

JOHN'S CORNER

Soil Amendments - Humate

By John Ferguson

The past few weeks we have been discussing soil amendments of volcanic origins. This week I want to talk about humate as a soil amendments and the best humates come from areas with volcanic activity nearby when they were formed.

Humate is a form of organic matter that once was alive and has decomposed into the form we call humate and is a component of soil humus.

Humic substances (soil humus) are the most important part of healthy fertile soil!

Humic substances come from organic matter that has decayed (composted native mulches, compost, humates, and even some types of coal). A healthy soil should contain 4-8% organic matter by weight (8% by weight is about 25% by volume). Most gardeners have soil organic matter less than 2% and this is one of the reasons they experience poor growth, diseases, insect problems, drought problems, less heat and cold tolerance, etc. Humus substances are the most important part of soil organic matter composing 65-75% of the total and humates are one of these humic substances.

Humates are composed of chains of carbon atoms linked together into complex structures. The material we call humate is actually composed of several components; humic acid, fulmic acid, ulmic acid and humins. These components are all similar but distinguished by their solubility in water and the length of their carbon chains that form the molecules.



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Note: Humate is the solid or chemical salt form of humic acid, fulmate is the solid or chemical salt form of fulmic acid, etc. and humins are the longest carbon chains and most resistant to further decomposition.

For those that want a little more technical explanation on the chemistry of humates see the paper: "Organic Matter, Humus, Humate, Humic Acid, Fulmic Acid and Humin: Their Importance in Soil Fertility and Plant Health" by Robert Pettit, PhD, Emeritus Associate Professor Texas A&M University. For those that want a detailed technical discussion see the book: "Humus Chemistry - Genesis, Composition, Reactions by F. J. Stevenson, ISBN 0-471-59474-1

Humates were formed eons ago when ancient swamps with a large accumulation of organic matter were covered by sediment or volcanic ash and exposed to heat and pressure (but not enough to form coal or oil). Over geologic time the organic matter became the product we call humates. Humates from volcanic regions tend to have many times more minerals than humates from non-volcanic areas or other sources.

Humates are found all over the world in huge quantities. In the USA many of our Western states have large deposits of humates. A few years ago a huge deposit of humates was discovered in Texas near the Big Bend area with over 50 million tons of humate.

Humic acids are not generally soluble in water except under alkaline conditions. The molecular size of Humic acids range from 10,000-100,000 and they readily bind clay minerals to form stable organic clay complexes with a open lattice arrangement that can bind nutrients to them and prevent leaching. Some good humates can have over 60 mineral elements in them in a form that can be readily utilized by plants.

Note: Just like everything else in life there are different qualities of products sold as humates. Low quality = poor or even bad and negative results. Low quality humates also have low price points.

Fulmic acids are soluble in water (neutral, acidic or alkaline). Fulmic acids are much smaller than humic acids and range from 1,000-10,000 in size. Fulmic acids are much more chemically reactive than humic acids and have double the cation exchange (CEC) capacity of humic acids. Due to their smaller size



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fulmic acids are readily absorbed by plants through their stems, leaves and leaves. As they enter the plants the trace minerals in them are carried into the plant tissue where they can be used. Hence fulmic acids are a key ingredient for foliar fertilizer applications.

Humins are not soluble at any pH and are very large molecules 100,000-1,000,000 units in length. Humins in soil are the most resistant to decay and are very slow to breakdown. Humins greatly increase a soils water holding capacity, improve soil structure and stability, and function as an important part of the cation exchange capacity of soils, hence are a key component of fertile soils.

All life requires energy. Soil microorganisms get there energy from eating (combining carbon atoms with oxygen thus releasing energy just like when wood is burned in a fireplace). By eating carbon containing molecules found in humic substances, microbes get the energy for various metabolic processes from growing and reproducing, creating soil structure to fighting disease and pathogens.

All forms of humic substances improve a soils water holding capacity and the efficiency of how plants use the water. They also create soil structure that allows water and air to enter the soil holding the water in the root zone where plants can use it. Humic substance can easily hold over seven times their weight in water and some types up to 15X.

Note: Humic substances (humus) are destroyed by synthetic fertilizers, hence the more synthetic fertilizer one uses, the more the quality of the soil declines resulting in more disease and insect problems.

A question I often get asked is: what is the difference between compost and humates? Humates are not compost. A few years ago I looked at some data on compost on the USDA website, and it showed that even an average compost will contain over 350 pounds of humic substances (humus) per cubic yard of compost. These humic substances will contain humic acid, fulmic acid, ulmic acid and humin just like humates. As a result, there is a large overlap in function with humates. Compost also has complex sugars, carbohydrates and many other compounds that are required by microbes and plants that are not in humates. The biggest difference is that compost is alive with billions of beneficial



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microbes per pound of compost. Humates work best when used with a good compost to provide the diversity and quantity of microbes need to best utilize the resources contained in humates.

In summary, humates can be another great tool for all gardeners to use. In Houston we are lucky that San Jacinto Environmental Supply distributes a high quality humate product called "Microlife Humates Plus" in bags to the better area retailers.

PROS:

- provides energy and nutrients
- unlocks soil nutrients
- enhances root development
- improves soil structure
- enhances seed germination and survival
- improves a plants resistance to stress
- stimulates the growth of beneficial microbes
- increase the CEC (cation exchange capacity) of soils
- increases the water holding capacity of soils
- helps break down toxic pesticides and herbicides and reduces their effectiveness
- helps with soil aeration

CONS:

- some humates are made by extracting humic substances from the soil destroying the soil in the process
- may cause mild eye irritation
- may cause irritation to the mucus membranes and respiratory passages
- does not work well on cool soil with minimum temperatures below 55 degrees
- has to be mined and shipped a long way compared to other types of humic substances hence contributes to global warming and energy consumption
- more costly that other types of humic substances
- huge variation in quality and value depending on the source
- easy to over use, too much can stunt a plants growth or even kill plants.

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