



Organic Soil Amendments Division *OSA1000TM*

Global Ecology Corporation (“GEC”), in concert with two soil microbiologists and a well-known agronomist, has recently completed development of several dynamic organic soil amendments and additives using its proprietary formula for environmentally safe and natural remediation of waste materials. The *OSA1000TM Product Groups* will enhance and increase productivity in virtually all agricultural applications.

The composting process we have been working with for the past few years is soon to be deployed domestically at the Company’s new production facility in Castleberry, Alabama. This product will use a mix that optimizes carbon to nitrogen ratio and includes several types of raw material to include; local “green” waste, chicken and cow manure. After treating the waste with our proprietary ionized mineral solution (IMS1000) to reduce odor-causing anaerobic activity and increase plant nutrients, the compost is mixed which causes rapid natural heating to occur as our special unique blend of compost-oriented microbes process the organic waste. When necessary, for certain specific customer needs, we will enhance the naturally occurring microbial process by increasing the quantity of certain beneficial bacteria through the addition of our proprietary consortium of micro-organisms. We can thus provide specific product blends that enhance nitrogen fixation, tailor soil conditions such that water management and nutrient transport are maximized. The *OSA1000TM* products are delivered both as liquids and solids.

The *Solid Product* can be used applications when the base soil is in particularly poor condition due to over use or is in a naturally lacking environment. Tilling the solid amendment into the existing soil will provide all of the nutritional benefits of our liquid product and will also cause the soil it is blended with to become “sponge like” as it relates to water and nutrient retention. The use of this product can create crop growing opportunities in soils that historically would have been considered to sandy or nutritionally void.

The *Liquid Product* the Company has developed can be described as a combination soil inoculant/compost tea that help plants develop stronger more robust root systems while providing certain plant nutrients when used for turf and crop production. These hardier roots absorb a greater portion of available water thus requiring less irrigation during the growing/production process. In sod applications the moist root/soil matrix achieved with addition *OSA1000TM Liquid Solution* facilitates easier harvesting and a longer “green” period for turf during transportation. An added benefit of this application is the preservation and re-use of land between crop cycles. This is a result of our proprietary blending and more efficient use of natural rain and managed irrigation. The *OSA1000TM Liquid Solution* is also extremely beneficial when introduced as a food source for the growing industry of hydroponic vegetable growth. By making use of this product as the primary food source, this form of farming becomes all natural while producing higher crop yields than traditional soil farming.

Using our *OSA1000™* organic liquid and soil products in concert with each other should be seen as a complete system of soil management, not just a means of reducing environmentally harmful Nitrogen inputs, which are frequently the result of using chemical fertilizers. The many benefits to using this technology include: increased earthworm populations, higher levels of soil organic matter, healthier “living” soils, stronger plants, more robust crops, increased root development and improved uptake of a wide range of plant nutrients including P and K (Phosphorous and Potassium), lower input costs, reduced environmental pollution, and in many cases, increased crop yields as well as a significant reduction in the use of pesticides (total elimination in some cases). Additionally, both solid and liquid products will produce healthier plants, greater size and accelerated growth in vegetable crops.

Composting and Soil Amendments Production - Technological Overview:

Our technology uses a mixture of several different organic components that break down and eliminate organic and inorganic contaminants. Basically, hydrocarbons are divided into their component parts of CO₂ and H₂O by our proprietarily developed microbes in concert with certain natural ingredients. As a result, the oxygen levels will increase causing the bacteria to become more active and consume increased quantities of contaminants.

The base ingredient is Humus which is a mixture of Humic and non-Humic substances derived from:

- plant residue
- lignin
- carbohydrates
- proteins
- phenolic compounds

Humus substances may be broken down to three categories:

- Humic Acid - soluble in dilute alkaline solution but insoluble in acid
- Fulmic Acid - soluble in acid or basic conditions
- Humin - insoluble in both acid and base conditions.

The Humic and Fulmic acids work in conjunction to interact with environmental chemical substances in the following five ways:

- Sorbitive reactions
- Solubilizing reactions
- Catalytic effects on hydrolysis
- Effects on the microbial processes
- Photosensitizing and quenching effects

Sorbitive Reactions: Humic substances and clays play a major role in immobilization of environmental chemicals. Environmental chemicals may be absorbed to humic substances by all known chemical interaction mechanisms.

For example: Van der Waals attractions, hydrophobic bonding, hydrogen bonding, charge transfer and ionic interactions. Covalent bonding may also occur in some cases. Substances that can be absorbed include metals and other elements, as well as organic and inorganic compounds.

Humic substances like ours can diminish the immediate and acute dangers of environmental chemicals. This is accomplished using its sorptive effect to diminish the chronic dangers of environmental organic chemicals. It does this by supporting the ultimate degradation of the organic pollutants via chemical and photolytic catalysis as well as microbial degradation. The water retention capacity of our humate is a definite aid for degradation of organic chemicals.

Soluble Reactions: Our proprietary humate derives efficacy from its ability to lower the surface tension of water and act as a surfactant. This is how it plays a role in the dispersion of otherwise insoluble substances. At the same time, the humic acids entrap the organic substances into micelles formed by intermolecular association with the surface active humic substances.

Catalytic Effects on Hydrolysis: Our humate brings into close contact waste, pollutants, and surface catalysts such as hydrogen ions and free radicals which are at high concentrations on the surface of the humic substances. Moreover the surface absorption of the chemicals may provide a favorable orientation for the hydrolytic reactions.

Effects on Microbial Processes: Our humate is derived by several favorable characteristics of the formula, including its ability to sequester toxic substances which diminishes the free concentrations on the toxins to levels tolerated by microbes. In this manner, microbes can degrade toxins without being damaged by excessively high levels of the toxins. Additionally, the soluble reactions of the humate on pollutants help disperse the pollutants in a manner favorable for microbial contact. In some cases the soluble reactions allow entry of toxins into the microbes where resident enzymes speed their breakdown.

Nutrients for the microbes are not only organic substances absorbed by the humate but trace metals like iron, salts (nitrates) and the humate substances themselves. They can support a mixed microbial population which ultimately enhances the biodegradation of complex organics because several species of microbes may be needed to accomplish the degradation of pollutants of interest.

Photosensitizing & Quenching Effects: Our humate can effect degradation of pollutants. Some of the functional groups within the humate can absorb UV radiation energy such that they can act as photo-sensitizers and participate in the photo degradation of the pollutants.

Some pollutants by themselves may absorb UV light. The absorption by the variety of the humic substances greatly increases the potential for photolytic degradation of a much broader range of pollutants. On the other hand, quenching may occur due to aromatic structures of humic substances acting as sinks for excitation energy. The generation of singlet oxygen by the humus substances exposed to UV radiation (sunlight) can play a role in degradation of the pollutants, as well as the humic substances themselves.

The mixing of humic substances in an appropriate ratio with an additional substance that provides an enhanced dispersion of the humus substances and pollutants, as well as buffering action for microbes, increases the potential of our humate to accomplish remediation of polluted water and soil.

In particular, bioremediation by on-site microbes is enhanced. The humate may be adjusted to take into account the nature of the water or soil at the site, microbial population at the site, the pollutants of interest at the site, and other special conditions at a given location.

Overall, the treatment removes all hazardous deposits of heavy metals dangerous pesticides, harmful bacteria and other human-caused pollutants. The process is so environmentally friendly that it essentially turns waste into a high-grade, nutrient-rich soil that can be resold for farming, park construction, golf course development and landscaping purposes.

Our Compost

The value of our compost goes well beyond its Nitrogen, Phosphorus, and Potassium content (NPK). The true value of high quality humified compost is its ability to balance the chemical, physical, and biological aspects of the soil while enhancing its ability to retain moisture.

NPK is certainly necessary and are naturally available in our high quality Humus. However, the value of compost is NOT solely or primarily in its NPK content. We know that many other minerals, such as Calcium and Magnesium, are necessary for healthy soil. Yet, the mineral nutrient content in soil is only one-third of the ENTIRE soil fertility picture. We call this the "Chemical" aspect of soil fertility. When supplemental mineral nutrients are mixed with humified compost, they combine chemically with the humic acids to form soluble (plant available) compounds. The humic acids also buffer the minerals across a wide pH range. In addition to making minerals available to the plants root system, humus itself is a source of necessary organic carbon and organic nitrogen.

The second aspect of high production soil fertility is the soil's structure, known as the "physical" aspect. Humified compost supplies humic acids which expand clay colloids in the soil, creating a porous structure which allows oxygen to penetrate. Humus also holds FOUR TIMES its weight in water, increasing the soil's water management capacity through the reduction of runoff, evaporation, and mineral leaching.

The third aspect of soil fertility is the "Biological," which pertains to the micro-life of the soil. Humus dramatically increases the number of beneficial microorganisms along with a large dose of the enzymes, root stimulants, and humic compounds that they produce. Furthermore, the nitrogen-fixing bacteria found in humified compost convert atmospheric Nitrogen into plant usable organic Nitrogen compounds.

Humus is the end result of organic matter decomposition and re-composition by microbes. When fresh, un-decomposed organic matter (green manures, animal manures and crop residues) is added to soil or placed in a compost pile, a rapid multiplication of soil microorganisms takes place. Certain microbes (bacteria, fungi, and actinomycetes) break this raw organic matter down

into smaller particles (gums, waxes, lignins) resistant to further decay and simple organic compounds (sugars, amino acids) that are water soluble. Following the breakdown phase, a second group of microbes bind these materials together, especially lignins and microbial biomass, into more stable humic substances (fulvic acid, humic acid, humins) in the buildup phase.

The physical, chemical, and biological transformation of raw organic matter into a complex humic substance is known as humification. Friable humus (also known as effective humus or nutritive humus), which supplies slow-release nutrients over a period of weeks or months, is a short-chain humic compound. This form of providing nutrients to plant matter contrasts dramatically with chemical fertilizers (even ones that are designed for time release) in that this slow constant feeding can be absorbed by plants in a more efficient fashion. Stable humus (also known as permanent humus), which has a half-life of years and may be viewed as the soil humus bank, is a long-chain humic compound.

When conditions are optimal, microbes attach these long-chain humic compounds to the clay fraction, resulting in clay-humus crumb. These clay-humus crumbs are full of "nooks and crannies" which provide shelter for soil microorganisms. The enormous surface area and negative charge associated with clay-humus provides exchange sites for cations, and building soil humus is one of the few ways farmers can actually increase the cation exchange capacity (CEC) of soils. Clay-humus crumbs are highly desirable in building soil tilth and maintaining good soil structure and water holding capacity.

The goal of humus management is to arrive at active, high-quality humus that is insoluble in water and therefore resists leaching of nutrients. Instead, nutrients are released through mineralization, a process driven by secretion of weak acids from plant roots and microbial action. In a healthy soil system, we propose an interactive feedback loop exists whereby plants secrete root exudates that tell soil microbes what they need. In response, soil microbes regulate mineralization and feeding of crop plants.

Our Liquid Soil Amendment (Compost Tea/Soil Inoculant)

Our various liquid products are produced using the aeration method of brewing. The basic materials used to create this product are our highly humified organic, pathogen-free compost, which was produced using our proprietary blend of specially selected microbes. We then combine permeable bags containing the compost with purified water and oxygen. This mixture is then brewed until the targeted number of microbes has been achieved.

This method allows for the different combinations of naturally occurring microorganisms, plus other micro-nutrients gleaned from our compost, to be tailored to maximize key traits for plant enhancement. The organisms inhabit the root zone and vascular system of a plant, helping to breakdown, hold and transport nutrients and water. Photosynthetic strains in the products are capable of converting radiant energy, including the sun's, into energy for plant growth. Other organisms have the extraordinary ability to unlock chemical bonds, facilitating nutrient uptake that would not be available to the plant in the organism's absence.

Our *OSA1000™* liquid products replace the natural soil microorganisms that are depleted through fumigation, tilling, harvesting and/or overuse of chemical controls. It is the only biological product on the market that is shelf stable, contains photosynthetic and other vegetative cultures and does not use growth inhibitors.

Our liquid products are different combinations of *naturally* occurring microorganisms that share key traits for plant enhancement. The organisms inhabit the root and vascular systems of a plant, helping to modify, retain and transport nutrients and water. Some of the organisms have an extraordinary ability to unlock chemical bonds, facilitating nutrient uptake that would not be available in the organism's absence. Photosynthetic strains in the products are capable of converting the sun's radiant energy into chemical energy in the form of sugar that is available to for plant growth.

OSA1000™'s nitrogen fixing bacteria are deployed using the liquid catalyst to become active in the soil and convert nitrogen from the atmosphere into a form that can be used by the crop. *OSA1000™* has the added advantages that, in addition to a range of soil active bacteria, it also contains a novel strain of entophytic bacteria which live on the leaves of the plant and supply nitrogen directly to the crop canopy. This means that *OSA1000™* is highly effective in a wide range of crops providing clear economic benefits resulting from either significant yield increases or production of comparable yields with reduced applications of nitrogenous fertilizers.

