USDA
United States Department of Agriculture

NATURAL RESOURCES CONSERVATION SERVICE

4A

SOIL TECH NOTES

Soil Structure

PROBLEM: "I'm noticing a hard pan in my soil. Seems to be getting worse!"

PROBLEM CAUSED BY:

- Excessive tillage
- Some tillage tools more apt to cause problems such as moldboard plow, large tandem disc
- Tilling when soil is wet.
- Non-tillage equipment in excess across fields, i.e. grain carts, semis, fertilizer trucks, earth moving equipment used in construction of sediment basins, waterways, etc.

HOW STRUCTURE FORMS:

Micro-aggregates, composed of clay, silt-sized aggregates, particulate organic matter, plant debris, and fungal hyphae, are combined into macro-aggregates by plant roots and action of microbes. These larger aggregates are held together by fungal hyphae, root fibers, and polysaccharides. These give the soil its structure and allow water and air movement. Compaction will break up these larger units, however, and cause structure to collapse.

Glomalin is an organic "glue" which cements the micro-aggregates together to form the larger units. It coats the plant roots and then coats the soil particles. It is formed by combining a protein from the mycorrihizal fungi with sugar from plant root exudates.

In order for the Glomalin to be produced, plants and mycorrihizal fungi must exist in the soil together. Glomalin needs to be continually produced because it is readily consumed by bacteria and other microorganisms. In tilled soils, bacteria are much more numerous than fungi. Because of this, lower amounts of glomalin are produced and what is produced is readily consumed. This leads to poor structural units in tilled soils.

POOR STRUCTURE CAUSES WHAT DAMAGE:

Structure units in the soils break down and "run together." Soil surface seals over. This shuts off or reduces water and air movement into the soil. Water runoff increase, water infiltration decreases and surface ponding of water increases. Reduction in freedom of air movement can cause soil in upper part to become anaerobic or without oxygen. Bacteria, Actinomyces, and Fungi are aerobic and need air. No air, they die and leave soil. Decomposition slows down and release of organic nutrients is reduced.

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POSSIBLE SOLUTIONS FOR IMPOVEMENT:

- Reduce or eliminate unnecessary tillage.
- Select somewhat less invasive tillage tools, i.e. chisel plow, field cultivator, etc.
- Wait "one more day" if surface conditions are damp or moist. Remember if a gob of soil will form a nice ball that sticks together when squeezed, soil is probably too wet.
- Use of **selected** cover crops can help hold the soil together and assist in keeping air and water moving into and through the soil
- Any **soil health management system** that adds organic matter to the soil will help hold the soil particles together and resist further structure breakdown.

unlock the SECRETS IN THE SOIL

National Soil Health Website:
www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/