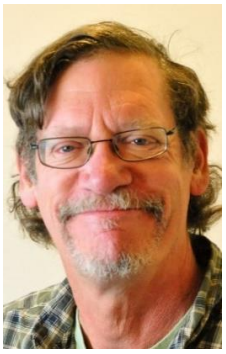
The Organic Components of Soil



By Bruce Lindsay
February 12, 2021

Maintaining the fertility level is key to success

Organic matter in soil consists of both living and nonliving material. The living organic matter is made up of bacteria, fungi, and plant roots. Non-living organic matter consists of plant residues and humus. It is now understood by science that much of the soil management practices is to encourage the diversity and quantity of bacteria and fungi. For example, cover crops may consist of several different species of plants in order to present a more healthy diet for the bacteria and fungi. When a soil has a high population of healthy microflora, it is less likely that pathogenic agents can get established and become damaging to a crop.

This represents the difference between soil building and soil mining. When a soil is not maintained, the organic matter as humus decreases and soils become more susceptible to erosion and compaction. A crop grown in this kind of soil will need more and more chemical fertilizer just to maintain a yield. As time goes on, the soil quality will deteriorate and result in soil mining.

In contrast, a soil in which organic matter is maintained by incorporating crop residues and using cover crops will maintain its fertility level because the cover crop will incorporate nutrients that would otherwise be leeched from the soil and wasted. Organic matter is one of the most important forms of nitrogen, but it must be managed to be available to a growing crop at the right time.

The bacteria populations will increase because of the ample organic matter. The soil nutrients that would otherwise be lost by leeching will be used by bacteria to make more bacteria. The nutrients will be held in reserve until the bacteria die, and then it becomes available to a new crop. This is how fertility levels can be maintained without having to add huge amounts of fertilizer every year.

Crop rotation is also part of fertility management. Some crops need a whole lot more fertility than others. Crop rotation is usually thought as a disease and insect management practice, and it is, but it is also important for soil fertility.

The zone of interaction between plant roots, bacteria, fungi, and mineral particles is called the "rhizosphere." It has been shown that fungal mycelium, called mycorhizae, extends between tree roots and helps them to share resources.

Organic matter is also very important in preserving the void space of soil pores. Bacteria and fungi generate slime that coats the mineral particles and helps to cement them together and prevent the collapse of the void spaces. Plant roots exude material that the bacteria and fungi feed on. Plants need the pore space to hold water and air so plant roots exude materials the bacteria and fungi need

to eat. In return, the bacteria and fungi help plants to absorb nutrients. It is a synergistic, cooperative system where each organism helps the other for their own benefit.

Nodules on legume roots contain bacteria that fix atmospheric nitrogen. *Photo courtesy of USDA Natural Resources Conservation Service.*

The living organic components of soil also include the plants as well as insects and animals. Soil is complex terrestrial ecosystem. The kind of plants and animals determines the kind of soil. The midwestern soils formed in grass prairies have abundant organic matter from grass roots.

In contrast, desert soils usually have low organic matter due to sparse plant growth. Soil formed in hot, humid environments generally has low organic matter because even though biomass production is high, the rate of decomposition is also very high. Hardwood and coniferous forests are usually quite different because of the nature of the product of plant decomposition and the bacteria and fungi that eat it.

RESOURCES:

- Bardgett, Richard D. *The Biology of Soil: Community and Ecosystem Approach*. Oxford University Press. 2005.
- Lowenfels, Jeff; *Teaming with Microbes-The Organic Gardener's Guide to the Soil Food We*b. Timber Press; 2010.
- Search: NRCS Soil Health; NRCS Soil Biology