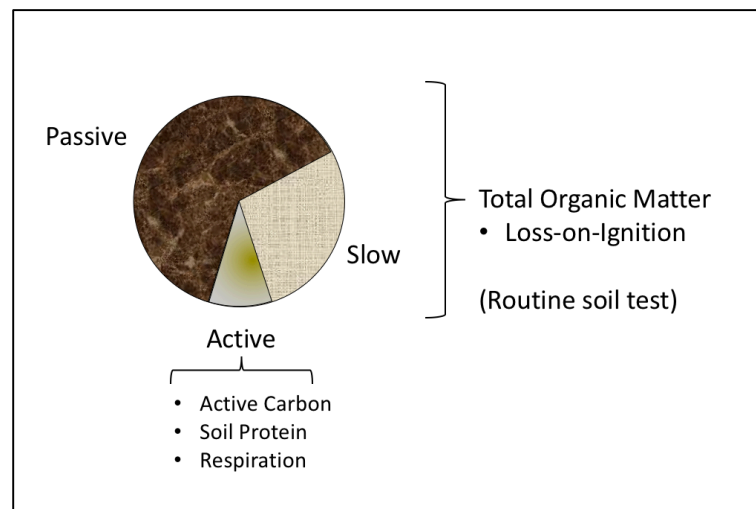




Soil Health and Active Organic Matter in Soils

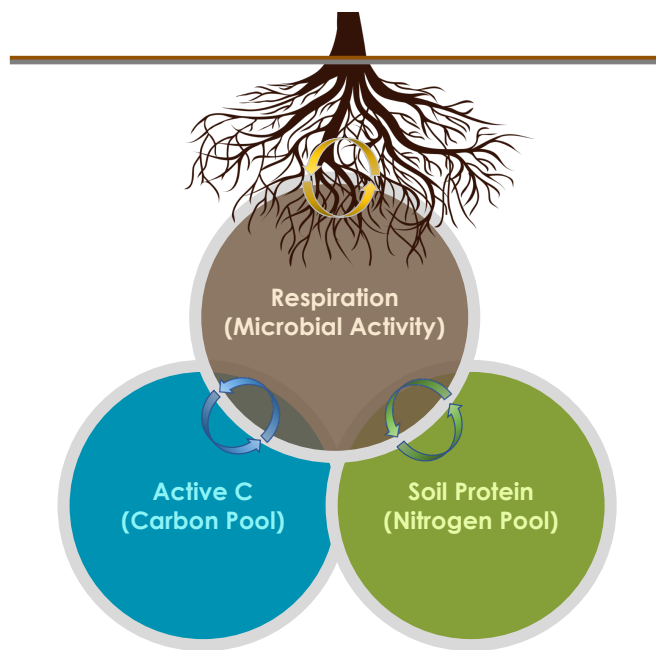
Total organic matter is a very important soil property that is commonly measured in routine soil tests. However total organic matter is not an ideal indicator of nutrient availability, because the majority of this pool is in forms that turnover slowly over time and hence not plant available. Active organic matter is only a small fraction (5-20%) of the soil's total organic matter, but is very important to crop nutrition since nutrients in this fraction are rapidly cycled and taken up by crops.

Not all organic matter is created equal. Total organic matter is made up of passive, slow and active pools. Each pool has different functions and important in its own right. The active pool feeds soil microbes and is the source of rapidly cycled nutrients that feed crops. Increasing the health of a soil will ultimately increase this smallest, but critical pool of organic matter.



We are working hard to develop meaningful and affordable soil health tests for farmers. Since soil organic matter influences so many soil properties, organic matter tests are of particular interest. Roughly half of organic matter is made up of carbon. Carbon is the backbone of life and is the currency that plants and the soil food web use to cycle nutrients and energy throughout the soil.

We are working with three tests that measure the active pool of organic matter: 1) active carbon, 2) soil protein, and 3) respiration. These tests each provide unique information about the active organic matter of a soil. They are complementary and related, as these three components interact to determine how fast and how much a nutrient will cycle within the soil and become available to growing crops. The larger the pools, the more fertile and resilient a soil will be.



This soil health test provides three measurements of active organic matter. Each measurement serves as an indicator of soil function. Respiration indicates how large and active the microbial community is. Active C indicates the amount of carbon (energy) available to the microbes. Soil protein indicates the amount of available organic nitrogen in the soil. Taken together these indicators provide insight into the health and fertility of a soil.

Active Carbon (Permanganate Oxidizable Carbon)

Active Carbon (POXC) is a simple, inexpensive test that uses a weak oxidizing solution to measure readily available carbon. Oxidation is the chemical process of decomposition with oxygen. We can think of it the same way as a fire using oxygen to burn wood. In the case of the soil, it's a microorganism using oxygen to get energy (fire) from soil organic matter (wood). The more oxidation that happens, the more active carbon there is in the soil. Research has shown active carbon to be very sensitive to management changes (cover crops, tillage, rotations, etc.) and it is therefore a good indicator of recent changes to management.

Soil Respiration

Soil Respiration is a method that measures the burst of CO₂ from a dried soil over 24 hours after it has been rewetted with water. Drying and wetting cycles occur naturally in soils. When soils dry down, organisms go into a resting state to survive. This method measures how fast the soil food web can 'wake back up' and become active again. Carbon dioxide (CO₂) is the product of oxidation of active organic matter. (We can use the same analogy here as the burning wood with a fire.) The more CO₂ that is respired, the more active organic matter is in the soil. Note the Solvita® test is based on this method. This test is also very sensitive to changes in management.

Soil Protein

Most of the nitrogen in soil is in an organic form, and the majority of this is made up of proteins from plants and microbes. Soil protein provides an important source of readily-available nitrogen that is recycled and taken up by plants. Our recent work shows this pool is a useful indicator of soil nitrogen availability. In addition to plant response, a robust soil nitrogen pool acts as a reservoir for the microbial community and soil resilience in general.