Humus Encyclopedia Article

Humus

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Humus

Humus is the more or less stable fraction of organic matter remaining in a soil after the major portions of added plant and animal residues have decomposed. No longer recognizable as living tissues, humus is comprised of large molecules (e.g., 2,000-300,000 g/mol) with variable structures and composition. Humus is characterized by dark-colored, complex, colloidal-sized, amorphous aromatic ring-type compounds, including polyphenols and polyquinones. Because of the chemical complexity of these compounds, humic materials are resistant to further microbial degradation.

Humus in a soil supplies nutrients as well as growth-promoting substances (e.g., vitamins, amino acids, auxins, and gibberellins) that are necessary for plant growth. Humus also indirectly affects plant growth by affecting soil properties and processes. Humic substances reduce the plasticity, cohesion, and stickiness of clayey soils, making these soils easier to till. They also improve the water-holding capacity and infiltration rate of a soil by improving the aggregation (structure) of soil mineral particles. Increased aggregation of soil particles also increases the number and volume of macropores in a soil, resulting in better aeration and oxygen supply to plant roots.

Humic substances are negatively charged due to the dissociation of hydrogen ions from carboxylic (-COOH) or phenolic (-OH) groups. Because of this charge, they can hold positively-charged nutrient cations (e.g., potassium, calcium, magnesium) in an easily exchangeable form so they can be used by plants but at the same time are prevented from leaching out of the soil profile by percolating water.

Traditionally humic substances are classified into three chemical groupings, based on solubility. Fulvic acid is the humic fraction that is lowest in molecular weight and lightest in color. Fulvic acid is soluble in both acid and alkaline solutions and is more susceptible to microbial degradation than other types of humic substances. Humic acid is medium in molecular weight and color, soluble in alkaline solutions but insoluble in acidic solutions, and is intermediate in resistance to microbial degradation. Humin is the highest in molecular weight, darkest in color, insoluble in both acid and alkaline solutions and is the most resistant to further microbial degradation. However, all three groups are relatively stable in soils. The half-life (time required to degrade half of the amount of a substance) of fulvic acid may range from 10-50 years, while the half life of humic acid is usually centuries.