

Bacteria and Fungi: Essential Organisms for Life as We Know It.

Yes, I know, certain bacteria and fungi can cause disease, both in animals and plants, and it is these detrimental aspects we normally think of first. But there are also many species of beneficial bacteria and fungi that we very much need and want to keep healthy. We have all seen the ads that tout the beneficial effects of bacteria (although the ads never use that word) in the proper functioning of our digestive systems.

We all know that the ultimate source of everything we eat is plants, either because we eat them directly, or indirectly when we eat animals.

While the great majority of the mass of a plant comes from the carbon dioxide in the air and the water in the soil, there are certain other essential nutrients that plants need in order to grow and reproduce. The three nutrients needed in largest amounts are nitrogen, phosphorus and potassium, and fungi and bacteria play critical roles in providing the plants with these nutrients.

Most all plants grow very thin “root hairs”, almost microscopic feeder roots, along the surface of larger roots and this is where most of the water and nutrients are taken up by the plant. Most plants are aided in this process by microscopic fungal threads or filaments covering the surface of the root hairs. These associations of root hairs and fungi are called mycorrhiza. The fungal filaments provide an enormous surface area which absorbs water and inorganic ions, especially phosphate, and some of the water and ions are transferred to the root hairs. The fungi obtain sugars and starches from the plant’s root hairs in exchange for the service they provide.

Nitrogen is the most commonly deficient nutrient in the soil and the one needed in greatest amounts by the plants. Elemental nitrogen, (N_2) in the air or in the soil is not a form that plants can use; plants need nitrogen in the form of nitrates or ammonium ions, and this is where bacteria come into the picture.

Healthy, fertile soil contains bacteria, along with other micro-organisms as well as larger species such as nematodes, earthworms, beetles, ants and other insects, and decomposing organic matter called “humus”. Healthy soil also contains water, oxygen and elemental nitrogen.

There are three types of bacteria in healthy soil that convert elemental nitrogen into nitrate and ammonium ions which the plants can take up and use. Nitrogen-fixing bacteria convert elemental nitrogen into ammonium ions. Ammonifying bacteria convert organic matter from decaying plant and animal tissues into ammonium ions also. Plants can take up ammonium ions, but do much better with nitrates, and there is a bacterium, nitrifying bacteria, that convert most of the ammonium ions to nitrate ions. Thus the

plants get the nitrogen they need to make proteins, DNA, enzymes and even chlorophyll.

Some types of plants, specifically legumes, naturally have nodules (small round growths) on their roots that actually have nitrogen-fixing bacteria living inside the plant. The bacteria get carbohydrates from the plant and the plant gets ammonium ions from the bacteria. (See my column on legumes back in February 28, 2013 on my website.)

Since we and all other animals can't make amino acids, the building blocks of proteins, from ammonium ions or nitrate ions or elemental nitrogen, we have only two ways to get these essential nutritional components: either from plants directly or indirectly from eating animal material.

In humans world-wide, protein deficiency is one of the most common forms of malnutrition, partly because not all types of plants have enough protein containing all of the essential amino acids humans need. Strict vegetarians must eat a variety of plant materials in order to obtain all of the necessary amino acids, a difficult task for many people in some parts of the world.

The protein content of plants depends on the nitrogen availability in the soil, and commercial inorganic fertilizers containing nitrates have helped to produce more nutritious food, worldwide. But inorganic fertilizers have environmental issues during production and can be leached out of the soil into the water table and into creeks and streams. Recycled organic material containing nitrogen from vegetative sources is better overall for the land and soil fertility.

Newer, better, farming methods may be the ultimate solution, and keeping our soil organisms healthy is a place to start.

Until next time...

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