



# FULVIC ACID - "THE GOLD STANDARD"

Fulvic Acid is arguably the most vital-to-life compound nature has provided to encourage healthy plant growth. It is one of the most basic minerals, however, most growers are fairly unaware of this wonder molecule and do not take advantage of the possibilities it presents for maximizing plant health and yield. Fulvic Acids have incredible potential when used for soil enrichment, in hydroponic applications, and as a foliar spray. There are a wide variety of scientific studies that have proven many times over that plants treated with fulvic acid grow faster, stronger and produce more at harvest time.

## What is Fulvic Acid?

Fulvic acid is a by-product of Humic acid. Humic acid is extracted from material containing well-decomposed organic matter — soil, coal, composts, etc. As humic material is decomposed by living microbes, these microbes create the most biologically complex organic compounds on earth — Fulvic Acid. Fulvic Acids are more plant active than humic acids due to their higher oxygen content and abundance of carboxyl groups. Humic acids have their own important place in growing and we explore those in our **Humic Acid Info Sheet**.

Fulvic Acids have chemical properties that allow plants to absorb more nutrients, and increases water storage capacity within a plant. Essential nutrients and vitamins, which plants may not be able to assimilate easily, will piggyback on the fulvic acid, to be transported to all cells that need them. Fulvic is so powerful that one fulvic molecule is capable of carrying 60 or more minerals and trace elements into the cells. It also prolongs the time that essential nutrients remain in the plant cells, maximizing nutritional potential. Fulvic acid increases plant metabolism, naturally increasing growth.

Plants treated with a regular diet of fulvic acid have a greater resistance to fluctuations in pH. The fulvic acid acts as a shock absorber because the nitrogen it contains is slowly released. This is extremely important because excess acidity will make minerals insoluble to plants while an alkaline pH will burn the plant. Fulvic Acids act as "free-radical" scavengers, supplying vital electrolytes, enhance and transport nutrients, catalyze enzyme reactions, increase assimilation, stimulate metabolism, chelate and change inorganic minerals into organically complex minerals, solubilize, energize, and transport major and trace elements to the site of need, and demonstrate amazing capacity for electrochemical balance.

## Using Humic Acid and Fulvic Acids together

Humic Acid allows the grow media and a plant's root cells to absorb more water. This creates a natural "osmotic" pull within the cell for more minerals. Fulvic complements this system by making nutrients flow into the cell faster and through chelation, keeping them available once within the cell. Used together, Fulvic and Humic greatly increase nutrient absorption and retention, and thus speed up the metabolism making for faster, stronger growth with a greater yield.

Fulvic Acids are more plant reactive, with an oxygen content twice that of Humic Acids. Fulvic Acid atoms of oxygen are "polar" and will carry an electronegative charge, making the molecule of Fulvic Acid even more soluble in water. Fulvic Acids are the most soluble and electronegative of all the types of Humates extracted and therefore are the most penetrating and mobile of all humates.

### What Can Fulvic Acid Do?

*"A wide range of beneficial attributes are associated with fulvic acid, including: Assistance in seed germination and growth; improved development of roots and shoots; resistance of plants to fungal attack; complexing of minerals; enhanced uptake of nutrients; improved nutritional physiology; stimulation of plant metabolism; positive effect on plant RNA and DNA; improved respiratory catalysis; increased enzyme activity; increased protein metabolism; enhanced permeability of cell membranes; enhanced cell division and elongation; improved chlorophyll synthesis; increased drought tolerance; increased crop growth and yield; improved soil microbe denitrification; improved pH and buffering capacity affinity for chemical 'balance'; participation in synthesis of new minerals; chemical weathering of inorganic substances; silicate decomposition by hydrogen ions of fulvic acids; assistance in the creation of new soil; ability to scavenge heavy metals; and detoxification of various pollutants."*

-W. R. Jackson, *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning: An Agricultural Text and Reference Book* (1993)



This far reaching involvement of fulvic acid in all metabolic processes almost makes it seem like a vitamin. But fulvic acid is neither a nutrient nor a vitamin; it is more accurately described as a “molecular tonic” that promotes and enhanced molecular transport, chelation and bio-reactivity throughout the garden. There have been numerous scientific studies that indicate the use of Fulvic Acid results in bigger plants and bigger veggies and quicker harvests. Here we highlight just a few of the many interesting and important findings about Fulvic Acid, the miracle molecule.

## **Fulvic Increases Growth Rates**

In experiments at the University of California, Riverside, using citrus plants, Dr. J.P. Martin, of the Department of Soils and Plant Nutrition, has found that combining Humic and Fulvic Acid with inorganic fertilizer improved the growth of first crop (one year) citrus seedlings by about 20% to 25%, and a second cropping, in the same soil, by 100% or more.

## **Fulvic Acid Increases Nutrient Uptake**

In a study published in the journal Plant and Soil, vol.63 (1981), scientists describe in detail the effects of Fulvic Acid treatments on the growth and nutrient content of hydroponically grown cucumber plants: After six weeks, the plant tissues were analyzed for their mineral content, and the differences between fulvate treated and control plants were noted:

*“The application of 100 to 300 ppm of FA yielded highly significant increases (compared to controls) in concentrations of N, P, K, Ca, Mg, Cu, Fe and Zn in shoots and also in the N content of roots. Under these conditions, concentrations of all elements in the shoots, with the exception of Fe, more than doubled. Also, concentrations of N in roots greatly increased....In just a six week growing cycle as was applied here, we can see that at the optimum concentration, fulvates enable the fullest expression of growth. It is as though fulvates dissolved in solution can “lubricate” and help to intercalate nutrients between plant cell membranes.”*

*“We observed that when 100 to 300 ppm of FA was applied, the roots were highly branched and rich in hairs, which increased the surface area and .. facilitated more efficient nutrient uptake. Also, FA, which is known to be surface active, could have increased the permeability of root membranes and so nutrient uptake. Additional plausible explanations for the activity of FA are that it contains structures that act like hormones, that it facilitates the translocation of nutrients throughout the plant, and that by complexing with metal ions it increases their solubility and availability to plant roots.”*

## **Fulvic Acid Increases Yield at Harvest Time**

In a study produced by Dr. Lynette Morgan, the Director of Research at New Zealand's SUNTEC International Hydroponic Consultants, the effect of Fulvic Acid on green bean plants also produced positive conclusions: treated plants experienced a 36% increase in bean weight at harvest, a 36.5% increase plant growth, and they flowered on average four days ahead of the control plants.

Research conducted by Dr. Vladimir Vaslenko of Canada's CERES Corporation on tomatoes showed an overall "changed growth pattern among treated tomatoes" including increased stem and height diameter, as well as increased leaf chlorophyll. The latter finding is of critical importance, since there is a close correlation between increased chlorophyll, improved photosynthesis, and the final yield of crops. According to the study, Humic Acid and Fulvic Acids increased the amount of chlorophyll in the tomato leaves by approximately 10%. The study emphasizes that photosynthesis in a plant's upper leaves is key to the plant's eventual yield; the use of humates results in 16 to 17% larger tomatoes as well as a slight increase in the overall number of tomatoes produced.

## **Fulvic Acid is an Electrolyte**

Fulvic acid is a natural organic electrolyte. It will in effect “spoon feed” plant tissues with the minerals, biostimulants, cofactors and vitamins you have added to your reservoir . By the virtue of being smaller and more electronegative than humates, Fulvic Acid readily complexes with itself, along with other organic molecules (like vitamins) and inorganic materials like minerals and metals. In the process of all this, it makes them all become even more “palatable” to plant roots. Within the fulvic acid “complexes” that float around in solution, nutrients are immediately absorbable and more transportable within the plant.

Fulvate increases the actual movement of micronutrient ions into plant cells that are normally difficult to mobilize or transport, such as iron. Experiments reported in the journal Plant and Soil, vol. 198 (1998) show that Fulvic Acids are required for Iron absorption and uptake. Found naturally in soil, Fulvic and Humic Acids should be added in hydroponic growing situations. By chelating these in “complexes” they become easily transportable through plant cell walls and membranes. Fulvic Acid inhibits minerals from interacting with one another, separating them down into the simplest ionic forms by chelation.



## Using Fulvic Acids in your Garden

Fulvic Acid can be applied either at the root zone or through foliar applications. It can be used either in hydroponic medias and systems or it can be applied in Coco or soil based projects. The amazing benefits of Fulvic Acids can be experienced in any gardening environment. For the very best results use Fulvic with Humic Acid.

### Foliar Spraying

Fulvic Acid molecules are so small, with such a low molecular weight, that they can readily enter plant stems and leaves, shuttling nutrients, hormones and more directly into the plant. Once applied to plant foliage, Fulvic Acids transport trace minerals directly to metabolic sites in plant cells. This allows for nutrients to be quickly delivered to all sites within the plant, correcting deficiencies and restoring natural balance. Fulvic Acid can be used to increase production in any given area through foliar application. you will see larger leaves and thicker shoots if foliar spray is applied during vegetative growth. To increase the number of internodes or flower sites a plant produces, fulvic acid should foliar sprayed as soon as the first fruit/flower sites appear. Fulvic acid applications are also known to slow down the vertical growth of plants; concentrating the available plant energy into more Bloom sites with larger fruits / flowers.

### A Note for Soil Growers using Fulvic Acid

Fulvic Acid can do alot for a soil grower. It will promote the complexing, chelation and diffusion of all soil-derived nutrients towards your plants and throughout the soil. Fulvic Acids also dissolve and transport vitamins, coenzymes, auxins, plant growth promoters and natural antibiotics that are generally not water soluble but are present in soil. These substances are effective in stimulating even more vigorous and healthy growth by promoting the plant and the beneficial bacteria, fungi, and Actinomycetes living symbiotically in your crop's root systems.

### Stress Resistance

Once plants are established, adding Fulvic Acid to the nutrient solution around the second week strengthens a plants immunity and increases resistance to stress. Plants are not as susceptible to slight environmental changes in temperature or humidity. Fulvic Acid will protect the plant against short term pH fluctuations at the root zone. This being said, Fulvic Acid will not compensate for poor growing practices; however, it does offer a buffer against minor inconsistencies.

## Our Favorite Fulvic Acid Products

**Grandma Enggy's Fulvic (F1)** - Made by Advanced Nurients, This Fulvic Acid supplement has a lot of science and research behind it. A 7-step extraction process creates Grandma's honey-golden Fulvic Acid that nourishes plant cells, roots and leaves to produce bigger, more aromatic flowers. Has been competitively tested against other Fulvic products and was found to produce quicker nutrient absorption, transport, and a greater cellular metabolism.



**Ruby Fulvic** - This very high quality fulvic that contains low levels of cytokines, auxins, and indoleacetic acid (IAA) all derived from fermented organic materials such as seaweeds, other algae and rich plant sources. Ruby Fulvic is designed to dramatically increase transpiration rates without showing an increase in ppm of the nutrient solution remaining in the reservoir.

**Diamond Nectar** - A Fulvic Acid extract which provides a highly available and diverse range of bioactive plant compounds. Diamond Nectar supercharges your nutrients in order to optimize the health of your plants and the quality of your crops. By accelerating nutrient absorption at the root boundary zone where minerals enter the plant, small particle sized fulvic acids optimize nutrient uptake in fast growing vegetation.

## A Note About Dosage

Too much of a good thing is usually not beneficial. Past 300 ppm, or 300 mg/ liter, fulvates can become a hindrance to mineral uptake as they will "over-chelate" metals by complexing with themselves as well as the nutrients. There is an ideal maximum concentration for all humates in general, right around 300 ppm.

### References:

- "Hydroponics and Humates: Acids for Modern Agriculture" (Dr. Vladimir Vaslenko, The Growing Edge September/October 2002)
- "Hydroponic Humates" (Dr. Lynette Morgan, Maximum Yield July/ August 2001)
- "Effects of Lactate, Humate, and Bacillus Subtilis on the Growth of Tomato Plants in Hydroponic Systems" (M. Bohme, International Symposium on Growing Media and Hydroponics 1999)
- "Leonardite and Humified Organic Matter" ( D.M Ozdoba et. al., Luscar Specialty Products Division
- "Humic, Fulvic and Microbial Balance: Organic Soil Conditioning: An Agricultural Text and Reference Book" (W. R. Jackson, 1993)

