

SOIL - Notes from Jan Goroncy (for Garlic Workshop)

Natural fertility results from two primary organic mechanisms.

One is the decomposition of organic material that drives an increase in the population of soil micro-organisms. The other is the micro-organism driven chelation of soil elements converting elements into ionic forms that plants can use. Together these two primary mechanisms and a chain of other similar microbial driven reflexive synergistic actions are responsible for natural fertility.

Bacteria and other topsoil dwelling bacteria, use the nutrients from organic decomposed substances to increase populations of topsoil micro-organisms. Organic nutrients feed soil microbes which use the nutrition for expanded protein synthesis. When the expanded population expires organic nutrients from their bodies, they are left in the soil and are immediately available for use by crops. This natural fertility is a result of air-breathing mechanisms living at the top 6 inches of the soil where the atmosphere can penetrate. Agronomists can usually identify natural fertility by both the level of productivity and the darker colour of the soil. Soil acids, the foundation of soil fertility are humic substances formed as pigmented polymers. These complex carbon structures contain all of the nutrients required by a crop to grow to its full genetic potential. These two actions result in the incorporation of nutritional elements into soil elements and other organic structures. Topsoil microbes, principally bacteria, store the nutrients from decomposition as soil acids. Anything organic that dies on the surface of the soil will ultimately deteriorate into a soil acid.

The decomposition of dead roots, green manures, grass clippings, leaves and so forth does not necessarily yield the correct biochemical properties to result in the formation of humus, as the only precursors of the humic acids are amino acids, which must come from a source of protein. Amino acids are the building blocks of protein, and most of the dead roots, grass clippings, green manure, leaves and most ingredients of compost are made up of carbohydrates- therefore compost alone is normally a poor source of humic acids.

According to soil micro-biologists such as Drs. Elaine and Russ Ingham of Solifood Web Inc, Dr Mike Amaranthus of Mycorrhizal Applications Inc and others, an acre of healthy topsoil may contain about four to five tons of living micro-organisms. This includes about a ton of bacteria, over a ton of fungus, and two to three tons of other microbes including blue-green algae, protozoa, nematodes, actinobacteria and other micro-organisms. By increasing this population, a grower increases the amount of biotic, or living fertility, due to the protein levels in these microbes.

Elemental composition of bacteria			
Nitrogen	14.0%	Hydrogen	8.0%
Phosphorous	3.0%	Sulfur	1.0%
Potassium	1.0%	Magnesium	0.5%
Calcium	0.5%	Iron	0.2%

HUMIC ACID

Humic acid is a condensed, refractive mixture of aromatic organic acids. It is complex and variable and has not been characterised (as far as I know) to any degree (except perhaps for some of the many functional groups). Humic acid contains Sulfur, Nitrogen, and Phosphorous in varying amounts. It also contains metals such as Ca, Mg, Cu, Zn etc, which can be 'chelated' in some undefined way. Humic acid can be broken down into two groups based on the the polarity and size of the individual 'compounds'. The smaller, more polar fraction is generally termed fulvic acid and the larger, more non-polar fraction is generally termed humic acid.

Humic acids are the end product of microbial degradation of plant and animal debris and are one of the most important constituents of fertile soils.