Soil Health Testing

A&L Canada Laboratories this season has introduced the first phase of a new suite of “Soil Health Tests” which will provide analysis that addresses the chemical, biological and physical components that impact Soil Health. The primary component of our Soil Health test will be a chemical analysis that measures the general fertility of a soil which A&L’s research has shown to be directly correlated to the plants ability to provide the necessary nutrients (carbon) that attract and support the organisms required to enhance plant growth.

Included in this test is the Solvita 1-day test that measures soil respiration of the soil microbes over a 24-hour period. The test also provides a new analysis of the “Reactive Carbon” demonstrated to be a more responsive test signaling the deterioration of physical, chemical, and biological properties. The soil factors that can cause a decline in “Reactive Carbon” include reduced aggregate stability, increased bulk density, reduced water infiltration and water holding capacity, microbial activity, and nutrient availability. Posted on A&L’s Web site are two Tech bulletins that describe and explain each of the parameters on this test.

In this Newsletter we are introducing the next phase of A&L’s soil Health with this novel suite of tests that includes both the microbial analysis of plants and the soil rhizospheres providing an even greater understanding of factors that influence crop growth.

**A&L’s Soil/Plant in Season Biological test**

The complex interactions that occur between the soil, plant roots, and microorganisms have an important effect on nutrient availability and plant productivity. Root exudates act as a source of food and signaling molecules for microbes, forming and shaping the interactions between the plants and the microbes of the soil surrounding the roots.

We developed two new mid-season analysis to compare the presence and abundance of key microbes and the associated plant health parameters of high and low producing areas within a farm.

**Timing of Biological Tests**

**Corn** – V8 to R1 stage

**Beans** – early flower to early pod (R1 to R4)
1. Analysis of key root-associated microbes

We focus on:

- **Nitrogen fixers**: make atmospheric nitrogen available to plants and it has great impact on legumes and non-legume production.

- **Rhizobium**: is a nitrogen fixer and produces exopolysaccharides that modify soil structure around the root system by forming soil aggregates that help plants up take water and nutrients, promoting plant growth specially under environmental stresses.

- **Pseudomonas**: produces antibiotics that protect plants from pathogens, solubilize phosphate, produce exopolysaccharides as *Rhizobium*, etc.

- **Gram positive (*Bacillus*)**: promote plants growth by producing plant hormones, solubilizing phosphates, producing antibiotics, etc. However, our research suggest that high numbers of *Bacillus* could negatively affect plant production.

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**Root Microbial Profile - Abundance of different microbes in high and low productive areas of same farm.**

Differences of at least 1 logarithmic unit (space between 2 horizontal lines) are considered significantly different. In this example, Gram positives (*Bacillus*) and *Pseudomonas* were significantly different between the two productive sites of the farm.
2. Sap quality and microbial analysis of endophytes:

Endophytes are microorganisms that colonize the inside of plants without causing them any obvious damage. Rather, they are considered as group of beneficial microorganisms that can promote plant growth. The type and the quantity of endophytes vary considerably between the healthy and stressed plants.

Plant sap pH, Brix index and plate counting with molecular finger printing of indicator microbes provide a quick health indicator of plants and the associated microbes, which will be used to calculate the health index to identify and compare the differences between high and low productive sites.

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Overall Biological Quality Index: 100 94 59

Plant quality index of high and low productive areas of same farm. The overall biological index is 94 in high productive (good) site compared to 59 in average productive (bad) sites. The bench mark for good health index is 80 or above.

Summary of the report:

The roots of the plants submitted had high counts of spore producing bacteria and fungi in the low productive sites which indicates the plants are stressed with unfavorable soil physical and chemical conditions. That is reverse in the high productive site soil. The same way, plant quality and microbial analysis indicates the quality score of the plants from the low productive soil is below the quality bench mark as compared to high productive site plants.
How do you sample for these tests?

**Root microbial profile:** We will require 2-3 plants with the intact root system and adhered soil, plus enough soil from the rhizosphere to do the SHTEST1 test. As this is a comparison profile you will need to send plants from the good and bad areas of the field. This analysis will include a Soil Health test of the rhizosphere, microbial profile of the roots and rhizosphere as shown in Figure 1. These organisms are indicator organisms that represent soil health. **This test will include a soil health test on each soil submitted as SHTEST1.**

**Sap quality analysis:** This analysis will require above ground plant part again from 2-3 plants (same plants as roots and soil sample for soil biological test). If it is corn 6-inch stem piece of mid plant ie. about 10-12 inch from the ground level. Soybean/wheat require a few plants of above ground plant parts.

**When can you expect the results:** 4-5 business days

**Cost:** As a launching promotion, this season both tests will be partially subsidised by A&L.

### Additional A&L Soil Health Tests

- SBT – Soil Health Analysis (Solvita Burst test)
- SBT1 – Soil Health Analysis (Solvita + NO3)
- SBT2 – Soil Health Analysis (Solvita + NO3 + NH4)
- SHTEST1 – 2017 Soil Health Test
- SHTEST – 2017 Soil Health Test with Water Extracted Carbon and Nitrogen
- SHERBINDEX - Residual Chemistry Profile Index
- SHSCN - C:N ratio
- SHSTEXT - Texture
- SHSTEXT2 - Texture + Available Water holding capacity estimate
- SHVAST - Volumetric Aggregate Stability Test
- SHWHC - Available Water Holding Capacity
- SHEPD - Heavy Metals
- SHNEM3 - Beneficial Nematodes
- SHNEM1 - Nematodes
- SHRMP – Root microbial profile
- SHSQA – Sap quality Analysis

We will require 2 bags of soils for the following tests: SHTEST2, SHWHC, SHERBINEX, SHNEM3