



Intro: Soil Health Testing


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Chemical: Traditional Soil Testing


- Reports available nutrient levels
 - Primary
 - Secondary
 - Micro's
 - Other- Salts, Nitrate, CEC, base saturation, soil texture, pH/ buffer pH
- Monitor nutrient trends (history of a field)
- Provide lime & fertilizer recommendation
- Long history and research of this in ag



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What is Soil Health?




The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans.

- **Soil Health Tool**
 1. Solvita (microbial respiration/activity)
 2. Water soluble Organic C (microbial food)
 3. Water soluble Organic N
 4. Org C:N
 5. Soil health score
 6. Cover crop suggestion

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We can Unlock the Secrets in the Soil




- It is estimated that in 1 gram of soil (enough to fit on top of a nickel) contains 1 billion living organisms.
- Consisting of roughly 10,000 species.

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Traits of a Healthy Soil: In Field

- Smell: Rich, earthy smell is produced by certain types bacteria as they decompose OM.
- Feel: soft, crumbly
- Sight: deep top soil layer, no signs or erosion, crusting, salts,
- Sight: earthworms, other larger soil organisms
- Sight: white filament network are signs of fungi
- Sight: deep abundant roots, no abrupt bends, many small root hairs.



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Aboveground diversity is a mirror for belowground diversity.

- Roots normally account for 10-20% of the total plant weight
- But contribute 12% of soil organic C, 31% soluble organic C, and 52% of the microbial biomass C (Liang et al. 2002)

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Soil Organic Matter is the "House" microbes live in, Water Extractable Organic Carbon is the "Food" they eat.

- **Soil food webs are based on 3 primary carbon (C) sources:**
 1. Root exudates/verticillium
 2. Litter or crop residue
 3. Soil organic matter (SOM)
- These C sources vary in their availability and accessibility to soil organisms, and can thus, increase the C flow and biodiversity within the food web.

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Trying to test what?

- Billions of organisms carrying out countless biological transformations and cycles.
- Its not just NPK think C-NPK. Carbon is the food source for the soil organisms, found in Organic Matter.
 - **Most soils have less than 6% OM but this controls over 90% of soil functions**
 - **Found in the top 6 inches**
- Biological activity enhances water retention, soil absorbcency structure and aeration. **Increasing the soil organic matter by 1% increases the retention of available water by one acre inch, or up to 10% of the soil's water holding capacity.**

Each 1 % of O.M. contains:

- 10,000 lbs. of C
- 1000 lbs. of N
- 100 lbs. of P
- 100 lbs. of S
- .3"-1" of H2O

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Testing?

- Pull like a normal soil sample.
 - Might want to gps the location to go back to same spot.
 - Composite??
 - Value of pulling several during growing season or pull same time for next sample.
- NRCS conservation programs
- Compare a field to field edge virgin soil and then make a management practice change
- Farmer led watershed groups
- Cover crop field test plots
- Company microbial test plots

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How can you test for that?

Soil Microbial Activity (respiration)

Solvita 1-day CO₂-C

Soil Microbial Activity Test with Digital Reader

- At a soil temperature of or 68 F most soil organisms have fully functional populations and may be actively reproducing, which means there is lot of mineralization happening, and the roots are taking full advantage of all the activity.

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C:N Ratio

- C:N = $\frac{\text{Water Soluble Carbon}}{\text{Water Soluble Nitrogen}}$

C and N are analyzed together.

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Soil Health Test Options

A soil health test provides a reference point to use in gauging the current quality of your soil and the impact of any steps that are taken to improve that quality.

Basic-\$35

1. **Soil Health Score**- Range 0-50 (Goal 20 or higher)
2. **Solvita CO₂ Respiration** -Microbial action 24 hrs, goal over 60
3. **C:N Ratio** – goal balance of the two, 8-17 For 3-5% OM soil C:N ratio of 10 or 12 is desired.
4. **Recommendation** -%s of cover crop, legumes



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Soil Health Test Options

Routine-\$40

1. **Basic soil health test**
2. **Water Soluble Extraction**-evaluated forms of nutrients most easily used by plants & soil organisms
 - Carbon-goal 150-300
 - Total N-goal 25-60 both C and N highest amounts and regulate soil life activity.
 - Nitrate N-goal 10-30
 - Ammoniacal N-goal 10-30
 - Orthophosphate P-form soluble in H₂O goal 1.5-3
 - Water Saturation %-amt of water held by soil/OM, goal 35-60 %
 - Solvita-estimates potential release from OM of mineralizable N & P

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Complete

- Includes basic and routine tests -\$45
- **Haney Extract (H3A)**
 - Looks at concentration and forms of nutrients present at roots it mimics root uptake.
 - Orthophosphate P- goal 10-20ppm
 - Phosphorus-15-25
 - Potassium 40-60
 - Iron, Al (varies)
 - Al:Fe Ratio greater than 5
 - P:Ca Ratio greater than 3
 - Ca:(Al+Fe) ratio greater than 200
- In general, a higher score means a more healthy soil & improving the score over time indicates that soil management and crop management practices are benefiting the soil and improving soil health.

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Soil Health Assessment

- Testing provides objective measure of soil quality
- Establishes a framework for improvement

"You can't manage what you don't measure."



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Current Limitations?

- Requires long-term investment in changes to soil.
- Short history of testing/research on a large scale, more research needed to determine yield advantages, management practices changes.
 - varies on soil type, throughout the year, soil close to root vs just 6 in away in the row).
- Lack of association between soil health metrics and yield in all plant needs are being met.
- One magic soil health number is unlikely. Results are specific to field history, crop type and genetics, soil type, environment, management, time
- Work continues and soil health tests will evolve.



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Questions?



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