**Soil Health Assessment Properties to be monitored as part of the Climate-Beneficial Vineyard Management Practices for the North Coast Area Project**

| Soil Property | Process type | | | Relationship to Soil Processes | Specific Laboratory Procedure* |
|---|---|---|---|---|---|
| | *Physical* | *Chemical* | *Biological* | | |
| Texture- % of sand, silt, clay, gravel content | ✓ | | | Inherent soil property that influences the potential to store organic matter and nutrients, form stable aggregates, retain/infiltrate/drain water. ★ | Hydrometer method, following gravel removal with 2 mm seive |
| Aggregate stability-% of aggregates stable to simulated rain | ✓ | | ✓ | Influences water infiltration and oxygen movement into soil. Changes relatively rapidly with soil management changes because of the role of living organisms in soil aggregation (e.g. fungal hyphae, earthworm casts, bacterial compounds stabilize aggregates). ★ ★ | Wet aggregate stability, first sieve for aggregates/particles between 0.25 and 2 mm |
| pH- measure of soil reaction (acid, neutral, basic) | | ✓ | | Influences nutrient availability, soil biology, and plant health. ★ ★ See under standard nutrient analysis | Soil pH |
| Phosphorus | | ✓ | | Important plant macronutrient. Deficiency is uncommon for grape vines, but if present will significantly affect yield. Retained in soil on clays and soil organic matter. ★ See under standard nutrient analysis | $PO_4^-$ -P following Mehlich 3 extraction |
| Potassium (K), Calcium (Ca), Magnesium (Mg) | | ✓ | | These elements are important plant macronutrients. A low Ca:Mg ratio is harmful to vine health and productivity, is often associate with K deficiency, and is found in serpentine-influenced soils. | K, Ca, and Mg following Mehlich 3 extraction |
| Cation exchange capacity (CEC) | | ✓ | | Cation exchange sites are on clay particles and organic matter. They are an important storage site for nutrients such as K, Ca, and Mg. | Calculation based on Mehlich 3 extraction of K, Ca, Mg |
| Total organic carbon (TOC)- the carbon contained in soil organic matter (SOM) | | ✓ | ✓ | TOC is highly correlated with total SOM measured as weight loss on ignition. SOM includes everything from living organisms, to plant residues, to humus (highly decomposed, amorphous organic compounds). Organic matter is a source of nutrients and improves soil structure and water-holding capacity. Storing greater amounts of C in soil (C sequestration), is an important mechanism for reducing atmospheric carbon dioxide levels and mitigating climate change. ★ ★ See under organic matter | Dry combustion of solid for total C |
| Active organic carbon- measured by permanganate oxidation. | | ✓ | ✓ | Active organic matter is recently added organic materials that are the main energy source for soil microbes. Measures of it, such as permanganate oxidizable carbon, have been found to change more rapidly than total organic carbon following changes in soil management, and to be more highly correlated with microbial biomass. ★ See under Reactive Carbon ★ See under active carbon | Active carbon- C that reacts with permanganate |
| Total nitrogen | | ✓ | ✓ | Approximately 98% of total soil nitrogen is in organic form. Therefore this measure and the TOC:Total N ratio are indicators of a soil's ability to supply plant available mineral N. | Dry combustion of solid for total N |
| Potentially mineralizable nitrogen- the amount of organic N converted to plant available mineral forms | | | ✓ | PMN is another indicator of a soil's N supply capacity. It is derived from microbial decomposition of organic materials, which releases mineral nitrogen. ★★ | Potentially mineralizable nitrogen- The increase in $NO_3^-$ -N following 28 day aerobic incubation under standard conditions |
| OPTIONAL TESTS | | | | | |
| Bulk density- the weight of dry soil per volume | ✓ | | | Bulk density increases with soil compaction, so it indicates the potential for healthy root growth, and water and air movement in soil. B.D. is used to convert properties measured on a weight basis (e.g. the % by weight of organic C) to a volume or area basis. ★ | See "Sampling Soils for a Soil Health Assessment in Vineyards" for protocols. |
| Water infiltration- rate of water entry into soil at field capacity water content | ✓ | | | Rapid water infiltration is vital to capture rainfall and prevent surface run-off and erosion during high intensity events. It is promoted by the presence of plant cover and root channels, by higher SOM, and by stable soil aggregates. ★ | See "Sampling Soils for a Soil Health Assessment in Vineyards" for protocols. |
| Compaction- loss of soil porosity or "densification", measured as resistance using penetrometer with conical tip | ✓ | | | Compaction occurs due to traffic during times when soil is wet and/or with heavy equipment and loads. It restricts root growth and therefore diminishes plant productivity, and it slows water movement through the soil profile. ★ See under surface and subsurface hardness | See "Sampling Soils for a Soil Health Assessment in Vineyards" for protocols. |

*Detailed procedures in "Oregon State University - Central Analytical Laboratory - Standard Operating Procedures 2017"

★ Find more information in the USDA/ NRCS Soil Quality Indicator Sheets at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=stelprdb1237387

★ Find more information in the Cornell Soil Health Manual at: https://soilhealth.cals.cornell.edu/training-manual/