

## **Effects of Humic Acid in Agriculture An Overview of Literature and a Review of Current Research**

### **INTRODUCTION**

Humates are an accessible raw material that can be used in agriculture. Humates are a part of soil humus and play an important role in the living organism. Modern farming practices have stripped the soil of its humus and no replacements have been used. Humic substances have not been appreciated and as a result not addressed in fertilizing practices. Today, our soils are low on these humic substances and as a result, animals and man are not receiving adequate amounts in their normal diet. Research has indicated that when soil humus percentages fall below 2%, the soil cannot provide sufficient quantities of humic materials into the crops grown for the amounts needed by the living organism.

### **SAFETY**

Humate is a safe material and exists in all soils, plants and animals. It is natural to the food chain and plays a role in the composting of dead matter into nutrients, transfer of minerals, and other roles within the living organism. Many technical papers attest to humate's safety. The level of toxicity on an LD-50 test of 0.536 grams per kilogram can be considered as a conformation of the harmlessness of humates (15).

### **DEFINITIONS**

**Humate:** Technically this term describes the salts of humic acid. Generically it is the term given to all humic substances.

**Humic Acid:** Humic Acid is a long chain molecule, which is high in molecular weight, dark brown and is soluble in an alkali solution. This is the portion of the soil responsible for composting which transfers the nutrient from the soil to the living organism. This material accompanies the nutrient into the organism and performs many benefits.

**Fulvic Acid:** Fulvic Acid is a short chain molecule, which has a low molecular weight, yellow in color and soluble in both acid and alkali. This is the portion of the soil responsible for chelating (grabbing hold of metals) minerals and transferring them to the living organism. Fulvic acid is unique in its chelation ability as it captures life essential minerals and places an electrical charge on them for ready uptake by the organism. Toxic metals are also chelated, but are neutrally charged and have difficulty in entering a living organism. Fulvic acids also act to detoxify the body of those heavy metals that may enter it.

**Ulmic Acid:** Ulmic acid is that portion of the soil that is soluble in alcohol. It is a dark semi-solid material. It is not very well understood for it has limited research history.

**Humin:** Humin is that portion of the soil that is non-soluble. It is a dark brown material, extremely high molecular weight and is responsible for the soils water holding capability, crumble and electrostatic conductivity.

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**Humic Substance:** The portion of the soil created by decaying organic matter. Humates exist in many locations around the world, but vary in composition much the same way as crude oils. They are hydrocarbons and contain aromatic and heterocyclic structures, carboxyl groups, and nitrogen. They contain fragments of DNA, RNA and possess many active hydrogen bonding sites making them very chemically reactive.

## **NUTRITIONAL VALUES**

Nutritional analysis (27) vary with humates from different locations. Humates used in the case studies at the end of this paper contained the following:

Protein, Ash, Fiber, Carbohydrates, Nitrogen, Moisture, Ammonia, Humic Acid and Fulvic Acid, and trace minerals (ppm) in chelated form such as:

Antimony	Holmium	Neodymium	Ruthenium	Thallium	
Cobalt	Indium	Nickel	Samarium	Thorium	
Barium	Copper	Iodine	Niobium	Scandium	Thulium
Beryllium	Dysprosium	Iridium	Osmium	Selenium	Tin
Bismuth	Erbium	Iron	Palladium	Silicon	Titanium
Boron	Eurpoium	Lanthanum	Phosphorus	Silver	Tungsten
Bromine	Fluorine	Lead	Platinum	Sodium	Vanadium
	Gadolinium	Lithium	Potassium	Strontium	Ytterbium
Calcium	Callium	Lutetium	Praseodymium	Sulfur	Yttrium
Cerium	Germanium	Manganese	Rhenium	Tantalum	Zinc
Cesium	Gold	Magnesium	Rhodium	Tellurium	Zirconium

## **MINERAL TRANSFER**

Humates contain both humic and fulvic acids. The fulvic acid is the chelator that carries the minerals. The humic acid acts as a dilator which increases the cell wall permeability.

## **MICROBIAL INTERACTION**

Humates are known to stimulate microbial activity. In soil testing for microbial activity, levels increased 400 to 5000 times with the introduction of humate (300 ppm) into the soil.

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