NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DEEP TILLAGE

(Acre)

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 purposes.

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

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land with adverse soil conditions 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, subsoiling, ripping or row-till performed 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 methods at the maximum depth to which the tillage will be done.

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

Additional Criteria to Fracture Restrictive Soil Layers

Use tillage equipment such as chisels, subsoilers, bent-leg subsoilers or rippers with the ability to reach the required depth.

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. Shank spacing shall be greater than the depth of tillage.

Complete fracturing of the restrictive layer is not required. The fractured zone shall be sufficient to permit root penetration below the restrictive soil layer and does not need to extend to the row middles. For broadcast-planted or drilled crops in narrow rows, (less than 15 inches) the fractured zone may be disrupted completely.

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

Use tillage equipment such as moldboard plows, disk plows or chisels with twisted points with the ability to reach the required depth.

The tillage operation shall uniformly mix soil to a depth of 6 inches or 2 times the depth of overwash, whichever is deeper, to achieve the desired available water-holding capacity and break the hydrologic barrier caused by the overwash layer.

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

Use tillage equipment such as moldboard plows, disk plows or chisels with twisted points with the ability to reach the required depth.

Mix a sufficient amount of uncontaminated soil with the contaminated material so that the concentration of the contaminant is below the crop tolerance level. Establish crop tolerance levels in accordance with Colorado State University guidance and recommendations. Uniformly distributed the soil contaminant throughout the deep tilled layer.

CONSIDERATIONS

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.

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 mixing infertile flood overwash with the pre-flood soil profile, enhance the soil rebuilding process by adding organic matter such as manure or cover crops utilized as green manure.

Where the flood overwash layer is too thick to mix with the pre-flood soil profile, redistribution of the overwash layer by smoothing or removal may be necessary. Generally, no more than about 6 inches of overwash will mix into the soil profile using commonly available equipment. Specialized equipment may be necessary where the overwash depth is greater than 6 inches.

Do not apply Deep Tillage where unfavorable soil materials such as sodium, calcium or gypsum are within the anticipated deep tillage depth.

Offsite transport of sediment-borne pollutants can be decreased when this practice is applied as part of a conservation management system to decrease the concentration of pollutants in the surface layer.

To decrease compaction, conduct normal tillage and harvest operations when soil moisture is less than 50 percent of field capacity. Field harvest 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.

For fields where crops produce less than 2,000 pounds of residue per year, chisel shanks should be spaced at least 24 inches apart to decrease residue destruction.

Complete Deep Tillage operations on the contour where water erosion is a concern or at right angles to the prevailing erosive wind direction where wind erosion is a concern.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or treatment unit according to the Criteria, Considerations and Operation and Maintenance sections of this standard. Specifications shall describe the requirements for applying the practice to meet the intended purpose.

Record practice specifications using approved specification sheets, job sheets, narrative statements in the conservation plan or other acceptable documentation.

OPERATION AND MAINTENANCE

Perform deep tillage for reduction of soil compaction whenever compaction reoccurs.

When deep tillage has been performed to decrease the concentration of soil contaminates, the contaminate levels in the root zone shall be monitored to determine when or if treatment should be reapplied.

REFERENCES

Colorado Field Office Technical Guide, Section I. Agronomy Technical Note No. 81. 1992. Residue Cover as Affected by Tillage. USDA, Natural Resources Conservation Service. Lakewood, CO.