Healthy Soils and Soil Basics

The conventional view of soil looks at three “independent” factors which make up soil and they are structural, chemical and biological. The understanding of soil and soil health through the soil food web is looking at the same three factors; but rather than looking at each component independently, soil health is achieved when all three are working together, not autonomously. Let’s consider the three factors independently and then how they should work together.

Soil texture tells us the size and portion of the particles within a sample, in other words the percentage of sand, silt, and clay found in the soil sample. The soil structure is the way these three elements are ‘glued’ together to form aggregates of solids and pore spaces (think granola!)

The chemical make-up of soils is the conventional way soil fertility is measured. A soil test will tell you the soluble values of macro (Nitrogen (N), phosphorus (P), potassium (K)) and micronutrients found in the sample. It will also measure the pH of the soil which is a critical factor in determining nutrient availability. The test should also measure the soils cation exchange capacity or CEC (the capacity of the soil to hold nutrients) and organic matter percentage. The chemical component to soils is certainly a key factor and one that should be understood but by itself will not achieve a healthy fertile soil.

The biological component of soil is probably the least discussed and perhaps the most influential factor in achieving soil health. The biological component is made of bacteria, fungi, protozoa and nematodes in addition to a variety of other soil life. Without good soil biology, pH alone will determine nutrient availability to your plants and manual input**s** will be required to maintain the nutrient levels needed for your plants.

Here are some of the microbes found in healthy soils. Bacteria are mostly decomposers which feed on plant exudates and fresh organic matter. They immobilize and retain nutrients in their bodies and are very nitrogen dense. Think of them as little bags of fertilizer! Fungi are also decomposers, feeding on more complex organic matter. The thread-like growth habit of fungi improves soil texture, transports water, and nutrients, and protects against pathogens. Protozoa, nematodes and other insects are the predators to bacteria and fungi.

These three components of structural, chemical and biological support each other to form healthy and fertile soil. The biology supports the structural aggregates and resulting pores, which allow water and

gases to freely exchange through those pores. The biology also helps transform the chemical nutrients in the soil into a plant available form.

The way that plants uptake these nutrients is a very complex and fascinating thing but let's try and simplify it to understand the importance of the biological component of soil.

Plants have a symbiotic relationship with their soils. Plants give up nearly 60 percent of their energy to their roots, which release exudates. Exudates are a food source for bacteria and the start of the nutrient cycling process within the soil food web. Soil organisms digest organic matter.

If you are applying fertilizer to your garden, and you have insufficient biological activity in the soil, there is no way for your plants to take up those necessary nutrients and very little defense against pests and diseases. In an organic environment, soil organisms need to digest the organic material (nutrients) and smaller organisms (soil food web) before any plant can benefit from the micronutrients. This is why synthetic fertilizers are so harmful and why we have become so dependent on them. Once the synthetic nutrient is absorbed into the plant, the runoff leaches into the ground, thus killing off the microorganisms in the soil. Once the organisms are gone, you become dependent on the synthetic fertilizer.

To speed up the nutrient cycling process, many organic farmers create and use custom blended compost teas. By suspending the micronutrients of quality compost in a liquid form, the plants and soil organisms can access the benefits of the compost/nutrients far more quickly and, if the soil is lacking in biodiversity, we can inoculate the soils with the necessary biology to ensure all necessary components are available for a healthy, sustainable soil.

Diversity is important because every soil is different. Having a wide variety of bacteria and fungi handles a wide variety of deficiencies. In order for the bi-products of the microbiology to be of any value, however, the soil food web needs to continue its cycle with the help of arthropods, nematodes and protozoa (the shredders, predators and grazers found in the third trophic level of the soil food web).

So, if you are considering taking a healthier, more sustainable approach to maintaining your soil, consider not only the nutrients the plants need, but also the biology and the whole ecology necessary to sustain the soil food web.