

Interpreting Soil Health

Soil health testing focuses on measuring the rate of biological activity in a soil sample. Available amounts of carbon and organic nitrogen control the soil's biological activity and its rate of nutrient cycling. A Soil Health Score provides a number related to these biological characteristics, with a higher number indicating a more healthy soil.

A Soil Health report combines the traditional chemical and physical soil testing, used to provide fertilizer guidelines and management practices, with water and weak acid extractions for the biological assessment.

Recommendations that enhance soil health are based on these biological assessments. Cover crops are recommended as the best way to enhance soil health. By retaining fertilizer nutrients and adding plant residue that easily decomposes, cover crops release nutrients to the soil over a longer period and boost biological activity. When the Soil Health Score is low a cover crop mixture high in legumes is recommended so that nitrogen is added to the soil, reducing the carbon to nitrogen ratio.

Basic Assessment

Soil Health Score – Calculated from the rate of microbial respiration and the water extractable carbon and organic nitrogen content to provide a simple number that ranges from 0 to a high around 50. Measures of the organic forms of nitrogen (N) correspond to the long term growth potential of the microorganisms, independent of the changes that come from applying fertilizer nitrogen. Increases in this score indicate an improvement in Soil Health, and come from increases in the respiration rate as well as the soluble carbon and organic nitrogen content.

Low	Med	High
0-9	10-29	30-50

Soil CO₂ Respiration – Measures the respiration rate of the soil microorganisms. A dry sample is allowed to absorb water and is kept in a sealed chamber for 24 hours. This one-day soil CO₂ respiration measurement predicts the average respiration rate in the soil under normal field conditions. Increasing respiration values are a sign of vigorous microbial growth.

Low	Med	High
0-60	61-150	151-300

Organic C:N Ratio – Measures the availability of the two most important nutrients for microorganisms in the soil. Carbon (C) is the energy source and nitrogen is a requirement for building proteins and enzymes. Because inorganic forms of N (nitrate and ammonium) fluctuate in the soil solution in relation to fertilizer use, measuring the soluble organic N is a more stable assessment. A desired Organic C:N ratio would be between 10 and 15. Maintaining the right balance is important and so a high number is not better in this case.

Low	Desired	High
<8	8-17	18-30

Routine Assessment adds:

Water Soluble Extraction – Evaluates the forms of nutrients that are utilized most easily by soil organisms and plants.

Carbon and Total Nitrogen – Used in determining the C:N ratio, are highest in concentration and regulate the soil biologic life. The water extraction includes the organic forms of nitrogen such as soluble organic matter, proteins and other by-products of decomposition as well as inorganic nitrate and ammonium nitrogen. This soluble nitrogen is readily used by plants and microorganisms, but it is also easily leached from the soil or it can be converted to gas if the soil is saturated with water. Soil microorganisms will utilize the soluble forms of nitrogen as they break down the soluble and solid carbon sources in the soil. As the microorganisms utilize and then release forms of nitrogen bound in the soil's organic material for their lifecycles it becomes plant-available. This is reported as Mineralizable N, below.

Mineralizable N and P – Estimates the potential release from organic matter of these elements. Fertilizer recommendations can be adjusted to account for this release by subtracting from the amounts indicated in the fertilizer guidelines. Estimating Mineralizable P requires the H3A (Haney) extraction as described below.

Complete Assessment adds:

H3A (Haney) Extraction – Evaluates the concentration of plant nutrients available at the root surfaces by using a combination of weak organic acids that mimic the solution secreted from roots during growth. This extraction helps to identify low availability or imbalances of critical nutrients in the soil.

The value of H3A extracted Orthophosphate will differ from the P value reported in the standard soil test because of the different extraction methods. Both results reflect the availability of P to the plant. Keep in mind that the fertilizer recommendations are based on the standard soil test result. The value reported as Phosphorus measures both the Orthophosphate-P and forms of phosphorus bound to organic compounds. This organic P is made plant-available by microbial action and is reported as Mineralizable P, above.

Extracted amounts of K and Ca are lower than those reported in the standard soil test and are not used in making crop fertilizer recommendations.

The ratios of P:Al+Fe and P:Ca in the H3A extraction evaluate the ability of the soil to remove or 'fix' applied phosphorus in forms that are unavailable to plants. Values below 3-5% indicate a greater tendency for this P fixation to take place. A Ca:Al+Fe ratio below 100% indicates a potential of improving P availability through liming.