NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

RESIDUE AND TILLAGE MANAGEMENT MULCH 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 crops in systems where the entire field surface is tilled prior to planting.

PURPOSE

- Reduce sheet and rill erosion.
- Reduce wind erosion.
- Maintain or improve soil quality.
- 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 chiseling and disking. It applies to stubble mulching on summer-fallowed land, to tillage for annually planted crops and to tillage for planting perennial crops.

It also includes some planting operations, such as hoe drills, air seeders and “no-till” drills that disturb a large percentage of the soil surface during the planting operation.

CRITERIA

General Criteria Applicable to All Purposes

All residues shall be uniformly distributed over the entire field. Combines shall be equipped with spreaders capable of redistributing residue over at least 80 percent of the working width of the header.

Residue shall not be burned.

The number, sequence, and timing of the tillage and planting operations, and the selection of ground-engaging components, shall be managed to achieve the planned amount, distribution, and orientation of the residue after planting or at other essential time periods. Acceptable alternative tillage sequences shall be initially determined by an appropriate evaluation tool such as Soil Conditioning Index or current soil erosion prediction tool.

The annual Soil Tillage Intensity Rating (STIR) value for all soil-disturbing activities shall be no greater than 60.

Additional Criteria to Reduce Sheet and Rill Erosion and Reduce Wind Erosion

Determine the amount of randomly distributed surface residue needed and the amount of surface soil disturbance allowed managing erosion to the planned soil loss objective using the current approved water and wind erosion prediction technology. Ensure that calculations account for the effects of other practices in the management system.

Additional Criteria to Maintain or Improve Soil Quality

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

Additional Criteria to Increase Plant-Available Moisture

Reducing Evaporation from the Soil Surface. A minimum of 2000 pounds per acre or 60 percent surface residue cover shall be maintained throughout the year.

Trapping Snow. Any fall tillage operation shall leave the crop stubble in an upright position.

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 at least 50% of the field.

Fall tillage operations shall be done as close to perpendicular as possible to the direction of prevailing winds during the time that significant snowfall is expected to occur.

Additional Criteria to Reduce Energy Use

Ensure the Soil Tillage Intensity Rating (STIR) for the single crop establishment and harvest is less than or equal to 80.

CONSIDERATIONS

General - Removal 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.

Mulch till may be practiced continuously throughout the crop sequence, or may be managed as part of a residue management system that includes other tillage methods such as no till. Selection of acceptable tillage methods for specific site conditions may be aided by an approved Soil Tillage Suitability Rating.

Production of adequate amounts of crop residue necessary for the proper functioning of this practice can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops and adjustment of plant populations and row spacing.

A field border 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.

Increasing Soil Organic Matter Level and Reducing CO_2 Loss from the Soil – Where improving soil tilth is a concern, use of undercutting tools will enhance accumulation of organic material in the surface layer.

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 tillage 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.

Increasing Plant-available Moisture – The effectiveness of stubble to trap snow increases with stubble height. Increasing the stubble height beyond the minimum required will increase the amount of snow trapped.

Variable height stubble patterns may be created to further increase snow trapping and storage.

Tillage and planting operations done on the contour will help slow overland flow and increase infiltration, thus increasing the potential for increased water storage in the root zone.

Providing Food and Escape Cover for Wildlife - Avoid disturbing standing stubble or heavy residue during the nesting season for ground-nesting species.

Forgoing fall shredding or tillage operations will maximize the amount of wildlife food and cover during critical winter months.

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.

PLANS AND SPECIFICATIONS

Plans and Specifications shall include:

- field number(s)and acres
- purpose(s) for this practice
- crops(s) where this practice will be used
- the type and timing of soil disturbing operations
- estimated surface residue following each operation

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Criteria, Considerations and O&M described in this standard. Specifications shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Evaluate/measure the crop residues cover and orientation for each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to either plan a new residue amount or orientation; or adjust the planting, tillage, or harvesting equipment.

REFERENCES

The following publications are available at the local NRCS field offices or the Iowa NRCS Home page at: http://www.ia.nrcs.usda.gov.

Revised Universal Soil Loss Equation Version 2 (RUSLE2) http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm.

Tillage Equipment Pocket Identification Guide ftp://ftp-fc.sc.egov.usda.gov/IA/intranet/Tillage.pdf

Bolton, Ryan. 2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatoon, Saskatchewan, CA.

Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO_2 loss across an eroded landscape. Soil Tillage Res. 81:183-194.

Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16th Triennial Conf., Int. Soil Till. Org. (ISTRO).

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 conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703.

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.

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.

U.S.D.A. Natural Resources Conservation Service. 2002. National Agronomy Manual. 190-V. 3rd ed.