

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

RESIDUE AND TILLAGE MANAGEMENT,

REDUCED TILL

CODE 345

DEFINITION

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

PURPOSE

This practice is applied as a part of a conservation management system to support one or more of the following purposes:

- Reduce sheet, rill and wind erosion – Resource Concern (SOIL EROSION - Sheet, rill, & wind erosion).
- Reduce tillage-induced particulate emissions – Resource Concern (AIR QUALITY IMPACTS - Emissions of Particulate Matter - PM - and PM Precursors).
- Maintain or increase soil quality and organic matter content – Resource Concern (SOIL QUALITY DEGRADATION –Organic matter depletion).
- Reduce energy use – Resource Concern (INEFFICIENT ENERGY USE – Farming/ranching practices and field operations).
- Increase plant-available moisture – Resource Concern (INSUFFICIENT WATER –Inefficient moisture management).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

This practice includes tillage methods commonly referred to as mulch tillage or conservation 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 (e.g. ridge till) but which do not meet the Soil Tillage Intensity Rating (STIR) no greater than 20) for Residue and Tillage Management - No Till (code 329). STIR is calculated using the RUSLE 2, WEPS or other approved erosion prediction models.

CRITERIA

General Criteria Applicable to All Purposes

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 residues.

The Soil Tillage Intensity Rating (STIR) value shall include all field operations that are performed during the crop interval between harvest of the previous cash crop and harvest or termination of the current cash crop (includes fallow periods). The STIR value rating shall be no greater than 80, and no primary inversion tillage implements (e.g. moldboard plow) shall be used.

To see example Mulch Till systems that meet the desired residue cover see the following NRCS MI EFOTG Reference:

- *Agronomy Tech Note 33, SCS Bulletin, Crop Residue Systems for Conservation and Profit, NRCS MI,*

To certify Mulch till System meets the planned percent residue cover and STIR to Tolerable

Soil Loss or T, use the NRCS MI job sheet called: Line Transect Residue and Cover Estimate or procedure or equivalent.

Additional Criteria to Reduce Sheet and Rill

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#) or visit the [Field Office Technical Guide](#).

Erosion and Reduce Wind Erosion

Use RUSLE2 or WEPS to meet the planned soil loss objective for the critical or predominate soil type determine the:

- amount of randomly distributed surface residue needed;
- time of year the residue needs to be present in the field,
- amount of surface soil disturbance allowed,

to reduce erosion to the desired level.

All 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 of 4%.

Additional Criteria to Reduce Tillage-Induced Particulate Emissions

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

Adopt tillage practices that reduce particulate emissions.

Additional Criteria to Maintain or Improve Soil Quality and Organic Matter

Ensure that an evaluation of the cropping system using the current approved soil conditioning index (SCI) procedure or OSUE Lucas SOM calculator prediction results in zero or higher. (SOM GAINS = >SOM LOSSES)

Where some crop residue is harvested for bio-energy or other purpose use the Ohio State University SOM Calculator. The SOM Calculator is available by request from the OSU South Campus at Piketon, OH or free via a MI Corn Growers Association Member.)

Additional Criteria to Increase Plant-Available Moisture

Reducing Evaporation from the Soil Surface.

Maintain a minimum 60 percent surface residue cover throughout the year. See Agronomy Tech note 33 to help design Mulch till Systems to achieve 60 percent residue cover.

Trapping Snow. Fall tillage operation shall leave the crop stubble in an upright position.

Maintain a crop stubble height during the time significant snowfall is expected to occur of:

- at least 10 inches for crops with a row spacing of less than 15 inches;
- at least 15 inches for crops with a row spacing of 15 inches or greater

Maintain these heights over at least 50% of the field.

Conduct fall tillage operations as close as possible to perpendicular to the direction of prevailing winds during the time that significant snowfall is expected to occur.

Additional Criteria to Reduce Energy Use

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

See the NRCS RUSLE 2 Model to calculate the before and after energy use with the NRCS simple SCI and Fuel Use template.

CONSIDERATIONS

General - 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. Selection of acceptable tillage methods for specific site conditions may be aided by the use of an approved Soil Tillage Intensity Rating (STIR).

Lower the STIR By:

- Eliminating secondary or primary tillage trips.
- Changing the type of tillage equipment
- Changing the crop rotation add small grains or hay
- Adopting No till farming systems in the crop rotation by alternating tillage with no till or going all no till.
- Adopting Irrigation Water Management
- Bio tilling with cover crops

- Surface applying manure, compost or pesticides rather than incorporating.

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, residue management, and tillage activities should be consistent with the USDA-Agricultural Marketing Service National Organic Program standard.

Considerations for improving Soil Organic Matter Content

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

- Shallow soil disturbance (1-3 inches) releases less CO₂ than deeper operations.
- When deep soil disturbance is performed, such as by subsoiling or fertilizer injection, make sure the vertical tillage slot created by these implements is closed at the surface.
- Planting with a single-disk opener no-till drill will release less CO₂ than planting with a wide-point hoe/chisel opener air seeder drill.
- Soil disturbance that occurs when soil temperatures are below 50° F will release less CO₂ than operations done when the soil is warmer.

Considerations for Improving Soil Health/Quality

Producers can achieve major improvements in soil health by using the following activities/practices:

- Adopting 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.
- Planting a cover crop after every cash crop in the rotation. Multi-species cover crop

mixes provide greater benefits than single-specie cover crops.

- Using undercutting tools rather than burying tools to 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.

Increasing Plant-available Moisture –

Increasing the stubble height beyond the minimum required will increase the amount of snow trapped.

Variable height stubble patterns may be created to further increase snow trapping and storage.

Tillage and planting operations done on the contour will help slow overland flow and increase infiltration, thus increasing the potential for increased water storage in the root zone.

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

Forgoing fall shredding or tillage operations will maximize the amount of Wild life 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.

The time that residue is present, the amount and orientation of residue, and the height of stubble needed to provide adequate food and cover for the target species shall be determined using *Biology Tech Note 12, Wildlife Habitat Evaluation* (eFOTG, Section I-G, Michigan Technical Notes, Biology.)

Residue height, amount, and time period shall be determined using *NRCS Michigan Biology., Grain Food Plots for Wildlife* (eFOTG, NRCS MI) Harvest or tillage operations that disturb or cover the entire field shall not be performed during the

nesting and brood-rearing period of the target species.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit. The specifications shall identify, as appropriate:

- The resource concern to be treated or the purpose for applying the practice
- Planned crop(s)
- The amount of residue produced by each crop.

All field operations or activities that affect:

- Amount of residue cover
- Residue orientation
- Surface disturbance
- The amount of residue (pounds/acre or percent surface cover) required to accomplish the purpose, and the time of year it must be present
- The maximum STIR value allowed to accomplish the purpose, and the time of year that soil disturbance is allowed
- The minimum soil conditioning index value required to accomplish the purpose

Record the specifications using the Practice Implementation Requirements document NRCS MI Mulch Till Job Sheet 345 Specification table or equivalent.

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 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.

Mulch 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. Selection of acceptable tillage methods for specific site conditions may be aided by RUSLE2 (eFOTG, Section I-D, Erosion Prediction, Water Erosion) or WEQ (eFOTG, Section I-D, Erosion Prediction, Wind Erosion). Also, refer to Agronomy Tech Notes:

- 8 [Transitioning to Organic Resources](#),
- 9 [No-Till Alfalfa MSU Bulletin](#),
- 15 [The Influence of Organic Matter on Herbicide Reaction](#),
- 16 [Visual Benchmark References and Estimates: Crop Residue Measuring Techniques](#),
- 17 [Conservation Tillage](#)
- 18 [Crop Residue](#)
- 22 [No-Till on Fine Textured Soils](#),
- 29 [Understanding SOM changes](#)
- 30 [Nutrient Stratification in No-Till](#)
- 33 [Crop Residue Systems for Conservation and Profit](#)
- 34 [Residue and Tillage Management Mulch till planting information](#).
- 41 [Narrow Strip-cropping](#)
- 42 [Effect of Controlled Release N on Con in Narrow Strip cropping](#)
- 48 [Using Cover Crops to Convert to No till](#).

(eFOTG, Section I Technical References, Michigan Technical Notes, Agronomy).

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ATTRA:

<http://attra.ncat.org/attra-pub/organicmatters/conservationtillage.html>