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SOILS AT GUELPH

The Nitty Gritty on soil biology

What has changed? We now understand that organisms play a key role in how nutrients become available to plants, are stored within the soil, and are lost to the environment.

Not sure if the Nitty Gritty Dirt Band had soil biology on their mind as they decided on a name, but when they were busy 'Fishin' in the Dark' a few decades back the concept of soil 'health' in agriculture was mostly an unheard-of idea. Soil was something to improve (aka through its tilth and drainage), to conserve (aka by reducing erosion), or to work (aka by tillage). So why are we talking about its 'health' now?

The quick answer is that the soil is more alive than we previously thought. Improvements in molecular biology techniques have allowed us to see that soil is teeming with organisms. We now understand that organisms play a key role in how nutrients become available to plants, are stored within the soil, and are lost to the environment. Soil organisms also impact soil structure and function. With all this LIFE in the soil, it's no wonder we are talking about the soil's health.

In a series of case studies by Soils At Guelph, growers and advisors explore concepts related to soil "health" agriculture from four different perspectives – 1) Soil Carbon, 2) Soil Biology and Agriculture, 3) Soil Health, and 4) Using and Losing Soil Nitrogen in Agriculture.

For example, the Soil Biology and Agriculture Case Study looks at how grower Bob Kerr of Kerr Farms has changed his thinking on soil biology over the last 54 cropping seasons. In the 1990s, he became interested in cover crops and soil building. Then in 2000, he transitioned some of his farm's acres to organic production because the economics were favourable.

Photo- Bob Kerr

"When you are organic, you are depending on the soil's biology," notes Kerr. Microbes can help with pest control, competing with or attacking harmful organisms before they reach a crop. But it's a learning curve.

In the early days of his soil biology explorations, Kerr's tomato crop was struck by late blight and he had to make tough decisions. While that season was not ideal, he learned the importance of having various practices to simultaneously promote beneficial soil microbes.

Kerr continues to conduct his own trials and experiments with various biological approaches, comparing business as usual with different combinations of biological programs, evaluating the

impact on food quality and input costs. He is also experimenting with laser weeding technology.

So, what do we know about soil biology and plant health?

Firstly, plants need microbes because microbes cycle energy and nutrients. All soil microbes need nutrient-containing molecules from the soil to obtain energy. Once consumed, nutrients remain within the body of the microbe – which is when we say that nutrients are 'immobilized'. However, once released or excreted by the microbes, the nutrients are considered 'mineralized'. Mineralized, nutrient-rich molecules are available for plants to use.

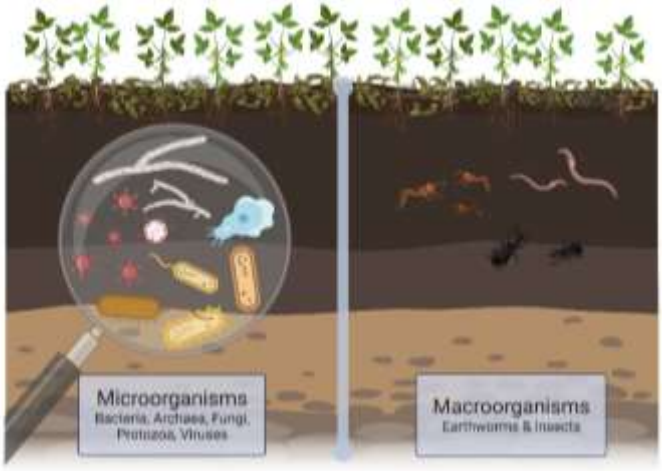

Figure shows different types of soil micro- and macro-organisms.

Secondly, soil microbes release gluey substances that help to create stable and porous soil aggregation. Porous and stable soils provide a good environment for root growth, so roots have easier access to moisture and nutrients in the soil's profile.

Finally, when it comes to soil microbes, is the goal to have more? Not necessarily – imagine if the microbes are pathogenic. The goal is to have functional redundancy, which means you need to support a team of microbes so that a crop stays healthy despite pressure from pathogens, drought, or excess moisture.

If conditions wipe out one type of microbe, functional redundancy ensures there is another microbe ready to step in to keep supporting the soil's ability to support the plant's needs. *

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