Residue and Tillage Management, No Till/Strip Till/Direct Seed (Acre) 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 only 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_2 losses from the soil.
- Reduce soil particulate emissions.
- 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.

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.

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

Residue left on the field shall 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 should be preformed 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 pertinent to 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).

Additional Criteria To Reduce Sheet And Rill Erosion

The amount of randomly distributed 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) found in the NRCS Michigan eFOTG, Section I,* or the latest erosion prediction technology. Calculations shall account for the effects of other practices in the management system.

Additional Criteria To Reduce Wind Erosion

The amount and orientation of standing and 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 Wind Erosion Equation (WEQ) found in the NRCS Michigan eFOTG, Section I, or* the current approved wind erosion prediction technology. Calculations shall account for the effects of other practices in the management system.

For additional information on wind erosion prediction and planning alternatives, see the National Agronomy Manual, Part 502 Wind Erosion, Subpart 502C or the following NRCS Michigan Standards:

- *Cross Wind Trap Strips - 589C*
- *Herbaceous Wind Barriers - 603*
- *Stripcropping - 585*
- *Residue Management Seasonal - 344*
- *Windbreak Shelterbelt Establishment - 380*

Additional Criteria To Improve Soil Condition

An evaluation of the cropping system using the current approved soil conditioning index procedure shall result in a positive trend. *See the Revised Universal Soil Loss Equation (RUSLE2) .found in the NRCS Michigan eFOTG, Section I, or the NRCS National Agronomy Manual Part 508 Soils, Subpart 508C, Soil Management.*

Additional Criteria To Reduce CO_2 Loss From The Soil

The average annual Soil Tillage Intensity Rating (STIR) value for all soil-disturbing activities 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.

See the Revised Universal Soil Loss Equation (RUSLE2) found in the NRCS Michigan eFOTG, Section I, or the NRCS National Agronomy Manual Part 508 Soils, Subpart 508C, Soil Management.

Additional Criteria To Reduce Soil Particulate Emissions

The amount and orientation of residue needed and the amount of surface soil disturbance allowed to reduce wind erosion to the tolerable soil loss value (T) shall be determined using *the Wind Erosion Equation (WEQ) found in the NRCS Michigan eFOTG, Section I, or* the current approved wind erosion prediction technology. Calculations shall account for the effects of other practices in the conservation management system.

Additional Criteria To Increase Plant-Available Moisture

Reducing Evaporation from the Soil Surface. The average 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 or Soil Management Groups 5a & 5b; 4a & 4b; 3a & 3b; and 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 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 percent 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 percent 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

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 shall be determined *using the Michigan Wildlife Habitat Worksheet, Michigan Technical Note Biology 12.*

Residue height, amount, and time period shall be determined *using the Michigan NRCS job sheet, Biology Series, Wildlife Food Plots.*

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 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 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.

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_2 Loss - CO_2 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_2 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_2 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_2 than operations done when the soil is warmer.

Reducing Soil Particulate Emissions - Slower operating speeds generally produce fewer particulate emissions.

Dry soils will produce more particulates than moist soils.

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.
- Reducing the number of soil-disturbing operations.
- Installing other practices to reduce wind erosion, such as Herbaceous Wind Barriers (603) or Cross Wind Trap Strips (589C).
- Using Irrigation Water Management strategies to keep the surface moist until the threat of wind erosion passes.

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. The minimum documentation required for 329 is as follows:

- *Location map or reference to plan identification*
- *Purpose*
- *Estimated kinds and amounts of residue*
- *Types of operations*
- *Previous crop residue*
- *Crops to be planted*
- *Residue orientation (wind only)*
- *Residue planned % cover after planting*
- *Strip (Zone) tillage operations needed*
- *Operation and Maintenance items*

OPERATION AND MAINTENANCE

No operation and maintenance requirements, national in scope, have been identified for this practice.

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 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 *- Where nitrogen materials have been surface applied, sample the top 2-3 inches of soil separately and lime to correct surface acidic 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 pentrometer 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 Management Sheet, Soil Compaction Symptoms, Causes, Correction, Prevention, prior to starting a no-till system.*

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 the new MSUE Bulletin E-2880, Steps to Successful No-till Establishment of Forages.*

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