**NATURAL RESOURCES CONSERVATION SERVICE**

**CONSERVATION PRACTICE STANDARD**

# RESIDUE AND TILLAGE MANAGEMENT,

# REDUCED TILL

**(Ac.)**

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

1. To reduce sheet, rill, and wind erosion;
2. To maintain or improve soil quality and organic matter content;
3. To reduce tillage-induced particulate emissions;
4. To reduce energy use;
5. To increase plant-available moisture.

## CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

This standard 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 that do not meet the Soil Tillage Intensity Rating (STIR) criteria for Residue and Tillage Management, No-Till (329).

## CRITERIA

### General Criteria Applicable to All Purposes

All residues shall be uniformly distributed 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 residue.

The Soil Tillage Intensity Rating (STIR) value shall include all field operations that are performed during the crop interval between harvest or termination of the previous cash crop and harvest or termination of the current cash crop (including 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.

### Additional Criteria to Reduce Sheet, Rill, and Wind Erosion

To reduce erosion to the to the tolerable soil loss level (T), use high residue producing crops as often as possible. Use the current approved water and/or wind erosion prediction technology to determine the amount of randomly distributed surface residue needed, the time of year the residue needs to be present in the field, and the amount of surface soil disturbance allowed.

Minimum residue requirements for this practice will be reflected by leaving all crop residues from row crops on the field following harvest. Crop residues are an important source of carbon and nutrients that increase soil organic matter and

provide nutrients to subsequent crops in the rotation. Leaving residues on the field is the preferred method for providing erosion control and promoting soil health. However, if residues such as corn stalks, small grain stubble 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.

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 Maintain or Improve Soil Quality and Organic Matter Content**

An evaluation of the cropping system using the current approved Soil Conditioning Index (SCI) procedure shall result in an SCI rating of zero or higher.

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

Adopt tillage practices that reduce particulate emissions. Reduce or modify tillage operations that create dust, especially during critical air quality periods.

**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.

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

Maintain a minimum of 2,000 pounds per acre or 60 percent residue cover on the soil surface throughout the year.

*Note: Specific programs may dictate criteria in addition to, or more restrictive than, those specified in this standard.*

## CONSIDERATIONS

**General Considerations Applicable to All Purposes**

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 an approved Soil Tillage Suitability Rating (STIR).

Removal of crop residue, such as by baling or grazing, can have a negative impact on resources. These activities should not be performed without a full evaluation of impacts on all resource concerns.

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.

**Additional Considerations to Improve Soil Quality**

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

1. Use a diverse crop rotation, incorporating multiple crop types (e.g., cool-season grasses, cool-season legumes/forbs, warm-season grasses, warm-season legumes/forbs) into the crop rotation;

2. Plant a cover crop after every cash crop in the rotation. Multi-species cover crop mixes provide greater benefits than single-species cover crops;

3. Using undercutting tools rather than burying tools will enhance accumulation of organic material in the surface layer;

4. Conducting soil-disturbing field operations when soil moisture is optimal, neither excessively wet nor too dry, will help maintain soil tilth and reduce the need for additional tillage in the future.

**Additional Considerations to Improve Soil Organic Matter Content**

Carbon 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 $CO_2$ than deeper operations;

2. When deep soil disturbance is performed, 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 $CO_2$ 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.

**Additional Considerations to Increase 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.

**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, and may be recorded in narrative form, on Implementation Requirements (IR) worksheets, on fact sheets, or other approved forms.

The appropriate fact sheet(s) and completed 345 IR worksheet can serve as the plan and specifications for this practice. The following items shall be addressed, as appropriate:

1. Purpose of the reduced tillage practice (identified resource concerns);

2. For each field, the cropping sequence and acceptable implements to be used, minimum Soil Conditioning Index (SCI) and Soil Tillage Intensity Rating (STIR) values to be maintained, and minimum percent residue needed to address the identified resource concern(s).

**OPERATION AND MAINTENANCE**

An Operation and Management (O&M) plan shall be prepared and is the responsibility of the client to implement. The appropriate fact sheet(s) and/or IR worksheet may serve as the management plan, as well as supporting documentation, and shall be reviewed with and provided to the client.

At a minimum, the following components shall be addressed in the O&M plan, as applicable:

1. Follow the specified crop rotation and implements to be used for each field. Contact NRCS before changing the cropping sequence and/or tillage methods, especially on HEL fields or when receiving financial assistance for this practice;

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

3. Limited tillage is allowed for spot treatment of weeds, leveling ruts, or similar purposes. No more than 25% of the field may be tilled for these purposes;

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

**SUPPORTING DATA AND DOCUMENTATION**

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

1. Location of the practice on the conservation plan 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. If applicable, soil loss calculations (RUSLE2 printouts);

4. SCI and STIR calculations, or SCI/STIR reference table, if applicable;

5. Completed IR worksheet, and copy of the appropriate fact sheet(s) or other specifications and management plans.

**REFERENCES**


1. Kuepper, George. 2001. *Pursuing Conservation Tillage Systems for Organic Crop Production*. ATTRA. http://attra.ncat.org/attra-pub/organicmatters/conservationtillage.html

2. Bolton, Ryan. 2003. *Impact of the Surface Residue Layer on Decomposition, Soil Water Properties and Nitrogen Dynamics*. M.S. thesis. Univ. Of Saskatchewan, Saskatoon, Saskatchewan, CA.

3. 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.

4. Reicosky, D.C. 2004. *Tillage-Induced Soil Properties and Chamber Mixing Effects on Gas Exchange*. Proc 16th Triennial Conf., Int. Soil Till. Org (ISTRO).

5. 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.

6. 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.

7. 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.

8. USDA, Natural Resources Conservation Service. *Conservation Practice Standards.* Delaware Field Office Technical Guide, Section IV.

9. USDA, Natural Resources Conservation Service. 2011. *National Agronomy Manual*. 190-V, 4rd ed.