Soil Compaction Worth Preventing

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Soil compaction is defined as a process of rearranging soil particles to decrease pore space and increase bulk density (weight per unit of volume).

An ideal soil might have 50 percent pore space. Compaction reduces the movement of gases and water in the soil, increases soil strength, and reduces crop yields significantly.

Soil oxygen is essential for seed germination, root development, nutrient uptake, and soil microb activity. Restricted water movement prevents beneficial drainage when soils are wet and limits the availability of water to roots when soils are dry. The increased soil strength caused by compaction directly blocks root growth.

Plants growing in compacted soils are slow to emerge. Stand and plant size are variable. Leaves may be off-color due to nutrient deficiency. Roots are shallow and malformed. Plants are especially susceptible to moisture stress (from either too much or too little water).

Compaction symptoms that may be observed in soil include crusting and cracking of soil surfaces, excessive erosion, ruts and standing water, higher power requirements for tillage, and only partial decomposition of crop residues.

Because water lubricates soil particles, wet soils compact more readily than dry soils. Fine-textured soils and soils with variable particle sizes compact more easily than uniformly coarse textured soils. Organic matter helps prevent soil compaction and reduces bulk density.

Freezing/thawing and wetting drying help to correct compaction in surface soil, but deep compaction is difficult to treat. Mechanical subsoiling gets limited and/or temporary results. The best approach is to minimize compaction by the following means:

- Reduce tillage. Consider using minimum tillage or no-till planting practices.
- Don't till or move equipment (or animals) on wet soils. The drier, the better. If its' too wet to till, it's also too wet to spread manure.
- Reduce traffic on fields. Aerial applications or wider equipment could help.
- Reduce weight of tractors and implements. However, remember that excessive tire slippage also causes compaction. Tandem wheels can distribute weight and reduce compaction.
- Increase soil organic matter. Use cover crops, manure, crop residue, mushroom compost, deep-rooted forage crops, and a rotation cropping system.
- Improve both surface and subsurface drainage when appropriate.

Most of the previous observations and guidelines relating to soil compaction were gleaned from a presentation by Doug Beegle, Penn State agronomist, at our recent Crops Days.