

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
RESIDUE AND TILLAGE MANAGEMENT
REDUCED TILL

(Ac.)

CODE 345

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

- Reduce sheet, rill, and wind erosion.
- Reduce tillage-induced particulate emissions.
- Maintain or increase soil quality and organic matter content.
- Increase plant-available moisture.
- Reduce energy use.

CONDITIONS WHERE PRACTICE APPLIES

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

This practice includes tillage methods commonly referred to as mulch tillage or conservation tillage where the entire soil surface is disturbed by full-width tillage operations such as chisel plowing, field cultivating, disking, or vertical tillage. It also includes some tillage/planting systems with no full-width tillage that do not fully meet the criteria for the VA 329 Standard for Residue and Tillage Management – No Till.

CRITERIA

General Criteria Applicable to All Purposes

Reduced till crops fall into two categories with respect to extent of soil disturbance allowed.

1. Reduced Till (Strip Till or ST).

Crops are established without full-width tillage, but with too much soil disturbance to qualify for VA 329 No Till.

No full-width tillage occurs during time interval starting with harvest or termination of the previous crop until harvest or termination of the reduced-till (ST) crop, regardless of the depth of the tillage operation. The only soil disturbance during this time interval is tillage in strips and slots. Tilled strips or slots are no wider than one third (33%) of the row width.

Multiple passes with no-till/strip-till ground disturbing equipment are allowed. This includes stand-alone strip tillage or minimum-surface-disturbance ripping conducted well ahead of planting. Post-planting row cultivation is also allowed.

The Soil Tillage Intensity Rating (STIR) value associated with any reduced till (ST) crop must be 40 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 (ST) crop.

Any crop that does not qualify as reduced till (ST) can still qualify as reduced till (mulch till or MT), see below.

2. Reduced Till (Mulch Till or MT).

Crops are established with limited full-width tillage.

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 (MT) 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 (MT) 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 (MT) crop.

All residue-related general and additional criteria under this standard apply equally to reduced till (ST) and reduced till (MT) crops.

Residues shall not be burned.

Residues shall be uniformly distributed over the entire field. However, residues may be selectively removed from the row area as part of the reduced-till planting operation (e.g., with planter-mounted residue managers).

Additional Criteria to Reduce Sheet, Rill, and Wind Erosion 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 Maintain or Increase Soil Quality and 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 reduced-till crop. 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.

Additional Criteria to Increase Plant-Available Moisture

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. A residue target less than 60% is not an option under this purpose, regardless of calculation results.

CONSIDERATIONS

General

Evaluate whether the criteria for this standard have been achieved 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).

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 clean tillage.

Use the following rules of thumb to help in determine whether STIR targets are achieved:

1. If the crop immediately preceding the reduced till crop is harvested with full width ground disturbance (e.g., potato digging), then count that as part of the tillage used to establish the reduced till crop.
2. STIR of 40 or less for Reduced Till (ST):

Planners may assume that the crop-specific STIR limit of 40 is met for the reduced till (ST) crop if:

- No full-width tillage is used to establish the crop (i.e., tillage in strips and slots only), and
- The total final width of disturbed strips is no greater than one-third (33%) of row spacing; 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 (ST) 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.

3. STIR of 80 or less for Reduced Till (MT):

Planners may assume that the crop-specific STIR limit of 80 is met for the reduced till (mulch 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 (MT) 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 the minimum residue level.

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 significant 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 should be recommended as a way to reduce the need for tillage. Key strategies for compaction prevention include:

- Staying off wet ground.
- Minimizing axle loads (e.g., keep haul 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 result in reductions in tillage and/or increases in 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.

Maintaining or Improving Soil Quality and Organic Matter Content

Use the following as a guide for setting Soil Conditioning Index (SCI) targets above +0.25, which is a key target under this standard for soil organic matter improvement:

Soil Conditioning Index (SCI) Score	Performance Level – Soil Organic Matter Improvement
+0.25 to +0.49	Minimum
+0.50 to 0.74	Intermediate
+0.75 or greater	Optimum

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, with a STIR value of 10 or less representing an optimum to strive for. This applies to STIR values associated with each crop as well as to the average annual STIR value for the overall cropping system.

Rotation to perennials and/or no-till crops can be effectively reduce average annual STIR. For example, a rotation involving crops established with full-width tillage followed by a significant period in perennial or no-till crops can result in a low average annual STIR value for the overall rotation.

Where improving soil tilth is a concern, use of undercutting tools will enhance accumulation of organic material in the surface layer.

PLANS AND SPECIFICATIONS

Specifications for implementation of this practice shall 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 shall 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. The general criteria that must be achieved in all cases for all reduced till crops (i.e., prohibition on burning, uniform residue distribution, no inversion primary tillage).
5. An explanation of whether the planned crops will be reduced till (strip till) or reduced till (mulch till) and a description of the type and extent of soil disturbance allowed.
6. The target residue level to be achieved after planting (30%, 60%, or other), based on the farmer's purpose and additional criteria in the standard.
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 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 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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