

Residue and Tillage Management, Mulch Till (Acre) 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 entire field surface is tilled prior to planting.

PURPOSES

- Reduce sheet and rill erosion.
- Reduce wind erosion.
- Maintain or improve soil quality.
- Increase plant-available moisture.
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

This practice includes tillage methods commonly referred to as mulch tillage where a majority of the soil surface is disturbed by tillage operations such as vertical tillage, chiseling and disking and also includes tillage/planting systems with relatively minimal soil disturbance but which do not meet the criteria for Residue and Tillage Management (No Till/Strip Till/Direct Seed (code 329). It applies to stubble mulching on summer-fallowed land, to tillage for annually planted crops and to tillage for planting perennial crops.

It also includes some planting operations, such as hoe drills that disturb a large percentage of the soil surface during the planting operation and cropping

systems in which the majority of surface area is disturbed during harvest operations.

CRITERIA

General Criteria Applicable To All Purposes

Uniformly distribute residues over the entire field.

Residue shall not be burned.

To achieve planned residue levels for a field:

- Plan equipment type.
- Adjust equipment to leave desired residue levels.
- Verify with a minimum of 3 or a maximum of 5 random line transect residue measurements.
- Repeat for each field.

See NRCS Michigan Conservation Sheet (345) Line Transect Residue and Cover Estimates (eFOTG, Section IV conservation practices).

To plan acceptable residue levels for percent cover after planting, use the residue budget procedure, Agronomy Tech Note 33, Crop Residue Systems for Conservation and Profit (eFOTG, Section I, Michigan Technical Notes, Agronomy).

Sow cover crops if needed in the crop rotation to provide additional crop residues to meet NRCS eFOTG quality criteria per the identified resource concern.

Additional Criteria to Reduce Sheet and Rill Erosion

Determine the amount of randomly distributed surface residue needed and the amount of surface soil disturbance allowed managing erosion to the planned soil loss objective for the critical soil type or predominate soil type using the Revised Universal Soil Loss Equation 2 (RUSLE2) model or the Water Erosion Prediction System (WEPS) model technology. Ensure that calculations account for the effects of other practices in the management system.

Additional Criteria to Maintain or Improve Soil Quality

Calculate the soil conditioning index using the latest version of RUSLE2, and the Michigan county Modular Soil Erosion Systems (MOSES) database (eFOTG, Section I, Erosion Prediction, or the Wind Erosion Prediction System (WEPS model). Ensure that calculations account for the effects of other practices in the management system.

Ensure that an evaluation of the cropping system using the current approved soil conditioning index (SCI) procedure results in a positive trend by:

- Reducing tillage or adopting no till
- Adding hay to the crop rotation
- Applying Irrigation Water Management
- Sowing bio till cover crops
- Spreading manure or compost for nutrients

Additional Criteria to Increase Plant-Available Moisture

Reducing Evaporation from the Soil Surface. Maintain a minimum of 60 percent surface residue cover throughout the year. Estimate residue cover and design mulch till systems to meet this residue level using Agronomy Tech Note 33, Crop Residue Systems for Conservation and Profit (eFOTG, Section I-, Michigan Technical Notes, and Agronomy) and approved erosion prediction models RUSLE 2 for water erosion or WEPS for wind erosion.

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 to:

- At least 10 inches for crops with 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

Ensure the Soil Tillage Intensity Rating (STIR) for the single crop establishment and harvest is less than or equal to 80. Lower the STIR by:

- Eliminating secondary or primary tillage passes
- Changing the type of tillage equipment
- Adopting no till farming in the crop rotation by alternating tillage with no till.
- Surface applying manure or pesticides rather than incorporating

CONSIDERATIONS

General - Removal of crop residue, such as by burning, 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.

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. Refer to the following MI NRCS eFOTG, Section 1 Technical Notes Agronomy.

8- Transitioning to Organic Resources,

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,

24- Terminology and Definitions for Agricultural Tillage Implements

25 - Terminology and Definitions for Soil Tillage and Soil Tool Relationships

32 - Conservation Tillage Implements

33 – Crop Residue Systems for Conservation and Profit

34 – Residue and Tillage Management Mulch till Planting Information.

41- Narrow Stripcropping
42- Effect of Controlled Release N on Corn in
Narrow Stripcropping
48 – Using Cover Crops to Convert to 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.

A field border (*see practice 386*) planted to permanent vegetation can:

- Allow unobstructed turning for equipment.
- Eliminate unproductive end rows.
- Provide food and escape cover for wildlife.
- Provide travel lanes for farming operations.
- Provide habitat for beneficial insects and pollinators

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.

Increasing Soil Organic Matter Level and Reducing CO₂ Loss from the Soil - Where improving soil tilth is a concern, use of undercutting tools will enhance accumulation of organic material in the surface layer.

CO₂ loss is directly related to the volume of soil disturbed, the intensity of the disturbance, and 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.

Increasing Plant-Available Moisture - The effectiveness of stubble to trap snow increases with stubble height. 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 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.

An approved habitat evaluation procedure will aid in determining the appropriate time and amount of residue and stubble needed to provide adequate food and cover for the target wildlife species.

PLANS AND SPECIFICATIONS

Plans and Specifications shall include:

- *Field number(s) and acres*

- *Purpose(s) for this practice*
- *Crop(s) where this practice will be used*
- *The type and timing of soil disturbing operations*
- *Estimated surface residue following each operation*

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Criteria, Considerations, and O & M described in this standard.

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.

REFERENCES

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

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

NRCS Michigan Electronic Field Office Technical Guide (eFOTG):

<http://www.nrcs.usda.gov/technical/efotg>

- Section I, Reference Materials Michigan Technical Notes, Agronomy and Biology
- Section I-, Erosion Prediction, Water Erosion and Wind Erosion
- Section IV, Conservation Practices, Nutrient Management 590 and Pest Management 595

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