



Ag Testing - Consulting

Account No. : 24781

Biological Soil Analysis Report

NOLAN, MIKE
41095 RD G
MANCOS

CO 81328

Invoice No. : 1289907
Date Received : 06/03/2019
Date Reported : 06/05/2019
Lab No. : 7394

Results For : MIKE NOLAN
Sample ID 1 : SARE
Sample ID 2 : 001

PLFA Soil Microbial Community Analysis
Functional Group Biomass & Diversity

Total Living Microbial Biomass, Phospholipid Fatty Acid (PLFA) ng/g 1473.00
Functional Group Diversity Index 1.158

Total Biomass	Diversity	Rating
< 500	< 1.0	Very Poor
500+ - 1000	1.0+ - 1.1	Poor
1000+ - 1500	1.1+ - 1.2	Slightly Below Average
1500+ - 2500	1.2+ - 1.3	Average
2500+ - 3000	1.3+ - 1.4	Slightly Above Average
3000+ - 3500	1.4+ - 1.5	Good
3500+ - 4000	1.5+ - 1.6	Very Good
> 4000	> 1.6	Excellent

Functional Group	Biomass, PLFA ng/g	% of Total Biomass
Total Bacteria	822.71	55.85
Gram (+)	516.28	35.05
Actinomycetes	131.08	8.90
Gram (-)	306.44	20.80
Rhizobia	0.00	0.00
Total Fungi	40.53	2.75
Arbuscular Mycorrhizal	0.00	0.00
Saprophytes	40.53	2.75
Protozoa	0.00	0.00
Undifferentiated	609.75	41.40

Reviewed By : Lance Gunderson

6/6/2019

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Community Composition Ratios

Fungi:Bacteria 0.0493

Bacteria tend to dominate in systems with fewer organic inputs or residues possibly leading to a lower C:N ratio. In addition, bacteria can be more prominent in the early spring or late fall as soil temperatures are usually cooler and vegetation is less active or absent. Dry conditions, slightly alkaline to alkaline pH values, or increased land disturbance through prolonged and extensive tillage, grazing, or compaction may also favor bacteria. While bacteria are important and needed in the soil ecosystem, fungi are desired and more often considered indicators of good soil health. Increased use of cover crops and/or other organic inputs and less soil disturbance should help the soil support more fungi. Adjustments to pH may also be recommended in some more extreme circumstances.

Predator:Prey ALL PREY

This ratio is also expressed as protozoa to bacteria. Protozoa feed on bacteria which helps release nutrients, especially nitrogen. A higher ratio indicates an active community where base level nutrients are sufficient to support higher trophic levels or predators. However, this ratio will always be a relatively low number because the prey will greatly outnumber the predators.

Gram (+):Gram (-) 1.6848

Gram (+) bacteria typically dominate early in the growing season and/or following a fallow period. They also survive better under certain environmental conditions or stressors such as drought or extreme temperatures due to their ability to form spores. Therefore, it is common to see higher values when the community is coming out of dormancy or is stressed. These values will typically begin to approach those of a more balanced bacterial community as the soil conditions become more favorable throughout the growing season. A gram (-) dominated soil may be due to anaerobic conditions or other stressors such as pesticide application or heavy metal contamination.

Stress and Community Activity Ratios

Sat:Unsat 2.8950

Bacteria alter their membranes under various environmental conditions in order to maintain optimal fluidity for nutrient and waste transport into and out of the cell. Saturated fatty acids may reflect a better adapted community to current environmental conditions. Communities under stressed conditions will increase their proportion of unsaturated fatty acids. This will likely occur most often as a result of low soil moisture or drastic changes in temperature. In general, a higher number indicates a healthier and more stable community.

Mono:Poly ALL MONO

The ratio of monounsaturated to polyunsaturated fatty acids is used along with the sat:unsat ratio to further indicate the degree of community stress. A higher ratio indicates less stress, while a lower ratio would depict higher levels of prolonged stress due to conditions such as temperature, moisture, pH, or nutrient availability (starvation).

Pre 16:1w7c:cy17:0 NONE FOUND

Cyclo (cy) fatty acids are more prominent during stationary phases of growth or under high stress conditions that influence membrane fluidity and growth rates such as temperature, pH, moisture, and nutrient availability. In general, a higher number or all Pre16/Pre18 is better and indicates an actively growing community experiencing fewer stressors. These values are typically higher early in the growing season (planting) when the community is becoming active and experiencing fast growth. The values may begin to drop towards the end of the growing season (harvest) following a decrease in plant growth activity or as the community approaches a stationary growth phase as the temperature/moisture changes between the seasons.

Pre 18:1w7c:cy19:0 ALL PRE 18:1

All ratios should be looked at separately, but should also be taken into context and compared with one another to better understand the big picture. These are general guidelines and statements regarding soil microbial communities. In addition, the scales and ranges presented here are specific for the type of extraction and analytical methods used for PLFA analysis at Ward Laboratories, Inc. They will not necessarily reflect ranges derived from other methods of analysis or the literature. The scales can and should be adjusted slightly depending on the time of year and conditions at sampling along with the climate and soil type of specific regions where comparisons are being made. Conditions such as time of year, past and present crop, moisture, pH, and fertility should be noted or measured close to sampling for PLFA analysis for a more in depth interpretation of results.

Scale	Rating
< 0.05	Very Poor
0.05+ - 0.1	Poor
0.1+ - 0.15	Slightly Below Average
0.15+ - 0.2	Average
0.2+ - 0.25	Slightly Above Average
0.25+ - 0.3	Good
0.3+ - 0.35	Very Good
> 0.35	Excellent

Scale	Rating
< 0.002	Very Poor
0.002+ - 0.005	Poor
0.005+ - 0.008	Slightly Below Average
0.008+ - 0.01	Average
0.01+ - 0.013	Slightly Above Average
0.013+ - 0.016	Good
0.016+ - 0.02	Very Good
> 0.02	Excellent

Scale	Rating
< 0.5	Gram (-) Dominated
0.5+ - 1.0	Slightly Gram (-) Dominated
1.0+ - 2.0	Balanced Bacterial Community
2.0+ - 3.0	Slightly Gram(+) Dominated
3.0+ - 4.0	Gram(+) Dominated
> 4.0	Very Gram(+) Dominated

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CO 81328

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Results For : MIKE NOLAN

Sample ID 1 : SARE
Sample ID 2 : 001
Lab No. : 7394

Sample ID 3 :
Sample ID 4 :
Soil Depth : 0 - 6 in

Haney - Soil Health Analysis

1:1 Soil pH	7.3	ICAP Sulfur, ppm S	5.5
1:1 Soluble Salts, mmho/cm	0.07	ICAP Calcium, ppm Ca	746
Excess Lime Rating	NONE	ICAP Magnesium, ppm Mg	142
Organic Matter, %LOI	3.8	ICAP Sodium, ppm Na	23
		ICAP Aluminum, ppm Al	194
Soil Respiration CO₂-C, ppm C	32.5	Calculations	
Water Extract		Microbially Active Carbon (%MAC)	27.6
Total Nitrogen, ppm N	22.3	Organic C : Organic N	8.9
Organic Nitrogen, ppm N	13.3	Organic N : Inorganic N	1.5
Total Organic Carbon, ppm C	118	Organic Nitrogen Release, ppm N	13.3
H3A Extract		Organic Nitrogen Reserve, ppm N	0.0
Nitrate, ppm NO ₃ -N	8.6	Organic Phosphorus Release, ppm P	2.6
Ammonium, ppm NH ₄ -N	0.1	Organic Phosphorus Reserve, ppm P	0.5
Inorganic Nitrogen, ppm N	8.7	Soil Health	
Total (ICAP) Phosphorus, ppm P	16	Soil Health Calculation	6.93
Inorganic (FIA) Phosphorus, ppm P	12.5	Cover Crop Suggestion	50% Legume 50% Grass
Organic Phosphorus, ppm P	3.2		
ICAP Potassium, ppm K	53		
ICAP Zinc, ppm Zn	0.33		
ICAP Iron, ppm Fe	51		
ICAP Manganese, ppm Mn	8.8		
ICAP Copper, ppm Cu	0.35		

Reviewed By : Lance Gunderson

6/6/2019

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Lab No. : 7394

Haney - Soil Health Analysis Contd.

Nutrient Quantity Available for Next Crop		Nitrogen Savings by using the Haney Test	
Nitrogen, lbs N/A	39.6	Traditional evaluation, lbs N/A	15.5
Phosphorus, lbs P ₂ O ₅ /A	34.8	Haney Test N evaluation, lbs N/A	39.6
Potassium, lbs K ₂ O/A	63.4	Nitrogen Difference, lbs N/A	24.1
Nutrient Value, \$/A	70.62	N savings, \$/A	15.40

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Biological Soil Analysis Report

NOLAN, MIKE
 41095 RD G
 MANCOS CO 81328

Invoice No. : 1300061
 Date Received : 10/07/2019
 Date Reported : 10/09/2019
 Lab No. : 15447

Results For : MIKE NOLAN
 Sample ID 1 : SARE
 Sample ID 2 : 002

PLFA Soil Microbial Community Analysis
Functional Group Biomass & Diversity

Total Living Microbial Biomass, Phospholipid Fatty Acid (PLFA) ng/g **6336.41**
 Functional Group Diversity Index **1.549**

Total Biomass	Diversity	Rating
< 500	< 1.0	Very Poor
500+ - 1000	1.0+ - 1.1	Poor
1000+ - 1500	1.1+ - 1.2	Slightly Below Average
1500+ - 2500	1.2+ - 1.3	Average
2500+ - 3000	1.3+ - 1.4	Slightly Above Average
3000+ - 3500	1.4+ - 1.5	Good
3500+ - 4000	1.5+ - 1.6	Very Good
> 4000	> 1.6	Excellent

Functional Group	Biomass, PLFA ng/g	% of Total Biomass
Total Bacteria	2987.76	47.15
Gram (+)	1507.79	23.80
Actinomycetes	508.33	8.02
Gram (-)	1479.97	23.36
Rhizobia	0.00	0.00
Total Fungi	1089.82	17.20
Arbuscular Mycorrhizal	366.66	5.79
Saprophytes	723.16	11.41
Protozoa	59.01	0.93
Undifferentiated	2199.83	34.72

Reviewed By : Raymond Ward

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Community Composition Ratios

Fungi:Bacteria 0.3648

Bacteria tend to dominate in systems with fewer organic inputs or residues possibly leading to a lower C:N ratio. In addition, bacteria can be more prominent in the early spring or late fall as soil temperatures are usually cooler and vegetation is less active or absent. Dry conditions, slightly alkaline to alkaline pH values, or increased land disturbance through prolonged and extensive tillage, grazing, or compaction may also favor bacteria. While bacteria are important and needed in the soil ecosystem, fungi are desired and more often considered indicators of good soil health. Increased use of cover crops and/or other organic inputs and less soil disturbance should help the soil support more fungi. Adjustments to pH may also be recommended in some more extreme circumstances.

Predator:Prey 0.0197

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Gram (+):Gram (-) 1.0188

Gram (+) bacteria typically dominate early in the growing season and/or following a fallow period. They also survive better under certain environmental conditions or stressors such as drought or extreme temperatures due to their ability to form spores. Therefore, it is common to see higher values when the community is coming out of dormancy or is stressed. These values will typically begin to approach those of a more balanced bacterial community as the soil conditions become more favorable throughout the growing season. A gram (-) dominated soil may be due to anaerobic conditions or other stressors such as pesticide application or heavy metal contamination.

Stress and Community Activity Ratios

Sat:Unsat 1.1332

Bacteria alter their membranes under various environmental conditions in order to maintain optimal fluidity for nutrient and waste transport into and out of the cell. Saturated fatty acids may reflect a better adapted community to current environmental conditions. Communities under stressed conditions will increase their proportion of unsaturated fatty acids. This will likely occur most often as a result of low soil moisture or drastic changes in temperature. In general, a higher number indicates a healthier and more stable community.

Mono:Poly 8.0046

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Pre 16:1ω7c:cy17:0 5.9734

Cyclo (cy) fatty acids are more prominent during stationary phases of growth or under high stress conditions that influence membrane fluidity and growth rates such as temperature, pH, moisture, and nutrient availability. In general, a higher number or all Pre16/Pre18 is better and indicates an actively growing community experiencing fewer stressors. These values are typically higher early in the growing season (planting) when the community is becoming active and experiencing fast growth. The values may begin to drop towards the end of the growing season (harvest) following a decrease in plant growth activity or as the community approaches a stationary growth phase as the temperature/moisture changes between the seasons.

Pre 18:1ω7c:cy19:0 7.1678

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< 0.05	Very Poor
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0.3+ - 0.35	Very Good
> 0.35	Excellent

Scale	Rating
< 0.002	Very Poor
0.002+ - 0.005	Poor
0.005+ - 0.008	Slightly Below Average
0.008+ - 0.01	Average
0.01+ - 0.013	Slightly Above Average
0.013+ - 0.016	Good
0.016+ - 0.02	Very Good
> 0.02	Excellent

Scale	Rating
< 0.5	Gram (-) Dominated
0.5+ - 1.0	Slightly Gram (-) Dominated
1.0+ - 2.0	Balanced Bacterial Community
2.0+ - 3.0	Slightly Gram(+) Dominated
3.0+ - 4.0	Gram(+) Dominated
> 4.0	Very Gram(+) Dominated



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Sample ID 1 : SARE

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Lab No. : 15447

Sample ID 3 :

Sample ID 4 :

Soil Depth : 0 - 6 in

Haney - Soil Health Analysis

1:1 Soil pH	7.5	ICAP Sulfur, ppm S	19.6
1:1 Soluble Salts, mmho/cm	0.42	ICAP Calcium, ppm Ca	1283
Excess Lime Rating	NONE	ICAP Magnesium, ppm Mg	229
Organic Matter, %LOI	3.6	ICAP Sodium, ppm Na	58
		ICAP Aluminum, ppm Al	122
Soil Respiration CO ₂ -C, ppm C	32.1	Calculations	
Water Extract		Microbially Active Carbon (%MAC)	16.8
Total Nitrogen, ppm N	23.5	Organic C : Organic N	11.2
Organic Nitrogen, ppm N	17.0	Organic N : Inorganic N	2.0
Total Organic Carbon, ppm C	191	Organic Nitrogen Release, ppm N	11.4
H3A Extract		Organic Nitrogen Reserve, ppm N	5.5
Nitrate, ppm NO ₃ -N	4.3	Organic Phosphorus Release, ppm P	3.5
Ammonium, ppm NH ₄ -N	4.1	Organic Phosphorus Reserve, ppm P	3.4
Inorganic Nitrogen, ppm N	8.4	Soil Health	
Total (ICAP) Phosphorus, ppm P	42	Soil Health Calculation	8.72
Inorganic (FIA) Phosphorus, ppm P	35.0	Cover Crop Suggestion	50% Legume 50% Grass
Organic Phosphorus, ppm P	6.9		
ICAP Potassium, ppm K	57		
ICAP Zinc, ppm Zn	0.24		
ICAP Iron, ppm Fe	24		
ICAP Manganese, ppm Mn	2.3		
ICAP Copper, ppm Cu	0.16		

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Lab No. : 15447

Haney - Soil Health Analysis Contd.

Nutrient Quantity Available for Next Crop		Nitrogen Savings by using the Haney Test	
Nitrogen, lbs N/A	35.6	Traditional evaluation, lbs N/A	7.7
Phosphorus, lbs P ₂ O ₅ /A	88.6	Haney Test N evaluation, lbs N/A	35.6
Potassium, lbs K ₂ O/A	68.1	Nitrogen Difference, lbs N/A	27.9
Nutrient Value, \$/A	91.36	N savings, \$/A	17.85

**Recommendations
In Actual Pounds of Plant Nutrients per Acre**

N Credit :

Sub-Soils :

Crop	(Haney) Garden, Unit/A	Crop	(Haney) Garden, Unit/A
Yield	1	Yield	1.3
Nitrogen N	45	Nitrogen N	75
Phosphorus P ₂ O ₅	0	Phosphorus P ₂ O ₅	0
Potassium K ₂ O	40	Potassium K ₂ O	40
Sulfur S	0	Sulfur S	0
Zinc Zn	3	Zinc Zn	3
Magnesium Mg	0	Magnesium Mg	0
Iron Fe	0	Iron Fe	0
Manganese Mn	0	Manganese Mn	0
Copper Cu	0	Copper Cu	0