United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT, NO TILL

CODE 329

(ac)

DEFINITION

Limiting soil disturbance to manage the amount, orientation and distribution of crop and plant residue on the soil surface year around.

PURPOSE

This practice may be applied as 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)
- Provide food and escape cover for wildlife – Resource Concern (INADEQUATE HABITAT FOR FISH AND WILDLIFE – Habitat degradation)

CONDITIONS WHERE PRACTICE APPLIES

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

This practice only involves an in-row soil tillage operation during the planting operation and a seed row/furrow closing device. There is no full-width tillage performed from the time of harvest or termination of one cash crop to the time of harvest or termination of the next cash crop in the rotation regardless of the depth of the tillage operation.

This practice includes planting methods commonly referred to as no-till, quality no till, never-till, zero till, slot plant, zone till, strip till, or direct seed. Approved implements are: no-till and strip-till planters; certain drills and air seeders; strip-type fertilizer and manure injectors and applicators; and similar implements that only disturb strips and slots.

CRITERIA

General Criteria Applicable to All Purposes

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

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All residues to be retained on the field will be uniformly distributed over the entire field on the soil surface. Moving or removing residue from the row area prior to or as part of the planting operation is acceptable.

Residues will not be burned.

No full-width tillage is performed from the time of harvest or termination of one cash crop to the time of harvest or termination of the next cash crop in the rotation regardless of the depth of the tillage operation. The Soil Tillage Intensity Rating (STIR) value will include all field operations that are performed during the crop interval between harvest or termination of the previous cash crop and harvest or termination of the current cash crop (includes fallow periods). The STIR value will be no greater than 20.

Additional Criteria to Reduce Sheet/Rill Erosion: Reduce Wind Erosion and Tillage Induced Particulate Matter

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
- the amount of surface soil disturbance allowed:

to reduce erosion to the desired level.

Additional Criteria to Improve Soil Quality and Organic Matter Content

Ensure that an evaluation of the cropping system using the current approved soil conditioning index (SCI) procedure results in a positive SCI rating or improves to a higher rating greater than 0.

Additional Criteria to Increase Plant-available Moisture and Reducing Evaporation from the Soil Surface

Maintain a minimum of 2000 pounds per acre or 60 percent residue cover on the soil surface throughout the year.

Crop stubble height will be 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.

These stubble heights will be present on at least 60% of the field during the time of expected evaporation losses.

Trapping Snow

The above crop stubble height during the time significant snowfall is expected to occur will be present over at least 50% of the field.

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

Additional Criteria to Provide Food and Escape Cover for Wildlife

Use an approved habitat evaluation procedure to determine when residue needs to be present, and the amount, orientation, and stubble height needed to provide adequate food and cover for target species.

Residues will not be removed.

CONSIDERATIONS

General

When integrating nutrient management, pest management, cover crops, and conservation crop rotation into a no-till/strip-till system, they should be specifically adapted to complement each other as well as to achieve sustainable outcomes and high soil health.

Refer to Indiana Agronomy Technical Notes located in Section I of the Indiana (IN) Field Office Technical Guide (FOTG) for additional steps for successful implementation.

Tailored Integrated Pest Management for weeds and other pests specific to no-till should be considered. Refer to IN FOTG (595) Integrated Pest Management for additional information.

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.

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

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.

Diverse biological soil communities are critical for the proper functioning of no till systems. Use cover crops, legume rotations, to increase earthworm and beneficial organism populations if populations are low.

Run combine head as high as feasible to leave crop stubble and residues high after harvest to maximize their cover and food source benefits.

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.
- Improving water holding capacity.
- Forming root channels and other near-surface voids that increase infiltration.
- Further reducing the amount of particulate matter generated by field operations.
- Sequestering more carbon in the soil.
- Improving aggregate stability, which provides additional resistance to sheet and rill erosion.
- Reducing flood risk by increasing water retention.

Improving Soil Health/Quality

To achieve major improvements in soil health requires more than no-till alone. The following activities/practices are needed to make significant changes in soil health:

- 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.
- Adjust combine to spread crop residue evenly and equipped with spreaders capable of distributing residue over at least 80 percent of the working width of the header.
- Utilize tracks, floatation tires and/ or controlled traffic to reduce surface soil compaction.

Improving Soil Organic Matter Content

Carbon 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:

- When deep soil disturbance is performed, such as fertilizer injection, make sure the vertical slot created by these implements is narrow and closed at the surface.
- Planting with a smooth single disk opener no-till drill will release less CO_2 and oxidize less organic matter than planting with a wavy coulter drill.
- Soil disturbance that occurs when soil temperatures are falling and below 50° F will oxidize less organic matter and release less CO2 than operations done when the soil is warming and above 50° F.
- Maximizing year-round coverage of the soil with living vegetation and/or crop residues builds organic matter and reduces soil temperature, thereby slowing organic matter oxidation.

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.

Avoid disturbing standing stubble or heavy residue during the nesting season for ground-nesting species. Killing sod in the fall may be more effective than doing so in the spring.

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.

Managing Soil Moisture and Protecting Crops from Freeze Damage

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.

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

Related Considerations

A field border planted to permanent vegetation can:

- provide food and escape cover for pollinators and wildlife,
- allow unobstructed turning for equipment,
- eliminate soil compaction and less productive end rows,
- provide travel lanes for farming operations.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice will be prepared for each field or treatment unit according to the Criteria, Considerations, and Operation and Maintenance described in this standard.

Specifications will be recorded using approved work sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

Document in the plans and specifications:

- 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 residue 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.

Greatest benefit and success is accomplished when managed as a part of a continuous conservation cropping system that includes nutrient and pest management, conservation crop rotation, cover crops and conservation buffers.

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