

## Residue and Tillage Management, No Till/Strip Till/Direct Seed (Ac.) 329

### 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 those necessary to place nutrients, condition residue, and plant crops.

### PURPOSES

- Reduce sheet and 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 planted.

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

Residue shall not be burned.

All residues shall be uniformly distributed over the entire field.

No full-width tillage shall be performed regardless of the depth of the tillage operation *except where specified for a reason listed in the O & M.*

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

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

The amount and orientation of surface residue needed and the amount of surface soil disturbance allowed to reduce erosion to the planned soil loss objective for the critical soil type or predominant soil type shall be determined using the Revised Universal Soil Loss Equation (RUSLE2) or the Wind Erosion Prediction System 1 (WEPS) Model found in the NRCS Michigan eFOTG, Section I, General References, Erosion Prediction, or the latest erosion prediction technology. 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 (SCI) procedure shall result in a positive trend.

*See the NRCS National Agronomy Manual Part 508 Soils, Subpart 508C, Soil Management for an explanation of the Soil Conditioning Index.*

*Either the RUSLE 2 or WEPS Models have an SCI Sub-model for calculating SCI using wind or water erosion estimates in average tons/Ac/Yr.*

#### Additional Criteria to Reduce CO<sub>2</sub> Loss from the Soil

The Soil Tillage Intensity Rating (STIR) value shall include all field operations that are 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 Reduce Energy Use**

*When switching to a No till farming system there is substantial fuel savings. See the NRCS MI Conservation Stewardship Program Enhancement Activity Sheet CSP 2010 ENR01 Fuel Use Reduction for Field Operations to estimate the fuel saved by crop year or crop rotation.*

**Additional Criteria to Increase Plant-Available Moisture and 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 for well drained sands or loamy sand textured soils in Michigan State University Soil Management Groups 5a & 5b; 4a & 4b; 3a & 3b; or 5c, 4c, and 3c if drained with subsurface drainage.

Crop stubble height during the time evaporation losses can be expected to occur shall be:

- At least 10 inches for crops with 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 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 Cover For Wildlife**

*Determine residue duration, amount, orientation and stubble height needed to provide adequate food and cover for target species using the Michigan NRCS job sheet, Biology Series, Wildlife Food Plots or the Michigan Wildlife Habitat Worksheet, Michigan Technical Note Biology 12.*

**CONSIDERATIONS**

**General** - Removing 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 purposes of this practice can be enhanced through the use of high residue crops and crop varieties, use of cover crops, and adjustment of plant populations via 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 more 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** - CO<sub>2</sub> 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:

- Shallow soil disturbance (1-3 inches) releases less CO<sub>2</sub> than deeper operations.
- 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.
- Planting with a single disk opener no-till drill will 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 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 2-3 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 trap more snow and provide better protection to plants from freezing or desiccation.

Variable-height stubble patterns may be created to further increase snow storage.

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

**Wildlife Food and Cover** - 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. Leaving unharvested crop rows for two growing seasons will further enhance the value of these areas for wildlife.

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

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

## PLANS AND SPECIFICATIONS

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

*At minimum, in the plans and specifications, required documentation for 329 is as follows:*

- *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 the crop residues 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.*

Residue left on the field should be uniformly distributed on the soil surface. To improve planter performance, combines should be equipped to spread residue over 80 percent of the working width of the header to prevent bunching of residue.

To prevent yield loss, leveling of ruts and removing soil compaction via deep tillage or bio-tillage with cover crops should be performed prior to no tillage if soil compaction is a resource concern.

Sow cover crops in the crop rotation to provide enough crop residues to meet the NRCS Michigan Electronic Field Office Technical Guide (eFOTG) quality criteria for the identified resource concern.

Partial removal of residue by baling or grazing shall be limited to retain the amount needed to meet soil loss Tolerance (T).

**Residue piling** - Where residue accumulates greater than 2 inches deep due to weather-related causes such as runoff or flooding, consider leveling the residue with one of the following options prior to planting:

1. Tilling or burying the residue.
2. Baling the residue.
3. Loading the residue in a manure spreader and spreading it over a larger area.
4. Spot burning (with permit if needed).

Try to maintain residue on driveways, headlands, loading areas, etc.

Where possible, avoid burying waterways with residue.

**High residue** amounts may require one of the following options to improve crop stands:

- Baling
- Combine chaff spreaders
- Light disking
- Strip tilling at or before planting
- Residue managers or removers

**Residue hair-pinning** - Consider using a chaff spreader on the combine set to distribute residue as wide as the header. Combines equipped with headers wider than 15 feet require a chaff spreader to prevent windrowing of chaff and residue. This will help prevent loss of stand to the next crop due to coulter hair pinning residue in the row and loss of good seed-soil contact with the seed.

**Ruts** - Where harvest operations leave the field rutted, use a full width tillage tool to prepare a level seed bed in these areas before planting the next crop. However, it is best to avoid harvesting these areas when wet to avoid creating soil compaction and rutted field conditions.

**Surface pH** – *After a few years of continuous no till where nitrogen materials have been surface applied, sample the top 2-3 inches of soil separately and lime to correct surface acidic (acid roof) conditions. Both nutrient uptake and herbicide activity will benefit from more frequent liming to correct the acid roof condition.*

**Soil compaction** - Where soil examination using a soil penetrometer or other visual observations indicate there is soil compaction present, to prevent yield loss, correct by following guidelines in the NRCS Michigan Deep Tillage Standard (324) and the NRCS *Michigan Conservation Job Sheets, 324.1 Soil Compaction Symptoms, Causes, Correction, Prevention, and 324.2 Deep Tillage prior to starting a no-till system. Also, see MI NRCS Agronomy Tech Notes 48, 49, 50 & 51 for bio-tillage with cover crops to remove soil compaction found in Section 1 of the NRCS MI eFOTG under references.*

**Herbicide carryover** - Check previous herbicides used and review the label for crop rotation restrictions. Triazine herbicides released by lime applications can be lethal to young alfalfa, oats, and other sensitive crops. Also, some chemistry requires longer waiting periods before sowing certain crops. Therefore, herbicide records and history are extremely important to ensuring success with no-till, especially alfalfa and small grains. Small grain sensitivity to triazine is as follows: oats, wheat, and then rye. Follow guidelines in MSUE Bulletin E-2880, Steps to Successful No-till Establishment of Forages also found as NRCS MI Agronomy Tech Note

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- [Web2.msue.msu.edu/bulletins/Bulletin/PDF/E2880.pdf](http://Web2.msue.msu.edu/bulletins/Bulletin/PDF/E2880.pdf). Steps to Successful No-till Establishment of Forages.