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 waters (Soil Erosion, Water Quality Degradation)
- 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 mulch tillage or conservation tillage where the entire soil surface may be 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 (e.g., ridge till) but which do not meet the soil tillage intensity rating (STIR) criteria for conservation practice Residue and Tillage Management, No Till (Code 329).

Uniformly distribute residues over the entire field. Removing residue from the row area prior to or as part of the planting operation is acceptable.

Do not burn crop residues.

The STIR value shall include all soil disturbance field operations that are performed during the crop interval (i.e., from the time immediately following harvest or termination of one cash crop through harvest or termination of the next cash crop in the rotation, including fallow periods). The planned crop interval STIR value rating must be no greater than 80, and it must be lower than the benchmark crop interval or rotation STIR value rating to ensure the practice purpose is achieved. No primary inversion tillage implements (e.g., moldboard plow) shall be used.

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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**Additional Criteria to Reduce Sheet, Rill and Wind Erosion, and Excessive Sediment in Surface Waters**

Use the current approved water and wind erosion prediction technology to document/determine the field operations to achieve the amount of randomly distributed surface residue needed, time of year residue needs to be present in the field, and the planned field operations allowed to reduce soil erosion to the planned crop interval or rotation objective, which must be no greater than "T" per planning criteria where soil erosion is an identified resource concern. Calculations shall account for the effects of other practices in the management system.

In ridge-till systems, plan ridge height and ridge orientation to manage runoff and minimize erosion, with a maximum row grade not to exceed four percent.

**Additional Criteria to Reduce Tillage-Induced Particulate Emissions**

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

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

Ensure the soil condition index (SCI) for the cropping system results in a rating of greater than zero. In addition, SCI result must be equal to or increased from the benchmark system to planned crop interval. SCI for longer periods of a reasonable, complete crop rotation rather the minimum planned crop interval may be calculated and used to meet this criteria.

**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 by baling or grazing, can have a negative impact on resources. 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.

**Additional Considerations for Maintaining or Improveing Soil Organic Matter Content and Soil Health**

Carbon loss is directly related to the volume of soil disturbed, intensity of the disturbance and 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 subsoiling or fertilizer injection, make sure the vertical slot created by these implements is closed at the surface.
- Planting with a single disk opener no-till drill will release less $CO_2$ and oxidize less organic matter than planting with a wide-point hoe/chisel opener seeder drill.

- Soil disturbance that occurs when soil temperatures are below 50° F will oxidize less organic matter and release less $CO_2$ than operations done when the soil is warmer.
- Maximizing year-round coverage of the soil with living vegetation and/or crop residues builds organic matter and reduces soil temperature, thereby slowing organic matter oxidation.
- Use a diverse crop rotation by incorporating multiple crop types (cool-season grass, cool-season legume/forb, warm-season grass, warm-season legume/forb) into the crop rotation.
- Plant a cover crop after every cash crop in the rotation. Multispecies cover crop mixes provide greater benefits than single-specie cover crops.
- Using undercutting tools rather than burying tools will enhance accumulation of organic material in the surface layer.
- Conducting any soil-disturbing field operation when soil moisture is optimal, neither excessive nor too dry, will help maintain soil tilth, and reduce the need for additional tillage in the future.

**Additional Considerations for Providing Food and Escape Cover for Wildlife**

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

Forgo fall shredding or tillage operations to maximize the amount of wildlife food and cover during critical winter months.

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

Use an 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 shall be prepared for each site and purpose and recorded in the approved implementation requirements document.

- Purpose for applying the practice.
- Planned crop(s).
- Amount of residue produced by each crop.
- All field operations or activities that affect—
  - Residue orientation.
  - Surface disturbance.
  - The field operations and amount of residue (pounds/acre or percent surface cover) required to accomplish the purpose, and the time of year it must be present.
- STIR values, SCI values, and erosion rates for benchmark and planned crop systems and notation of improvements.
- Benchmark and planned energy consumptions.

## OPERATION AND MAINTENANCE

Evaluate/measure the crop residue cover and orientation for each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to either plan a new residue amount or orientation; or adjust the planting, tillage, or harvesting equipment.

If there are areas of heavy residue accumulation (because of movement by water or wind) in the field, spread the residue prior to planting so it does not interfere with planter operation.

## REFERENCES

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