



MANAGE Soil Compaction... and Protect Your Profits *(Part 1)*

Compaction is "a decrease in soil volume and porosity; an increase in soil bulk density; may cause a crushing of soil aggregates."

While most farmers are aware that "**Crushed Soil Aggregates**" are not a good thing, but many under- estimate the significance of soil compaction. Soils low in organic matter tend to be more susceptible to compaction because they do not form strong aggregates. The spaces between these aggregates (up tp 50% in healthy soil) are filled with water and air.

Obviously, compaction reduces these open spaces, and is a natural result of normal farming practices – and have become a bigger concern as the size/weight of our farm equipment increases.



You can often see evidence of compaction in the angled tillage tracks across a corn field at V4–V5. This is often caused by cold damp weather that left the top two inches of the soil profile in less than desirable planting conditions. The urge to get the seed in the ground is understandable, but often the decision to delay a day or two for some additional drying time may make a big difference.

Is Compaction a problem on your farm?

Here's some questions to consider.

1. Is crop growth poor, every year, all crops?
2. Is there a spatial pattern to crop growth (wheel tracks, equipment width)?
3. Does the soil surface appear smooth and crusted?
4. Has there been a change in equipment or operations?
5. If you scrape away the surface, can you see dense layers and/or horizontal root growth?
6. Do you observe a general deterioration of soil structure?
7. Is there a lack of active biology?

Causes... Once we see evidence of a compaction problem, we can identify the cause(s) and work toward possible solutions.

First, identify where compaction is evident in the soil profile. Many times, a hardpan will form at the depth of a particular tillage operation. The disk is an implement that can cause the formation of such a hard pan, but all tillage passes will alter soil structure. In addition, tilling compacted soils may make them more susceptible to re-compaction.

Second, can anything be done to eliminate excessive loads? Research shows that up to 80% of total compaction occurs in the first pass. Can traffic be confined to certain areas of the field?

Third, wait for field conditions to improve. And yes, we understand... this is easier said than done.

Fourth, is drainage the issue? Improvements in drainage offer the greatest return on investment for the long term. Where applicable, properly engineered surface drainage and pattern tiling offers dramatic results.

How can we measure compaction?

A good place to start is with a **soil penetrometer**. A penetrometer measures the resistance of soil in pounds per square inch (psi), much like a tire gauge measures air pressure. By vertically inserting the tip of the penetrometer into the soil we can get a fairly accurate reading of the psi.

A penetrometer helps to identify the compaction profile and the depth of the restrictive layers. Research has shown that root growth (penetration) essentially stops at 300 psi. Penetration resistance is related to soil water content. Ideally, we would take readings during the spring or the fall when the soil is near its field capacity water content, or during the summer after a substantial rain event. **Talk to your sales rep about taking some penetrometer readings on your farm.**



Once the approximate depth of the compacted layer is determined, dig a hole with a shovel to visually assess the problem. If digging while a crop is growing, take special care to exhumate the entire root mass of a plant and note whether or not roots are able to penetrate the compacted layer. Many times the root direction will make an abrupt change sideways, denying the plant the moisture and nutrients available at greater depths.

If you really want to get the whole picture, dig a soil pit with a backhoe so you (and your neighbors)* can examine the entire soil profile. There is much to be learned by observing what the plant roots are able to do and to what depth. ** Let us know. We'll sponsor a field day so we can all learn together.*

Impacts/Effects:

Soil density – the most direct effect of soil compaction is the increase in bulk density. As soil texture varies, so does optimum bulk density.

No-till soils often have a high bulk density, but because of higher organic matter content and greater biological activity, soil structure is usually favorable to root growth.

Soil Texture	Ideal bulk density ----- g/cm ³ -----	Bulk density restricts root growth
Sand, loamy sand	< 1.60	> 1.80
Sandy loam, loam	< 1.40	> 1.80
Sandy clay loam, clay loam	< 1.40	> 1.75
Silt, silt loam	< 1.30	> 1.75
Silty clay loam	< 1.40	> 1.65
Sandy clay, silty clay	< 1.10	> 1.58
Clay	< 1.10	> 1.47

Let's take a look at some of the possible impacts of soil compaction:

- As soil aggregates degrade, we can expect reduced emergence due to crusting
- Restricted root growth
- Stunted, drought stressed plants
- Increased soil erosion due to decreased protective residue
- Surface pounding, water run-off
- Decreased water infiltration
- Decreased water storage capacity; decreased pore space
- Reduced hydraulic conductivity, the ability of the soil to move water upward from the subsoil as surface moisture evaporates.
- Anaerobic soil condition resulting in decreased root growth
- Reduced nutrient uptake; nitrogen, phosphorus, potassium
 - More denitrification losses
 - Less mineralization of organic nitrogen
- Decreased ability of roots to extract water and oxygen
- Reduced yield; yield variability
- Restricts the potential for ground water recharge
- Organic matter decomposition will be slower
- Less biological activity will occur
- Earthworm numbers decrease
- As soil moisture content increases, so does the depth of soil compaction

Compaction is a real concern. It inhibits healthy root growth, is detrimental to plant health, and limits the profit potential of your farming operation.

Checkout Part 2 of our focus on soil compaction... where we identify several action steps you can do this spring to reduce soil compaction on your farm.



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Give us a call today so we can help you maximize your Total Farm Profitability.