

USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

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

CODE 329
(Reported by Acre)

DEFINITION

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

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 improve soil organic matter;
4. To reduce CO₂ losses from the soil;
5. To reduce soil particulate emissions;
6. To increase plant-available moisture;
7. 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 practice includes planting methods commonly referred to as no-till, zero-till, slot-plant, row-till, zone-till, or strip-till. Approved implements include: 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 minimally disturb plant residue. Typically, this disturbance is in narrow strips or slots. Implements that will result in significant disturbance are not compatible with this standard.

No-till, strip-till, and direct-seed means satisfying the criteria of this standard continuously throughout the crop rotation.

CONSIDERATIONS

General

“No-till” refers to planting crops into a narrow slot or opening in the soil created by coulters, row-openers, or other devices for the purpose of inserting seed or transplants.

“Strip-till” refers to planting crops into a cultivated or tilled strip no wider than one-third of the row spacing. Strips may be tilled as part of the planting operation or in a separate, earlier operation.

Distinguishing between no-till and strip-till in the field is not necessary, because both are acceptable under this standard. In all cases, however, producers should be encouraged to minimize soil disturbance in order to maximize the benefits of this practice.

Removing crop residue, such as by baling or grazing can have negative impacts on resources. These activities should not be performed without full evaluation of impacts on soil, water, air, plants, and animal resources.

Production of adequate amounts of crop residues necessary to achieve the purposes 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.

Using no-till/strip-till/direct-seed for all crops in

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the rotation or cropping system can enhance the positive effects of this practice by:

1. Increasing the rate of soil organic matter accumulation;
2. Keeping soil in a consolidated condition, which provides additional resistance to sheet and rill erosion;
3. Sequestering more carbon in the soil;
4. Further reducing the amount of particulate matter generated by field operations;
5. Forming root channels and other near-surface voids that increase infiltration.

Improving Soil Organic Matter

An SCI score of a positive 0.2 is the lowest level of performance acceptable in a High Residue (i.e., grain corn) Continuous No-Till Cropping System. Consider setting SCI targets for higher levels of performance using the following table:

Soil Conditioning Index (SCI) Score	Performance Level – Soil Organic Matter Improvement
+0.2 to +0.40	Minimum
+0.40 to +0.6	Intermediate
+0.6 or greater	Optimum

Performance in High Residue Continuous No-Till Systems can be further enhanced by minimizing STIR values (e.g., no STIR values greater than 20).

Reducing CO2 Loss from the Soil

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

2. 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;
3. Soil disturbance that occurs when soil temperatures are below 50 degrees F will release less CO₂ than operations done when the soil is warmer.

Reducing Soil Particulate Emissions

To reduce particulate emissions, consider operating at slower speeds, and avoid operating on dry soils.

Reducing the wind erosion rate below the tolerable soil loss will help reduce particulate emissions. This can be done by:

1. Increasing the level of crop residue cover;
2. Reducing the number of soil-disturbing operations;
3. Installing other practices to reduce wind erosion, such as Herbaceous Wind Barriers (Code 603) or Cross Wind Trap Strips (Code 589C).

Managing Soil Moisture and Protecting Crops from Freeze Damage

The type, timing, and depth of soil-disturbing activities all influence moisture loss. Shallow operations (1-2 inches) or operations that do not invert the soil will reduce 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 reduces the rate of evaporative loss from the soil.

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

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

Providing Food and Escape Cover for Wildlife

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 crop residues undisturbed after harvest (do not shred or roll) will maximize their food and cover benefits.

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.

No full-width tillage (moldboard plow, chisel plow or disking of the entire field) shall be performed regardless of the depth of the tillage operation.

The annual Soil Tillage Intensity Rating (STIR) value for all soil-disturbing activities shall be no greater than 30.

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 Improve Soil Organic Matter

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

Additional Criteria to Reduce CO2 Loss from the Soil

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

Additional Criteria to Increase Plant-Available Moisture

To reduce evaporation from the soil surface, 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 evaporation losses can be 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 stubble heights shall be present on at least 60% of the field.

Additional Criteria to Provide Food and 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.

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

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 shall address the following, as applicable:

1. Crop rotation for each field;
2. Minimum Soil Conditioning Index (SCI) and Soil Tillage Intensity Rating (STIR) values to be maintained, as applicable, and acceptable activities to maintain those values;
3. If row cultivation or spot treatment for weeds, leveling ruts, or similar operations are needed, limit tillage to maintain residue levels along with SCI and STIR values to the extent practicable and disturb only the area where the problem occurs.

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 this standard);
2. Identify the field location and extent of practice in acres, and complete the assistance notes. Assistance notes shall include dates of site inspections, name or initials of the person who made the inspections, specifics as to what was inspected, alternatives discussed, decisions made, and by whom;
3. Ensure that field number, acreage, crop rotation, SCI, STIR, and percent residue needed to address identified resource concern(s) are recorded as needed in the conservation plan or on an applicable job sheet;

4. Operation and Maintenance plan or job sheet that includes the crop rotation, SCI & STIR values and minimum percent residue needed to address identified resource concern(s);
5. Soil loss calculations, if needed.

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