

Soil Health Key Points

NRCS fact sheet *Soil Health Key Points* lists “four ways to promote healthy soils.” First is keep your soil covered. A covered soil holds more water by binding to soil organic matter (SOM) and loses less water to runoff and evaporation. SOM increases when soil is covered by vegetation and dead plant material residue. SOM holds 18-20 times its weight in water and recycles nutrients for plants to use. One percent SOM in the top six inches of soil holds approximately 27,000 gallons or 1 acre-inch water. In addition, 1% SOM holds about 1,000# of nitrogen and roughly 100# each of phosphorus, potassium, and sulfur.

Soil microorganisms exist in large numbers as long as there is a carbon source for energy. There are more microbes in a teaspoon of soil than there are people on the earth. Bacteria, due to their large numbers yet small size, tend to dominate in most tilled soils. Fungi populations may be 50 times smaller, but due to their larger size, they are similar in biomass to bacteria in undisturbed soil. Fungi are important for decomposing hard to digest organic compounds (lignin) while bacteria tend to decompose the readily available and easy to digest organic compounds (sugars, proteins). Healthy productive agricultural soils have a balance of bacterial and fungal species and diversity in microbial populations.

A cover crop is needed on the soil 24 hours a day, seven days a week to build SOM, hold water and stop erosion. Continuous live or dead cover helps maintain soil health and protects it from heat and raindrop impact. SOM retains soil nutrients and when there is little or no SOM, nitrogen and phosphorus are leached from the soil. The nitrates and soluble reactive phosphorus are leached into ground water or carried into ponds, lakes and streams by run-off water.

Second, do not disturb the soil. “Do not disturb” means to avoid tillage. In No-till fields, water infiltrates through pores without destroying aggregate integrity. The SOM in no-till soils absorbs and hold water. One of the key methods of restoring soil health is to let nature do its work by avoiding tillage. Most SOM comes from roots and tillage destroys SOM by oxidizing (adding oxygen) to the soil, changing the soil microbial community, especially bacteria.

Bacteria have incredible ability to digest lots of carbon and multiply rapidly. It is decomposition gone wrong, just like cancer devours the human body and causes it to malfunction. Tillage stimulates the soil bacteria to feed on the body (the soil structure) and soil aggregation is diminished, so soils become harder and compacted. When this happens, soils do not store water and nutrients efficiently and soil function declines.

In addition to SOM and microorganisms, a healthy soil is full of earthworms. Soil is normally inhabited with earthworms when it contains SOM. Earthworms are major decomposers of dead organic matter and derive their nutrition from bacteria and fungi that grow on it. Earthworms dramatically alter soil structure, water movement, nutrient dynamics and plant growth. They are

not essential to all healthy soils, but their presence is usually an indicator of a healthy system. Earthworms perform several beneficial soil functions including 1) Mix and aggregate soil, 2) Stimulate microbial activity, 3) Increase infiltration, 4) Improve water-holding capacity, 5) Provide channels for root growth, and 6) Bury and shred plant residue.

The third key point is to use covers and crop rotation to feed and protect your soil. A Michigan State study found that each additional crop added an additional 10% to yield for each crop grown. Longer crop rotations, especially with cover crops, add plant and microbial diversity and increases crop yields long-term. The constant change in crops from crop rotation and diverse cover crops prevent pests (insects, weeds, diseases) from becoming dominant. Soil microbes keep soil nutrients recycling in a plant-available form. Microbes are just soluble bags of fertilizer and live plants have 1,000-2,000 times more microbes than bare soil.

Fourth, develop a soil health management plan which is a system of practices needed to enhance soil function and improves or sustains water quality, air quality, energy efficiency and wildlife habitat. In addition, it provides environmental, economic, health, and societal benefits. Implementation of a soil health plan saves energy by using less fuel for tillage and nutrient cycling is maximized. It also saves water and increases drought tolerance by improving infiltration and water holding capacity as SOM increases. As soil health is improved, plants become healthier, which increases farmer income sustainability.