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

This practice supports one or more of the following purposes:

- Bury or mix soil deposits from wind or water erosion or flood overwash – Resource concern (DEGRADED PLANT CONDITION – Undesirable plant productivity and health).
- Fracture restrictive soil layers – Resource concern (SOIL QUALITY DEGRADATION – Compaction).

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 cemented hardpans (duripan) in the root zone, overwash or deposits from wind and water erosion or flooding.

This practice does not apply to normal field operations and tillage methods for planned crop production.

CRITERIA

General Criteria Applicable to All Purposes

Deep tillage operations shall be performed 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 Fracture Restrictive Soil Layers

Deep tillage operation to fracture restrictive layers shall be operated, at a minimum, to a depth of 1" below the bottom of the restrictive layer

The horizontal extent of the fractured layer, at a minimum, shall be sufficient to permit root penetration below the restrictive soil layer.

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

Deep tillage operation to invert and mix soil deposits shall be operated to a the depth needed to meet planning objectives

Soil deposits shall be inverted and mixed a minimum of 2 times (2X) the depth of the deposited material

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.

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 reduce recompaction. Typical bias-ply tires require excessive inflation pressures which can concentrate the loads on the soil surface and cause excessive soil compaction. Radial tires offer superior soil compaction and traction characteristics when properly inflated to the manufacturer's specifications. 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.

To help reduce development of compacted restrictive layers, conduct normal tillage operations when soil moisture is less than 50 percent of field capacity. When possible, harvest operations should be avoided when soil moisture is greater 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.

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 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.

Transport of sediment-borne pollutant(s) offsite can be reduced when this practice is used in a conservation management system, by reducing the concentration of pollutants in the surface layer.

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 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 selected conservation practice purposes, criteria and conditions, and considerations in this conservation practice standard.

Record practice design using approved Implementation Requirements document.

OPERATION AND MAINTENANCE

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

REFERENCES

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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.

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