



## Natural Resources Conservation Service

### CONSERVATION PRACTICE STANDARD

## DEEP TILLAGE

### CODE 324

#### (ac)

#### DEFINITION

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

#### PURPOSE

This practice supports one or more of the following purposes:

- Bury or mix soil deposits from wind or water erosion or flood overwash
- Reduce soil compaction by fracturing restrictive soil layers

#### CONDITIONS WHERE PRACTICE APPLIES

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

This practice does not apply to normal field operations and tillage methods.

#### CRITERIA

##### General Criteria Applicable to All Purposes

Perform deep tillage operations when soil moisture is less than 30–50 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 Bury or Mix Soil Deposits from Wind and Water Erosion or Flood Overwash

Invert and mix soil deposits to a minimum of twice the depth of the deposited material.

##### Additional Criteria to Reduce Soil Compaction by Fracturing Restrictive Soil Layers

Operate deep tillage equipment at a minimum depth of 1 inch below the bottom of the restrictive layer.

Root penetration is sufficient when the horizontal extent of the fractured layer is below the restrictive soil layer.

#### CONSIDERATIONS

Where restrictive layers are a concern, consider additions of organic matter (e.g., manure, green manure cover crops, etc.) or alternative crops and rotations, tillage and planting systems with high levels of added crop residues (e.g., deep rooted crops, no-till, mulch till, etc.), or with roots that extend to and penetrate the restrictive layer.

When operating on wet or otherwise easily compacted soils consider the type, weight, and contact pressure of equipment (e.g., balloon tires, dual tires or tracks for tractors, grain wagons, slurry tanks, etc.).

Tillage conducted several inches deeper than the compacted layer does not promote increased yields, requires excessive amounts of tillage energy, and promotes future compaction from nearby vehicle traffic.

During periods when soils are prone to compaction and formation of tillage pans consider reducing passes or scheduling equipment passes. Limit equipment passes during tillage and harvest operations to end rows or designated haul roads. Site equipment haul roads over nonfractured compacted field soils to limit rutting and soil compaction beneath fractured field soils.

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.

Consider redistribution of the overwash layer by smoothing or removal where the flood overwash layer is too thick.

This practice should not be applied 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.

Moldboard plows and large tandem disks, when used to bury and mix soil deposits, can have a 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 tillage implements or appropriate residue and tillage techniques. 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**

Develop plans and specifications for each field or treatment unit according to the requirements of this standard. Specifications must describe the requirements to apply this practice to achieve the intended purpose. Record the following specification components in an approved Deep Tillage, 324, implementation requirements document.

- Soil moisture
- Depth and thickness of restrictive layer (inches)
- Soil deposit depth
- Equipment to be used
- Depth of tillage (inches)
- Date and time of tillage
- Location

## **OPERATION AND MAINTENANCE**

Evaluate effectiveness of deep tillage field operations applied for fracturing restrictive layers or mixing soil deposits. Adjust plan if needed and reapply deep tillage when these field conditions reoccur.

## **REFERENCES**

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

USDA, NRCS. 2003. Soil Compaction: Detection, Prevention, and Alleviation. Technical Note 17.