

The Biotic Fertility Revolution

By John B. Marler
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THE BIOTIC GROWING REVOLUTION

Biotic fertilizers are a breakthrough innovation in agriculture that will surpass the technologies of the Green Revolution of the late 1940's. The basis of the Green Revolution was chemical science that originated in the mid 19th century and expanded in the early 20th century. Biotic fertility is the result of microbiology science that is less than 15 years old. Biotic fertility uses a biological approach to agriculture that relies on the expansion of living microorganism populations that dwell in the top six inches of the soil in which the atmosphere can penetrate. By use of protein synthesis nutrients, specifically targeted to topsoil bacteria, biotic fertilizers accelerate the level of organic fertility in the soil. Large scale commercial applications have proven the superiority of biotic fertility over conventional fertilizer practice. Over 50,000 crop acres of successful biotic fertility since 2001 have proven biotic fertility theory. Biotic crop yields and quality meet or exceed conventional fertility. The biotic system mimics the best of natural fertility at a replenishment level superior to the slow natural cycles of nature. The following chart offers a quick introductory comparison between the two fertility systems.

Quick Comparison to Biotic Fertility to Conventional Fertility		
	BIOTIC FERTILITY	CONVENTIONAL FERTILITY
Yields	Excellent+	Excellent
Cost	Low	Low
Efficiency	High	Low
Sustainability	High	Low
Quality	Exceptional	Good
Brix	High	Low
Pesticides	None	Required
Fungicides	None	Required
Sustained Protein Synthesis	Yes	No
Environmental Impact		
Atmospheric Pollution	Reduces	Causes
Surface Erosion	Reduces	Causes
Sub-Surface Pollution	Reduces	Causes

Every Grower Must Grow Two Crops

Biotic fertility concepts require that a grower produce two crops. The first crop is an expanded population of topsoil microorganisms that provide the fertility for the second crop, which is the crop that a grower will harvest.

BIOTIC FERTILITY

Perfect Blend's biotic fertilizers are a result of in-house research and development. Perfect Blend Organics which has initiated manufacturing patent protection covering these products. The work undertaken by Perfect Blend has benefited from intensive world-wide biological research into the soil over the last 20 years by independent soil biologists.

For the past 150 years agronomists have viewed the soil as a chemical medium renewable by chemical applications. We now know the soil is a complex biological medium which is affected and stimulated by elemental chemicals but is actually more efficient when left to biological stimulus. Biotic fertilizers mimic natural topsoil fertility but act in a faster manner. They provide a pre-processed carbon nutrient that can build natural fertility in a manner that is more efficient than nature's annual cycles of material decomposition. In a temperate climate nature normally takes a decade to form an inch of topsoil. Biotic fertilizers are able to efficiently and quickly remediate and increase the natural fertility in poor and worn soils. They have demonstrated the ability to increase formation of natural fertility in sand which contains no other nutrients in a year while producing an income producing crop to its full genetic potential.

Biotic fertility uses waste manure from Confined Animal Feeding Operations (CAFO) as a Nitrogen feedstock. CAFO waste is currently a major source of environmental pollution that is available worldwide. Conventional Nitrogen fertility is a product of the use of hydrocarbons. The increased global cost of hydrocarbons is acting to consolidate and restrict the production of this fertility to "stranded gas" locations which require expensive transport costs to deliver it to growing areas. In addition, environmentalists are beginning to understand the global environmental expenses associated with conventional Nitrogen fertility. Some environmentalist activists have implicated Nitrogen fertility fertilizers as causes of major environmental problems. These problems include atmospheric pollution, ground and surface water pollution. Biotic fertilizers solve both the environmental problems associated with CAFO waste as well as providing cost efficient replacements for conventional Nitrogen fertilizers. Biotic fertilizers herald the entry of agriculture into an era of sustainable biological based farming on a commercial scale.

Biotic fertility has the potential to largely supplement or even replace existing chemical fertility practice. The reason for this change in fertility sources is simply stated. In addition to being superior to conventional fertility in all comparable agronomic factors biotic fertility is simply much more environmentally friendly than conventional practice.

Global Nitrogen Implications

Biotic fertility concepts will allow people around the world to use the waste generated by their own protein production as the Nitrogen source for growing their food. This shifts Nitrogen production dependence from a global hydrocarbon marketplace to a supply within a country or region. Disconnecting from the global nitrogen marketplace will empower growers of all levels from subsistence growers to large commercial enterprises with international markets.

TWO DECADES OF INTENSE BIOLOGICAL SOIL INVESTIGATION

In the past twenty years soil researchers have made remarkable progress in understanding the nature of the carbon components of the soil and the resulting natural fertility. Fertilizer developers at Perfect Blend Organics used this science to manufacture biotic fertilizers using the theory that high quality complex nutrients for topsoil microbes would result in an increase in protein synthesis. The high conversion efficiency of these complex water-soluble foods from nutrients into synthesized protein accelerates topsoil microorganism population growth enabled by protein synthesis. This growth is directly responsible for an increase in soil fertility. Perfect Blend Organics developed these fertilizers drawing on published research by soil scientists such as Dr. F. J. Stevenson, Dr. Jerzy Weber of the University of Wroclaw, and other members of the International Humics Substances Society.

NATURAL FERTILITY

Natural fertility results from two primary organic mechanisms. One is the decomposition of organic material that drives an increase in the population of soil microorganisms. The other is the microorganism driven chelation of soil elements converting elements into ionic forms that plants can use. Together these two primary mechanisms and a chain of other similar microbial driven reflexive synergistic actions are responsible for natural fertility.

Bacteria and other topsoil dwelling bacteria use the nutrients from organic decomposed substances to increase populations of topsoil microorganisms. Organic nutrients feed soil microbes which use the nutrition to for expanded protein synthesis. When the expanded population expires organic nutrients from their bodies are left in the soil and immediately available for use by crops. This natural fertility is result of air-breathing organisms living in the top six inches of the soil where the atmosphere can penetrate. Agronomists can usually identify natural fertility by both the level of productivity and the darker color of the soil. Both these factors are a function of soil acids. Soil acids, the foundation of soil fertility are humic substances

formed as pigmented polymers. These complex carbon structures contain all of the nutrients required by a crop to grow to its full genetic potential. These two actions result in the incorporation of nutritional elements into soil acids and other organic structures. Topsoil microbes, principally bacteria, store the nutrients from decomposition as soil acids. Anything organic that dies on the surface of the soil will ultimately deteriorate into a soil acid. Unfortunately for growers, nature can take decades or centuries to develop or replenish natural fertility. It was the dual challenge of re-creating natural fertility and doing so in an accelerated manner that drove the research and development of biotic fertilizers.

BIOTIC FERTILITY DEFINED

Biotic fertility is the use of living (biotic) topsoil microorganisms to increase soil fertility. Soil microorganism protein synthesis is the basis of natural soil fertility. While many different soil microorganisms are involved in the biotic fertility cycle we believe the primary microorganism enabling biotic fertility to be cyanobacteria (blue-green algae). Many cyanobacteria fix dinitrogen (N₂) atmospheric nitrogen under aerobic conditions providing their own primary nutrient (Nitrogen) for the protein synthesis when provided balanced biotic fertility nutrients. Cyanobacteria prokaryotes belong to the Bacteria domain and have the ability to perform oxygenic photosynthesis as well as produce pigments which correlate to the pigmented nature of fertile soil.

Topsoil microbes have balanced structures that contain every nutrient necessary for plant growth. They are high in protein. Topsoil bacteria contain, on average, about 90% protein. This means that they contain, by dry weight, about 14% Nitrogen. When growers apply efficient bulk nutrients tuned to the needs of topsoil bacteria the reflexive response is to enlarge their populations. When provided with the correct nutrients their populations are capable of very high speed reproduction. In essence, the bacteria population “blooms” adding large quantities of chelated nutrients to the soil in a single event. In addition to the contained Nitrogen levels in topsoil bacteria are levels of other elemental nutrients essential to plant growth.

Elemental composition of bacteria			
Nitrogen	14%	Hydrogen	8.0%
Phosphorus	3.0%	Sulfur	1.0%
Potassium	1.0%	Magnesium	0.5%
Calcium	0.5%	Iron	0.2%

SOURCE OF BIOTIC FERTILITY

According to soil micro-biologists such as Drs. Elaine and Russ Ingham of Soilfood Web, Inc., Dr. Mike Amaranthus of Mycorrhizal Applications, Inc. and others an acre of healthy topsoil may contain about four to five tons of living microorganisms. This includes about a ton of bacteria, over a ton of fungus, and two to three tons of other microbes including blue-green algae, protozoa, nematodes, actinobacteria, and other microorganisms. By increasing this population a grower increases the amount of biotic, or living, fertility due to the protein levels in these microbes. Independent laboratory testing has proven the ability of biotic fertilizers to rapidly increase populations of soil microorganisms. This increase naturally results in an increase in soil fertility.

The acceptability and conversion efficiency of a biotic fertilizer from a solid nutrient into an increase in protein synthesis is the result of providing topsoil bacteria with nutrients in a form that they can and will readily use in reproduction and expansion of their populations. A microbial food that is high in acceptability and convertibility is essential to enhanced biotic fertility. Topsoil microbial nutrition reproduction requirements are sensitive to a number of physical factors important to the success or failure of a fertilizer. Biotic fertilizers differ from other organic nutrients in their high degree of solubility and careful focus on nutrient conversion. Ordinary organic nutrients without the solubility of a biotic fertilizer and immediate suitability for

conversion must first undergo significant bacterial and fungal decomposition prior event to entry of their contained nutrients into the topsoil. Due to this loss of nutrients, and frequently poor levels of nutrients to begin with, the conversion ratio of most organic nutrients into accelerated microorganism protein synthesis is poor. Often this decomposition occurs on the “O” Horizon of the soil, the top surface of the soil, where a large amount of the nutrients are lost to microbial driven volatilization of nutrients resulting in the entry of CO₂, methane, ammonia, and other gases into the atmosphere.

Immediate suitability of conversion is another factor in differentiating biotic fertilizers from other organic soil amendments. Biotic fertilizers must be “tuned” to a level of high suitability and immediate and rapid consumption by topsoil bacteria and other topsoil dwelling microorganisms. Factors important to this understanding include size, nutrient balance, pH, homogenous nature, levels of chelation, and quality of the retained nutrient values after processing. Rapid computer monitored algorithmic adjustments are typically used to achieve these goals during the manufacturing process.

Large scale commercial applications of biotic fertilizers for both organic and non-organic conventional crops have proven the concepts of biotic protein synthesis fertility. Biotic fertility has been widely observed to be effective in growing crops to their full genetic potential while at the same time building carbon and elemental content in the soil. The benefits of biotic fertility include completely sustainable soils, increased levels of chelated elements that plants can immediately use, increased moisture retention in topsoil, and a steady source of organic based nutrients for crops.

60 Years of Conventional Fertility – Discontinued !

Johnson Agripriises, LLC is a 4th generation family owned farm in Eastern Washington. Last year their prize winning 1,800 acre potato crop was grown with biotic fertility. After using conventional fertility programs for almost 60 years, the Johnsons now rely on biotic fertilizers to provide them with “an assured source of fertility” that they apply in the fall. Their fall 2007 potato crop was superior in yield, solids, acceptability, and all other factors than the crops they previously grew with conventional fertility. In addition, the Johnsons use less pesticide and less fungicide than they previously used in their conventional programs. According to their farm manager incidents of black and white fungus has become rare instead of common.

BENEFITS OF BIOTIC FERTILITY

Biotic fertility programs have demonstrated the ability to produce yields and quality of crops equal to or greater than conventional fertility programs. Unlike many conventional programs, biotic fertility does not subject crops to the protein synthesis – proteolysis switch described by Francis Chaboussou in his book Healthy Crops. Biotic fertility has lower Nitrogen requirements than conventional fertility programs. It offers a method of growing resulting in less volatilization of Nitrogen into the atmosphere, less leaching of Nitrogen into ground and surface water and better moisture retention in topsoil. Biotic fertility offers better chelation of soil elements than conventional fertility which offers the prospect of increasing mineral, and therefore vitamin content in foodstuffs.

Nutrient Density – Increased Vitamin Levels in Foods

Biotically grown foods will have naturally higher levels of elemental nutrient density which automatically results in higher vitamin levels. Plants require minerals to synthesis vitamins. Biotic fertilizers contain chelated minerals which are ready for use by crops. They also build soil acids which are the primary chelators of elemental minerals. Conventional water soluble fertilizers have no such chelation agents, other than water.

FEEDSTOCK SOURCE

The source of the basic feedstock for a biotic fertilizer is Confined Animal Feeding Operation (CAFO) manure. Any type of CAFO manure is usable. Some are better than others as the Nitrogen value can vary according to animal and collection methods. The conversion of CAFO manure into efficient biotic fertility is of great universal value. CAFO manure nutrient pollution in the atmosphere, soil and water is a global problem.

METHOD OF MANUFACTURE

Biotic fertilizer manufacturing process is a mechanical, chemical, and physical process that takes about an hour and can occur in an enclosed facility with modern atmosphere pollution controls. This process does not and cannot use composting as a production tool. Composting is a wasteful practice and releases high level of Greenhouse Gases. Particulate, methane, CO₂, ammonia, and other gases volatilize into the atmosphere during the composting process. This loss of nutrients produces a product which has a low biotic efficiency scale. The biotic fertilizer manufacturing process is not wasteful of nutrients. It captures Nitrogen and other important nutrients on almost a 1:1 basis.

THE NITROGEN CYCLE

Conventional fertility systems use a fertility measurement system that is based on Units of Nitrogen. The synthetic inorganic Nitrogen in conventional programs is easily measured since the Nitrogen being measured is easily quantifiable. Many agronomists will admit that the Nitrogen levels used in conventional growing have been exaggerated due to the easy manner of volatilization that occurs with inorganic Nitrogen. The USDA believes that at least 50% of Nitrogen is lost to volatilization. Some University studies cite losses as high as 82%.

Soil scientists have only recently realized that the Boussingault Nitrogen Cycle, which has been used by the fertilizer industry for over 150 years is deeply flawed. The Boussingault Cycle postulated that organic nitrogen is transformed into inorganic Nitrogen before a plant can use it. This theory, based on science by the French chemical researcher Jean Boussingault, originated in the mid-19th Century. This science has essentially remained unchallenged until 2000 when a massive 10 year study in the Amazon basin, (Perakis and Hedin) reported in Nature (415) magazine revealed that the majority of nitrogen in a pristine area is actually organic nitrogen. This finding differed from the earlier science performed in areas polluted by the burning of Carbon based fuels such as wood and coal. Scientists now realize that organic Nitrogen can be used directly by a plant without first being converted into inorganic Nitrogen.

Given these developments agriculture must develop new methods of measurement for organic Nitrogen as current soil tests only measure inorganic Nitrogen.

A BIOTIC MODEL FOR ORGANIC NITROGEN CONVERSION

The following simple calculation is a means of demonstrating a comparison of organic Nitrogen to units of synthetic inorganic Nitrogen. All foods have a conversion ratio of nutrients to protein. Bacteria are very efficient in this conversion when their nutrients are properly prepared. This example assumes that the biotic nutrient is only 50% efficient in the conversion of a solid nutrient into an increased population of topsoil microorganisms resulting from the nutrition as a result of the enabling of protein synthesis.

Amount of applied 4-4-4 biotic fertilizer	2,000 lbs. (per acre application)
Efficiency of conversion – estimated at 50%	X .50 (percent)

Total mass of biotic fertility	1,000 lbs.
Nitrogen content of bacteria	X .14 (percent)
Total amount of Nitrogen	140 lbs. Organic Nitrogen

Biotic fertilizers with their water soluble nature, high amino acid content and their balanced elemental contents enable the rapid protein synthesis which results in biotic fertility. Stable soil acid molecular structures retain the organic Nitrogen until accessed by plants or soil microbes.

COMPARISON OF BIOTIC FERTILITY TO CONVENTIONAL FERTILITY PROGRAMS

Yields

Biotic fertility mimics natural fertility. It is superior to conventional fertility programs in that natural fertility provides an uninterrupted nutrient supply to crops. Synthetic inorganic Nitrogen based fertility volatilizes into the atmosphere, ground and surface water so quickly that it must rely on a high level of N. that shocks the plant and switches it from protein synthesis to proteolysis.

Quality

Biotic fertility crops are usually of higher over-all quality than crops grown with conventional fertility. Synthetic inorganic Nitrogen often provides too much N. to crops which affect the quality of the produce. In addition, conventional fertility does not promote the full genetic potential of the plant in the same manner as biotic fertility which surrounds crop roots with organic nutrients in an ionic form readily usable by plants.

Cost

Biotic fertility is cost effective when compared to conventional fertility programs.

Sustainable fertility

Biotic fertility constantly amends and re-mineralizes depleted soils. Growers no longer worry about exhausting soils. A well designed and well made biotic fertilizer provides nutrients that are excessive to the needs of crops.

Biotic fertility programs work to reduce the amount of applied fertility

Typically growers using biotic fertilizers are able to back off the amounts applied after their soils are restored to a level of fertility. Conventional programs typically increase the amount of fertility required as they deplete soil organic matter in the soil.

Biotic fertility does not upset topsoil C:N balance in the soil.

Synthetic inorganic nitrogen fertility can upset the C:N balance in the soil which results in the loss of vital soil acid gels which act to hold the surface of the soil in place resulting in erosion. Biotic fertility restores organic content to the topsoil rebuilding the soil acids critical to preventing soil erosion.

A fertility program that is able to produce superior nutrient density, sugar content, and vitamin density than conventional fertility.

Biotic fertility builds complex organic soil nutrients that conventional fertility does not contain or encourage. Soil acids that result from biotic fertility are nature's chelation agents that convert elemental minerals in the soil into ionic forms that plants can uptake.

A fertility program that requires less pesticides and fungicides than conventional fertility

Biotic fertility provides crops with uninterrupted protein synthesis. This steady nutrition enables stronger plants that are less susceptible to insects, disease, and fungal attack.

ENVIRONMENTAL BENEFITS OF BIOTIC FERTILIZERS

Biotic fertilizers have low levels of elemental nutrients that leach into surrounding waters after an application. Biotic fertilizers have the characteristic of building nutritional levels in the soil area below the point of application. Unlike more volatile N-P-K fertilizers the organic nutrients in biotic fertilizers are absorbed quickly into the topsoil where they are rendered into protein before cell lysis occurs and renders them into stable soil acid nutrients with little tendency to leach or migrate.

Biotic fertilizers have low levels of elemental nutrients that volatilize into the atmosphere. Biotic fertilizers are made with more stable components, or with lower amounts of these compounds than conventional N-P-K fertilizers. They will naturally volatilize less than conventional fertilizers insuring greater delivery and more efficient use of contained nutrients. A global change from the use of synthetic inorganic nitrogen fertilizers to biotic fertilizers would greatly reduce the amounts of green house gases volatilized into the atmosphere from conventional fertilizers.

Biotic fertilizers do not rely on hydrocarbons for their source of nutrients. The primary nutrient source of conventional fertilizers, synthetic inorganic Nitrogen, is typically manufactured using natural gas as a heat source to extract nitrogen from the atmosphere. A biotic fertilizer manufacturing facility not only has a much smaller carbon footprint than conventional fertilizer facilities the price of the biotic fertilizer ingredients is not directly linked to the global hydrocarbon marketplace in the same manner as conventional inorganic synthetic nitrogen fertilizers.

Biotic fertilizer is manufactured from CAFO waste – providing a solution to a major environmental problem. The safe disposal of Confined Animal Feeding Operation waste is a major environmental problem. Such waste is the major feedstock for a biotic fertilizer. The biotic fertilizer manufacturing process changes the CAFO waste from an unpredictable, unreliable soil amendment into a predictable, reliable fertilizer with stable Nitrogen. .

Biotic fertility requires less pesticides and fungicides. Natural fertility does not require the use of pesticides and fungicides as it uses natural protection systems based on mineral and polysaccharides content to protect plants. This lowers toxic levels on farms and in foods grown with conventional fertility.

Biotic fertilizer is easily produced locally or on a regional basis. Most conventional synthetic inorganic nitrogen nutrients are sourced globally adding expensive transportation costs. A typical Haber-Bosch synthetic inorganic Nitrogen manufacturing facility produces about 300,000 tons of ammonia a year at an investment of about \$500,000,000. For the same amount of money approximately 40 Regional Biotic Fertilizer plants can be built with total production capacities of 3,200,000 tons of biotic fertilizers a year.

Perfect Blend Organics

188 106th Ave NE, Suite 401

Bellevue, WA 98004 - USA

Tel. 425.456.8890

www.perfect-blend.com