Fulvic Acids in Plant Health

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William R. Jackson, PhD, wrote in his book, *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*, that if there is a magic in nature, like the miracle of pulling "rabbits from a hat," it would be fulvic acids.

Humic substances are the major constituent of soil humus. Soil materials consist of a series of formerly living protoplasts from animal and plant tissues that are referred to as organic matter. The dark colored homogeneous material, somewhat resistant to further decomposition, is called humus (humus is actually a Latin word for soil). *Humic substance* includes heterogeneous organic substances. These are yellow to black in color and of high molecular weight. It includes nonhumic and humic substances. Nonhumic substances include amino acids, carbohydrates, fats, peptides, pigments, proteins, resins, waxes, and other low-molecular weight organic materials. These are easily attacked by soil micro-organisms. However, the majority of the organic matter in soils are made up of *humic substance*. This is characterized by being amorphous, of light brown to black in color, hydrophilic (strong affinity for water), acidic, and polydispersed or widely dispersed substances of various molecular weights. *Humic substance* is broadly classified into 1) humic acid, which is water soluble in dilute alkaline solution but precipitated in a weak acid solution, 2) fulvic acid, which is humic material that remains in acid solution and is soluble in both acid and/or water, or base, and 3) humin, which is not extracted by dilute base or acid.

The table below shows a distribution of five elements in humic acid and fulvic acid:

Element	% of humic	% of fulvic
C Carbon	56.1	45.8
H Hydrogen	4.6	5.4
N Nitrogen	3.2	2.1
O Oxygen	35.3	44.8
S Suphur	0.8	1.9

This table shows the solubility of components of *humic substance*

Component	Solubility in Acid	Alkali	Water
Fulvic Acid	soluble	soluble	soluble
Humic Acid	insoluble	soluble	sparingly
Humin	insoluble	insoluble	insoluble

Humic substance is the end product of decayed matter. It contains up to 5,000 calories per gram, providing energy that can be used for plant growth. Humates (metal complexes of humic acid) supply growing plants with food. *Humic substance* increases water holding capacity of soil, and helps to break up unproductive clay soils. *Humic substance* can help in retaining water soluble inorganic fertilizers, releasing them as needed, and helps prevent soil leaching.

This leads to a more detailed discussion of fulvic acid. The high-molecular weight humic substances, humic acids and humates, alter the physical characteristics of soil, while the low-molecular weight *humic substance*, fulvic acids and fulvates, are involved in chemical reactions in the soil. Microorganisms are needed in the soil to create fulvic acids.

Fulvic acids result principally from the oxidation of organic matter (thus the higher oxygen content of fulvic acids compared to humic acids). As we go down in soil depth, less fulvic acids are found (less oxygen deeper).

Summary of Fulvic Acids in Soil (from Jackson, W. R.)

1. Assistance in seed germination and growth
2. Improved development of roots and shoots
3. Resistance of plants to fungal attack
4. Metal complexing and nutritional physiology
5. Enhanced uptake of nutrients
6. Stimulation of plant metabolism
7. Chelation and effects on the plant growth cycle
8. Positive effect on plant respiration

9. Catalysts in plant respiration

10. Increased metabolism of proteins

11. Increased activity of multiple enzymes

12. Enhanced permeability of cell membranes

13. Enhanced cell division and cell elongation

14. Aid to chlorophyll synthesis

15. Increased drought tolerance

16. Increased growth and yield of crops

17. Assist denitrification by microbes

18. pH buffering capacity

19. Special chemical affinity for balance

20. Participation in synthesis of new minerals

21. Chemical weathering of inorganic substances

22. Silicate decomposition by hydrogen ions of fulvic acids

23. Aid in the creation of fertile new soil

24. Ability to scavenge heavy metals

25. Detoxification of various pollutants

Because fulvic acids are so beneficial to the soil and plants, would they also be beneficial in human health? Several reports show very good results when used on dairy cows, hogs, mink, and poultry.

Fulvic acids occurs in plants and soils. A single fulvic acid molecule can carry 60 or more minerals and trace elements into the body. It has been in recent years that its value for human health is being recognized. We need at least 90 nutrients for optimal health (a minimum of 59 minerals, 16 vitamins, 12 amino acids, 3 essential fatty acids).

Here is a partial list of reported benefits for human health:

- Increased energy
- Powerful antioxidant and free radical scavenger
- Chelates heavy metals and toxins

- Transports nutrients into cells (increases bioavailability)
- Potentiates the availability of essential nutrients
- Increases metabolism of proteins and contributes to DNA and RNA synthesis
- Powerful natural electrolyte
- Increases activity of enzyme systems
- Helps the immune system

Some reported beneficial claims for external use include the following:

- Treats open wounds, cuts, and abrasions
- Heals burns; decreases pain and scaring
- Eliminates discoloration due to skin bruises
- Acts as a wide spectrum anti-microbial and fungicide
- Treats rashes and insect bites
- Neutralizes poison ivy and poison oak

What about what some consider toxic elements such as aluminum that is contained in fulvic acids? One of the major elements of natural soil is aluminum (makes up 12% of the earth's crust). In its organic form, as occurs in fulvic acids, it is not harmful. After all bananas and many other commonly used fruits and vegetables have small amounts of aluminum in them (including almonds, apples, broccoli, carrots, grapes, tomatoes). Indeed aluminum is now known to be necessary to activate succinic dehydrogenase, a necessary body enzyme. Even minute amounts of arsenic is essential for optimal health. The metabolic antagonism between mercury and selenium results in protection from selenium toxicity by mercury and mercury toxicity by selenium.

Tests were done in Freiberg, Germany on human patients requiring transplantation or replacement of bone during surgery. Human donor tissues have disadvantages (legal requirements, pathogen problems, etc.) and if bone is taken from another part of the body, this means another surgical site to heal and care for. Taking bone tissue of an animal (bovine calcium hydroxyapatite) has been tried and is well tolerated. However, there is a problem of it being reabsorbed properly. Remarkable bone regeneration and resorption has occurred when the animal bone implants were impregnated with a low molecular weight fulvic acids prior to transplant into patients.

A study in Beijing (1988) showed fulvic acids helped with overactive thyroid (hyperthyroid) with a 90.9% cure rate. Another study, also in China, showed a 90% success rate, with 80% having complete cures, by using fulvic acids in cases of thyroid tumors.

There are several products on the market that contain fulvic acids. Do your research to find one that seems the best (high amount of fulvic acids, prepared in non-toxic forms, etc.).