

DIGGING DEEPER

*A COMPARISON BETWEEN
STANDARD SOIL TESTS AND THE
HANEY SOIL HEALTH TEST*



ILLINOIS
SUSTAINABLE
AG PARTNERSHIP



This resource provides a general comparison of a **Standard Soil Fertility Test** and the **Haney Soil Health Test**. This is not meant to endorse one test over the other, but to provide farmers and agricultural professionals guidance regarding the similarities and differences, and how results can be used to inform management decisions.

Standard Soil Test

The standard soil fertility test measures nutrients in solution and bound to exchange sites (exchangeable nutrients). Results are used to predict yield response given fertility inputs.

Extractant - Typically uses Mehlich-3, Bray, or Olsen chemical extractants for nutrient analysis. These are strong acid extractants.

Analysis - Measures exchangeable nutrients meaning that the final numbers are not necessarily indicative of what is plant available in the soil solution. These numbers are showing what is in solution plus what is tied to CEC or potentially bound by clays etc.

Using the Results - Results are calibrated and used to determine P, K, and lime application based on likely yield response to fertilizer inputs.

Sample Frequency & Cost - Farmers typically sample fields every 2-3 years (or based on crop rotation), gathering 1 sample per 2.5-5 acres. Analysis cost: \$8-12 per sample.



Torey Colburn, Conservation Agronomist with American Farmland Trust, collects soil samples on a central Illinois farm.

Haney Soil Health Test

The Haney Soil Health Test measures nutrients in solution, which more closely indicates plant available nutrients. Results can help farmers figure out where and when to cut back on fertility inputs.

Extractant - Uses H₃A and water as extractants – H₃A is made of weak acids designed to mimic the exudates of plant roots in the soil.

Analysis - Measures nutrients found in the soil solution, more closely representing plant available nutrients. Also measures Soil Respiration, an indication of a soil's potential biological activity, which is critical to soil functions such as aggregate formation and nutrient cycling.

Using the Results - Results provide insights into increased biological and nutrient cycling activity achieved through better soil health management.

Sample Frequency & Cost - Farmers typically sample fields every 2-3 years, gathering 1 sample per 20-40 acres (based on management zones). Analysis cost: \$50-60 per sample.

Insights - Soil health improvements take time. We believe that farmers utilizing cover crops and other soil health practices will find value in using the Haney Soil Health Test *in combination with* the Standard Soil Test in the early years. Over time, changes in plant available nutrients and soil respiration rates will become apparent and farmers will gain confidence to make fertility decisions based on the Haney test results.

Regardless of which test you are doing, it is **recommended to collect soil samples at the same time during the year**. Sampling consistently during the fall, or consistently during early spring, provides a better comparison over time.

Comparing Test Results

Results from soil samples taken in a North Central Illinois field using no-till and cover crop practices.

CEC - Cation Exchange Capacity

is a measure of the total negative charge of the soil, correlating to the number of cations (positively charged) that the soil can hold and exchange into soil solution.

Percent Cation Saturation

represents the percentage of the cation exchange sites occupied by the respective cations.

Standard Soil Test

Sample ID	Lab Number	Organic Matter %	Phosphorus		Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Soil pH	Buffer pH	CEC meq/100g	Percent Cation Saturation				
			Bray-1 Equiv ppm-P	Bray P2 ppm-P								% K	% Mg	% Ca	% H	% Na
1	60071	4.1	22 M		150 M	575 VH	1950 M		6.7	6.9	16.1	2.4	29.7	60.5	7.4	



Organic Matter

Organic matter is typically determined via "loss on ignition" where a portion of soil is dried and weighed and then combusted in an oven. The sample is re-weighed, and the change in weight is equal to the organic matter content of the sample.



Soil pH

Soil pH measures the acidity or alkalinity of a soil. Analysis performed by mixing soil with distilled water and reading water pH with a calibrated pH meter. Buffer pH is a measure of "reserve" or potential acidity.

Both the Standard Soil Test and the Haney Soil Health Test provide measurements for organic matter, pH, phosphorus, potassium, calcium, and magnesium. Nutrient values for the Haney test are lower due to different extractant chemicals, and more closely represent "plant available" nutrients. The Haney test also lists Soil Health results that are not included on a standard soil test (light brown below, and defined on the next page).

Haney Soil Health Test

Lab #	Nitrogen									Phosphorus					
	H3A Extract			H2O Extract						H3A Extract					
	Nitrate ppm NO3-N	Ammonium ppm NH4-N	Inorg. N ppm N	Total N ppm N	Org. N ppm N	Org. N: Inorg. N	Org. N Rel. ppm N	Org. N Res. ppm N	Avail. N lbs/A	Total P ppm P	Inorg. P ppm PO4-P	Org. P ppm P	Org. P Rel ppm P	Org. P Res. ppm P	Avail. P lbs/A
29167	2.6	3.7	6.3	20.1	15.2	3.15	15.2	0.0	45.1	23.2	17.9	5.3	5.3	0.0	53.3
Rank															

Lab #	Other Soil Measures					Fertility									
						H3A Extract									
	Soil pH 1:1	Buffer pH Mod. WDRF	Soluble Salt mmho/cm	Excess Lime	Soil OM % LOI	Potassium ppm K	Calcium ppm Ca	Magnesium ppm Mg	Sodium ppm Na	Zinc ppm Zn	Manganese ppm Mn	Iron ppm Fe	Copper ppm Cu	Aluminum ppm Al	Sulfur ppm S
29167	6.9	-	0.05	NONE	4.4	56	653	235	9	0.77	3.2	63	0.15	136	3.29
Rank															

Lab #	Soil Health						Nitrogen Comparison				Reviewer Comments	
	H2O Extract											
	Soil Resp. ppm CO2-C	Org. C ppm C	MAC %	C:N	SHC	Cover Crop Suggestion	Traditional N lbs/A	Haney N lbs/A	Differ. N lbs/A	Savings N S/A		
29167	103.3	194	53.3	12.72	14.00	40% Legume 60% Grass	5.4	45.1	39.8	41.35		
Rank												

Soil Respiration

Water Extractable Organic Carbon (WEOC)

% Microbial Available Carbon (%MAC)

C:N Ratio

% Water Extractable Organic Nitrogen

Multiply by 2 to convert from ppm to lbs/A

Haney Soil Health Test Terminology

Soil Respiration

- Soil is dried then re-wet. CO₂-C output is measured over a 24-hour period to evaluate how well the soil “breathes.”
- The higher the CO₂-C reading, the more microbial activity is present in the soil.
 - An indicator of healthy soil function including nutrient cycling, formation of stable organic matter (OM), capacity to build soil aggregates, and suppression of pathogenic organisms.
- Readings range from 0-1000 ppm.
 - Most agricultural soils are at least somewhat degraded – scoring < 200 ppm.
- Values fluctuate with season and environmental conditions.

Water Extractable Organic Carbon (WEOC)

- Fraction of soil organic matter (SOM) that is readily available to soil microorganisms as food. Can indicate the quality of SOM rather than simply the quantity expressed by total SOM.
- Higher numbers indicate more food is available to soil microbes.
- Organic inputs such as manure, compost, or cover crops can increase WEOC.
- Levels fluctuate throughout the growing season based on soil temperature and organic inputs.
 - Lower temperatures tend to slow respiration and increase WEOC.
 - Having living roots present throughout the year provides organic carbon for microbes and leads to more stable cycling of carbon, increasing WEOC.
 - Conventional row crop soils have larger peaks and valleys (less stable cycling of carbon).

% Microbial Available Carbon (%MAC)

- The quantity of WEOC that microorganisms acted upon – measured as CO₂ respiration.
- Looking for percentages to be between 50-75% in most cases.
 - >80% MAC indicates WEOC may be limiting factor and management should focus on bringing more carbon into the soil system.

% Water Extractable Organic Nitrogen (WEON)

- Measures the pool of organic N in the soil that is available to microorganisms.
 - Organic N is contained in amino acids and proteins.
 - Microbes consuming a “high protein” diet will cycle more nitrogen back into plant available, inorganic forms (NO₃ & NH₄).
 - Healthy soils have greater N cycling potential and higher WEON values.
 - Can be used to guide reductions in N fertilizer inputs.

C:N Ratio

- Ratio of WEOC to WEON – represents only the C:N in the water extraction of the test.
 - Should not be confused with C:N ratio of the soil, plant residues, manure, etc.
 - Results between 10:1 and 15:1 indicate optimum soil function.

Additional Resources:

- [Haney Soil Health Test Results Interpretation Guide](#)
- [ISAP's Introduction to Soil Health Practices](#)

To view a pdf version of this document, please visit <https://ilsustainableag.org/resource/digging-deeper-a-comparison-between-standard-soil-tests-and-the-haney-soil-health-test/>