

Conservation Evaluation and Monitoring Activity 216 – Soil Health Testing Job Aid

This worksheet is designed to help the user ensure that the selected laboratory offers the necessary (preferred or alternative) methods of analysis for selected indicators. Many labs have multiple packages and methods. It is important that you call to ask if they offer the correct method for the suite of indicators that you have chosen. Table 1 is a list of the soil health indicators and their associated methods for reference. Table 2 is a form to support lab identification and method documentation.

Sampling Strategy

Attach a map that documents three distinct composite samples. Implement effective sample strategies to ensure the best quality results:

1) Random sampling: ideal for uniform fields, 2) Stratified sampling: best for different soil types or landscapes, 3) Problem sampling: compare poor-performing and undisturbed areas. Collect three composite samples per planning land unit, each made from five subsamples. Sample at a depth of 6 to 8 inches with a spade, avoiding wheel tracks and saturated soils for the most accurate results. Utilize the same methods to measure the indicators at the beginning and at the end of the contract.

Table 1. Indicators used to evaluate soil health, their importance, and associated lab methods

Soil Process or Indicators	Importance	Preferred lab Method OR Alternate lab Method
Soil Stability – Aggregation	Improved aggregation can: <ul style="list-style-type: none"> • Improve water infiltration and storage • Decrease erosion and gully formation • Resist compaction • Improve nutrient storage • Improve soil organism habitat 	Wet Sieving OR Cornell Sprinkler infiltrometer
Soil Organic Carbon (SOC)	Increased SOC can: <ul style="list-style-type: none"> • Improve soil physical structure • Improve nutrient storage and cycling • Increase soil water-holding capacity • Support diverse soil biota, which provides biological control of pests and pathogens • Lower the harmful effects of both natural and human-made toxins 	Dry combustion OR Loss on Ignition
Microbial Activity – Soil Respiration	Increased microbial activity can indicate: <ul style="list-style-type: none"> • Increased nutrient cycling • Increased carbon sequestration (higher SOC) • Increased biological control of pests and pathogens 	Carbon dioxide (CO ₂) respire, 24-hr incubation OR Carbon dioxide (CO ₂) respire, 96-hour incubation

Carbon Food Source for Soil organisms (Labile Carbon)	<p>More carbon food for soil organisms can indicate:</p> <ul style="list-style-type: none"> • Larger microbial populations/activity (see benefits of higher microbial activity) • Increased carbon sequestration (higher SOC) 	<p>Permanganate oxidizable C (POXC), OR Water extractable organic C (WEOC)</p>
Bioavailable Nitrogen – Food Source for soil organisms	<p>More organic nitrogen for soil organisms can indicate:</p> <ul style="list-style-type: none"> • Larger microbial populations/activity • Increased nitrogen availability for plants 	<p>Autoclaved citrate extractable (ACE) protein content OR Water extractable organic nitrogen (WEON)</p>
Soil Texture	<p>The ratio of sand, silt, and clay in the soil affects physical and chemical properties that influence the soil health potential. This measure is used to provide context to the health indicators.</p>	<p>KSSL Particle size Distribution Analysis OR Hydrometer Method</p>
Soil pH	<p>Soil pH is a measure of the acidity or alkalinity of the soil. Close to neutral pH is ideal for microbial activity. Soils that are highly acidic or alkaline can negatively impact nutrient availability, microbial activity, and microbial diversity.</p>	<p>1:1 water extraction OR 0.01M CaCl₂ extraction</p>
Microbial Biomass and Diversity	<p>Higher microbial biomass can indicate higher activity (see microbial activity for benefits). Increased microbial diversity has been linked with:</p> <ul style="list-style-type: none"> • Increased biological control of pests and pathogens • Improved cropping system function and resiliency 	<p>Phospholipid fatty acid (PLFA)</p>
Microbial Activity – Potential Enzyme Activity	<p>Increased enzyme activity can indicate increased plant/microbial activity and nutrient cycling. The following enzymes are key in the given nutrient cycling: choose 3 of the following:</p> <ul style="list-style-type: none"> • β-Glucosidase (BG) – <i>Carbon Cycling</i>** • N-acetyl-β-D-glucosaminidase (NAG) – <i>Carbon and Nitrogen Cycling</i> • Protease (PR) – <i>Nitrogen Cycling</i> • Acid and Alkaline Phosphatase (Pase) – <i>Phosphorus Cycling</i> • Arylsulfatase (AS) – <i>Sulfur Cycling</i> 	<p>Potential enzyme activity</p>

To use Table 2 below:

1. Identify farm name and chosen payment scenario.
2. Indicate soil testing lab, contact, and lab package name.
3. Use Section 1 and 2 to ensure that the laboratory offers the required indicators and methods for each CEMA 216 scenario.
4. Utilize Section 3 to record any additional notes specific to the lab.
5. Use Section 4 to record lab guidance on amount of soil needed, storage, and lab certification.

Table 2. Form for identification of labs that provide the required analyses

Farm Name:		Date:	
Chosen Scenario:			
Lab Name and Lab Contact:		Lab Phone Number:	
Lab Package Name (if applicable):			
Indicator	Preferred Methods	Alternative Methods	Offered (Yes/No)
Section 1. Indicators and methods needed for Soil Health Testing			
Wet aggregate stability	Wet sieving	Sprinkle infiltrometer	
Soil organic carbon	Dry combustion	Loss on Ignition	
Soil respiration	24-hour incubation	96-hour incubation	
Labile Carbon	Permanganate Oxidizable Carbon (POXC)	Water Extractable Organic Carbon (WEOC)	
Bioavailable Nitrogen	Autoclave Extractable Protein (ACE Protein)	Water Extractable Organic Nitrogen (WEON)	
Soil pH	1:1 water	0.01M CaCl ₂	
Soil Texture	KSSL Particle Size Distribution Analysis by pipette	Hydrometer Method	
Section 2. Indicators and methods for Advanced Soil Health Testing			
Indicator	Preferred Method	Alternative Method	Offered (Yes/No)
Microbial Community	Phospholipid Fatty Acid (PLFA)		
Soil Enzyme Activity		Choose 3 enzymes: β -glucosidase, N-acetyl- β -D-glucosaminidase (NAG), arylsulfatase, protease, acid/or alkaline phosphatase, Arylsulfatase	

Section 4. Lab Guidance	
Amount of Soil and Preparation Required	
Sample Storage until shipment	
Lab Certification	

Approved Lab Certifications:

The Performance Assessment Program (PAP) from the North American Proficiency Testing Program (NAPT) under the auspices of the Soil Science Society of America, *or*
The American National Standards Institute (ANSI) National Accreditation Board (ANAB), *or*
The International Organization for Standardization (ISO/IEC 17043:2010) for ISO 10694:1995, *or*

State-approved certification program that considers laboratory performance and proficiency to assure accuracy of soil health test results.