WARD Laboratories, Inc.

Ag Testing - Consulting

An update on Soil Health tests and measurement at Ward Laboratories for the new year.

PLFA Analyses has become an extremely valuable tool in establishing the presence of the microbial functional groups presented in the Soil Food Web excluding the nematodes for now. The extraction method we were using has become outdated in comparison to the latest extraction technology developed and reported by Buyer and Sasser which is proving to be superior to the old extraction method. Early indications are that this technology has improved our detection sensitivity around 7 to 10-fold.

Soil Respiration as measured with the 24-hour CO2-C evolution and reported in parts per million (ppm) of C captured. Since this is still an extremely valuable tool in assessing the level of soil microbial activity; to qualify the presence of soil life and quantify in totality the overall very broad activity levels. It does however present some limitations and we caution against over valuing it as a primary indicator of soil health.

We see just too many instances where soil samples have extremely high respiration values well more than 100 ppm exhibit several soil function deficiencies such as poor aggregate stability, poor water holding capacity, poor fungal to bacterial ratios, incomplete microbial functional groups, and a poor microbial diversity index. These samples have one common denominator; high organic material content originating from partially decomposed crop residues and/or added composted biomass. We have also heard several prominent workers within the soil health industry comment that high Soil Health scores where the soil respiration is the major denominator do not always reflect the correct status of a known soil.

Interpreting the CO2-C reading in a linear fashion is a mistake as pointed out by Dr. David Johnson in a recent presentation. The efficiency of microbial activity to provide and maintain the soil functions improves with microbial diversity and as the “working microbial teams” become more complete a sigmoid curve is more appropriate if you want to use the soil respiration as an indicator of soil health.

A further limitation of using soil respiration as a primary indicator of soil health is that it measures the net quantum result of natures “decomposition” (catabolism) and the “building or regeneration” (anabolism) process. In any agricultural regenerative system, the building process is dominant over the decomposition side or at least in equilibrium with the decomposition process as would be the case in a stable ecosystem. You could thus have extremely high CO2 soil respiration measurements from high rates of decomposition with minimal soil health building and / or maintenance contribution. Yes, you will be mineralizing nitrogen in this instance, but it is from old carbon and nitrogen organic residue and thus a finite source.

There is no substantial evidence of significance confirming that carbon emanating from “old” carbon feedstock (residence organic material) makes a significant contribution to the total carbon sequestration vs the contribution from “new” (incorporated through root exudates) which is regarded as the dominant source of carbon sequestration.

The important point is therefore not to accept a high CO2-C value as the only soil health indicator as this by itself provides little proof soil function attainment.

Water extractable organic carbon (WEOC) and nitrogen (WEON) is not the only microbial food substrate within a soil; larger carbohydrate molecules such as cellulose and protein fragments of peptides should be included to express the microbial food utilization more sensibly. In this instance you could consider the incorporation of the ***POXC and ACE Protein analyses*** to elaborate this and provide a better insight into the soil organic matter feedstock that make up the microbial food source representing the non-water-soluble carbon and nitrogen components.

The linearity of the soil respiration rates can therefore overstate the value of a soils’ true health.

H3A extractant and Ward Laboratories update. Over several years of using this extractant we have found it to understate the Phosphate and micronutrient amounts in high pH soils above 7. The reason being that it is not sufficiently buffered for this purpose. In the live situation the root would provide a continuous flow of exudate maintaining the lower pH within the rhizosphere can not be mimicked by the H3A extract under laboratory conditions. Our new Soil Health tests will provide Mehlich 3 extraction for phosphorus and sulfur, Ammonium acetate extraction for cations and base saturation, DTPA for micronutrients. H3A extraction will be available on request.

Mycorrhizae root inoculation measurement will also be available very soon. Possibly the most important measurement a Regenerative Farmer needs to know is whether the Mycorrhizae spores measured from a PLFA soil analyses is colonizing the crop roots. The presence of Mycorrhizae spores and hyphae in a soil PLFA test is no guarantee that root colonization is taking place to perform the nutrient mineralization from the unavailable soil minerals as measured by the Total Nutrient Digest.

This analyses together with the ***Total Nutrient Digest (TND)*** will provide an extremely good picture of a soils ability to utilize the freely provided resources.

A microscopy testing facility is also on the horizon to zone in on more detail provided by the PLFA to identify the missing pieces if any that make up stable farm ecosystem. This program will enable regenerative farmers to immediately identify the strength and weaknesses of their natural resources as well as the limitations to the deployment.

These are a few of the improved soil health tests that will become available from Ward Laboratories in the new year.

Our objective is to provide information with interpretation of value that can be used in management decisions to improve soil health by identifying and quantifying the resource concerns.