RESIDUE AND TILLAGE MANAGEMENT - NO TILL/STRIP TILL/DIRECT SEED

(Acres)
Code 329

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year round while limiting soil-disturbing activities to only those necessary to place nutrients, condition residue, and plant crops.

II. Purpose

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

- reduce sheet and rill erosion.
- reduce wind erosion.
- improve soil organic matter content.
- reduce CO2 losses from the soil.
- reduce soil particulate emissions.
- increase plant-available moisture.
- provide food and escape cover for wildlife.

III. Conditions Where Practice Applies

This practice applies to all cropland and other land where establishing crops or other vegetation with a minimum amount of soil disturbance is necessary to address an identified resource concern.

This practice includes planting methods commonly referred to as *no till*1*, strip till,* and *direct seed*. Approved implements include no till and strip-type fertilizer and manure injectors and applicators and similar implements that only disturb strips and slots. Any implement considered to be full-width or capable of full disturbance may not be used.

Note: In the context of no till, direct seed refers to a method of planting without soil disturbance, and does not refer to methods of planting alfalfa with a

companion crop.

IV. Federal, State and Local Laws

Users of this standard shall be aware of potentially applicable federal, state and local laws, rules, regulations or permit requirements governing residue management. This standard does not contain the text of federal, state, or local laws.

V. Criteria

A. General Criteria Applicable to All Purposes

1. Residue shall not be burned or removed.
2. All residues shall be uniformly distributed over the entire field and planned residue levels maintained from harvest until after planting.
3. No full-width tillage shall be performed regardless of the depth of the tillage operation. Planters or drills will be equipped to plant directly through untilled residue or a "narrow" strip within each row in the case of strip tillage. Disturbance of the soil by tillage devices such as rotary tillers, sweeps, multiple coulters, or row cleaning devices shall be limited to the soil surface within the crop row. No more than 30 percent of the entire soil surface shall be disturbed by the planting operation and associated nutrient placement activities.
4. The amount of uniformly distributed surface residue needed and the amount of soil disturbance allowed to reduce erosion to the planned soil loss objective shall be determined using the current approved sheet and rill erosion prediction technology (*RUSLE2*) located in Section I of the Wisconsin electronic Field Office Technical Guide (eFOTG). Calculations shall account for the effects of all practices in the management system.
5. The annual *Soil Tillage Intensity Rating (STIR)* value for all soil-disturbing activities

shall be no greater than 15 as calculated by RUSLE2.

Conservation Practice Standards are reviewed periodically and updated if needed. To obtain the current version of this standard, NRCS, WI contact your local NRCS office, visit the electronic Field Office Technical Guide, or contact the Standards Oversight Council (SOC). 10/06

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Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

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6. Manure Injection will be allowed as long as all associated soil disturbing activities are documented in the RUSLE2 soil loss calculation and the resulting annual STIR value is no greater than 15.

7. Corn silage may be included in the crop rotation if the resulting STIR value is less than 15 and a positive *Soil Conditioning Index (SCI)* calculated using RUSLE2 for the crop rotation is achieved.

Note: Early planted cover crops or the addition of solid manure are recommended alternatives to replace crop residue. Regulations may limit locations where manure can be used for residue replacement.

B. Additional Criteria to Reduce Wind Erosion and to Reduce Soil Particulate Emissions

Soil loss and soil particulate reductions will be met by maintaining the necessary amount and orientation of crop residue, by managing the amount of soil disturbance, and by implementing additional conservation practices as necessary to address the identified resource concerns. The current approved wind erosion prediction technology, located in Section I of the Wisconsin eFOTG, shall be used.

C. Additional Criteria to Improve Soil Condition

An evaluation of the cropping system using the current approved SCI procedure shall be zero or above when calculated for the entire crop

rotation.

D. Additional Criteria to Reduce CO2 Loss from the Soil

1. The annual STIR value for all soil-disturbing activities calculated for the entire rotation shall be no more than 15.
2. An evaluation of the cropping system using the current approved SCI procedure shall result in a value equal to or greater than zero.

E. Additional Criteria to Provide Food and Cover for Wildlife

Where wildlife habitat is identified as a resource concern, the following criteria shall be implemented as appropriate.

1. To enhance the value of residues for wildlife, maintain a minimum residue cover of 50 percent uniformly distributed residue over the soil surface throughout the year.
2. Leaving crop residues undisturbed after harvest (by not shredding or rolling) maximizes cover and food sources for wildlife.
3. To protect ground-nesting species, avoid disturbing standing stubble or heavy residue during the nesting season.

VI. Considerations

A. General

1. Soil quality, porosity, and soil health will improve with each subsequent year of no till/strip till. Research has shown that maximum gain will be achieved after six consecutive years of no tillage.
2. No till can reduce the potential for compaction by improving soil infiltration rates and increasing the organic layer. Caution must still be used to prevent compaction by implement traffic during wet conditions.
3. Removing crop residue by baling or

intensive grazing should be discouraged if targeted residue levels are negatively impacted.

4. Using no till/strip till in conjunction with any of the following will increase crop residue.

• Use of high residue crops and crop varieties.

• Use of cover crops.

• Increase amount of seed per acre planted and/or use of narrower row spacings.

5. Using no till/strip till/direct seed for all crops in the rotation or cropping system can enhance the positive effects of this practice by:

• increasing the rate of soil organic matter accumulation.

• keeping soil in a consolidated condition, which provides additional resistance to sheet and rill erosion.

• sequestering more carbon in the soil.

• further reducing the amount of particulate matter generated by field operations.

• forming root channels and other near-surface voids that increase infiltration.

6. Concentrated flow channels, where present, need to be controlled through the use of additional Wisconsin FOTG, Section IV, conservation practices such as:

• Standard 386, Field Border.

• Standard 412, Grassed Waterway.

• Standard 330, Contour Farming; Standard 332, Contour Buffer Strips; and Standard 585, Stripcropping.

The use of these practices will not only reduce erosion, but may provide easier field access, eliminate unproductive end rows, and provide wildlife habitat.

B. Increasing Soil Organic Matter Level and Reducing CO2 Loss

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. A STIR value of 20 is considered to be the breakeven point for maintaining soil carbon. Values below 20 build soil organic matter. Values greater than 20 deplete soil organic matter and increase the release of CO2.

The following guidelines can make this practice more effective.

• 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.

• Shallow soil disturbance (1-3 inches) to the degree permitted by this practice standard minimizes the release of CO2.

• Planting with a single disk opener no-till drill will release less CO2.

• Soil disturbance that occurs when soil temperatures are below 50° F will release less CO2 than operations done when the soil is warmer.

C. Reducing Soil Particulate Emissions

1. Minimizing the number of tillage operations and reducing tractor operating speed during tillage operations generally produce fewer particulate emissions.
2. Dry soils will produce more particulates than moist soils.
3. Reducing the wind erosion rate below the *tolerable soil loss* will help reduce particulate emissions. This can be done by:

• increasing the level of crop residue cover.
• installing other practices to reduce wind erosion, such as Wisconsin FOTG, Section IV, Standard 380, Windbreak/Shelterbelt Establishment, or Standard 340, Cover Crop.

VII. Plans and Specifications

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the criteria described in this standard. Specifications shall be recorded using narrative statements in the conservation plan or other acceptable documentation.

VIII. Operation and Maintenance

No operation and maintenance requirements have been identified for this practice.

IX. References

The following publications are available at the local NRCS field offices or the Wisconsin NRCS home page located at: http://www.wi.nrcs.usda.gov.

• USDA, Natural Resources Conservation Service, Wisconsin electronic Field Office Technical Guide, Section I, Soil Erosion Prediction Models.
• USDA, Natural Resources Conservation Service, Wisconsin electronic Field Office Technical Guide, Section IV, Standards and Specifications.
• A Guide to Managing Crop Residue USDA, NRCS/UW-Ext GWQ029 R-09-10M-200-S2005.

• USDA, Natural Resources Conservation Service, Tillage Equipment Pocket Identification Guide, 2005.
• USDA, Natural Resources Conservation Service, Wisconsin Agronomy Technical Note WI-4, Estimates of Residue Cover Remaining After

Single Operation of Selected Machines.

• Revised Universal Soil Loss Equation, Version 2 (RUSLE2) program and guidance.

• USDA, Natural Resources Conservation Service, Tillage Practice Guide, 2006.

• USDA, Natural Resources Conservation Service, National Agronomy Manual, 190-V.

• RUSLE2 Users Reference Guide: http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm.

For assistance and additional local information on no till and strip till, contact the local Land Conservation Department, Natural Resources Conservation Service, or University of Wisconsin Extension Service.

Additional Resources:

• 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.

• 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.

• Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16th Triennial Conf., Int. Soil Till. Org. (ISTRO).

• 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 conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703.

• 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.
• 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.

X. Definitions

No Till / Strip Till / Direct Seed (III) – The soil is left undisturbed between crop harvest and planting of the next crop except for disturbance within the crop row caused by the planter and disturbance outside of the crop row caused by the placement of nutrients into the soil. The total area of soil surface disturbed by all planting and nutrient placement activities may not exceed 30 percent. Planting or drilling is accomplished using disc openers, coulter(s), row cleaners, in-row chisels or roto-tillers. Other common terms used to describe this practice include slot planting, zero till, row till and slot till. In the context of this standard, Direct Seed means seed is planted using a No Till or Strip Till type system. See the NRCS Tillage Practice Guide for additional guidance.

RUSLE2 (V.A.4.) – Revised Universal Soil Loss Equation Version 2. A soil erosion prediction tool that is also used to analyze trends in soil quality over a cropping rotation. RUSLE2 mathematically calculates on a daily basis the effects of erosivity factor rainfall (R), erodibility factor (Soil K value), slope length (L), slope steepness (S), cover management which includes crop rotation and all associated tillage (C), and supporting conservation practices (P) such as contour over the length of the cropping rotation.

Soil Tillage Intensity Rating (STIR) (V.A.5.) – A measurement that compares the effect of various tillage operations throughout the growing season and rotation. STIR value takes into consideration the number of tillage operations, the degree of disturbance such as depth, speed, type of equipment,

along with the overall amount of soil surface disturbed. STIR value is calculated using the RUSLE2 program.

Soil Conditioning Index (SCI) (V.A.7.) – A measurement that compares the consequences of cropping systems and tillage practices. It provides a means to evaluate and design conservation systems that maintain or improve soil condition. SCI provides a rating that compares biomass production(crop residue), field operations (tillage),

and erosion rates for the particular soil. SCI is calculated using the RUSLE2 program.

Tolerable Soil Loss (VI.D.3.) – The estimated rate of soil erosion when soil formation and soil loss is in balance and soil productivity is not expected to degrade. Soil loss tolerance is specific for individual soil units and reflects the characteristics of that soil in the climatic location it is found. Soil loss tolerance is expressed as "T" value which indicates how many tons of soil loss per acre per year can be tolerated.