USDA
NATURAL RESOURCES
CONSERVATION SERVICE

DELAWARE CONSERVATION
PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT; MULCH TILL

CODE 345
(Reported in Acres)

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.

PURPOSES

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 particulate 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 uses where crops are planted.

This standard includes tillage methods commonly referred to as mulch tillage, or chiseling and disking, for annually planted crops and for planting perennial crops. Additional specialized tillage equipment may be used to achieve the benefits of this practice.

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.

Mulch till may be practiced continuously throughout the crop sequence. Mulch till can also include no-till methods in the rotation. Selection of acceptable tillage methods for specific site conditions may be aided by an approved Soil Tillage Suitability Rating.

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.

Production of adequate amounts of crop residues 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.

Increasing Soil Organic Matter Level and Reducing CO2 Loss from the Soil

Where improvement of 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:

1. Shallow soil disturbance (1-3 inches)

releases less CO2 than deeper operations.

2. When deep soil disturbance is performed, such by subsoiling or fertilizer injection, make sure the vertical tillage slot created by these implements is closed at the surface.

3. 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.

4. 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

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

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.

Avoid disturbing standing stubble or heavy residue during the nesting season for ground-nesting species.

CRITERIA

Criteria Applicable to All Purposes

All residues shall be uniformly distributed over the entire field.

Additional Criteria to Reduce Sheet and Rill Erosion and Wind Erosion

To reduce erosion, use high residue producing crops as often as possible. The amount of randomly distributed surface residue needed and the amount of surface soil disturbance allowed to reduce erosion to the tolerable soil loss value (T) shall be determined using the current approved erosion prediction technology.

Minimum residue requirements for this practice will be reflected by leaving all crop residues from row crops on the field following harvest. When residues such as corn stalks or soybean residue are removed, a cover crop will be used to supplement cover lost from residue removal. Calculations shall account for the effects of other practices in the management system.

Additional Criteria to Maintain or Improve Soil Condition

An evaluation of the cropping system using the current approved soil conditioning index (SCI) procedure shall result in a positive value.

Additional Criteria to Increase Plant-Available Moisture

To reduce evaporation from the soil surface, a minimum of 2000 pounds per acre, or 60 percent surface residue cover, shall be maintained throughout the year.

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.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail to ensure successful implementation of this practice. Documentation shall be in accordance with the section "Supporting Data and Documentation" in this standard.

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. Identify resource concern(s) to be treated (see the "purposes" section of the standard);
2. Identify the field location and extent of the practice in acres;
3. 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;
4. 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 on the applicable job sheet;
5. 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);
6. Soil loss calculations, if needed.

REFERENCES

1. Bolton, Ryan.2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatchewan, CA.
2. 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.
3. Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc 16th Triennial Conf., Int. Soil Till. Org (ISTRO).
4. Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to Universal Soil Loss Equation (RUSLE). U.S. Handbook No. 703.
5. Shaffer, M.J., and W.E. Larson (ed.) 1987. Tillage and surface-residue sensitive potential evaporation submodel. In NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.
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.
7. USDA, Natural Resources Conservation Service, 2002. National Agronomy Manual. 190-V 3rd ed.