NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DEEP TILLAGE

(Acres)

CODE 324

DEFINITION

Performing tillage operations below the normal tillage depth to modify the physical or chemical properties of a soil.

PURPOSES

This practice may be applied as part of a conservation management system to support one or more of the following:

- Fracture restrictive soil layers.
- Bury or mix soil deposits from wind or water erosion or flood overwash.
- Reduce concentration of soil contaminants which inhibit plant growth.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land having adverse soil conditions which inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as claypans, overwash or deposits from wind and water erosion or flooding, or contaminants in the root zone.

This standard includes tillage operations commonly referred to as deep plowing, chiseling, subsoiling, or ripping, performed from time-to-time below the normal tillage depth.

CRITERIA

General Criteria Applicable to All Purposes

Deep tillage operations shall be performed when soil moisture is less than 30 percent of field capacity, according to the “feel test” or other acceptable method, at the minimum depth to which the tillage will be done.

Additional Criteria to Fracture Restrictive Soil Layers

Tillage equipment such as chisels, subsoilers, bent-leg subsoilers, or rippers, with the ability to reach the required depth shall be used.

The depth of tillage shall be a minimum of one inch deeper than the depth of the restrictive layer. Tillage depth should be set carefully and periodically checked to maintain this working depth.

Complete fracturing of the restrictive layer is not required, but is allowed. The fractured zone, as a minimum, shall be sufficient to permit root penetration below the restrictive soil layer. The fractured zone does not need to extend to the row middles and should be limited to the area near the rows (in the case of crops broadcast-planted or drilled in narrow rows, less than 15 inches).

Additional Criteria to Bury or Mix Soil Deposits from Wind and Water Erosion or Flood Overwash

Tillage equipment such as moldboard plows, disk plows, or chisels with twisted points with the ability to reach the required depth shall be used.

The tillage operation shall uniformly mix soil six inches or two times (2X) the depth of overwash, whichever is deeper, to achieve a desired available water-holding capacity (AWC) and to break the hydrologic barrier caused by overwash layer.

Additional Criteria to Reduce Concentration of Soil Contaminants which Inhibit Plant Growth

Tillage equipment such as moldboard plows, disk plows, or chisels with twisted points with the ability to reach the required depth shall be used.

The tillage operation shall mix a sufficient amount of uncontaminated soil with the contaminated material so that the concentration of the contaminant is below the crop tolerance level. Crop tolerance levels shall be established in accordance with Land Grant University guidance and recommendations.

The soil contaminant shall be uniformly distributed throughout the deep-tilled layer.

CONSIDERATIONS

Poor management will lead to undesirable structure and tilth. This practice will give temporary relief from problems such as crusting, compaction, and root-restricting layers. Long term solutions can be achieved only through elimination or reduction of the causes.

Where restrictive layers are a concern, the effects of this practice can be enhanced by including deep-rooted crops in the rotation that are able to extend to and penetrate the restrictive layer. Further enhancement can be achieved by the use of continuous no-till.

Soils that will usually benefit from this practice are those with traffic pans, or naturally occurring pans.

Research on numerous crops has shown that tillage conducted excessively deeper than the compacted layer does not promote increased yields, requires excessive amounts of tillage energy, and promotes future compaction from nearby vehicle traffic.

Reduce or control equipment traffic during periods when soils are prone to compaction and formation of tillage pans.

When infertile flood overwash is mixed with the pre-flood soil profile, the soil rebuilding process can be enhanced by additions of organic matter, such as manure or cover crops utilized as green manure. Crop rotations, tillage, and planting systems which maintain high levels of crop residues, such as no-till, can also accelerate this process.

Where the flood overwash layer is too thick to effectively mix with the pre-flood soil profile, redistribution of the overwash layer by smoothing or removal may be necessary. Generally, no more than about six inches of overwash can be uniformly mixed into the soil profile using commonly available equipment.

Specialized equipment may be necessary where greater depths of overwash are to be incorporated.

Where unfavorable soil materials such as high sodium, calcium, gypsum or other undesirable materials are within anticipated deep tillage depth and would be brought to the surface by deep tillage operations, this practice should not be applied.

Transport of sediment-borne pollutant(s) offsite will be reduced when this practice is used in combination with aggressive use of erosion control systems that minimize runoff.

To help reduce compaction, it is desirable to conduct normal tillage operations when soil moisture is less than 50 percent of field capacity. When possible, field operations should be avoided when soil moisture is greater than 50 percent of field capacity. Haul traffic should be limited to end rows or haul roads. Compacted regions between crop rows that are not fractured can assist in supporting vehicle traffic, limiting rutting and soil compaction beneath the row.

If application of this practice will impact cultural resources (archaeological, historic, historic landscapes, or traditional cultural properties), follow NRCS national policy and State operating procedures for considering cultural resources.

Examples of soils that are prone to develop restrictive layers and may benefit are Autryville, Durham, Granville, Kalmia, Kenansville, Norfolk, Orangeburg, Wagram, Varina, Dothan, Bonneau, Goldsboro, Blaney, Butters, Cowarts, Foreston, Fuquay, Marvyn, Ocilla, Pocalla, Suffolk, Vaucluse, and Wrightsboro. Almost any Coastal Plain mineral soil is subject to pan development if trafficked when wet.

Where the removal of more than six inches of the surface occurs, the resulting surface soil will be largely void of soil life. Applications of animal waste, use of high-residue crops, cover crop use, composting, or other similar measures will facilitate a more rapid return of soil biological processes.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the criteria, considerations, and operations and maintenance described in this standard.

As a minimum, the following shall be provided:

- Guidance on setting the depth of tillage needed to achieve the intended purpose.
- Additional guidance on mixing overwash or contaminated soil.
- Additional measures needed to reduce compaction and manage restrictive layers.
- Determination of the potential to impact cultural resources.

OPERATION AND MAINTENANCE

As a minimum, the following operation and maintenance information should be provided.

- Deep tillage for reduction of soil compaction shall be performed whenever compaction reoccurs.
- When deep tillage has been performed to reduce the concentration of soil contaminates, the contaminate levels in the root zone shall be monitored to assist with determining when or if treatment will be reapplied.