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 soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Reduce sheet, rill, and wind erosion, and excessive sediment in surface waters
- Reduce tillage-induced particulate emissions
- Improve soil health and maintain or increase organic matter content
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland.

CRITERIA

General Criteria Applicable to All Purposes

This practice includes tillage methods commonly referred to as mulch tillage or conservation tillage where the entire soil surface may be disturbed by tillage operations such as chisel plowing, field cultivating, tandem disking, or full-width vertical tillage. It also includes tillage/planting systems with less tillage, including systems with tillage limited to strips and slots, which do not meet the soil tillage intensity rating (STIR) or other criteria for conservation practice Residue and Tillage Management, No Till (Code 329).

Full-width tillage is allowed during the time interval starting with harvest or termination of the previous crop until harvest or termination of the reduced-till crop. However, no primary inversion tillage implements (e.g., moldboard plows or substantively similar tools) are allowed.

The Soil Tillage Intensity Rating (STIR) value associated with any reduced-till crop must be 80 or less. This STIR value reflects all field operations that are performed during the time interval starting with harvest or termination of the previous crop until harvest or termination of the reduced-till crop.

Residue will not be burned.

Distribute all residues uniformly over the entire field, except that residues may be selectively removed from the row area prior to or as part of the planting operation (e.g., with planter-mounted residue managers).

Additional Criteria to Reduce Sheet, Rill and Wind Erosion, and Excessive Sediment in Surface Waters and Tillage-Induced Particulate Emissions

Immediately after reduced-till planting (i.e., from planting until two weeks after planting), the soil surface must be protected by an overall average of at least 30% raindrop-intercepting residue cover, as determined by the line transect method.

In some cases, higher residue levels and/or less soil disturbance ahead of one or more reduced-till crops may be needed to achieve the site-specific soil loss objective for the overall cropping system. In these cases, use current water and/or wind erosion prediction technology as the basis for planning more aggressive targets for residue cover and/or soil disturbance.

In other cases, it may be possible to achieve the site-specific soil loss objective for the overall cropping system with less than 30% residue cover for reduced-till crops. In these cases, plan residue targets below 30% only if complete analysis of the cropping system using current approved water and/or wind erosion prediction technology indicates that overall soil loss objectives can still be met.

Additional Criteria to Improve Soil Health and Maintain or Increase Organic Matter Content

Immediately after reduced-till planting (i.e., from planting until two weeks after planting), the soil surface must be protected by an overall average of at least 60% raindrop-intercepting residue cover, as determined by the line transect method.

In some cases, higher residue levels and/or less soil disturbance ahead of one or more reduced-till crops may be needed to achieve the site-specific soil organic matter management objective for the overall cropping system. In these cases, use current erosion prediction and Soil Conditioning Index (SCI) technology as the basis for planning more aggressive targets for residue cover.

In other cases, it may be possible to achieve the site-specific soil organic matter management objective for the overall cropping system with less than 60% residue cover for reduced-till crops. In these cases, plan residue targets below 60% only if complete analysis of the cropping system using current erosion prediction and SCI technology indicates that overall soil organic matter management objectives can still be met.

Use the following to guide interpretation of Soil Conditioning Index (SCI) results for purposes of implementing these additional criteria:

A. A cropping system predicted to maintain total soil organic matter content should have an SCI score of 0.00 or greater and predicted sheet and rill erosion at or below the soil loss tolerance level (T).

B. A cropping system predicted to improve total soil organic matter content should have an SCI score of +0.25 or greater and predicted sheet and rill erosion at or below the soil loss tolerance level (T).

C. See “Considerations” for SCI targets for higher levels of performance.

Additional Criteria to Reduce Energy Use

Immediately after reduced-till planting (i.e., from planting until two weeks after planting), the soil surface must be protected by an overall average of at least 60% raindrop-intercepting residue cover, as determined by the line transect method.

In some cases, higher residue levels and/or less soil disturbance ahead of the reduced-till crop may be needed to achieve site-specific energy use reduction objectives for the overall cropping system or the individual crops to be reduced-tilled. In these cases, use current energy use estimation technology as the basis for planning more aggressive targets for residue cover.

In other cases, it may be possible to achieve the site-specific energy use reduction objective with less than 60% residue cover after planting reduced-till crops. In these cases, plan residue targets below 60% only if analysis with current energy use estimation technology shows that a drop in energy use of at least

25% compared to the baseline condition can be achieved. Conduct this analysis on a crop-by-crop basis for each crop for which residue levels less than 60% will be allowed.

CONSIDERATIONS

General Considerations

The criteria for this standard can be applied on a crop-by-crop basis (i.e., it is possible for one crop in the rotation to qualify as reduced till even if prior or subsequent crops do not).

This standard applies to all crops, whether or not they are harvested.

Reduced till may be practiced continuously throughout the cropping sequence, or may be used only for one or more crops in a rotational tillage system that includes no-till (329) and/or clean tillage.

Use the following rules of thumb to help in determine whether crops grown using reduced tillage achieve maximum STIR targets:

1. If the crop immediately preceding the reduced-till crop is harvested using full- or partial-width ground disturbance (e.g., potato digging), then count that soil disturbance as part of the tillage used to establish the reduced-till crop – this prior soil disturbance could therefore disqualify the reduced-till crop from meeting this Standard.
2. If the reduced-till crop is harvested using full- or partial-width ground disturbance, count that soil disturbance as part of the tillage used to establish the next crop – this soil disturbance at harvest therefore typically will not disqualify the reduced-till crop from meeting this Standard.
3. Planners may assume that the crop-specific STIR limit of 80 is met for the reduced till crop if:
    - No inversion primary tillage (moldboard plow or substantively similar tool) is used; and
    - No more than three non-inversion soil-disturbing passes occur, including the planting operation. Examples of allowable three-pass sequences include: chisel+disk+plant; disk+disk+plant; chisel+field cultivator+plant; no-till subsoil+vertical till (“turbo-till”)+plant; and
    - A total of at least 30% raindrop-intercepting residue is present immediately after planting; and
    - The only post-planting soil disturbance is cultivation between crop rows (count any digging or soil disturbance during harvest of the reduced till crop towards the next crop)
    - If the above conditions are not met, use RUSLE2, WEPS, or other appropriate tools to determine on a case-by-case basis if the STIR limit has been achieved.

Increasing residue cover beyond the minimum targets in this standard should be encouraged, even if soil loss, SCI, or energy use objectives are met with minimum levels of residue.

Living vegetation as well as dead plant material may be counted towards meeting the minimum cover targets in this standard.

Whenever tillage is used, special emphasis should always be placed on delaying tillage operations until soil is sufficiently dry. Tilling wet soil causes compaction, cloddiness, and damage to soil structure

Completing tillage and planting in a single operation, or performing primary tillage no more than three days before planting, can minimize exposure to erosion or loss of moisture for germination.

Tillage and planting operations done on the contour will generally help slow overland flow, increase infiltration and water storage, and reduce erosion.

Adopting complementary practices can significantly improve the conservation performance of cropping systems involving full-width tillage. Key complementary practices are crop rotation and cover cropping.

Soil compaction prevention is one way to reduce the need for tillage. Key strategies for compaction prevention include:

- Staying off wet ground.
- Minimizing axle loads (e.g., keep grain or silage trucks out of the field,) and minimizing tire-to-soil contact pressure (e.g., keep road tires out of the field).
- Minimizing the percentage of the field tracked over time (e.g., use controlled traffic to keep tires in the same tracks on every pass).

Adopting practices that reduce tillage and/or increase residue may trigger the need for adjustments to nutrient and pest management practices. Maintaining a diverse crop rotation will often facilitate such adjustments.

Forgoing fall tillage operations can improve the value of crop residue for wildlife food and cover during critical winter months. Consider leaving rows of unharvested crop standing at intervals across the field to further enhance the value of residues for wildlife. When managing to benefit a particular wildlife species, consider that species' preference for mowed vs. standing residue.

Additional Considerations to Increase Soil Health and Organic Matter Content

Refer to the following VA NRCS guidance document for interpreting and selecting Soil Conditioning Index (SCI) targets beyond the minimum for soil organic matter improvement, which is +0.25:

- Assessing Soil Organic Matter (SOM) Resource Concerns and Trends in Virginia with the Soil Conditioning Index (SCI) (VA NRCS Technical Note, Agronomy #11, November 2016)

Minimizing soil disturbance can enhance soil quality in ways that are not fully accounted for by SCI. Soil Tillage Intensity Rating (STIR) provides a useful measure of soil disturbance to complement SCI. A STIR value of 10 or less (for both the overall rotation and each individual crop) is an optimum to strive for.

PLANS AND SPECIFICATIONS

Specifications for implementation of this practice will be prepared for each field or CMU (Conservation Management Unit).

Customize the language and level of detail in specifications as needed for each particular case. Focus above all on providing the client with the practical guidance needed to effectively put the practice on the ground.

Specifications will at a minimum include all of the following elements:

1. A list of the field(s) and/or CMU(s) where crops will be reduced-till.
2. A list of the purpose(s) for which the standard is being implemented.
3. A list and/or description of the crops that will be reduced till.
4. A statement of the general criteria that must be achieved in all cases for all reduced till crops (i.e., prohibition on burning, prohibition on full-width tillage, etc.).
5. If applicable, a description of more aggressive targets for residue cover for reduced till crops (60%, etc.), based on additional criteria in the standard and plan objectives.
6. A description of additional limits on soil disturbance, if any, for reduced till crops (e.g., description of implements to be used, etc.), based on additional criteria in the standard and plan objectives.
7. In those cases where site-specific analysis of energy use or overall cropping system performance is used to adjust residue cover targets for reduced till crops, a description of any complementary practices (crop rotation, cover crops, etc.) that must be carried out in order to achieve planned overall conservation objectives.
8. In those cases where site-specific analysis of energy use or the overall cropping system performance is used to adjust residue cover targets for reduced till crops, documentation of planned conservation objectives as well as inputs and outputs for the decision-support tools used (RUSLE2, SCI, etc.). This is especially important when planned minimum residue cover targets are less

protective than those listed in the relevant additional criteria.

Use the practice job sheet (IR) to plan and certify this practice.

OPERATION AND MAINTENANCE

Evaluate crop residue quantity and distribution for each crop to ensure planned residue targets are being achieved and adjust management as needed.

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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