# Healthy Soils – Healthy Farms
## *Part 2 of 2*

**by Ross Wilson,** *CCA-ON 4R-NMS*

*"To be a successful farmer one must first know the nature of the soil."* — Xenophon, Oeconomicus, 400 B.C.

### How Do I Measure Soil Health?

There is a plethora of soil health tests available through the commercial agricultural labs, mostly focusing on chemical and occasionally biological aspects of soil health. Most of these soil tests retain the benefit of simple and easy sample collection, handling and preparation methods. These methods are well understood as many people have similar experience with collecting soil fertility samples in the same manner. In many cases, you send your collected soil samples to the lab and the lab simply performs a different test on them. The Comprehensive Assessment of Soil Health (CASH) suite of tests from Cornell University is one of the better known examples. However, many important soil health indicators require more than a simple collected sample and a simple lab analysis.

### Crop Yield = Soil Health?

Crop yield is frequently used as an indicator of soil health. Recent increases in crop yields lead some to believe soil health is also improving. This is too simplistic and can lead to incorrect conclusions. Both genetic improvements and agronomic advances have contributed significantly to recent yield increases. In reality, there are many factors that affect yield that are unrelated to soil health. Agronomic practices like timely planting and fertility management have a big effect on yield. Disease and pest pressure can also affect yield, regardless of soil health. Too little or too much rain or heat at the wrong time can affect yield, but is unrelated to soil health. Not that yield is a terrible indicator of soil health. Crop yield can integrate many aspects of the water and nutrient management functioning of the soil. Care needs to be taken with interpretation of yield maps as soil health maps.

### Field Tests For Soil Health

Many important soil health tests, particularly those that focus on physical aspects of soil health, must be done in undisturbed soil under 'field conditions'. These are referred to as 'in-situ' tests. One of the simplest examples is compaction testing with a cone penetrometer to test for the ease in which roots, air and water can penetrate through the soil. This involves the pushing of a penetrometer probe into the soil to discover where the greatest resistance to penetration is and how large it is. This process can't be replicated adequately in a lab by collecting soil samples, and then re-packing the soil into a block in preparation for testing. The process of collecting the disturbed samples and then attempting to repack the soil to the same density (hopefully) is unlikely to yield results consistent with field results. These cone penetrometers provide useful and important values, although a simple tile probe can also be used effectively with appropriate training. Even a shovel can be used for this purpose if other more specialized equipment is not available. Water infiltration is one of the best in-situ soil health tests. This is partly because there is a huge difference between health soils and unhealthy soils, so it provides good resolution to discriminate between soils of varying soil health.

### Sample Representativeness

OMAFRA recommends the collection of a minimum of 20 cores for an aggregated soil fertility sample representing no more than 10 hectares (25 acres). The collection of the cores throughout the 25-acre parcel is done in a manner so that all spots within that 25-acre parcel are represented proportionately. Thorough mixing of the soil sample ensures that an 'average' sample will be submitted for analysis. So, a single sample can represent 25 acres reasonably well. In contrast, 'in-situ' samples cannot be 'aggregated' in the same manner that a fertility sample can be. As a result, many more in-situ samples are required to adequately represent that same 25 acres. With a cone penetrometer, many readings in that 25-acre parcel can be collected quickly. However, other undisturbed tests, such as water infiltration tests, can take dozens of minutes each, so much fewer samples can be collected compared to penetrometer readings or fertility samples. A natural consequence is that the selection of the 'in-situ' sampling locations is exceptionally important to ensure that the samples adequately represent the 25 acres. A rigorous soil sampling and analysis strategy is necessary to adequately evaluate the status of soil health.

The ultimate goal for achieving a sustained high level of soil health is a stable supply of food and fibre products. An evaluation of soil health is necessary to determine how close we are to this goal.

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