Farm Name	Your Neighborhood Christmas Tree Farm
Farm #	107
Soil Sample #	F19137
Site Name	Vegetable garden
GPS Coordinates	40.053439, -105.280440
NRCS Soil Type	Valmont cobbly clay loam, 1 to 5 percent slopes
Collection date	9/20/2019
Lab Report date	10/1/2019
Lab Invoice #	1299193
Core Depth	0-8"
Soil Temp	60
Precip/irrig date	9/19/2019
Drought?	No
Recent Tillage date	7/30/2019
Type tillage	hand turn with fork
Most recent crop	mixed vegetables
Planting date	5/30/2019
Termination date	10/19/2019
Recent Amendment	fertigation 20-20-20 with trace and Hydra-Hume 0-0-1;
Application date	varies. Most recent 8/25/19

Overview

All soil contains many small, easily-absorbed, plant-available molecules of minerals like **Soluble Salts, Trace Minerals, Inorganic Nitrogen (Nitrates), Inorganic Phosphorus (Orthophosphates),** and **Potassium**. Soil has an inherent **pH** (acid/base balance) that determines how well some of these minerals are absorbed by plant roots.

Soil also contains **Soil Organic Matter**, which is where soil microbes live, eat and die. **Soil Organic Matter** contains **Organic Carbon**, which microbes eat. **Soil Organic Matter** also stores **Organic Nitrogen** and **Organic Phosphorus** in large complex organic molecules which are not readily plant-available. Soil microbes break down ("mineralize") some of these large organic molecules into small easily-absorbed plant-available molecules of **Nitrate** and **Orthophosphate**. As they work, soil microbes exhale CO_2, measured as **Soil Respiration**.

The Haney test measures **1)** the small, easily-absorbed, plant-available molecules of soil nutrients which are already present in soil, plus **2)** the portion of the large complex organic molecules of soil nutrients which soil microbes are in the process of breaking down and making plant-available. We call this second pool of organic nutrients your **"Water-Extractable-Organic-Carbon, Nitrogen and Phosphorus"** (WEOC, WEON and WEOP) Haney measurements of **Nitrogen, Phosphorus** and **Potassium** (lbs./acre) are generally higher than traditional soil tests, because Haney credits growers for that portion of the large complex organic molecules which soil microbes are in the process of making plant-available. Thus, Haney shows growers how they can decrease fertilizer costs by working with soil microbes to make more of their soil's nutrients plant-available.

The PLFA test is a snapshot of the soil's microbial community at the time of sampling. Your microbial community changes with soil conditions. **pH**, temperature, season, soil moisture, soil type, **Soil Organic Matter**, tillage, crop rotation, cover crops, and pesticides all affect soil microbes. The PLFA test helps growers compare effects of different management decisions on soil health.

Questions about your results? Call/email Lance Gunderson: Lgunderson@wardlab.com (800) 887-7645

Haney Results Highlights		Results	Explanation
Soil Health Score	**32.94**	**0-50 =** Normal National Ranges.(Most < 30) **> 7** = a good starting point **>10** = Good for most soils **2-15 = Normal Colorado Ranges**	Your **Soil Health Score** represents the overall health of your soil system. Tracking your **Soil Health Score** over time allows you to gauge the effects of your management. In Colorado, a score greater than 18 is rarely attainable. Colorado soils are limited by soil **pH**, soil texture, and annual precipitation. Compare your soil health score to others nearby to set realistic goals for what you can achieve.
Cover Crop Suggestion		**10% Legume 90% grass**	Your suggested Cover Crop Mix is designed to provide your soil with a multi-species cover crop to improve soil health and fertility. The percentage of grass to legumes/brassicas is based on your **Water Extractable Organic Carbon : Water-Extractable-Organic Nitrogen Ratio**, **Soil Respiration**, and **Soil Health Score** (on pages 4, 2, 1.)

Nutrient quantity available in your soil for the next crop		
Nitrogen available for next crop	**192.7** lbs. N/acre	This value includes your **Inorganic Nitrogen** PLUS the **Nitrogen** expected to be released by soil microbes. (Lbs. of **Nitrogen** = (**NO3** ppm + **NH4** ppm + **Org. N Release** ppm) * 0.3 * Depth of sample in inches)
Phosphorus available for next crop	**476.8** lbs. P2O5/acre	This value includes the **Inorganic Phosphorus (Orthophosphate)** PLUS the **Phosphorus** expected to be released by soil microbes. (Lbs. of **Phosphorus** = (**PO4** ppm + **Org. P Release** ppm) * 2.3)
Potassium available for next crop	**443** lbs. K2O/acre	This is the pounds of plant-available **Potassium (K2O)** already in one acre of your soil. **Potassium** levels are naturally adequate in most Colorado soils. (Lbs. of **Potassium** = (**Potassium** ppm) * 1.2)
Nutrient Value	**$530.78** $/acre	**This** is the price of nutrients currently in your soil. It is calculated as (**Current Fertilizer Prices) x (lbs./acre of N + P + K** currently in soil**).**
Traditional Nitrogen Evaluation	**94** lbs. Nitrogen/acre	This is the Lbs./ acre of **Nitrogen** in your soil that would have been measured using a traditional soil test where **Nitrate (NO_3)** was the only test used.
Haney Test Nitrogen Evaluation	**192.7** lbs. Nitrogen/acre	This is the Lbs./acre of **Nitrogen** in your soil measured with the Haney Test.
Nitrogen Difference	**98.7** lbs. Nitrogen/acre	This is the difference in the amount of **Nitrogen** in your soil using the Haney Test compared to the traditional **Nitrate (NO_3)** testing method. This value increases with better soil health.
Nitrogen Savings	**$63.18** /acre	This is the $/acre saved when using the Haney Test to calculate fertilizer application rates, compared to traditional soil testing methods measuring only **Nitrate (NO_3)**.

Test	Results (Good / Average / Concerning)	Normal Ranges	Explanation
pH	**7.5**	**<5.5**-Strongly acidic **5.5-6.2**-Moderately acidic **6.2-7.0**-Optimal for most crops **7.0-7.7**-Moderately alkaline **>7.7**-Strongly alkaline	**pH** is a measurement of how acidic or alkaline the soil is. It controls how available nutrients are to crops. If **pH** is too high (alkaline), phosphorous, iron, manganese, copper and boron become unavailable to the crops. If **pH** is too low (acidic), calcium, magnesium, phosphorous, potassium and molybdenum become unavailable. Most Colorado soils are alkaline, with a **pH** between 7.2 and 8.3. Amending soil with **Sulfur (S**) can lower soil pH.
Soluble Salts 1:1 mmho/cm	**0.54**	**0-1.2** - Non-saline. Satisfactory for crops. **1.2-2.5** - Slightly saline. **2.5-5** - Moderately saline. **5-9** - Strongly saline. High for many crops. **>9** - Very strongly saline	**Soluble Salts** are easily dissolve-able compounds of sodium, potassium, calcium and other minerals. High levels of **Soluble Salts** can hurt plant root growth and microbial function. Crops vary a lot in their tolerance to **Soluble Salts**, so your values must be interpreted in relation to the specific crop you want to grow. Common causes of high **Soluble Salts** are poor drainage and manure or irrigation water high in salt.
Excess Lime	**NONE**	**None**, **Low** or **High**	**Excess Lime** in the soil helps buffer against **pH** changes due to fertilizer additions and biological activity. It is used to determine whether **Sulfur (S)** will be an effective amendment in sodium reclamation.
Sulfur ppm S	**48.4**	**5 - 20** - Desired for most crops. **At least 20** adequate for most crops	**Sulfur** is a major plant nutrient that is mainly derived from organic matter decay in the soil. Deficiency symptoms include stunting, plant yellowing, and thinning of stems.
Calcium ppm Ca	**1706**	**250-5000 ppm** has no apparent deficiency or excess in plants.	**Calcium** varies a lot in Eastern Colorado, but is usually never deficient. **Calcium** present as **calcium carbonate** has an influence on **pH.**
Soil Organic Matter %LOI, SOM	**14.7**	**0.5-3.0%** - Normal ranges for Eastern Colorado	**Soil Organic Matter (SOM)** is the percent of your soil that contains large complex carbon-based organic molecules made from living things. **SOM** is the "house" that soil microbes live in. **SOM** helps form stable soil aggregates and improves the water-holding capacity of your soil. **SOM** contains about 95% of all soil **Nitrogen (N)**, and provides a slow release of nutrients. Each 1% of **SOM** present will release about 30lbs of **Nitrogen(N**) per acre during the cropping season (slower release rates at higher elevations).
Water Extractable Organic Carbon (WEOC) ppm C	**416**	**100-300 ppm** - Normal range **The higher the number the better.**	**Water Extractable Organic Carbon** is the small portion (about 1.25%) of your **Soil Organic Matter (SOM)** that your soil microbes can easily feed on. **Soil Organic Matter (SOM)** is the house that microbes live in, but **Water Extractable Organic Carbon** is the food they eat. **Water Extractable Organic Carbon** tends to respond to changes in management sooner than **Soil Organic Matter (SOM)**. Manure, compost or cover crops can raise your **Water Extractable Organic Carbon** levels.
Soil Respiration CO2-C ppm C	**292.9**	**0-10** - Very Low **11-20** - Low **21-30** - Below average **31-50** - Slightly below average **51-70** - Slightly above average **71-100** - Above Average **101-200** - High **201+** - Very High	**Soil Respiration** measures the **CO_2** released in 24 hours by your soil microbes, and reflects the abundance and activity of your soil microbes. In general the higher the number the better. Soil microbes produce **Carbon Dioxide (CO_2)**, as they break down plant residues in the soil and turn large complex organic molecules into plant-available forms. **Soil Respiration** is influenced by **Soil Organic Matter (SOM)**, soil texture, overall fertility, soil type and climate. Sandier soils and dryer climates tend to score lower. Focus on the relative differences between samples and changes in this number over time in response to management, rather than on the number itself.
Carbon Calculations	**Results**	**Normal Ranges**	**Explanation**
Microbially Active Carbon %MAC	**70.3**	**50% - 75%** is ideal for most production systems.	**Microbially Active Carbon** represents how much of your **Water Extractable Organic Carbon** was acted upon by your soil microbes. It is calculated as **Soil Respiration ÷ Water Extractable Organic Carbon** (values above). **<25% - Water Extractable Organic Carbon** is probably not limiting your **Soil Respiration**. Rather the soil's fertility, cold temperatures or drought may be limiting your soil microbes. **50% - 75% -** The soil has a good balance of fertility and **Water Extractable Organic Carbon**. **> 80% - Water Extractable Organic -Carbon** could limit microbial respiration soon, and you should consider adding more carbon to your soil.

Nitrogen	N, P, K and trace values below are NOT comparable to values on traditional soil tests, because of the use of the Water and H3A Extractants.		
Total Nitrogen ppm N	81.6	The desired **Total Nitrogen** depends on the crop, time of year and how much of the **Total Nitrogen** is made up of **Nitrate (NO_3)** and **Ammonium (NH_4)**.	The **Nitrogen** in your soil is found in one of two forms: **Inorganic** or **Organic**. • **Inorganic Nitrogen** is made up of small highly soluble molecules that easily cross cell membranes, and so are immediately available to your plant. **Nitrate (NO_3)** and **Ammonium (NH_4)** are the most common forms of **Inorganic Nitrogen**, and are commonly found in chemical fertilizers. However, **Inorganic Nitrogen** is also made by soil microbes breaking down ("mineralizing") large organic molecules of **Organic Nitrogen** into **Nitrate (NO_3)** and **Ammonium (NH_4)**. • **Organic Nitrogen** is made up of large complex molecules (amino acids, proteins, DNA) that do not easily cross cell membranes, and so are not readily plant-available. Most **Organic Nitrogen** is stably and tightly bound in **Soil Organic Matter (SOM)**, with nearly 1000 lbs./acre of **Organic Nitrogen** for every 1% of **SOM**. Soil microbes have a hard time accessing most of this tightly bound **Organic Nitrogen**. However, some **Organic Nitrogen** is in transition from decaying material and has not yet been bound tightly in **SOM**. This is your **Water-Extractable-Organic Nitrogen**, AKA **WEON**.
Water-Extractable-Organic Nitrogen or **WEON** ppm N	36.9	**5 to 100 ppm** - Normal range **10 and 30 ppm** - Range for most soils. **Better** if value is higher, if it is balanced with **Water Extractable Organic Carbon**. **Best** if most of **Total Nitrogen** (value above) in this form **(WEON)**.	**Water-Extractable-Organic Nitrogen** is the small soluble fraction of your total **Organic Nitrogen** that is easily broken down, or "mineralized" by soil microbes and made available to your growing plants. Because **Water-Extractable-Organic Nitrogen** is made up of large molecules like proteins, it is not easily lost from your soil system by leaching or volatizing. Soil microbes break **Water-Extractable-Organic Nitrogen** down into **Inorganic Nitrogen** forms **(Nitrate (NO3) + Ammonium (NH4))** which are plant available. 30 ppm of **Water-Extractable-Organic Nitrogen** is equal to nearly 60 lbs. of **Nitrogen** fertilizer to the acre at a 6-inch sample depth.
Inorganic Nitrogen ppm N	43.4	**<5ppm** during dormant season **>5 ppm** OK during growing season depending on crop.	**Inorganic Nitrogen** is the combined amount of plant available **Nitrogen** in the form of **Nitrate (NO_3)** and **Ammonium (NH_4),** (2 values below, added together).
Nitrate or NO3-N ppm N	39.2		Most of the **Inorganic Nitrogen** in your soil is in the **Nitrate (NO_3)** form. **Nitrate (NO3)** is a small, soluble molecule which is easily absorbed by plants' roots. However, **Nitrate (NO_3)** is also easily lost from soil through surface runoff, subsurface leaching and erosion. In water logged conditions it can revert back to a gas and volatize. If your **Nitrate (NO_3)** levels are high (above 50 lb./ac), consider using grasses to convert this easily lost form of **Nitrogen** back to **Organic Nitrogen**, which is more stable.
Ammonium or NH4-N ppm N	4.3		**Ammonium (NH_4)** is a form of **Inorganic Nitrogen** which usually is quickly converted to **Nitrate (NO_3)** by soil microbes. It is less susceptible to leaching than **Nitrate (NO3)**.
Nitrogen **Calculations**	**Results**	**Normal Ranges**	**Explanation**
Water-Extractable-Organic Nitrogen : Inorganic Nitrogen	0.8	**<2 - Very Low** **>5 - Best**	The ratio of **Water-Extractable-Organic Nitrogen to Inorganic Nitrogen** in your soil reveals how dependent your soil is on fertilizer inputs. Fertilizer dependent soils often have a ratio <1. Microbes can use **Inorganic Nitrogen** fertilizers, but if that is their only source of **Nitrogen**, they steal it from your growing crop. Building up your **Water-Extractable-Organic Nitrogen** with crop rotations, livestock and cover crops maximizes the efficient use of fertilizers by microbes and your crop.
Organic Nitrogen Release ppm N	36.9	The higher the better, but this will never be greater than your **Water-Extractable-Organic Nitrogen** number	**Organic Nitrogen Release** is the total amount of **Nitrogen** that will be released from your **Water-Extractable-Organic Nitrogen** pool through microbial activity. **Organic Nitrogen Release** increases as your soil system gets healthier. It is counted as a credit to your next crop and is subtracted from the recommended **Nitrogen** needed to produce your next crop (if you provided crop and yield goals.)
Organic Nitrogen Reserve ppm N	0	**0:** Increase **Water-Extractable-Organic Nitrogen to** get larger credit next year. **>0:** Increase **Soil Respiration** or balance **Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio.** Get more credit next year.	The **Organic Nitrogen Reserve** is how much of your **Water-Extractable-Organic Nitrogen** pool is left after soil microbes use up the **Organic Nitrogen Release** (value above). **(Organic Nitrogen Reserve = Water-Extractable-Organic Nitrogen - Organic Nitrogen Release.)** Your soil is constantly refilling the **Organic Nitrogen Reserve** by breaking down plant residues, manure, compost, and dead soil microbes. Addition of fresh residue helps this process.

C : N Calculation	Results	Normal Ranges	Explanation
Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio	**11.3**	**<8:1 - Poor.** Increase carbon inputs; graze shorter to retain carbon **8:1 - 15:1 - Good.** Make slight adjustments to keep within this range **10:1 - 12:1 - Ideal.** Increase intensity to drive both **Water Extractable Organic Carbon** and **Water-Extractable Organic Nitrogen** up together to increase biologic activity **15:1 - 20:1 - Marginal**. Increase legumes or covers; reduce high carbon inputs; graze longer to reduce carbon **>20:1 - Poor,** Increase legumes/covers; reduce high carbon inputs; graze longer	**Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio** is Haney's version of a **Carbon: Nitrogen Ratio**. This **Ratio** is not the same as the total **Carbon: Nitrogen Ratio** of your soil, manure or cover crop. Haney's **Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio** compares the transitional fractions of **Carbon** and **Nitrogen** that are not yet tightly bound in **Soil Organic Matter (SOM)**. If the **Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio** is below 8:1, it means there is not enough **Carbon** for microbes to eat, and they do not have enough energy to turn transitional forms of **Nitrogen** and **Phosphorus** into plant-available forms. As the **Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio** increases and **Carbon** is added to the system, soil microbes prosper, and turn transitional **Nitrogen** and **Phosphorus** into plant-available forms which benefit your crops. But if the **Water Extractable Organic Carbon to Water-Extractable-Organic Nitrogen Ratio** rises above 20:1, it means there is lots of **Carbon** for microbes to eat, but very little **Nitrogen**. Soil microbes will use all the available transitional **Nitrogen** and **Phosphorus** themselves, and will not make extra nutrients available for your plants. **Nitrogen** and **Phosphorus** are "tied up" in this case.
Phosphorus	**Values below are NOT comparable to traditional soil tests, because Haney uses Water and H3A extractants.**		
Total Phosphorus ppm P	**207**	**25 to 60** for most production systems.	**Total Phosphorus** (**P**) is the sum of **Inorganic** and **Water-Extractable-Organic Phosphorus** (values below). **Phosphorous** is an essential plant nutrient, used by plant cells to build DNA and regulate metabolic reactions. At high levels, **Phosphorous** can pollute waterways and at very high levels it interferes with plant uptake of iron and zinc. Optimal values for **Phosphorous** vary, depending on individual soil type, a realistic yield goal and demand by a given crop. A **Total Phosphorus** value of 15 ppm may produce a 'healthy' 100 bushel corn crop. However, if the field has a greater yield potential, you would want a **Total Phosphorus** value of 25-40 ppm to produce a 'healthy' 250 or 300 bushel corn crop.
Inorganic Phosphorus ppm P	**174.9**	**>20 and <50** for most production systems.	**Inorganic Phosphorus** (or **Orthophosphate (PO_4)**) is the easily absorbed plant-available form of **Phosphorus**. Desired levels depend on the crop grown and expected yield goal.
Water-Extractable-Organic Phosphorus ppm P	**32.4**	**<10** = Normal range unless **Total Phosphorus** >100ppm. The higher the better.	**Water-Extractable-Organic Phosphorus** is the fraction of **Organic Phosphorus** that is not currently plant available but may be made available by soil microbes**.** Most of the **Organic Phosphorus** found in the soil is stable and tied up in **SOM**, but a relatively small fraction of this **Organic Phosphorus** is soluble. This soluble **Organic Phosphorus** is the fraction being measured as **Water-Extractable-Organic Phosphorus** in the Haney Test. The actual total **Organic Phosphorus** would be much higher if it were measured with traditional soil tests.
Phos. **Calculations**	**Results**	**Normal Ranges**	**Explanation**
Organic Phosphorus Release ppm P	**32.4**	The higher the better, but this will never be greater than your **Water-Extractable-Organic Phosphorus** number.	**Organic Phosphorus Release** is the amount of **Phosphorus** that will be released from your **Water-Extractable-Organic Phosphoru**s pool through microbial activity. The Organic Phosphorus Release is dependent on how much **Water-Extractable-Organic Phosphorus** you have, how high your **Soil Respiration** is, and how balanced your **Water Extractable Organic Carbon: Water-Extractable-Organic Nitrogen Ratio** is.
Organic Phos. Reserve ppm P	**< 0.1**	**0 or more.** See ->	The **Organic Phosphorus Reserve** is how much of your **Water-Extractable-Organic Phosphorus** pool is left after soil microbes use up the **Organic Phosphorus Release** (value above). **(Organic Phosphorus Reserve = Water-Extractable-Organic Phosphorus -- Organic Phosphorus Release.)** Similar to **Organic Nitrogen Reserve** above.
Trace	**Values below are NOT comparable to traditional soil tests, because Haney uses Water and H3A extractants.**		
Potassium ppm K	**369**	**0-20** - 20-50%sufficiency **21-40** - 45-80% sufficiency **41-60** - 70-95% sufficiency **61-100** - 90-100% sufficiency	**Potassium** is an essential plant nutrient that helps with heat and cold tolerance and promotes fruit development. **Potassium** levels are adequate to high in most Colorado soils, especially with annual applications of compost or manure. Deficiencies occasionally occur in soil with low organic matter and in sandy soils.
Zinc ppm Zn	**3.9**	**0.5+** adequate for all crops, depending on **pH** and crop.	**Zinc** levels increase with soil organic matter and decrease with higher **pH** and with excess **Phosphorus**. **Zinc** deficient plants have small leaves and shortened internodes.

Iron ppm Fe	**42**	**20. +** adequate for all crops	All soils have plenty of **Iron**, but a high soil **pH** (alkaline soil) can make the **Iron** unavailable to plants. **Iron** is essential for chlorophyll formation, respiration and photosynthesis. Plants deficient in **Iron** develop chlorosis.
Manganese ppm Mn	**3.2**	**1.5 +** adequate for all crops	**Manganese** and **Iron** are closely associated. **Manganese** is required for respiration and photosynthesis. New leaves are the first part of the plant to show deficiency symptoms.
Copper ppm Cu	**0.31**	**.05 +** adequate for all crops	**Copper** is part of the transport system in photosynthesis. **Copper** deficiency interrupts protein synthesis, disrupting growth and causing dieback.
Magnesium ppm Mg	**348**	**100+** adequate for all crops	**Magnesium** is adequate in finer textured soils of semi arid regions. Deficiency symptoms are interveinal chlorosis in older leaves, progressing to younger ones.
Sodium ppm Na	**185**	**< 200 ppm**	Use this value to see if **Sodium** may be a potential problem. Excess **Sodium** can cause soil to be hard and cloddy when dry, to crust badly, and to take water very slowly.
Aluminum ppm Al	**43**	There is no defined desired range for **Aluminum** using the Haney Test.	Aluminum toxicity may be a problem when soil pH values are at 5.5 or below (strongly acidic), depending on the crop being grown. Colorado soils are generally alkaline, so this is usually not a problem here.
PLFA RESULTS: Test	**Results** Good Average Concerning	**Normal Ranges**	**Explanation**
Total Microbial Biomass PLFA ng/g	**9110.91**	**<500 - 1000** - Very Poor to Poor **1000 - 3000** - Below Average to Above Average **3000 - 4000+** - Good to Excellent	This number represents the total microbial life in your soil. **pH**, temperature, moisture, soil type, **Soil Organic Matter,** intensity/type of tillage, crop rotations, cover crops, and herbicide or pesticide applications will all change this number. **There is no baseline "normal range" for biological testing like there is for chemical analysis.** The PLFA is most useful for comparing different management over time.
Functional Group Diversity Index	**1.442**	**<1.0 - 1.1** - Very Poor to Poor **1.1 - 1.4** - Below Average to Above Average **1.4 - 1.6+** - Good to Excellent	This number represents how many different classes of microbes are found in your soil. The higher the number, the more varied your microbial community is, and the better your soil health is. However, the "normal ranges" listed here are based on soil tests from all over the US, and may be different for Colorado's Front Range.
Total Bacteria	**4847.21** 53.20%	This number represents all the different kinds of bacteria in your soil. Bacteria are the smallest, most plentiful and hardiest microbes in your soil. They can survive under harsh conditions like tillage. However, as single-celled organisms, they need a film of water to survive. When conditions are ideal, Bacteria reproduce in 30 minutes, and have a short life span. Bacteria contain a lot of **Nitrogen** because they are the first microbes to digest new organic residues in the soil. When bacteria die, the **Nitrogen** in their cells is released to the soil in plant-available forms. Bacteria are like little bags of fertilizer that power your soil nutrient cycle.	
Gram(+) Bacteria	**2502.86** 27.47%	**Gram(+) bacteria** are larger, have thicker cell walls, and tend to resist water stress better than **Gram(-) bacteria**. The Gram(+)/Gram (-) classification of bacteria was invented as a way to differentiate different kinds of disease carrying bacteria for medical purposes. **Gram(+) bacteria** absorb a particular stain and look purple under a microscope. **Gram(-) bacteria** do NOT absorb the stain and appear clear. Gram(+) and Gram(-) does **NOT** indicate pathogens versus beneficials in your soil.	
Actinomycetes (Gram(+) Bacteria)	**732.51** 8.04%	**Actinomycetes** are a group of **Gram (+) bacteria** that act a lot like **fungi**. They extend thread-like filaments out into the soil, form spores and break down woody plant residue like fungi do. They secrete natural antibiotics, which fight off pathogens and become part of a crop's "immune system." **Actinomycetes** are active at high **pH** levels like we have in Colorado. They form nitrogen-fixing relationships with over 200 species of plants, and can degrade and neutralize pollution-causing chemicals.	
Gram(-) Bacteria	**2344.35** 25.73%	This number represents all the **Gram(-) bacteria** in your soil. **Gram(-) bacteria** are smaller, and tend to be more stressed by drought.	
Rhizobia (Gram(-) Bacteria)	**0** 0.00%	Rhizobia are **Gram(-) Nitrogen-fixing bacteria**. **Rhizobia** infect roots of legumes and form root nodules, where the **Rhizobia** take **Nitrogen gas (N2)** from the atmosphere and turn it into plant-available forms of **Nitrogen** which the legume uses to grow. The **Nitrogen** in the growing legume enriches your soil when the legume is turned back into the soil. As legumes die, their root nodules release **Rhizobia** back into your soil where they wait for a new host. Commercial seed inoculants contain several strains of **Rhizobia**.	
Total Fungi	**1122.88** 12.32%	**Fungi** are rapid-growing multi-celled organisms that need a constant food source. They form symbiotic relationships with plants, by tapping directly into a plant's roots for food. In exchange, **Fungi** send hyphae, or threads, many feet out into the soil to gather and transport water and nutrients back to the plant. They prefer slightly acidic, low disturbance soils, and high carbon residues. They are not as hardy as bacteria, and decline with conventional tillage. Fungi are better at storing **Carbon** than **Nitrogen** in the soil.	

Arbuscular Mycorrhizal Fungi	**455.1** 5.00%	**Arbuscular Mycorrhizal Fungi** penetrate plant roots to feed directly from them. In exchange, they help plants capture water and nutrients such as **Sulfur**, **Nitrogen**, micronutrients, and especially **Phosphorus**. **Arbuscular Mycorrhizal Fungi** colonize 80% of vascular plant families. However, this fungi does not colonize members of the mustard family (brassicas). Many commercial soil inoculants contain **Arbuscular Mycorrhizal Fung**i. Do not apply these innoculants to bare soil as these fungi need a living root to survive.
Saprophytes (Fungi)	**667.78** 7.33%	**Saprophytes** are decomposers, feeding on dead and decaying organic matter. They decompose woody plant material like cellulose and lignin, by sending mycelia or threads into the material. Some of the by-products of this decomposition turn to humus and remain in the soil for centuries. Some **saprophytes** also form mushrooms.
Protozoa (Predator)	**17.01** 0.19%	**Protozoa** are predators and graze on bacteria. Bacteria contain far more **Nitrogen** than **Protozo**a need, so **Protozoa** release the extra **Nitrogen** as **Ammonium (NH_4-N)**, a highly soluble plant-available form of **Nitrogen**. So **Protozoa** are essentially teeny fertilizer factories.
Undifferentiated	**3123.81** 34.29%	This number represents soil microbes that cannot be categorized. 90% of soil microbes have not yet been identified. Scientists don't know what most of them do or how to culture many of them. Some microbes seem to change their DNA in the lab, morphing from one kind of organism to another, an action that makes them doubly difficult to categorize.

Community Composition Ratios		**Normal Ranges**	**Explanation**
Fungi : Bacteria	**0.2317**	**<0.05** - Very Poor **0.05-0.1** - Poor **0.1-0.15 -** Below average **0.15-0.2 -** Average **0.2-0.25 -** Above average **0.25-0.3 -** Good **0.3-0.35 -** Very good **>0.35 -** Excellent	This is the ratio of **Fungi to Bacteria** in your soil. **Bacteria** are important and needed, but **Fungi** are desired and usually indicate good soil health. Cover crops, organic inputs and less tilling will help your soil support more **Fungi**. Forests tend to have fungal-dominated soils. Highly productive agricultural soils tend to have higher ratios of **Fungi to Bacteria.** Grasslands and agricultural soils usually have bacterial-dominated soils. **Bacteria** dominate in early spring or late fall, in systems with fewer organic inputs, under dry conditions, in alkaline soils, and after tillage, grazing or compaction of soil.
Predator : Prey	**0.0035**	**< 0.002 - 0.005 -** Very Poor to Poor **0.005 - 0.013 -** Below Average to Above Average **0.013- >0.02 -** Good to Excellent	This number represents the ratio of **Protozoa** to **Bacteria** in your soil. **Protozoa** feeding on **Bacteria** release nutrients, especially **Nitrogen** into your soil. A higher ratio means your soil is healthy and has enough nutrients and microbes to support large numbers of predators. However, the prey **(Bacteria**) will always greatly outnumber the predators.
Gram(+) : Gram(-)	**1.0676**	**<1.0** - Gram(-) dominated **1.0 - 2.0** - Desired Range **>2.0** - Gram(+) dominated	This number represents the ratio of **Gram(+) to Gram(-) Bacteria** in your soil. **Gram(+) Bacteria** dominate as soil is coming out of dormancy, or during droughts or extreme temperatures. This ratio changes though the growing season, becoming more balanced as growing conditions improve. **Gram(-)** dominated soil may be due to water-logged soil, pesticides or heavy metals.

Stress and Community Activity		**Normal Ranges**	**Explanation**
Saturated : Unsaturated Fatty Acids	**1.2564**	**< 1.0 :** More stressed microbes **> 1.0 :** Healthier and more stable microbes. **The higher the number, the better.**	This is the ratio of **Saturated Fatty Acids** to **Unsaturated Fatty Acids** in your soil. When **Bacteria** are stressed, they change the proportions of **Saturated and Unsaturated Fatty Acids** in their cell walls. A higher number means **Bacteria** are better adapted to current conditions; conditions are stable and conducive to life. A lower number means **Bacteria** are stressed, usually from low soil moisture or big temperature swings.
Mono-Unsaturated : Poly-Unsaturated Fatty Acids	**29.3146**	**> 4.0** - Desired Range **Higher number:** less stress **Lower number:** more stress	This is the ratio of **Mono-Unsaturated Fatty Acids to Poly-Unsaturated Fatty Acid**s in soil. This ratio is used along with the **Saturated: Unsaturated Ratio** above to assess stress levels of soil microbes . Common stressors are temperature, moisture, **pH**, or starvation.
Pre 16:1w7c:cy17:0	**ALL PRE 16:1**	**All Pre 16**- Active Growth phase **> 5.0 Pre 16** - Active Growth Phase **< 5.0 Pre 16** - Slowing growth **All Cyc 17** - Very slow/latent growth phase **None Found** - Can't detect. Don't worry.	These two values represent the ratios of **Precursor-Fatty-Acids to Cyclo-Fatty-Acids** in your soil. There are more **Precursor-Fatty-Acids** when microbes are actively growing and reproducing. There are more **Cyclo-Fatty-Acids** during periods of low growth or high stress (temperature, moisture, **pH**, or starvation). At planting time when microbes are becoming active and experiencing fast growth, values are higher. Values usually drop towards the end of the growing season (harvest).
Pre 18:1w7c:cy19:0	**19.8815**	**All Pre 18**- Active Growth phase **> 5.0 Pre 18** - Active Growth Phase **< 5.0 Pre 18** - Slowing growth **All Cyc 19** - Very slow/latent growth phase **None Found** - Can't detect. Don't worry.	