



# Is your soil alive? Healthy soils have more life!

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## What is Soil Health?

Soil is full of life, and healthy soils have more life. Soil health takes into account the physical, chemical, and biological characteristics of the soil. An important part of healthy soil is the diversity of life in the soil from the bacteria to the plants and animals on the surface. The life in the top 6" of soil in an acre of land is estimated to weigh between 2,500 and 5,000 lbs. Determining your level of soil health, monitoring your soil health, and implementing the practices that work for you to maintain or improve soil health can help with crop yield, crop health, and water quality.

## What are the Benefits of Good Soil Health?

- Improved soil structure and pore space
- Increased organic matter
- Increased water infiltration and holding capacity
- Increased nutrient cycling and holding

**Improved Soil Structure and Pore Space:** The bacteria and fungi in the soil are the drivers of soil structure. They make organic glues as organic matter is digested, and the organic glues bind soil particles and organic matter into aggregates. More, larger aggregates result in more pore spaces. Soil with larger and more soil pores and aggregates has a higher resistance to compaction from crop management or animal traffic. Increasing the amount and size of pore space encourages larger and deeper root growth because of less resistance from compacted soil.

**Increased Organic Matter:** Organic matter is anything in the soil that was once alive. This includes crop residues, manure residues, and dead microorganisms. Organic matter in the soil increases due to increased application of organic materials, continued cover on the soil, and more microorganisms in the soil. Organic matter is measured in the Agro-One Lab by LOI (Loss on Ignition). The samples are placed in a 500°C oven for 2 hours.

**Increased Water Infiltration and Holding Capacity:** More, larger aggregates and pore spaces help water infiltrate better for two main reasons:

1. Larger aggregates are more resistant to breaking and splashing when rainfall occurs. This reduces both the potential for the soil to go into suspension then runoff, and for small soil particles to form a crust.
2. Water has a place to go when it lands on the surface, it infiltrates rather than run off or pool. Leading to decreased runoff, decreased soil loss, decreased nutrient loss, and decreased potential for ponding and drowning of plants.

Water holding capacity is the amount of water a soil can hold for crop use. Soil organic matter has a natural magnetism for water. As soil organic matter increases, so does the water holding capacity of the soil.

Overall, improving soil health and increasing or-

ganic matter, aggregates, and pore space will provide the crops in the field a more consistent supply of water throughout the growing season. With increased infiltration times, high volumes of water will be safer for the crop. Increased organic matter and infiltration will allow the soil to capture and hold onto water for crop use when moisture needs to be conserved.

**Increased Nutrient Cycling and Retention:** The microorganism population in the soil cycle the nutrients from field application, organic matter, and plants. As the population grows more of the applied nutrients can be cycled in the system until they are taken up by plants, similar to slow release fertilizers.

## How Do We Measure Soil Health?

As mentioned in the beginning of the article, soil health takes into account the physical, chemical and biological characteristics of the soil.

There are some things you can go out to your field and do to measure soil health: feel the soil, smell the soil, look for earthworms, watch the field during rainfall, observe the condition of the soil surface after rainfall, and take penetrometer readings. It is hard to know what is going on in your soil and fields if you don't take the time to look. The presence of earthworms is a great indicator. Earthworms will not stay where there is no food, and if there is not enough organic matter or microorganisms, there will not be enough food. Taking the time to see how much destruction and mixing of your soil occurs during and after a rainfall is an indicator of aggregate stability, water infiltration, and the potential for nutrient and soil loss. A penetrometer is used to determine if there is compaction in the soil. A probe is inserted into the soil and the pressure required to insert the probe depth inserted are used in combination to tell us the depth and amount of compaction in the field.

Multiple researchers have developed lab tests to give us all more detail about the health of the soil. Lab analysis for soil health include aggregate stability, carbon respiration, nitrogen mineralization, available water capacity, organic matter, active carbon, soil protein, and root pathogen pressure.

Starting this spring, Agro-One will be offering the Solvita® and SLAN® tests. The Solvita® test measures soil carbon respiration. This is done by rewetting a subsample of the soil sample you are sending in for chemical analysis, placing it in a sealed container in an oven at a constant temperature to measure the CO<sub>2</sub> that is respired from the soil for a 24 hour period. Similarly, the SLAN® test is measures amino-N released from the soil in a 24 hour period. Results of these test will be presented and interpreted as follows:

Soil Status	CO <sub>2</sub> Burst mg/kg CO <sub>2</sub> -C	SLAN mg/kg Amino-N
Very Low Biological Activity	0 – 20 mg/kg	<80 mg/kg
Moderate Biological Activity	21 – 60 mg/kg	100 – 160 mg/kg
Very High Biological Activity	61 – 150 mg/kg	>180 mg/kg
To convert SLAN mg/kg to pounds per acre of Amino-N multiply mg/kg by 0.89.		

Table 1: Measure soil health

**Very Low Biological Activity** – Low in microbes and microbial activity, associated with depleted and dry sandy soils, and little or no organic matter

**Moderate Biological Activity** – Moderate microbial life and activity, soil is moderately balanced and has likely been receiving organic matter additions

**Very High Biological Activity** – High microbial like and activity, soil will range from well supplied to excessive amounts of organic matter

These are not the only soil health tests available, but they are easily repeatable, good for monitoring over time, do not require any special sampling procedure or size, and can be done on the sample you are already sending for chemical analysis (pH, Buffer pH (lime requirement), organic matter and Modified Morgan extractable phosphorus, potassium, calcium, magnesium, aluminum, iron, zinc, and manganese).

## How Do We Improve Soil Health?

The goals of improved soil health are to increase biological activity, increase aggregation and pore space, increase water infiltration, and decrease runoff to increase plant health and yield. Below is a list of the management areas and practices to consider.

- **Increase Biological Activity**
  - Crop Diversity
    - Rotations
    - Cover Crops
  - Organic amendments
    - Animal manure
    - Waste feed
    - By-Products
    - Crop residue
- **Increase Aggregation and Pore Space**
  - Increased Diversity
    - Cover Crops and/or Crop Rotation
  - Reduced tillage

For more information, please contact Sally Flis via e-mail at [sally.flis@dairyone.com](mailto:sally.flis@dairyone.com), or the Agro-One and Forage Lab customer support team via phone at 800.344.2697, extension 2172.