NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT NO TILL/STRIP TILL/DIRECT SEED

(Ac.)

CODE 329

DEFINITION

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

PURPOSE

- Reduce sheet/rill erosion.
- Reduce wind erosion and associated airborne particulate matter.
- Maintain or improve soil quality.
- Reduce CO_2 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.

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/slot-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.

Where combines or similar machines are used for harvesting, they shall be equipped with spreaders capable of uniformly distributing residue over at least 80 percent of the working width of the header.

No full-width tillage shall be performed regardless of the depth of the tillage operation.

Planters or drills shall be equipped to plant directly through untilled residue or in a tilled seedbed prepared in a narrow strip along each row by planter attachments such as rotary tillers, sweeps, multiple coulters, or row cleaning devices.

Seedbed preparation, planting, and fertilizer placement shall not disturb more than one-third of the row width for strip till or direct seed systems or more than one-fourth of the row width for no-till systems.

Fertilizer and manure placement shall be limited to low disturbance methods such as surface application or injection with narrow knives on 30-inch or greater spacing.

If spot treatments for weed escapes, leveling ruts or center pivot tracks, or similar situations become necessary, tillage shall be limited to operations which minimize burial of surface residue.

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 10 for no-till and 15 for strip till or direct seed.

Additional Criteria to Reduce Sheet/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 shall be determined using the current approved water erosion prediction technology. Soil loss calculations shall account for the effects of other practices in the conservation management system.

Partial removal of residue by means such as baling, grazing, or other harvest methods shall be limited to retain the amount needed to meet the erosion reduction objective. The remaining residue shall be maintained on the surface through periods when erosion has the potential to occur, or until planting, whichever occurs first.

Additional Criteria to Reduce Wind Erosion

The amount and orientation of standing and surface residue required, the amount of surface soil disturbance allowed, and the row direction and ridge height needed at specific times of the year to reduce erosion to the planned soil loss objective shall be determined using the current approved wind erosion prediction technology. Wind erosion calculations shall account for the effects of other practices in the conservation management system.

Partial removal of residue by means such as baling, grazing, or other harvest methods shall be limited to retain the amount needed to meet the erosion reduction objective. The remaining residue shall be maintained on the surface through periods when erosion has the potential to occur, or until planting, whichever occurs first.

Additional Criteria to Maintain or Improve Soil Quality

The Soil Conditioning Index (SCI) will be utilized to determine whether there is a positive or improving trend in soil condition/quality. The SCI is calculated within the Revised Universal Soil Loss Equation, Version2 (RUSLE2) and included as output on NE-CPA-30. It is also included in the output from the Wind Erosion Prediction System (WEPS). Calculations shall account for the effects of other practices in the conservation management system.

Additional Criteria to Reduce CO2 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 15.

An evaluation of the cropping system using the current approved soil conditioning index procedure shall result in a positive trend.

Additional Criteria to Increase Plant-available Moisture

Reducing 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 15.

Crop stubble height or soil surface cover during the time of expected evaporation losses shall be one of the following:

- 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.
- at least 50 percent of the soil surface is covered with crop residue.

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 the entire field and at least 50 percent of the crop stubble shall be left standing after harvest.

Fall or winter field operations are not allowed.

Additional Criteria to Provide Food and Cover for Wildlife

Crop selection, residue management including type, amount, disturbance, timeframes, and other factors shall have a minimum habitat index value (0.5) as shown in Wildlife Habitat Quality Criteria in Section III of the FOTG. The Wildlife Habitat Evaluation Worksheet for cropland (NE-CPA-32) will be utilized to conduct the habitat evaluation. The residue management shall address the necessary habitat values to meet the needs of wildlife.

Residue and tillage management is directly related to the Disturbance factor and may be influenced by the Crop Rotation factor. The planned system may also need to address Field Size; Field Borders; Buffers; Odd Areas; and Interspersion of Habitats in order to meet quality criteria requirements for wildlife.

CONSIDERATIONS

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

Production of adequate crop residues to achieve the purpose of this practice can be enhanced through the use of high residue crops and crop varieties, the use of cover crops, and adjustment of plant populations through seeding rates and row spacing.

Crop residues provide food and habitat for soil organisms which positively impacts soil aggregate stability, moisture retention, infiltration and fertility.

No-till planting cover crops that will winter-kill in the late summer and fall will provide additional food and cover for wildlife, supplemental grazing, soil erosion protection, and water (snow) retention without adding additional weed control measures.

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 additional 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 (code 386) 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, and
- provide habitat for beneficial insects and pollinators.

Soil compaction may be reduced by controlled traffic, in which wheel traffic from all operations is limited to the area between designated rows or traffic areas.

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 – In areas that are in non-attainment for PM10, and for other areas with particular sensitivities to PM from dust, residue cover is especially important and should ensure that off-site PM levels are below critical thresholds, including maintenance of proper visibility.

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 (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 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.

Providing *Food and* Escape *Cover* for Wildlife - 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.

Managing Long Term No-till with Crop Rotations - Crop diversity is an important part of long term no-till. Use of spring and fall planted crops, small grains, legumes, and/or cover crops in conjunction with row crops is important in managing pests, increasing biological activity and providing long term sustainability.

Planning Considerations for Establishing No-till Cropping Systems on Highly Erodible Land - Refer to Nebraska Agronomy Technical Note No. 109.

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 including crop rotation, tillage and planting system type, fertilizer placement and method of application, crop residue cover, timeframe and other appropriate management requirements shall be recorded using Nebraska Conservation Planning Sheets, approved specification 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.

Critical eroding areas (concentrated flow areas, or overland flow areas with inadequate cover) need to be stabilized with a cover crop, mulch, run-off control structure or other acceptable method as identified in the conservation plan. Critical area treatment needs to be applied immediately following harvest (or immediately following seedbed preparation on newly sodbusted ground).

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