

**Healthy Soil is Essential to Farming's Success**  
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Farmers have had to contend with increased pressures. Due to international politics, market have vanished. Production costs have increased to say nothing of increased weather variability. According to a 2019 report, the USDA states that some US regions run the risk of draught every 3 – 5 years. In addition, some of these same regions run the risk of spring flood that washes away valuable topsoil.

One trend that has been successful is the increased use of chemical insecticides, fungicides, and fumigants; however, these chemical agents destroy the soil's natural biological life. According to Dr. Barack at the University of Wisconsin – Madison, he has seen the soil age 5,000 years in 30 years due to the use of chemical agents and fertilizers. We fix one problem with our limited knowledge or outlook and cause others (the law of unintended consequences).

According to the same USDA report (Agricultural Resources and Environmental Indicators, 2019), 55% of rivers and streams, 71% of lakes, and 84% of bays and estuaries have impacted water quality. Agricultural chemicals are deemed as the second largest contributor. In spite of the increased use of chemicals, farm production peaked in 2015 and has drifted down since. Given the approaches and science applied, we reached the laws of diminishing returns.

Excess pest control residue and excess fertilizer run off the soil and end up in our water supplies as we see in the above statistics. Cumulatively, the annual late summer/fall expansion of the Dead Zone in the Gulf of Mexico is the worst example of water contamination by farm chemicals.

Other than university research projects, there are some farmers taking a Healthy Soil approach or the soil is a teeming mass of bioactivity and an ecosystem that contributes to the health of the environment and life on earth. We are also missing the point that central and western regions of the US have a coming water crisis, and some farmers can be left "high and dry". Water usage is far beyond annual rainfall; aquifers are taxed; allocations and litigations are common. It is time to accept the fact that soil is more than a growing medium and is a teeming mass of regenerative life that cleans and replaces the air we breathe and contributes to the water we need for crops and other life-giving purposes.

The Soil Food Web at Oregon State University took an acre of Healthy Soil and measured its contents six inches deep and compared its contents against a six-inch acre of Depleted Soil. The weight of each mass was 2-million pounds; however, the presence of life was dramatically different:

<u>Life Form</u>	<u>Healthy Soil</u>	<u>Depleted Soil</u>
- Bacteria	2,600 pounds	< 500 pounds

- Actinobacteria	1,300 pounds	< 300 pounds
- Fungi	2,600 pounds	<1,000 pounds
- Algae	90 pounds	<90 to 200> pounds
- Protozoa	90 pounds	<50 pounds
- Nematodes	45 pounds	>100 pounds
- Earthworms	445 pounds	<50 pounds
- Insects/arthropods	830 pounds	<200 pounds

This comparison shows what can happen when soil isn't managed and is abused with an abundance of modern chemical inputs. Microbes allow the soil to hold water and maintain its nutritional balance. Chemical fertilizers and pest controls kill the soil's natural organisms, interrupt the organic matter cycle (OM Cycle), rob the soil of its nutritional balance, and water regulation abilities. The results show up in the USDA data. Yields per acre are flat to down and water and fertilizer usage are up. More input is needed for the same or less output; the world is trying to achieve the opposite. (Please see my article on Healthy Soil.)

Microbes unlock soil nutrients like nitrogen, aluminum, iron, carbon, and phosphorous not readily available for plant metabolism. If nutrients are more readily available, less amounts are needed. Soil microbes build highways to efficiently transport and store moisture, gases and nutrients. They help decay organic matter and convert it into nutrient forms that plants can use. Long-term, microbes will help increase carbon content, organic matter, and soil stability. And, according to Dr. Clapperton of Montana State, microbes help the soil mediate soil temperature and moisture – retain moisture during dry hot times and release water when it is cooler or plenty of water or rain is available.

Microbes, a delicate form of life, are essential to the healthy soil mass. Microbes produce glomalin (soil glue) that create needed soil aggregates essential for nutrient exchange and water circulation. Hence, they reduce ponding and runoff. Water remains in the soil mass. Without the subsurface paths created by glomalin, crops require more fertilizer for the same yield. These soil aggregates are a storehouse of soil carbon where slow-acting microbes reside.

Microbes also create plant fine root hairs that more efficiently grab nutrients and require less carbon. Microbes also unlock the soil's chemical bonds on N, P, and S making them more readily available for plant metabolism. In multi-crop situations, microbes can help transfer N and other nutrients from legume root systems to root systems of non-legumes.

We know that erosion and runoff are annual issues. A 2019 USDA reports claims 70% of a fertilizer application is utilized by a crop; the rest remains in the soil or runoff into streams and rivers and plays havoc with fish and water supplies downstream. We see what the accumulation can do by the expanding of the "Dead Zone" in the Gulf of Mexico every late summer. The OM level in the soil increases its holding capacity with every percentage point increase. A 2% OM level holds 32,000 gallons of water and 5% OM holds 80,000 gallons. At 8% we have 128,000 gallons of water content. We lose billions of tons of soil every year through erosion because the soil lacks organic matter.

How long would it take to increase OM by 2%? For forage crops, it would be the fastest. It would take about 5 years. For other crops, it would depend on the amount of the crop harvested (the residue of the plants left in the field), or the amount of the crop left to recycle in the field. You can understand why no-till farming is gaining interest.

BIOMAX Soil Enhancer with SumaGrow™ offers a solution to the increased use of chemicals. Applying our formula of microbes and fungi at planting or beginning of the growing season requires that fertilizer application be reduced by 50%. The synthetic fertilizer kills the microbes, so less fertilizer is required because the microbes make the nutrition more readily available to the plants. Pest and fungicide applications (kill soil microbes) must be applied two weeks before microbe application. The results include at least a 10% yield increase as well as crop quality improvement – enhanced nutritional content. Vegetables and fruit are more flavorful, and flavor is the mark of nutritional content. It translates to more money per unit of crop yield. Chemical runoff is reduced as well as an improved local water supply. BIOMAX is cheaper than the fertilizer replaced.

I would love the opportunity to carry on our discussion. I can be reached at [jim.mcclain1842@sbcglobal.net](mailto:jim.mcclain1842@sbcglobal.net) or you can reach me at 714-728-0376. Thank you, Jim