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## **SOIL FERTILITY VS. ENVIRONMENTAL STRESS**



**CASE STUDIES IN  
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**"HUMIFIED"  
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**VITAMIN D:  
HOW MUCH  
DO YOU NEED?**

## ***The Topsoil Revolution***

Biotic Fertilizers for Natural Soil Health

by John Marler



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# The Topsoil Revolution

## Biotic Fertilizers for Natural Soil Health

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Natural soil fertility is an organic phenomenon that is the result of soil microorganisms. Developments over the past 20 years in microbiological science have led to astonishing realizations and stunning new conclusions about soil life and its role. Natural soil fertility can be increased in any topsoil by growing large populations of living soil microorganisms. We are now learning how to use focused organic nutrients to efficiently and economically create and recreate such fertility. These understandings have been enabled by an ever-increasing body of work by soil scientists and microbiologists. Worldwide, their knowledge in this field doubles in volume every 18 months, assuring incredible growth in this field for decades.

Biological or biotic fertilizers offer solutions for many of the woes of conventional fertility programs. Over the last 60 years of conventional fertility programs based on synthetic inorganic nitrogen, growers have increasingly come to understand the limitations and downside of these programs. We are now entering an era of soil sustainability that will see topsoils remediated and rejuvenated, along with better crops, better nutrient density in crops, and less overall toxicity. As a result of work done over the last decade, agriculture is entering an age of natural soil fertility. Growers can now, at will, rebuild natural fertility nutrients in the top 6 inches of soil that exchanges air with the atmosphere the topsoil.

How does nature create naturally fertile soils, and how can we create and recreate natural fertility in any soil? These questions have challenged farmers for thousands of years. Some soil researchers now believe the answers are really not very complicated. Everywhere on Earth, in all soils, natural soil fertility is the result of an expansion of populations of soil microorganisms, primarily bacteria, resident in the topsoil. Soil scientists such as Dr. Elaine Ingham of Soil Foodweb Inc. and Dr. Mike Amaranthus of Mycorrhizal Applications have estimated that the living

population of soil microbes in an acre of topsoil could easily total 4 to 5 tons.

Bacteria, the predominant occupants in the soil, are almost pure protein - every single soil bacterium is, in fact, a tiny bag of nature's Perfect Blend of fertilizer. Every bacterium contains a complete complement of elemental nutrients in an ionic molecular form. Plants can easily uptake and use these forms of chelated elemental minerals. After a short lifespan, soil bacteria die, and their remains and waste are incorporated into the molecular structure of soil acids.

Expanding an average of 4-5 tons of soil microbes an acre by only 10 percent would add 1,000 pounds of soil microbes to an acre of topsoil - and a thousand pounds of some types of soil bacteria can contain about 100 to 140 pounds of nitrogen, 30 pounds of phosphorus, 10 pounds of potassium, 10 pounds of sulfur, 5 pounds of calcium, 5 pounds of magnesium, 2 pounds of iron, and proportionate trace minerals. These natural formulations of elemental minerals are all of the nutrients necessary for healthy plant growth, as well as being balanced in the proper proportions for achieving this growth.

Bacteria, like all living things, have preferences in foods and an instinctive appreciation for the correct foods that will allow them to thrive and reproduce. They are able to grow at an exceedingly fast rate, doubling in number every 15 minutes to an hour. If a single bacterium could be provided infinite nutrients and the proper conditions for reproduction, then it and its offspring could outweigh the entire planet Earth within only 72 hours.

Growing a ton of bacteria in an acre of soil is thus a relatively simple task, given the right nutrients and adequate moisture. Creating natural fertility in any soil, be it sand or hardpan, ultimately requires providing soil microorganisms with nutrients that are targeted for the specific purpose of expanding their populations. Ultimately, all the nutrients in bacteria and their waste

end up in the topsoil as a stable soil acid, and the soil acids which result from the growth of soil microbes are nature's perfect plant food. The trans-cellular abilities of soil acids enable them to enter plant roots upon contact, carrying with them a full complement of ionic nutrients that plants can immediately use.

Biotic fertilizers accelerate soil bacteria growth, and the growth of other soil microbes, by not only providing nutrients, but also by providing a base level of nutrition that allows the microbes to efficiently utilize other nutrient sources in the soil. Dropped leaves, dead plant roots, crop detritus and other forms of waste, cellulose and lignin are all scavenged nutrients used by soil microbes to accelerate their populations. In addition to increasing the utilization of other carbon sources, biotic fertilizers facilitate and accelerate photosynthesis and the extraction and use of atmospheric nitrogen by cyanobacteria. Cyanobacteria are omnipresent in the top 1 inch of topsoil and are often visible as a green patch on the surface of soils. Providing their colonies with focused nutrients enables them to convert sunlight into complex sugars and atmospheric N<sub>2</sub>, nitrogen gas, into vital organic nitrogen. Pioneer growers who have used this new science in commercial applications have discovered that biotic fertilizers are able to grow excellent crops, superior to those grown with conventional fertilizers.

Nature has provided plants with growing programs that are as old as the Earth and much more effective than anything ever conceived by man, but finding naturally occurring fertile soils has become increasingly difficult. The last large area of naturally fertile soils in the United States was found in Alaska in the early 1900s. Old photos show incredible crops grown without any fertilizers. Today, growers around the world have been quietly astounded at the remarkable ability of biotic fertilizers to grow crops to their full genetic potential. Even more impressive to growers has been the ability of these fertilizers to amend and build soil organic matter in the soil in the form of nutrient-rich soil acids. At the same time, growing crops to their full genetic potential. Now, scientists have unlocked the simple code of reproducing natural soil fertility economically and quickly in any soil, meaning that any soil can be transformed into a rich, sandy loam with a program of focused biotic nutrients and moisture.

Applications of this science are already well advanced and proven. The first wave of developed biological fertilizers has been applied on over 78,000 acres of commercial agriculture crops with stunning success in six countries around the world. Commercial applications and trials in the US, the UK, Mexico, Canada, Saudi Arabia and Israel with over 80 types of crops, ranging from stone fruit, citrus fruit, grapes, cereal grains, cole crops, tubers, legumes, melons, nuts, avocados, dates, bananas, and many other food crops have proven that yields, quality, and nutrient density based on natural soil fertility are almost always superior to that provided by conventional, synthetic nitrogen formulation fertilizers. One Israeli agronomist confronted by a squash grown with biotic fertility refused to believe that it had not been "waxed" to improve its appearance. He described it as having a sheen and glow that he had never seen before in any vegetable. Such comments are not unusual in describing any crop grown with natural fertility, as only complex natural fertility can promote a plant's full genetic expression.

In future articles for Acres U.S.A. we will take a detailed look at biotic fertilizers and the new science of biological fertility - and that's just the opening act. Fueled by increasing biological soil science knowledge, new biotic fertility programs are emerging as powerful, readily applicable technologies. With soil knowledge doubling every 18 months, the topsoil revolution will accelerate at an even faster pace.

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# Benefits of Biotic Fertilizers

*Full genetic potential:* Crops grown with the steady nutrition provided by the complex ionic nutrients contained in soil acids are usually superior in appearance, size and nutrient density to crops grown with conventional fertility formulations. Equal or greater yields: Biotic fertilizers have equaled or excelled in crop yields when compared with conventional fertility programs in both organic and NPK + biotics formulations.

*Cost:* Biotic fertilizer costs are equal to, or less than, costs associated with conventional fertilizers. When oil prices and natural gas prices increase, the cost of conventional fertilizers increases, but the cost of biotic fertilizers stays relatively stable.

*An end to arable soil erosion and loss of topsoil:* Conventional fertilizers are easily over applied. The result is an imbalance in the carbon: nitrogen ratio in a soil, which accelerates the loss of topsoil. Biotic fertilizers work in a natural manner to rebuild soil acids and soil acid gels that act to hold topsoil in place.

*Soil remediation:* Biotic fertilizers have the ability to grow a crop to its full genetic potential while remediating and building soil organic matter, in the form of complex nutrition soil acids.

*Less toxicity:* Biotic fertilizers come in both organic and non-organic forms. While organic forms are naturally less toxic, even the non-organic forms have been shown to require less use of pesticides and fungicides. As a result, conventional fertility programs fortified with biotic fertilizers are not only less toxic, but also have lower costs normally associated with pesticide and fungicide applications.

*Less crop attack by pests:* Organic growers have noted that organic crops experience fewer attacks by pests when compared to crops fertilized with conventional fertilizers. Biotically fertilized crops, particularly those grown with USDA National Organic Program fertilizers, typically exhibit little attraction for insects. Nature has a means for protecting healthy plants from insects, and biotic fertilizers enable these protective mechanisms.

*Less fungal attack and disease:* Biotically fertilized crops have repeatedly shown an ability to resist fungal attack and plant disease. Growers with many different crops in diverse regions have reported that the incidence of powdery mildew, fungus, and other specialized fungal attacks, such as club root in cole crops, are diminished by the use of biotic fertilizers. The mechanism behind this ability is suspected to be the chelated forms of natural elemental fungicides, such as copper, magnesium and zinc that are contained in the biotic formulations.