

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

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

(Ac.)

**CODE 329**

**DEFINITION**

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

**PURPOSE**

- Reduce sheet/rill erosion.
- Reduce wind erosion.
- Improve soil organic matter content.
- Reduce CO<sub>2</sub> losses from the soil.
- Reduce energy use.
- Increase plant-available moisture.
- Provide food and escape cover for wildlife.

**CONDITIONS WHERE PRACTICE APPLIES**

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

This practice includes planting methods commonly referred to as no-till, strip till, direct seed, zero till, slot till or zone till. Approved implements are: no-till and strip-till planters; certain drills and air seeders; strip-type fertilizer and manure injectors and applicators; in-row chisels; and similar implements that only disturb strips and slots. All others are considered to be full-width or capable of full disturbance and therefore not compatible.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Do not burn residues.

Distribute residues uniformly over the entire field.

Do not perform full-width tillage regardless of the depth of the tillage operation.

The Soil Tillage Intensity Rating (STIR) value shall include all field operations performed during the crop interval between harvest of the previous crop and harvest or termination of the current crop (including fallow periods). The STIR value shall be no greater than 30.

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

Use current approved erosion prediction technology to determine the amount of randomly distributed surface residue needed, and the amount of surface soil disturbance allowed while decreasing soil erosion to the planned soil loss objective. Calculations shall account for the effects of other practices in the management system.

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

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

**Additional Criteria to Reduce CO<sub>2</sub> Losses from the Soil**

The Soil Tillage Intensity Rating (STIR) value shall include all field operations performed during the crop interval between harvest of the previous crop and harvest or termination of the current crop, and shall be no more than 20.

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**

The annual Soil Tillage Intensity Rating (STIR) value for all soil-disturbing activities in the cropping system shall be no more than 20.

Crop stubble height during the time of expected evaporation losses shall be:

- at least 10 inches for crops with a row spacing of less than 15 inches
- at least 15 inches for crops with a row spacing of 15 inches or greater.

These stubble heights shall be present on at least 60% of the field.

### **Trapping Snow**

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

- at least 10 inches for crops with a row spacing of less than 15 inches;
- 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 field operations that disturb residue 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**

Determine residue duration, amount, orientation and stubble height needed to provide adequate food and cover for target species using an approved habitat evaluation procedure.

### **CONSIDERATIONS**

#### **General**

Removing of crop 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 crop residues to achieve the purpose of this practice can be enhanced through the use of high residue crops and crop varieties, the use of cover crops, and adjustment of plant populations through seeding rates and row spacing.

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 provides additional resistance to sheet and rill erosion.
- sequestering additional carbon in the soil.
- further reducing the amount of particulate matter generated by field operations.
- reduce energy inputs to establish crops.
- forming root channels and other near-surface voids that increase infiltration.

A field border 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.

### **Increasing Soil Organic Matter Level and Reducing CO<sub>2</sub> Loss**

The amount of carbon dioxide (CO<sub>2</sub>) lost from the soil is 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.

Use the following guidelines to plan tillage scenarios for this purpose.

- Shallow soil disturbance (1-3 inches) releases less CO<sub>2</sub> than deeper operations
- When planning deep soil disturbance by subsoiling or fertilizer injection, make sure the vertical slot created by these implements is closed at the surface
- Plant with a single disk opener no-till drill to release less CO<sub>2</sub> 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 CO<sub>2</sub> than operations done when the soil is warmer

### **Managing Soil Moisture and Protecting Crops from Freeze Damage**

The type, timing and depth of soil-disturbing activities all influence soil moisture losses.

Shallow operations (1-2 inches) or operations that do not invert the soil will decrease moisture loss compared to deeper operations or those that invert and mix the soil.

Soil-disturbing operations performed when the soil surface is moist will result in greater moisture loss than operations done when the top two to three inches of soil have dried.

Leaving stubble taller than the minimum required will increase the relative humidity close to the soil surface, which decreases the rate of evaporative loss from the soil.

Leaving stubble taller than the 10-inch minimum will trap more snow and provide better protection to plants from freezing or desiccation.

Variable-height stubble patterns will further increase snow trapping and soil water storage.

Performing all field operations on the contour will slow overland flow and allow more opportunity for infiltration.

### **Wildlife Food and Cover**

To maximize wildlife food and cover, leave crop residues undisturbed after harvest (do not shred, mow or roll).

Leaving rows of unharvested crop standing at intervals across the field or adjacent to permanent cover will further 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.

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

### **PLANS AND SPECIFICATIONS**

Prepare plans and specifications for each field or treatment unit according to the Criteria, Considerations and Operation and Maintenance sections of this standard.

Specifications shall describe the requirements for applying this practice to meet the intended purpose.

Record practice specifications on the Colorado Residue and Tillage Management 329, No Till/Strip Till/Direct Seed, Conservation Practice Job Sheet.

Document the following components in the 329 Job Sheet, as a minimum.

- Planned crop(s)
- Specify the type of equipment for No Till/Strip Till/Direct Seed for each crop
- Specify the planned residue amounts for: (1) after harvest of the prior crop and (2) the planned residue cover after seeding the planned crop.

### **OPERATION AND MAINTENANCE**

Evaluate/measure crop residue cover and orientation after each crop to verify planned amounts and orientation. Adjust management as needed to plan new residue amounts and orientation, or adjust planting and/or harvesting equipment.

### **REFERENCES**

- Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO<sub>2</sub> loss across an eroded landscape. *Soil Tillage Res.* 81:183-194. <http://www.sciencedirect.com/science/article/pii/S0167198704001941>
- Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16th Triennial Conf., Int. Soil Till. Org. (ISTRO). <http://afsrweb.usda.gov/SP2UserFiles/Place/36450000/Products-Reprints/2003/1042.pdf>
- U.S.D.A. Natural Resources Conservation Service. 2011. National Agronomy Manual. 190-V. 4th ed.