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James J. Hoorman
Hoorman Soil Health Services
Website: HoormanSoilHealth.com
Email: HoormanSoilHealthServices@gmail.com
Cell: 419-421-7255

Soil Health Indicators

As spring arrives, farmers should be evaluating their fields for soil health. Since the soil is too wet to farm yet, March and early April is a great time to assess farm fields. For soil health, evaluate fields is in the spring or fall; when the soil is not too hard, dry, or too hot. All you need is a notebook, shovel, boots, and a strong back! Here are seven ways to quickly and inexpensively evaluate soil health.

The Natural Resource Conservation Service (NRCS) suggests evaluating these seven soil health indicators. First, look at soil biological activity which determines nutrient cycling and promotes plant growth and yield. Dig a hole and evaluate how many earthworms, mites, beetles, spiders, and other active creatures you see. In active healthy soils with good biology, crop fields will have fewer pests (weeds, harmful insects, and disease). Earthworm middens have 13X higher structural stability, 2.5X more nitrogen, 3X more phosphorus, 3X more potassium, and 4.5X more calcium than regular soil. The number of earthworms and earthworm middens is an indicator of good soil health.

Second, evaluate soil cover, including the crop residue and the living plants on the soil surface. Plants protect soil from water and wind erosion. In the last 160 years, current estimates are that 56 trillion metric tons of topsoil have been lost to erosion in the USA. Covers buffer soil temperatures, keeping soils cooler in the summer and warmer in the winter. Plant roots secure soil, filter out, and recycle soluble nutrients that tend to leave in water runoff. Soil cover provides food and shelter for soil biology. Plant vegetation adds soil organic matter (SOM) and helps form stable soil aggregates. Record and count the number of plants per square foot. For residue, lay out a 100-foot tape measure out and count every foot how many times the string touches residue. Ideally, there should be at least 70% residue. After a while, its fairly easy to eye ball the amount of surface crop residue. Cover crop plants and residue with good biological activity become the carbon needed to obtain high crop yields. Carbon has become the most limiting nutrient in soils, and cover crops make it more available. In highly active biological soils, crop residue should break down fairly quickly, if not, then soil biology or some other factor is limiting.

Aggregate stability is easy to evaluate. Evaluate how easy the soil crumbles. Soils that have lots of roots and soil biology should have high fungal hyphae populations that form large and small

aggregates on plant roots. These aggregates give soil structure, stability to hold up farm equipment, and it promotes improved drainage. Ideally, your soil should look like cottage cheese if soil aggregates are present, and not like a wet solid clump of cement. With good soil health, water should drain away fairly easy and be clear, not muddy.

Fourth, evaluate soil crusts which forms after a rain when the soil dries out. Crusting soil is a sign of weak aggregate stability. Ideally, less than 20% of the soil surface should crust so that the 80% non-crusted soil can allow infiltration of rain water. Crusted soil tends to layer and you can feel individual soil particles when you rub a dry clod. Cover crops greatly reduce surface crusting or surface compaction AND deep compaction. Next evaluate soil compaction at deeper levels. Compacted soils tend to layer and fracture along a tillage line. Usually, its fairly easy to see at what depth past tillage has been performed. Good soils should have many worm holes and root channels so that roots can easily penetrate the soil to deeper depths, to obtain moisture and nutrients.

Six evaluate roots and soil pores. An indication of good soil health occurs when a rhizoshealth forms on roots. Rhizoshealths are roots that have soil sticking to the roots. This area is high in microbial activity due to root exudates that are released. The rhizoshealth is where new aggregates are being formed and where soil nutrients are being processed. Dig out plant roots and look for rhizoshealths and for areas of compaction, where roots are struggling to get deeper into the soil.

Finally, evaluate your soil color. Soil color is an indicator of SOM levels. Soil texture or the amount of sand, silt, and clay in a soil will affect soil color. Sandy soils generally have less SOM than clay soils. If you take a picture of your soil, long-term cover cropping and long-term no-till should lead to a color change over time as your soil health improves. Adapted from an article by Stephanie McClain, USDA-NRCS.