCES

Soil Conditioning Index Fact Sheet located in the Conservation Planning section of Wisconsin's NRCS web page.

Soil Tillage Intensity Rating Fact Sheet located in the Conservation Planning section of Wisconsin's NRCS web page.

USDA, Natural Resources Conservation Service, Tillage Equipment Pocket Identification Guide, 2005.

USDA, Natural Resources Conservation Service, Wisconsin Agronomy Technical Note WI-4, Estimates of Residue Cover Remaining After Single Operation of Selected Machines.

USDA, Natural Resources Conservation Service, Tillage Practice Guide, 2006.

Kuepper, George, 2001. Pursuing conservation tillage systems for organic crop

production—ATTRA. http://attra.ncat.org/attra-pub/organicmatters/conservationtillage.html

Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO2 loss across an eroded landscape. Soil Tillage Res. 81:183-194.

Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16th Triennial Conf., Int. Soil Till. Org. (ISTRO).

USDA, Natural Resources Conservation Service, National Agronomy Manual, 190-V. 4th Ed.