

# THE ELEMENTS FOR SUCCESS

## Beneficial Microbes The Living Element for Success

Plants serve as hosts to a vast array of microscopic organisms during their life cycle. These behind the scenes dynamos interact with the plant from the time a seed lands in the dirt or growing media, until the final remnants of the dead plant decomposes. Microorganisms are crucial to the varied eco-systems on this planet and play a vital role in the health and vigor of higher plants.

Microbes bring life to your indoor garden or hydroponic system, providing vitamins, hormones, antibodies, enzymes for chelating key nutrients, and organic acids required for plant growth. Microbes liberate mineral elements through decomposition of organic matter, feed plants directly with metabolites and aid in nitrogen fixation. They also produce compounds that stimulate natural defense mechanisms in plants to prevent or combat disease.

There are four main types of microorganisms that live naturally in symbiotic relationships with plants, each playing indispensable roles during various stages of growth and development.

**Algae** - These microflora decompose organic residues, converting them into plant nutrients and other useful compounds. Blue-green algae, also known as cyanobacteria, also extract nitrogen from the air, transforming it into compounds eventually useable by higher plants.

**Fungi** - The majority of fungal species, such as *Trichoderma* spp. and *Cellulosic* spp., actually benefit higher plants, although some species, such as *pythium* and *botrytis* cause disease. Fungi help higher plants absorb nutrients and protect against disease pathogens by increasing surface area with fibrous, fungal microstrands attached directly to plant roots. Field trials show that mycorrhizae, a form of root fungi, suppress nematode infestations and dramatically improve the efficiency of nitrogen and phosphorus uptake while protecting plant roots from pathogen assault. All fungi are aerobic (require oxygen) and tolerant of pH variations.

**Bacteria** - These microbes are the simplest and smallest form of life, and the most numerous. Since bacteria reproduce by dividing, they have an un-limited potential to increase in numbers given that food, competition and environmental conditions are favorable. Bacteria are highly versatile and colonies can survive under extreme environmental conditions. Bacteria cells also function and multiply in a wide pH range from 4 to 9, but certainly do best at 6 to 8.5. Like fungi, bacteria attack and digest organic compounds, proteins, sugars, fats, oils, cellulose and other carbonaceous compounds. Bacteria compete, excluding disease causing pathogens, and produce important hormones, organic acids and enzymes used by plants. Mycorrhizae are also assisted and their activities enhanced in the presence of certain bacteria.

**Actinomycetes** - This specialized group of bacteria, are extremely efficient in breaking down complex organic compounds and releasing nitrogen. Actinomycetes also produce valuable antibiotics to guard against disease. These microbes are responsible for the "earthy" smell of compost and healthy soils.

**Protozoa** - These unicellular microfauna are the simplest form of animal life. Like their microscopic flora brethren, protozoa decompose organic materials. Protozoa are also micropredators, regulating the size of bacterial populations and releasing nutrients from digested cells.

**Mixed microbe systems most effective** - Hydroponic and indoor gardens will see the most benefit from a hearty mixed microbe colony. A proficient mix should include saprophytic microbes, which live on dead or decaying organic matter, and serve as a biological buffer zone preventing disease pathogens from entering the host plant. Saprophytic bacteria such as *Bacillus subtilis*, consisting of 90+ subspecies, produce antibodies against the pathogens *R. Solani* and *Fusarium* spp., while secreting growth-promoting metabolites for improved root development. Research with *B. subtilis* also demonstrates effective control of early and late blight, gray mold, bacterial spot, downy and powdery mildew and sclerotinia. *Bacillus megatarium* liberate phosphorus from rock phosphate and other bound forms into a plant usable form.

*Azotobacter*, another advantageous microbe, produce antibiotics that ward off *fusarium* and other diseases, and also produce growth-promoting metabolites. And, *Agrobacterium* demonstrate a propensity to antagonize crown gall. *Nitrobacter*, *Nitrosomonas*, and *Nitrosococcus* are also helpful in hydroponic systems for their ability to oxidize nitrogen compounds into plant useable forms and fix CO<sub>2</sub> to fulfill energy and carbon needs. Disease pathogens find it hard to establish a foothold where healthy beneficial microbial colonies create high competition, coupled with antibiotic secretions and direct parasitism.

And, in organic systems, microbes are absolutely required to free plant nutrients (mineralization) from the growing media. Microbes also produce cementing compounds that improve media structure and aggregation and increase water holding capacity.

Microbes bring not only life, but add balance to your plant environment. Coupled with comfortable temperatures, humidity and light, suitable nutrition and quality water, microorganisms improve plant growth, enhance flower and fruit quality and increase yields. Is this living element for success missing from your growing system?

### Want more information?

Jackson, William R. PhD. *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*. Evergreen, CO: Jackson Research Center, 1993.

Soil Foodweb, Inc. [www.soilfoodweb.com](http://www.soilfoodweb.com)

National Sustainable Ag Information Service. [www.attra.com](http://www.attra.com)

Thomas, Luther. *Bioponics - The Application of Organic Gardening to Hydroponics*. The Growing Edge Magazine. Corvallis, OR: New Moon Publishing.

Zuberer, David A. *Soil Microbiology FAQ's*.

<http://organiclifestyles.tamu.edu/soil/microbeindex.html>

Beneficial Microbes Associated with Phaseolus Plants.

[www.agron.iastate.edu/plantscience/Beneficial\\_microbes.htm](http://www.agron.iastate.edu/plantscience/Beneficial_microbes.htm)

Alexander, Martin. *Introduction to Soil Microbiology*, 2nd ed. Malabar, FL: Krieger Publishing Company, 1991.

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