**EVALUATION OF A NEW TEST TO MEASURE SOIL HEALTH**

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**Introduction**

- Microbial respiration is a process used to evaluate soil health. Soil microorganisms immobilize carbon (C) and nitrogen (N) to build their biomass. Respiration occurs as microbes metabolize organic residues and evolve carbon dioxide (CO₂). To accomplish these tasks microbes need plant exudates or plant and animal residues as an energy source.
- Many standardized tests measure microbial activity but can be time consuming and expensive. The Solvita test is a commercialized method to measure CO₂ from dried soils that have been rewetted and incubated for 24-hours. The test uses inexpensive equipment, no reagents, and is promoted by the Natural Resource Conservation Service.¹
- While Solvita claims their test, the Organic Matter Loss on Ignition (LOI) test, and the Potentially Mineralizable Nitrogen test are strongly correlated, preliminary studies with some Minnesota soils have shown high amounts of variability in Solvita measurements after rewetting following their recommended capillary action method.

**Project Objectives**

1. Evaluate three different methods for rewetting soil samples
2. Determine the relationship between Solvita measurements, soil organic matter content, and inorganic N concentrations
3. Determine if the Solvita test can identify differences in soil management from a Minnesota Certified Organic farm

**Methods**

- Soil samples were collected from Garden Farme, a no-till permaculture organic farm
- Heyder and Braham comprise the soil series that has a coarse-loamy to fine-loamy texture
- Preliminary experiment used the following methods for rewetting soil: Method 1: Parnes and Brinton: 28 grams oven dried soil rewetted with Deionized (DI) water to 70% saturation, and mix 12 additional grams of oven dried soil
- Method 2: 50% water filled pore space (WFPS): calculation for amount of DI water to add: (Volume oven dried soil – 40 grams + 2.65 (particle density)) x 50%
- Method 3: Capillary Action: 40 grams of oven dried soil, added directly to beakers, put into Solvita jars, and 20 mL of DI water added to base of jar
- Determined Solvita CO₂ concentration, soil organic matter content (LOI) and KCl extractable NH₄⁺ and NO₃⁻ for 31 samples at 2 depths (0-20 and 30-45 cm, n=62)

**Results**

**Table 1. Solvita (CO₂-C ppm) Prairie Samples**

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Description</th>
<th>Soil</th>
<th>Organic Matter (LOI)</th>
<th>Extractable Inorganic N ppm</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Garden Prairie, T</td>
<td>2814</td>
<td>93.1</td>
<td>2.6</td>
<td>41.53</td>
<td>19.76</td>
</tr>
<tr>
<td>A-2</td>
<td>Full Sun Prairie, T</td>
<td>2814</td>
<td>93.1</td>
<td>2.6</td>
<td>31.67</td>
<td>17.82</td>
</tr>
<tr>
<td>A-3</td>
<td>Low Sun Prairie, T</td>
<td>2814</td>
<td>93.1</td>
<td>2.6</td>
<td>9.43</td>
<td>3.5</td>
</tr>
</tbody>
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**Table 2. Evaluation of Solvita (CO₂-C ppm), Organic Matter LOI, and Extractable Nitrogen Tests, n=60**

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**Table 3 & 4. Comparison of Solvita measurements using three methods to rewet Becker¹ (Sandy) and Wasca² (Clay Loam) soil**

- Method 2 resulted in the highest Solvita measurements and was easier to prepare due to faster rewetting of the soil

**Conclusions**

- “Science” is too simple a word to name the complex of relationships and connections that compose a healthy farm — a farm that is a full membership of the soil community.³ — Wendell Berry
- The capillary action method resulted in the lowest Solvita measurements (Table 1), likely due to samples becoming anaerobic. Solvita scientists should reconsider recommending this method of rewetting soil.
- Further studies involving Potentially Mineralizable Nitrogen tests are needed to correlate Solvita with available nitrogen.
- Further studies are needed to assess accuracy of the Solvita Digital Color Reader between runs (Table 2).

**Acknowledgements and References**