

**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 around.

PURPOSE

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

CONDITIONS WHERE PRACTICE APPLIES

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

A single no-till planting operation (i.e., one pass with a no-till planter, drill, or transplanter) is the only soil disturbance allowed during the time interval between harvest or termination of the previous crop and harvest or termination of the no-till crop. In-row tillage (including under-row ripping) and seed row/furrow closure carried out in conjunction with the no-till planting operation are allowed.

CRITERIA

General Criteria Applicable to All Purposes

Residue shall not be burned.

All residues must be uniformly distributed over the entire field. However, residues may be selectively removed from the row area as part

of the no-till planting operation (e.g., with planter mounted residue managers).

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

Any tillage in strips or slots must be performed in conjunction with the no-till planting operation. Stand-alone strip tillage or minimum-surface-disturbance ripping ahead of planting are not allowed, even if that disturbance is limited to strips and slots. Post-planting row cultivation is not allowed.

The Soil Tillage Intensity Rating (STIR) value associated with any no-till crop must be 20 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 no-till crop.

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

Immediately after no-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 no-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 no-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 no-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 no-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 no-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 no-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 no-till crop may be needed to achieve site-specific energy use reduction objectives for the overall cropping system or the individual crops to be no-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 no-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 no-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 NT even if prior or subsequent crops do not).

No 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 reduced till (345) 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 NT crop is harvested with full width ground disturbance (e.g., potato digging), then count that as part of the tillage used to establish the NT crop.
2. Planners may assume that the crop-specific STIR limit of 20 is met for the no-till (NT) 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 soil disturbance is the planting operation (i.e., a single pass by a NT planter, drill, or transplanter).
 - 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.

Some operations traditionally referred to as strip-till or (“ST”) will meet this VA 329 Standard (i.e., all strip tillage is carried out in conjunction with the planting operation). Some other operations traditionally referred to as ST will not (e.g., when strip tillage and planting do not occur in the same pass).

Any tillage method or crop that does not qualify as NT under this Standard may still qualify as reduced till under Standard VA 345.

Regardless of terms commonly used in the field, any crop that meets the criteria of this VA 329 Standard is classified as NT.

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

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

In the large majority of cases, continuous NT should be promoted as the optimal tillage system for conservation purposes. Properly-managed continuous NT systems often provide soil benefits not fully accounted for by current erosion prediction tools or SCI. Such additional resource benefits include:

- Improvements in soil structure, including a consolidated yet porous condition that better resists erosion and traffic compaction while increasing infiltration.
- Improvements in soil biological activity associated with continuous surface cover and reduced physical disturbance of the soil environment.

A “transition period” of three to five years or more may be needed before the producer observes the soil quality benefits of continuous NT such as better soil tilth, more resistance to compaction, etc. Starting the continuous NT process by no-tilling annuals into the residue of a killed perennial crop such as alfalfa is one way to shorten this transition period.

Crop rotation and cover cropping are key complementary practices for successful implementation of NT in general and continuous NT in particular. Key strategies include:

- Producing large amounts of crop biomass and residue.
- Including perennial crops in the rotation.
- Maintaining a continuous cycle of living vegetation.
- Maintaining a diverse crop rotation that includes nitrogen-fixing legumes.

Soil compaction prevention is important for successful NT and is particularly crucial during the transition period after continuous NT is first adopted. Recommendations include:

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

Pre-existing soil compaction may require remediation before NT can be successfully adopted. In severe cases, multiple years of improved organic matter management and gradual tillage reduction may be required before soil structure has improved sufficiently to support the transition to continuous NT.

Adoption of practices like NT that result in significant reductions in tillage and/or increases in residue levels will often trigger the need for adjustments to nutrient and pest management practices. Maintaining a diverse crop rotation will often facilitate such adjustments.

Reducing soil sampling depth as well as adjusting rate and frequency of lime applications is often recommended after conversion to continuous NT.

Not all soils are equally well suited to continuous NT management. Typically, successful adoption of continuous NT on poorly-drained soils requires a higher degree of management and complementary practices.

Consider leaving rows of unharvested crop standing at intervals across the field to enhance the value of residues for wildlife food and cover. When managing to benefit a particular wildlife species, consider that species' preference for mowed vs. standing residue.

Maintaining or Increasing 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. 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 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 NT.
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 NT.
4. A statement of the general criteria that must be achieved in all cases for all NT 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 NT 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 NT 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 NT 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 NT 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.

Limited tillage may be acceptable after or before NT crops to close or level ruts from harvesting equipment. The amount of soil disturbance allowed shall be determined on a case-by-case basis by the appropriate local NRCS personnel. In no case may more than 25% of the field be tilled for this purpose.

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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