NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT,

NO-TILL

(Ac.)

CODE 329

DEFINITION

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

PURPOSE

This practice may be applied for one or more of the following purposes:

1. To reduce sheet, rill, and wind erosion;
2. To maintain or improve soil quality and organic matter content;
3. To reduce tillage-induced particulate emissions;
4. To reduce energy use;
5. To increase plant-available moisture;
6. To provide food and escape cover for wildlife.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

This practice involves only in-row soil disturbance during the planting operation and a seed row/furrow closing device.

This practice includes planting methods commonly referred to as no-till, zero-till, slot-plant, row-till, zone-till, or strip-till. Approved implements include: 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 minimally disturb plant residue. Typically, this disturbance is in narrow strips or slots. Implements that will result in significant disturbance are not compatible with this standard.

CRITERIA

General Criteria Applicable to All Purposes

All residues shall be uniformly distributed over the entire field. Do not burn crop residue.

No full-width tillage (moldboard plow, vertical tillage, chisel plow or disking of the entire field) shall be 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. Removing residue from the row, prior to or as part of the planting operation, is acceptable.

An evaluation of the cropping system using the current approved Soil Conditioning Index (SCI) procedure shall result in a value that is at least a positive trend.

The Soil Tillage Intensity Rating (STIR) value shall 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 (including fallow periods). The STIR value shall be no greater than 20.

Additional Criteria to Reduce Sheet, Rill, and Wind Erosion, and Tillage-Induced Particulate Matter

To reduce erosion to the tolerable soil loss level (T), use high residue producing crops as often as possible. Use the current approved water and/or wind erosion prediction technology to determine the amount of randomly distributed surface residue needed, the time of year the residue needs to be present in the field, and the amount of surface soil disturbance that is allowed.

Minimum residue requirements for this practice will be reflected by leaving all crop residues from row crops on the field following harvest. Crop residues are an important source of carbon and nutrients that increase soil organic matter and provide nutrients to subsequent crops in the rotation. Leaving residues on the field is the preferred method for providing erosion control and promoting soil health. However, if residues such as corn stalks, small grain stubble or soybean residue are removed, a cover crop will be used to supplement cover lost from residue removal. Calculations shall account for the effects of other practices in the management system.

Additional Criteria to Maintain or Improve Soil Quality and Organic Matter Content

An evaluation of the cropping system using the current approved Soil Conditioning Index (SCI) procedure shall result in an SCI rating of zero or higher.

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 Increase Plant-Available Moisture and Reduce Evaporation from the Soil Surface

Maintain a minimum of 2,000 pounds per acre or 60 percent residue cover on the soil surface throughout the year.

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.

Note: Specific programs may dictate criteria in addition to, or more restrictive than, those specified in this standard.

CONSIDERATIONS

General Considerations Applicable to All Purposes

Producers should be encouraged to minimize soil disturbance in order to maximize the benefits of this practice.

Removing crop residue, such as by baling or grazing, can have negative impacts on resources. These activities should not be performed without a full evaluation of impacts on all resource concerns.

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

Residue should not be shredded after harvest. Shredding residue makes it susceptible to movement by wind or water, and areas where residue accumulates may interfere with planting the next crop.

Using no-till for all crops in the rotation or cropping system can enhance the positive effects of this practice by:

1. Increasing the rate of soil organic matter accumulation;

2. Keeping soil in a consolidated condition, which provides additional resistance to sheet and rill erosion;

3. Sequestering more carbon in the soil;

4. Further reducing the amount of particulate matter generated by field operations;

5. Forming root channels and other near-surface voids that increase infiltration.

Additional Considerations to Improve Soil Quality

Improving soil quality/health requires more than no-till alone. Consider using the following practices to significantly improve soil health:

1. Use a diverse crop rotation, incorporating multiple crop types (e.g., cool-season grasses, cool-season legumes/forbs, warm-season grasses, warm-season legumes/forbs) into the crop rotation;

2. Plant a cover crop after every cash crop in the rotation. Multi-species cover crop mixes provide greater benefits than single-species cover crops.

Additional Considerations to Improve 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:

1. 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;

2. Planting with a single disk opener no-till drill will release less CO_2 and oxidize less organic matter than planting with a wide-point hoe/chisel opener air seeder drill;

3. Soil disturbance that occurs when soil temperatures are below 50° F will oxidize less organic matter and release less CO_2 than operations done when the soil is warmer;

4. 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.

Additional Considerations to Reduce Tillage-Induced Particulate Emissions

To reduce particulate emissions, consider operating equipment at slower speeds and avoid operating on dry soils.

Reducing wind erosion below the tolerable soil loss will also help reduce particulate emissions. This can be done by increasing the level of crop residue cover, reducing the number of soil-disturbing operations, and installing other practices to reduce wind erosion.

Additional Considerations to Manage Soil Moisture and Protect Crops from Freeze Damage

The type, timing, and depth of soil-disturbing activities all influence moisture loss. Shallow operations (to a depth of 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.

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

Additional Considerations for Wildlife Food and Cover

Leaving rows of unharvested crops 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.

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

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

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail to ensure successful implementation of this practice, and may be recorded in narrative form, on Implementation Requirements (IR) worksheets, on fact sheets, or other approved forms.

The appropriate fact sheet(s) and completed 329 IR worksheet can serve as the plan and specifications for this practice. The following items shall be addressed, as appropriate:

1. Purpose of the no-till practice (identified resource concerns);

2. For each field, the cropping sequence and acceptable implements to be used, minimum Soil Conditioning Index (SCI) and Soil Tillage Intensity Rating (STIR) values to be maintained, and minimum percent residue needed to address the identified resource concern(s).

OPERATION AND MAINTENANCE

An Operation and Management (O&M) plan shall be prepared and is the responsibility of the client to implement. The appropriate fact sheet(s) and/or IR worksheet may serve as the management plan, as well as supporting documentation, and shall be reviewed with and provided to the client.

At a minimum, the following components shall be addressed in the O&M plan, as applicable:

1. Follow the specified crop rotation and implements to be used for each field. Contact NRCS before changing the cropping sequence and/or tillage methods, especially on HEL fields or when receiving financial assistance for this practice;

2. Evaluate/measure 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;

3. Limited tillage is allowed for spot treatment of weeds, leveling ruts, or similar purposes. No more than 25% of the field may be tilled for these purposes;

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

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Location of the practice on the conservation plan map;

2. Assistance notes. The notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom;

3. If applicable, soil loss calculations (RUSLE2 printouts);

4. SCI and STIR calculations, or SCI/STIR reference table, if applicable;

5. Completed IR worksheet, and copy of the appropriate fact sheet(s) or other specifications and management plans.

REFERENCES

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4. Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool and D.C. Yoder, coordinators. 1997. *Predicting Soil Erosion by Water: A Guide to Universal Soil Loss Equation (RUSLE)*. U.S. Handbook No. 703.

5. Shaffer, M.J., and W.E. Larson (ed.) 1987. *Tillage and Surface-Residue Sensitive Potential Evaporation Submodel.* In *NTRM, a Soil-Crop Simulation Model for Nitrogen, Tillage and Crop Residue Management.* USDA Conserv. Res. Rep. 34-1. USDA-ARS.

6. Skidmore, E.L. and N.P. Woodruff. 1968. *Wind Erosion Forces in the United States and their Use in Predicting Soil Loss*. U.S. Department of Agriculture. Agriculture Handbook No. 346.

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8. USDA, Natural Resources Conservation Service. 2011. *National Agronomy Manual*. 190-V, 4rd ed.