USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

# RESIDUE AND TILLAGE MANAGEMENT, MULCH-TILL

CODE 345
(Reported by Acre)

## 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 crops in systems where the entire field surface is tilled prior to planting.

## PURPOSE

This practice may be applied for one or more of the following purposes:

1. To reduce sheet and rill erosion;
2. To reduce wind erosion;
3. To reduce soil particle emissions;
4. To maintain or improve soil condition;
5. To increase plant-available moisture;
6. To provide food and escape cover for wildlife.

## CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland and other land where crops are planted.

This practice includes tillage methods commonly referred to as mulch tillage, or chiseling and disking. Additional specialized tillage equipment may be used to achieve the benefits of this practice. This practice also applies to stubble mulching on summer-fallowed land, to tillage for annually planted crops, and to tillage for planting perennial crops.

## CONSIDERATIONS

### General

"Mulch-till" refers to full-width tillage involving one or more tillage trips which disturbs all of the soil surface and is done prior to and/or during planting. Tillage tools such as chisels, field cultivators, disks, sweeps or blades are used.

Removal of plant 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.

Mulch till may be practiced continuously throughout the crop sequence, or may be managed as part of a residue management system which includes other tillage methods such as no-till. Selection of acceptable tillage methods for specific site conditions may be aided by an approved Soil Tillage Suitability Rating.

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 planted to permanent vegetation can:

1. Allow unobstructed turning for equipment;
2. Eliminate unproductive end rows;
3. Provide food and escape cover for wildlife;
4. Provide travel lanes for farming operations.

**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.

$CO_2$ 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. Consider the following guidelines to make this practice more effective:

1. Shallow soil disturbance (1-3 inches) releases less $CO_2$ than deeper operations;
2. 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;
3. Planting with a single disk opener no-till drill will release less $CO_2$ than planting with a wide-point hoe/chisel opener air seeder drill;
4. Soil disturbance that occurs when soil temperatures are below 50° F will release less $CO_2$ 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 disturbing standing stubble or heavy residue during the nesting season 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 crops standing at intervals across the field or adjacent to permanent cover will enhance the value of residues for wildlife food and cover. Leaving unharvested crops for two growing seasons will further enhance the value of these areas for wildlife.

## CRITERIA

**General Criteria Applicable to All Purposes**

All residues shall be uniformly distributed over the entire field.

Residue shall not be burned.

**Additional Criteria to Reduce Sheet and Rill Erosion**

The amount of randomly distributed surface residue needed and the amount of surface soil disturbance allowed to reduce erosion to the planned soil loss objective shall be determined using the current approved water erosion prediction technology. Calculations shall account for the effects of other practices in the conservation management system.

**Additional Criteria to Reduce Wind Erosion**

The amount and orientation of residue needed and the amount of surface soil disturbance allowed to reduce erosion to the planned soil loss objective shall be determined using the current approved wind erosion prediction technology. Calculations shall account for the effects of other practices in the conservation management system.

**Additional Criteria to Reduce Soil Particulate Emissions**

The amount and orientation of residue needed and the amount of surface soil disturbance allowed to reduce wind erosion to the tolerable soil loss value (T) shall be determined using the current approved wind erosion prediction technology. Calculations shall account for the effects of other practices in the conservation management system.

**Additional Criteria to Maintain or Improve Soil Condition**

An evaluation of the cropping system using the current approved soil conditioning index procedure shall result in a positive trend.

**Additional Criteria to Increase Plant-Available Moisture**

***Reducing Evaporation from the Soil Surface*** - A minimum of 2,000 pounds per acre or 60% surface residue cover shall be maintained throughout the year.

***Trapping Snow*** - Any fall tillage operation shall leave the crop stubble in an upright position.

Crop stubble height during the time significant snowfall is expected to occur shall be:

1. At least 10 inches for crops with a row spacing of less than 15 inches;

2. At least 15 inches for crops with a row spacing of 15 inches or greater.

These heights shall be present over at least 50% of the field.

Fall tillage operations shall be done as close to perpendicular as possible to the direction of prevailing winds during the time that significant snowfall is expected to occur.

**Additional Criteria to Provide Food and Escape Cover for Wildlife**

An approved habitat evaluation procedure shall be used to assess 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.

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.

*Note: Specific cost-sharing programs or other funding sources may dictate criteria in addition to, or more restrictive than, those specified in this standard.*

## PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Considerations, Criteria, and O&M described in this standard. Specifications shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

## OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be prepared for this practice. Appropriate job sheets may be used to serve as the management plan as well as supporting documentation, and shall be provided to the land user.

The producer/client is responsible for the operation and maintenance of the practice. Operation and maintenance activities address the following:

1. Crop rotation for each field;

2. Minimum percent residue to be maintained for each crop;

3. Type of tillage implements to be used.

## SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Location the practice on the conservation map.

2. Assistance notes. The notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom.

3. Identify resource concern(s) to be treated (refer to the "Purposes" section of this standard);

4. Provide documentation for identified concerns (e.g., soil loss calculations) as appropriate;

5. Ensure that field location, acreage, crop rotation, and percent residue needed to

address identified resource concern(s), and type(s) of tillage implements used are recorded in the conservation plan or national Mulch-Till Residue Management Conservation Practice Job Sheet – 345;

6. Operation and Maintenance plan or job sheet that includes the crop rotation, tillage implements, and minimum percent residue needed to address identified resource concern(s).

## REFERENCES


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4. Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool and D.C. Yoder, coordinators. 1997. *Prediciting Soil Erosion by Water: A Guide to Universal Soil Loss Equation (RUSLE).* U.S. Handbook No. 703.

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6. Skidmore, E.L. and N.P. Woodruff, 1968. *Wind Erosion Forces in the United States and their Use in Predicting Soil Loss.* U.S. Department of Agriculture, Agriculture Handbook No. 346.

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8. USDA Natural Resources Conservation Service, March, 2006. *Maryland RUSLE2 Manual*.