

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**DEEP TILLAGE**

(Ac.)

CODE 324

**DEFINITION**

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

**PURPOSE**

- Fracture restrictive soil layers.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to land having adverse soil conditions which inhibit plant growth due to compacted layers formed by field operations (plow pans) or restrictive layers such as cemented hard pan in the root zone. It will have minimal effect and high cost when used on certain soils. These soils have dense layers found just above bedrock in subglacial (basal) till soils. This practice does not apply to normal tillage practices to prepare a seedbed.

This standard includes tillage operations commonly referred to as deep plowing, in-row subsoiling, strip-tillage, paratilling, subsoiling, ripping, or row-till, performed not as a part of the normal tillage operations or at an altered 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 maximum depth to which the tillage will be done.

**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 to fracture the restrictive layer.

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. 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), the fractured zone may be disrupted completely].

**CONSIDERATIONS**

Where restrictive layers are a concern, the effects of this practice can be enhanced by including deep rooted crops in the rotation, if applicable, that are able to extend to and penetrate the restrictive layer. This can also be achieved through the use of diverse cover crops (Conservation Practice Standard 340 – Cover Crop), which include deep rooted crops such as radish.

Reduce or control equipment traffic during periods when soils are prone to compaction and formation of tillage pans. Caution should also be exercised when excessively heavy equipment is used to ensure that soils are not

prone to compaction. Loads greater than 6 tons/axle have been found to cause compaction to depths of approximately 16 inches which is below normal depths of tillage and may cause yield reductions for several years.

Reducing contact pressure between the load and the soil may also be helpful to avoid re-compaction following deep tillage. Complete field operations with appropriate tires selected for soils and site conditions which are inflated at the correct pressure per manufacturer's specifications to reduce compaction on the field. Other methods that can be used to further spread the load and potentially reduce soil recompaction include using dual tires or tracks beneath tractors, grain wagons, slurry tanks, etc.

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.

To maximize effectiveness and minimize compaction, deep tillage should be performed at an appropriate soil moisture content. Percent available water capacity can be estimated in the field (see Estimating Soil Moisture by Feel and Appearance <http://nmp.tamu.edu/content/tools/estimatingsoilmoisture.pdf>). Soils closer to field capacity (100% awc), will be more likely to compact during field operations.

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.

## **NRCS, CT**

**December 2013**

Generally, no more than about 6 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.

In rocky soils, deep tillage often brings up many large stones from below the historic plow level. Use spring resets on the subsoiler shanks and adjust the tension per manufacturer's recommendations for optimal performance. Moldboard plows and large tandem disks, when used to bury and mix soil deposits and/or contaminants, have a severely destructive effect on soil physical characteristics. These implements create conditions ideal for soil compaction to occur. Chisels with twisted points have a slightly less destructive impact.

Disruption of the soil surface is not desired and should be minimized where possible through proper selection of shanks. Excessive disturbance of the soil surface can cover plant residues which should be maintained on the soil surface to intercept rainfall and impede surface runoff.

## **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 & Maintenance described in this standard.

## **OPERATION AND MAINTENANCE**

When deep tillage has been performed to reduce the concentration of soil contaminants, the contaminate levels in the root zone shall be monitored to assist with determining when or if treatment will be reapplied.

Deep tillage for reduction of soil compaction shall be performed whenever compaction reoccurs.

**REFERENCES**

Baumhardt, R.L., O.R. Jones, and R.C. Schwartz. 2008. Long-term effects of profile modifying deep plowing on soil properties and crop yield. *Soil Sci. Soc. Am. J.* 72:677-682.

Reeder, R. and D. Westermann. 2006. Soil management practices. p. 63. In M. Schnepf

and C. Cox (ed.) *Environmental benefits of conservation on cropland: The status of our knowledge.* Soil and Water Conservation Society, Ankeny, IA.

USDA, NRCS. 1996. *Soil Quality Information Sheet: Sediment deposition on cropland.*