AGNITION
A BRAND OF RALCO

HEALTHIER SOIL, HEALTHIER FARMS

WHAT IS SOIL HEALTH?

Your soil is alive and made up of trillions of microbes (bacteria, fungi, protozoa, etc.) that work together to provide nutrients to plants and carry out processes in the soil.[1] Healthy soil is needed to make efficient use of fertilizer and inputs, and critical to fuel plant growth and increase yields. But how do you measure if your soil is healthy or not?

Today, soil health is heavily discussed in the industry but not necessarily well understood. Over the years quantitative tests have emerged to measure key characteristics of healthy soil. The Haney Soil Nutrient Tool and the Phospholipid Fatty Acid (PLFA) test are two well-known soil tests in the industry, and we used them to put our Agnition products to the test.

HANEY RESULTS: INCREASED MICROBIAL ACTIVITY

Utilizing the Haney test we measured the biological and chemical response of **Agnition** treated soils to demonstrate the level of microbial activity. Our Haney tests results showed an increase in:

- Nutrient availability
- Microbial activity
- Overall soil health score

Haney Value	Description	Total Average Check	Total Average Treated	% Change from Check	P value (*p≤0.1)
Water Extractable Organic Carbon	Driving energy source for microbes (ppmC)	318.23	337.03	5.91%	0.529
Water Extractable Organic Nitrogen	Easily broken down by microbes to inorganic and made available to plants (ppmN)	21.16	22.77	7.57%	0.428
Water Extractable Organic Carbon:Nitrogen	8:1 to 15:1 is a good ratio for N uptake for plants; 20:1 or above N is tied up	15.35	15.51	1.00%	0.897
Solvita 1-day CO2-C Test	The amount of CO2-C released in 24hrs from the microbial population (ppm)	61.91	75.48	21.92%	0.258
Soil Health Calculation Scale (0-50)	Balance of soil carbon and nitrogen and their relationship to microbial activity	9.46	10.70	13.13%	0.314

Table 1. Haney Soil Health Results from Ward Laboratories, Inc

HANEY TEST: HOW IT WORKS

- **Nutrient Availability:** The Haney test measures the availability of nutrients in the soil but more importantly the availability of water extractable nutrients in the soil. Meaning, the portion of organic matter and nutrients that can be dissolved in water and therefore more accessible to soil microbes and plants.[2]
  - *(More microbial activity = More water extractable nutrients)*
- **Microbial Activity:** The Haney test identifies the amount of microbial activity in the soil by measuring the amount of respiration given off by microbes.[2] Similar to humans when we run, microbes produce more CO2 the more they work. Meaning, the more active microbes are, the more CO2 they give off.
  - *(More microbial activity = More CO2)*

PLFA RESULTS: INCREASED MICROBIAL BIOMASS & DIVERSITY

Using the PLFA test we found an overwhelming positive trend of increased microbial biomass and diversity in **Agnition** treated soils. For example, we saw a 200% increase in Rhizobia biomass, a microbe that works with soybean plants to fix nitrogen and increase the availability of it in the soil.

Overall, based on our PLFA results, **Agnition** treated soils have improved:

- Nutrient cycling
- Pathogen resistance
- Soil structure
- Nutrient utilization
- Residue breakdown
- Soil health

Increased microbial diversity and biomass = Healthier soil

PLFA Value	Description	Total Average Check	Total Average Treated	% Change from Check	P value (*p≤0.1)
Total Biomass (ng/g)	More Biomass = More Nutrient Cycling	2519.22	2984.15	18.46%	0.294
Relative Diversity Index	Higher Level = Healthier Soil	1.42	1.57	10.42%	0.002*
Total Bacteria Biomass (ng/g)	Release N and other Nutrients	1390.39	1644.28	18.26%	0.307
Actinomycetes Biomass (ng/g)	Decompose Tough Material and Fix N	303.30	363.51	19.85%	0.27
Rhizobia Biomass (ng/g)	Makes Root Nodules and Fix N	22.55	67.95	201.29%	0.008*
Total Fungi Biomass (ng/g)	Break Down Complex Matter	207.92	325.50	56.55%	0.046*
Arbuscular Mycorrhizal Biomass (ng/g)	Penetrates Cortical Cells and Provides Nutrients and H2O	74.37	111.60	50.07%	0.096*
Saprophytes Biomass (ng/g)	Decays Organic Matter	133.55	213.89	60.15%	0.031*
Protozoa Biomass (ng/g)	Release Nutrients Tied Up in Bacteria	14.69	27.46	86.90%	0.037*
Fungi:Bacteria	Higher Ratio = More Developed Soil	0.14	0.19	35.32%	0.004*

Table 2. PLFA Results from Ward Laboratories, Inc

PLFA TEST: HOW IT WORKS

- **Soil Health:** PLFA test measures microbial biomass and microbial diversity in the soil. Greater microbial biomass means an increase in the number of microbes and processes carried out in the soil for improved soil health.
  - *(Greater microbial biomass = Increased number of microbes and improved soil health)*
- Phospholipid fatty acids are structural molecules found in the membranes of all active organisms.[2] Certain fatty acids are used to indicate which bacteria, fungi, or other types of microbes are in the soil. By measuring the fatty acid content, you can indicate the biomass of a specific microbial group as well as the biomass of the entire microbial population.[2]

References:

1.) http://www.asmscience.org/content/report/colloquia/colloquia.18

2.) https://www.extension.purdue.edu/extmedia/AY/AY-366-W.pdf

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