

Effects of Humic Substances

A. Physical Conditions of the Soil.

1. Desirable structure, texture, and looseness or friability and crumbling are of particular importance in tight clay soils.
2. Adequate drainage.
3. Suitable aeration.
4. Water holding capacity.
5. Heat absorption (in the event of darker colored substances).
6. Buffering properties (that is, the prevention of rapid changes in soil acidity and alkalinity, which is accomplished by the humic substance readily assisting the soil in accepting or donating free hydrogen ions).
7. Openness for easy surface absorption of water, thus reducing surface water runoff, soil erosion, and soil water accumulation.

B. Mechanical Conditions. In this category of soil humic substance values, the following can be listed:

1. A more favorable medium for plant root system development, which is especially important in the production of root crops.
2. A desirable environment for beneficial microorganism development.

C. Soil Chemical Activity. Humic substances are of essential value as they contribute to:

1. The further active disintegration of soil rock, thus releasing additional supplies of important plant nutrients.
2. Soil chemical reactions that convert a number of important plant elements, including chemical compounds available for plant root uptake (for example, the conversion of phosphorus into a form available for plant use, the chelating of soil ion compounds to a form suitable for plant utilization in leaf chlorophyll development - yellowing of leaves, known as chlorosis, is the result of iron starvation, generally speaking).
3. A reduction of "locking up" of P₂O₅ (Phosphorus) in the soil, especially soil with clay base.
4. The liberation of carbon dioxide from soil calcium carbonate, thus increasing the availability of this important plant nutrient through plant roots for carbohydrate synthesis.
5. The neutralization of soil chemical substances that may cause plant toxicity. The benefit of a high ion exchange capacities in soil allow better retention and utilization of various elements, including: minerals and soil nitrogen. This prevents excess loss of these ingredients through drainage water leaching from plant root zone areas. In the presence of an adequate amount of humic substance, the plant food nutrients are held in the soil and made available to the plant roots upon demand.
6. The storage of plant nutrients gradually decomposition of organic matter/humic substance by soil microorganism actions results in the availability of:
 - a. Carbon dioxide.
 - b. Nitrogen, as ammonia quickly changed to nitrites and nitrates by bacteria.
 - c. Phosphorus and other elements essential for plant growth, such as sulfur potash.

7. Through soil biochemistry and microorganisms, the high-molecular-weight organic materials are broken down, making up to 5,000 calories per gram of energy available to be used by plants until further biodegradation takes place.
8. A retardation of the growth of soil organisms injurious to plants.
9. The promotion and conversion (chelation) of a number of elements into "food", forms nutrient uptake, thus is available to plants.

D. **Biochemical Values.** More directly, plant botanists, plant physiologists, and horticulturists around the world have claimed the following general effects:

1. The stimulation of plants cellular growth and division, including accelerated growth due to the presence of auxin type reactions.
2. The effective development of plants circulatory systems.
3. The most favorable function plant respiration and transpiration systems.
4. The decrease of plant stress and premature deterioration.

The above listed plant physiological activities are further benefited by humic acids because they contribute to the formation of plant stimulating substances known auximones. These substances seem to be absorbed by plant roots, and bring about desirable plant physiological activities in greater degrees by increasing plant cellular membrane and plasma permeability. This promotes the uptake of plant nutrients by increasing the development of polyphenols that function as respiratory catalysts, thereby causing an in living plant metabolism. Thus, there is a contribution to the plant enzyme system that is intensified, accelerating the plant cell division. This introduces us to the fifth, generalized function of humic substances.

E. **Pragmatic results.** As a result of the factors listed above, plant growth is stimulated, as reflected in these observations:

1. Improved seed germination.
2. Greater growth of fibrous roots.
3. Increases in legume root nodule formation (numbers and size).
4. Greater resistance to insects.
5. Greater plant resistance to drought and effects of frost damage.

Note: These effects are of economic value in that they contribute to increased yields and to improved crop quality, including the storage life of perishable crops.

Reference: Jackson William R. Ph.D. Organic Soil Conditioning

New Century, Inc / Rich Earth™

(757) 625-3886

www.richearth.net