JOB SHEET

Deep Tillage

Oklahoma Conservation Practice Job Sheet ***324***

USDA Natural Resources Conservation Service (NRCS)

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Landowner_____

WHAT IS DEEP TILLAGE?

Deep Tillage is performing tillage operations below the normal tillage depth to modify the physical or chemical properties of the soil.

PURPOSES

Deep tillage is applied as part of an overall conservation management system to:

- 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

HOW IT HELPS THE LAND

Deep tillage applied to the land can alleviate soil conditions which inhibit plant growth. Deep tillage will effect compacted soil layers that form during field operations and restrictive soil layers such as clay pans by fracturing and opening the soil up to increase moisture infiltration and improve root penetration. When deposits of soil resulting from flooding or wind and water erosion bury existing topsoil, deep tillage can be used to mix the overwash and the topsoil. Concentrations of soil contaminants in the root zone can also be reduced by mixing uncontaminated soil with the contaminated soil.

WHERE THE PRACTICE APPLIES

Deep tillage is used on any land having adverse soil conditions which inhibit plant growth. Deep tillage includes tillage operations commonly referred to as deep plowing, ripping, subsoiling, or row-till, performed from time to time below the normal tillage depth.

WHERE TO GET HELP

For assistance in planning, contact your local Natural Resources Conservation Service or your local Conservation District office.

APPLYING THE PRACTICE

Have the location and depth of underground utilities checked prior to using deep tillage in a field.

Fracturing Restrictive Soil Layers

First determine the depth of the restrictive soil layer. This can be done a number of ways:

- **Rooting Patterns** – Dig a hole about 2 feet deep and look for rooting patterns. In particular, look for masses of roots running horizontally or the absence of roots below certain depths.
- **Soil Sampling Tube or Steel Rod** – Push the tube or rod into the ground and notice any resistance felt.
- **Penetrometer** – The penetrometer is a steel rod

with a gauge that displays the pressure needed to penetrate the soil as it is pushed through the profile. Follow the directions closely when using this tool.

Once the restrictive layer depth is determined, tillage equipment such as chisels, subsoilers, or rippers can be used to shatter the restrictive soil layer. Tillage depth should be at least 1 inch deeper than the restrictive layer. It is most effective if done when the soil is dry (less than 30% of field capacity soil moisture).

Research at OSU suggests that few Oklahoma soils have restrictive layers deep enough and with high enough bulk densities to warrant subsoiling.

Other research has shown that tillage conducted excessively deeper than the compacted layer does not promote increased yields and requires more energy. Subsoiling can be an expensive operation and should be used only when needed.

Probably the best way to handle soil compaction is to avoid conditions that cause it.

- Avoid making tillage operations when the soil is wet. Water in the soil acts like a lubricant, so soil particles are easily rearranged and jammed together tightly decreasing pore space in the soil and increasing bulk density. A good rule of thumb is that soil squeezed in your hand then tossed about should fall apart. If not, it is too wet.
- Reduce the number of tillage trips across the field. Try to combine as many tillage trips as possible or settle for a less perfect seedbed. Most of the new drills and planters operate well under minimum tillage conditions.
- Vary the depth of tillage from year to year and restrict the use of disc plows. Use chisels more than plows to do primary tillage. Sometimes chisels may require more energy to pull but leave residues on the soil surface. They also shatter and loosen the soil better.

Soil of any texture will compact and form restrictive layers. Soils made up of a uniform mixture of sand, silt, and clay will compact more than soils made up of particles about the same size. The reason for this is that the soil pores become filled with the smaller soil particles. Therefore soils such as sandy loams are more susceptible to compaction because of the more uniform mixture of sand, silt, and clay.

***Average minimum bulk densities that restrict root penetration in soils of various textures**

Texture	Bulk Density g/cc
Coarse, medium, and fine sand	1.80
Loamy sand and sandy loam	1.75
Loam and sandy clay loam	1.70
Clay loam	1.65
Sandy clay	1.60
Silt and silt loam	1.55
Silty clay loam	1.50
Clay	1.40

*Reference – OSU Extension Factsheet No. F-2244

Bury or Mix Soil Deposits from Wind and Water Erosion or Floodwater Overwash

Tillage equipment such as moldboard plows, disc plows or chisels with twisted points do well for mixing soil. Tillage needs to uniformly mix soil 6 inches deep or 2 times the depth of the overwash, which ever is deeper to achieve the desired water-holding capacity and to break the hydrologic barrier caused by the overwash layer.

When flood overwash is more than 6 inches deep, it is generally too thick to mix effectively. Other equipment used for smoothing or removal may be needed to help accomplish the job.

Reduce Concentration of Soil Contaminants Which Inhibit Plant Growth

Moldboard plows, disc plows, and chisels with twisted points that can reach the desired depth will work for mixing soil. The tillage operation should mix sufficient amounts of uncontaminated soil with the contaminated material so that concentrations are below the crop tolerance level and are evenly distributed throughout the deep tilled layer.

CONSIDERATIONS

When compacted or restrictive layers are a concern, using deep rooted crops in the rotation will enhance this practice.

Some flood overwash is relatively infertile. Additions of organic matter like green manure crops can enhance this practice. Also, tillage systems that encourage high levels of crop residues on the surface, such as no-till, can accelerate the soil rebuilding process.

Check the soil to see that unfavorable materials that could inhibit plant growth will not be brought to the surface during deep tillage operations (sodium, calcium, gypsum, etc.).