DEEP TILLAGE

CONSERVATION JOB SHEET - Agronomy Series 324.2

Natural Resources Conservation Service

Michigan

WHAT IS DEEP TILLAGE?

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

Deep tillage is performed to improve rooting depth of plants and weather proofing them against dry weather; i.e., improving the ability of plants to utilize subsoil moisture by removing dense soil layers (soil compaction) in the root zone.

Soil compaction reduces pore space, decreases water infiltration, increases runoff, and restricts root growth. Crop yield reduction due to soil compaction depends on the degree of stress the plant experiences during the growing season (Harrigan 1992).

Surface compaction is described in research literature as being in the top 12 inches of the soil profile (Voorhees 1987). Mechanical tillage such as moldboard plowing or chisel plowing can remove surface compaction.

Subsoil compaction occurs deeper than 12 inches in the soil profile. Mechanical tillage such as V ripping a high soil disturbance method or zone building a low soil disturbance method ahead of no till is used to create root pathways.

What are the Corrections for Soil Compaction?

According to Dr. Gary C. Steinhardt, Purdue University, "to minimize or correct soil compaction you need to … identify the nature and extent of the problem in the field," (Steinhardt 1985).

There are two methods to determine the presence of soil compaction and depth of the compaction layer or tillage pan.

One way is to dig a hole and observe the soil structure for compacted, platy soil layers. Dig a hole 2 feet deep and look for wormholes and old root channels. With a strong bladed knife stuck 3 inches deep near the bottom of the hole, slowly pull the knife up the sidewalls of the hole until it is nearly impossible to lift higher. Your hand will feel resistance. This is the bottom of a compaction pan. Determine the depth of the pan by following the same procedure from the soil surface. Look for roots growing parallel to the soil surface.

A second way is to use a soil penetrometer. This is a thin rod with a spring-loaded gage that records the pressure needed to penetrate the soil. Push the penetrometer slowly into the soil until it becomes difficult to do so. Stop and measure the depth. Then push the penetrometer deeper until it becomes increasingly easy to penetrate the soil. This method determines the width and depth of soil compaction.

Determine Field Soil Moisture Condition

Use the soil moisture content descriptions and pictures on pages 2 through 4 to estimate field soil moisture.

<u>When soil conditions are right to plow, it is a good time to check for soil compaction.</u>

The soil must have soil moisture near 25% of field capacity, i.e., within the 2 foot depth the soil needs to feel damp to the touch, or at the right moisture to till without making wet clods. If either the knife or penetrometer methods are used when it is too wet or too dry, they will provide a false reading of the width and depth of the horizontal compaction pan.

Navy bean root parallel to the soil surface indicates depth of hard pan.

A soil penetrometer is one tool to check soil compaction depth.

Farm Operator: _____
County: _____
Time of Year Planned: _____

Planned by: _____
Cultural Resource Review: _____

Township	Sec.	Tract	Field Number(s)	% Soil Moisture[1]	Compaction Depth	Recommended Tillage Equipment Depth		Meets Standard

[1]Appearance of sandy loam and fine sandy loam soils (soil management group 3.0) at less than 25% moisture will be dry, forming a very weak ball of soil when squeezed in palm of the hand, aggregated soil grains break away easily from the ball. Refer to next page with pictures for higher soil moisture contents.

[1]Appearance of sandy clay loam, loam, and silt loam soils (soil management groups 1.5 or 2.5) at less than 25% moisture will be dry, soil aggregations break away easily, and clods will crumble with applied pressure, there will be no staining on the fingers. Refer to next page with pictures for higher soil moisture contents.

[1]Appearance of clay, clay loam, and silty clay loam soils (soil management groups 1.0 or 0) at less than 25% moisture will be dry, soil aggregations separate easily, and clods will be hard to crumble with applied pressure. Refer to next page with pictures for higher soil moisture contents.

Checked by: _____ Date: _____

For more information on Soil Compaction see the NRCS Agronomy Job Sheet 324.1, Soil Compaction Symptoms, Causes, Correction, and Prevention.

Appearance of Soils at 25-50% and 75-100% Available Water Capacity

75-100% moisture on sandy clay loam, loam, and silt loam soils corresponding to soil management groups 1.5 and 2.5.

Description:
Wet, forms a ball with well-defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger.

25-50% moisture on sandy clay loam, loam, and silt loam soils corresponding to soil management groups 1.5 and 2.5.

Description:
Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away.

75-100% moisture on sandy loam and fine sandy loam soils corresponding to soil management group 3.0.

Description:
Wet, forms a ball with wet outline left on hand, light to medium staining on fingers, makes a weak ribbon between the thumb and forefinger.

25-50% moisture on sandy loam and fine sandy loam soils corresponding to soil management group 3.0.

Description:
Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away.

25-50% moisture on clay, clay loam, and silty clay loam soils corresponding to soil management groups 0 or 1.0.

Description:
Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure.

50-75% moisture on clay, clay loam, and silty clay loam soils corresponding to soil management groups 0 or 1.0.

Description:
Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger.

75-100% moisture on clay, clay loam, and silty clay loam soils corresponding to soil management groups 0 or 1.0.

Description:
Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger.

Reference: Estimating Soil Moisture by Feel and Appearance. 2005. USDA NRCS Program Aid Number 1619.