

Getting out of the rut of soil compaction

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AT A GLANCE

Soil pore space is crucial to maintaining soil health, and preventing compaction could help avoid detrimental damage to the soil ecosystem.

The 2019 growing season will be remembered as one of the most challenging on record. It was cold, wet and frustrating. But while farmers and consultants were thinking about what was going on above ground, I couldn't help but get wrapped up in what must be going on below the soil surface.

Soil components

Soil is made of three basic

ingredients. Well, it's actually two ingredients, and the absence of both makes the third. Let me explain. If you have living and/or decomposed organic material, like leaves and bugs and roots and such, and you combine that with a mineral material like sand, silt or clay, you've technically made soil. But nothing will be able to grow in it. Soil is an ecosystem, and an essential element of an ecosystem is the ability to have

transactions. Pore space is created when particles in the soil don't fit perfectly together and is essential for the transactions that sustain life. These transactions include plant uptake of nutrients, bacteria converting nitrogen among its many forms and our applied fertilizers getting to the right places where the crop can take it up. Pore space is the absence of organic and mineral material, makes up about 50% of soil and is absolutely essential for soil to work.

Soil pore space can be thought of as a system of roadways in the soil. It provides channels for water to flow in the soil, allows bacteria and other microfauna to scoot around and do their work, and it allows for the vital exchange of gasses between the soil system and the air above. We all know that plants "breathe" CO₂ above ground, but did you know the root system actually respire below ground as well? The pore space of the soil allows the respiration gasses to escape the roots, so they can continue to breathe. It also goes without saying that pore space simply gives plant roots a place to go – to physically exist.

Compaction complications

Understanding the importance of pore space is crucial following such a wet harvest season. When the soils in our fields have pores filled with water (a scientific way of saying "muddy"), the water acts as a lubricant between the soil particles and we can all guess what that leads to: compaction. To say it scientifically, compaction is a reduction in the amount of pore space in the soil. To say it more basically, compaction makes good soil lousy. All of the vital functions mentioned above become less efficient and less effective. Often times, the compaction is below the surface and is out of sight, but if aerial imagery of a field shows wheel traffic patterns, it's pretty clear what the problem is. A quick internet search of compaction in alfalfa will provide some visual examples of how this unseen compaction can impact yield.

There are always caveats. How susceptible a soil is to compaction is decided not only by the soil moisture, but also by the soil texture – the relative amounts of sand, silt and clay. A really sandy soil is less likely to experience compaction than a loamy soil under the same moisture and pressure conditions. This is mainly due to the size of the soil particles. Sand grains are pretty big and can't really get as packed together as smaller silt and clay particles.

So, great. We have compacted soil. Now what? Should we quit farming? Should we throw all the soil in the trash and bring in fresh soil? There is good news – we can

keep farming. In fact, one of the best solutions is to farm more! Specifically, adding cover crops can help to correct and repair compaction. Tap-rooted cover crops like tillage radishes can push through and help break up compacted soils. Cover crops with a more fibrous rooting system, like rye, will have a difficult time pushing roots through a compaction layer, so they may not be as effective, but they are still better than not having a cover crop. If a compaction layer is relatively shallow in the soil profile, routine tillage may be sufficient to break it up. Simply breaking the compaction layer is just the first step, though.

Compaction prevention

Soil really is a living thing and compaction has a detrimental impact on the entire ecosystem. Breaking the compaction creates new, artificial pore space that will allow the soil interactions to technically take place but, while better than nothing, the soil will still perform at a lowered efficiency until it can fully heal. Breaking the compaction mechanically repairs the soil the same way a detour offers a solution when you encounter roadwork. Yes, you'll technically get to where you wanted to go, but it wasn't how you would have preferred to get there. If persistent compaction is deep in the soil profile, a subsoil ripper may be necessary to break the compaction layer and set the soil on a path to healing.

As with everything in life, prevention is worth much more than the cure. The best way to prevent further damage to our precious soil is to establish wheel patterns in the field. It's not reasonable to think that we can't drive through the fields, but it's perfectly reasonable to choose where we'll drive through the fields. The first pass of wheel traffic causes most of the compaction. This means that it's much better to drive a lot in the same spots than to drive a little in a lot of spots. This is especially true and reasonable when we think about wheel traffic of on-road vehicles. These vehicles, like 18-wheelers and pickup trucks, have narrow tires that exert much higher psi on our soils than a much heavier tractor with larger wheels. Keeping the on-road traffic to the edges of the field can mean healthier, more productive soils that continue to yield more cash. 🌱

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