Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT, REDUCED TILL

CODE 345

(ac)

DEFINITION

Managing the amount, orientation and distribution of crop and other plant residue on the soil surface year round while limiting the soil- disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.

PURPOSE

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

- Reduce sheet, rill and wind erosion – Resource Concern (SOIL EROSION - Sheet, rill, & wind erosion)
- Reduce tillage-induced particulate emissions – Resource Concern (AIR QUALITY IMPACTS - Emissions of Particulate Matter - PM - and PM Precursors)
- Maintain or increase soil quality and organic matter content – Resource Concern (SOIL QUALITY DEGRADATION –Organic matter depletion)
- Reduce energy use – Resource Concern (INEFFICIENT ENERGY USE – Farming/ranching practices and field operations)
- Increase plant-available moisture – Resource Concern (INSUFFICIENT WATER –Inefficient moisture management)

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

This practice includes tillage methods commonly referred to as mulch tillage where a majority of the soil surface is disturbed by tillage operations such as vertical tillage, chiseling and disking and also includes tillage/planting systems with relatively minimal soil disturbance but which do not meet the criteria for Indiana (IN) Field Office Technical Guide (FOTG) Standard Residue and Tillage Management, No-Till (329). It applies to stubble mulching on summer-fallowed land, to tillage for annually planted crops and to tillage for planting perennial crops.

It also includes some planting operations, such as hoe drills that disturb a large percentage of the soil surface during the planting operation and cropping systems in which the majority of surface area is disturbed during harvest operations.

Also included is the use of a “modified no-till” system (Indiana definition) that uses full width tillage but leaves as much as 85% of the initial residue on the soil surface.

CRITERIA

General Criteria Applicable to All Purposes

Use of this standard requires compliance with all applicable federal, state, and local laws and regulations.

Native plant species will be used whenever possible. Known invasive species will not be used.

Uniformly distribute residues over the entire field. Removing residue from the row area prior to or as part of the planting operation is acceptable.

Do not burn residues.

The Soil Tillage Intensity Rating (STIR) value will include all field operations that are performed during the crop interval between harvest of the previous cash crop and harvest or termination of the current cash crop (includes fallow periods). The STIR value rating, for the above time period, will be no greater than 80, and no primary inversion tillage implements (e.g. moldboard plow) will be used.

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

Use the current approved water and/or wind erosion prediction technology to determine the:

- amount of randomly distributed surface residue needed;
- time of year the residue needs to be present in the field, and
- amount of surface soil disturbance allowedto reduce erosion to the desired level.

Calculations will account for the effects of other practices in the management system.

In ridge-till systems, plan ridge height and ridge orientation to manage runoff and minimize erosion, with a maximum row grade of 4%.

Additional Criteria to Reduce Tillage-Induced Particulate Emissions

Reduce or modify tillage operations that create dust, especially during critical air quality periods.

Adopt tillage practices that reduce particulate emissions.

Soil Tillage Intensity Rating (STIR) will be less than 30.

Additional Criteria to Maintain or Improve Soil Quality

The total residue left after planting will be adequate to meet soil loss criteria. Maximum Soil Tillage Intensity Rating (STIR) will be less than 30.

An evaluation of the planned cropping system using the current approved soil conditioning index (SCI) procedure will result in a positive trend as compared to the existing cropping system. Ensure that calculations account for the effects of other practices in the management system.

When planning this practice to reduce soil compaction or manage soil density, an evaluation of the depth and severity of compaction will be made to determine the operating depth and type of equipment to be used.

Equipment and residue management systems that meet the Indiana “modified no-till system” definition, sometimes referred to as a “vertical tillage system,” meet this criteria.

Indiana “modified no-till systems” are defined as implements that use an in-line low disturbance (<33% of the surface) subsoiler/ripper operated at depths of 8”-16”; a rotary harrow (i.e. Phillips Harrow, Phoenix Harrow, and other similar implements), coulter caddy seedbed finisher (i.e. Salford RTS, Turbo-Till, and other similar implements); or similar implement to size and distribute surface residue and break any soil-surface crust that will operate at a maximum depth of 2”.

Additional Criteria to Increase Plant-Available Moisture

Reducing Evaporation from the Soil Surface
Maintain a minimum 60 percent surface residue cover throughout the year.

Trapping Snow
Fall tillage operations will leave the crop stubble in an upright position.

Maintain a crop stubble height during the time significant snowfall is expected to occur to at least:

- 10 inches for crops with a row spacing of less than 15 inches;
- 15 inches for crops with a row spacing of 15 inches or greater

Maintain these heights over at least 50% of the field.

Conduct fall tillage operations 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 Reduce Energy Use

Reduce the total energy consumption associated with field operations by at least 25% compared to the benchmark condition. Use the current approved NRCS tool for determining energy use to document energy use reductions.

CONSIDERATIONS

General - Removal 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 the impacts on soil, water, animal, plant and air resources.

Reduced till may be practiced continuously throughout the crop sequence, or may be managed as part of a residue management system that includes other tillage methods such as no till. Selection of acceptable tillage methods for specific site conditions may be aided by an approved STIR.

Production of adequate amounts of crop residue necessary for the proper functioning of this practice can be enhanced by selecting high- residue producing crops and crop varieties in the rotation, use of cover crops and adjustment of plant populations and row spacing.

Energy savings in fuel used can be estimated using NRCS approved energy software or other software to determine the impact of alternative tillage systems.

Rotations that include high residue crops year after year (such as continuous corn) may require additional management to ensure successful seed establishment as well as a balanced soil C:N ratio.

When providing technical assistance to organic producers, residue management and tillage activities should be consistent with the USDA- Agricultural Marketing Service National Organic Program standard.

An evaluation of chemicals and pesticides to be used that may be harmful to beneficial organisms, pollinators, fish and wildlife will aid in selection of products with lowest impact to non- target species.

A field border planted to permanent vegetation can:

- reduce soil compaction from turning equipment
- eliminate less productive end rows
- provide food and escape cover for wildlife
- provide travel lanes for farming operations.

Considerations for improving Soil Organic Matter Content

Carbon loss is directly related to the volume of soil disturbed, the intensity of the disturbance, 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 tillage slot created by these implements is narrow and 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 falling and are below 50° F will release less CO_2 than operations done when the soil is warming and above 50° F.

Considerations for Improving Soil Health/Quality

Producers can achieve major improvements in soil health by using the following activities/practices:

- Use a diverse crop rotation, incorporating multiple crop types (cool-season grass, cool- season legume/forb, warm-season grass, warm-season legume/forb) into the crop rotation.
- Plant a cover crop after every cash crop in the rotation. Multi-species cover crop mixes provide greater benefits than single-specie cover crops.
- Using undercutting tools rather than burying tools will enhance accumulation of organic material in the surface layer.
- Conducting any soil-disturbing field operation when soil moisture is optimal, neither excessive nor too dry, will help maintain soil tilth, and reduce the need for additional tillage in the future.

Increasing Plant-Available Moisture – The effectiveness of stubble to trap snow increases with stubble height. Increasing the stubble height beyond the minimum required will increase the amount of snow trapped.

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

Tillage and planting operations done on the contour will help slow overland flow and increase infiltration, thus increasing the potential for increased water storage in the root zone.

Reducing the number of tillage passes, particularly when soil temperatures are greater than 50°, will reduce moisture loss.

Providing Food and Escape Cover for Wildlife - Avoid tillage and other soil and residue/stubble disturbing operations during the nesting season and brood-rearing period for ground-nesting species

Forgoing fall shredding or tillage operations will maximize the amount of wildlife food and cover during critical winter months.

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.

An approved habitat evaluation procedure will aid in determining the appropriate time and amount of residue and stubble needed to provide adequate food and cover for the target wildlife species.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice will be prepared for each field or treatment unit. The specifications will identify, as appropriate:

- The resource concern to be treated or the purpose for applying the practice
- Planned crop(s)
- The amount of residue produced by each crop.
- All field operations or activities that affect:
- Amount of residue cover
- Residue orientation
- Surface disturbance
- The amount of residue (pounds/acre or percent surface cover) required to accomplish the purpose, and the time of year it must be present
- The maximum STIR value allowed to accomplish the purpose, and the time of year that soil disturbance is allowed
- The minimum soil conditioning index value required to accomplish the purpose

Record the specifications using the Practice Implementation Requirements document.

OPERATION AND MAINTENANCE

Evaluate/measure the crop residues cover and orientation for each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to either plan a new residue amount or orientation; or adjust the planting, tillage, or harvesting equipment.

If there are areas of heavy residue accumulation (because of movement by water or wind) in the field, spread the residue prior to planting so it does not interfere with planter operation.

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