

Mustards and Soil Health

Before we talk about mustards and soil health we must first define what mustard(s) and soil health are.

The definition of soil health is elusive and exhaustive from literature resources. In the old days it was called soil quality where it referred to the chemical, physical, and biological properties of the soil. I have read numerous definitions of soil health, so I will paraphrase soil health the best I can:

Soil Health—*is the current and continued beneficial capacity of the soil's physical, chemical, and biological properties to function as a vital living ecosystem that sustains plant growth vital for animal and human health—for today and for future generations. Soil health is heavily dependent upon its organic matter content and quality.*

Mustards are from the Cruciferae Family that have compounds loaded with sulfur. Most mustards are sulfur rich. That is why most mustards are yellow (some are blue or white). Mustards are used as a cover crop for their natural pesticide abilities through sulfur and through compounds called glucosinolates. When mowed and tilled into the soil as green material, mustards provide a good recycling of nitrogen, phosphorus, potassium, and sulfur, as well as nature's pesticide in the form of glucosinolates. If tilled in at a later date when yellow flowers have fully formed, the quantity of those compounds starts declining. (I refer to this in the cover crop section). Mustards are one of a few species that can extract phosphorus from soils even at very low soil P levels and then fix this P into their organic matter system that can be recycled later.

The mustard I use is Pacific Gold. It is a PVP variety bred by University of Idaho Plant Scientists' (Jack Brown, Jim Davis, et.al.). It is fast growing. You can plant this variety on August 10th in eastern Idaho at elevation 4,400 feet and by October 10th have 3-5 tons of biomass.

So let's get to soil health.

Soil health is directly related to its active organic matter content and the number of beneficial biological organisms that it supports. Soil health has a much higher population of beneficials to parasite ratio. The higher a soil health content, the higher that a soil can ward off plant diseases and parasites. This is why I called soil health an ecosystem of itself. It functions. Mustards can aid in soil health by reducing parasite potential and increasing beneficials through decomposition of freshly added organic matter.

In a speech I gave 25 years ago (1990), I said a soil was either healthy, diseased, or somewhere in between. It is either suppressive or regressive. My dad, John P Taberna (Soil Scientist), stated also at that time that we were creating designer diseases and designer weeds. The lesser the soil health, the more products (pesticides and fertilizers) we would need to keep the crops alive and healthy for higher yields.

Soil health can be evaluated in many ways. Here I will list a few:

1. Earthworm counts. Earthworms are a sign of healthy organic matter in the soil.
2. Soil respiration. The carbon dioxide levels gives an idea of microbial activity.
3. Wind or water erosion potential or observations. Wind and water erosion are detrimental.
4. Beneficial Nematode counts. Harry Kreeft at Western Labs counts these populations.
5. Plant parasitic nematode counts as related to beneficial nematodes (Western Labs service).

6. Soil organic matter content and quality
7. The amount of conventional inputs needed to raise a crop. If excessive, then poorer soil health.
8. Chemistry quality such as pH, NPK, salts, percent lime.
9. Physics quality such as soil plasticity, water infiltration; percent sand, silt, clay. So forth.
10. Root Health. Are they fibrous and extensive?
11. Compaction
12. Many more.

Pacific Gold is known to have deep root systems when plants have reached just 10-inches tall. When plants reach 2 feet tall, root systems are very fibrous and can be down to three feet deep. It is well known that water infiltration and water uniformity increases on silt loam soils following Pacific Gold. It is also known and observed that wind erosion is greatly decreased on sands following Pacific Gold.

Pacific Gold aids in nutrient capture and nutrient recycling. Pacific Gold's deep roots can gather nitrates down to 3 feet or deeper, thus reducing nitrate leaching potential.

Pacific Gold aids in soil health in several ways:

1. Nutrient Recycling
2. Disease and weed suppression
3. Organic Matter additions
4. Improved soil infiltration in compaction soil types
5. Reduced wind erosion

In general, Pacific Gold, an oriental mustard, improves soil health and earth health by sequestering atmospheric carbon dioxide, mobilizing NPKS into the plant system and recycled later to crops, improving soil water conditions, increasing microbial food sources from the organic matter compounds, and adding organic matter for other soil organisms such as earthworms.

No need to re-invent the wheel. I have included two sources of materials on soil biology, and one research material done using cover crops in Fort Hall, Idaho.

The first is the **Soil Biology Primer** written by Dr. Elaine R. Ingham. She is probably the guru in soil health that started sparking interest in soil biology in the 1980s through her system called the Soil Food Web.

The second is an extensive, but easy to read booklet on soil biology by Cornell University.

The third is the research project that we called the **Fort Hall Green Manure Project**. This project involved mustards, radishes, soil health, and the economics for potatoes grown in Fort Hall. It was published in 2003, but involved work done in 2000-2003. The investigative parties involved were the Shoshone-Bannock Tribes, USDA-NRCS Fort Hall, University of Idaho, Agricultural Resource Management Fort Hall, Fort Hall Lease Holders Association, Northwest Coalition for Alternatives to Pesticides, USDA-NRCS Three Rivers RC&D, Western Ag Research, Cedar Farms, and Western Laboratories.

In the Fort Hall Green Manure Project, we show results of not only crop yields and quality, but also on soil biology and soil health as related to conventional practices and those practices following radishes and mustards.