The Soilsmart Newsletter

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CARBON SEQUESTRATION AND YOUR SOIL

In a recent special report on 'Climate Change' Weekend Australian March 30, 2008 noted that increasing Carbon in the soil could be an important part of the answer to global warming. Derek Parker reported that research from the Food and Agriculture Organisation of the UN, indicated that the earths' soil contains twice as much Carbon as the earths atmosphere and three times as much as all plant life. Soil is an integral part of the Carbon equation, with Carbon extracted from the atmosphere by plants and being trans-located into the soil by the natural biological decomposition processes. What was most interesting about this article was the fact that the role of soil as a Carbon sink was treated as 'News'. One of the earliest advocates of the soil and its complex systems was, Sir Albert Howard (1873 – 1947)

Sir Albert has been referred to as the father on 'Modern Organic Agriculture' and as the 'Father of Composting' he was one of the first to look upon the soil as an 'Ecological System' with soil microbes providing the link between the Humus (the soils' natural Carbon reserves) and the living plant. He saw the essential role of soil biology in decomposing organic matter and constantly replenishing the important soil humus levels. Howard is quoted as saying that "the health of the soil, plants, animals and man are as one and indivisible"

Following World War I, munitions factories began producing artificial fertilizers which began the large scale degradation of farming soils. In 1940 Howard said "the restoration and maintenance of soil fertility has become a universal problem, the large scale poisoning of the life of the soil by artificial manures is one of the greatest calamities which has befallen mankind" He was indeed ahead of his time, even today many soil scientists and managers underestimate the importance of the soil as a complex ecological system.

ORGANIC MATTER OR ORGANIC CARBON ?

Perceptions about 'Organic Matter' are often misguided, because not all organic substances are equal, which is why we should talk more about organic Carbon. Organic matter is a label which is conveniently given to any dead plant matter or manure material that may contain some level of carbon. The Organic Carbon present in that organic matter however, will differ significantly depending on the stage and type of decomposition process that the material has undergone. Some material such as chicken manure contains lots of organic Carbon, but because of the ineffective decomposition process used, the molecular structure of the Carbon in chicken manure, like most manure, is short chain, simple molecules, which are easily broken down and lost. These simple Carbon molecules easily join with Oxygen molecules and disappear from the soil as CO^2.

On the other hand, because of the natural decomposition process, the organic Carbon contained in worm castings (OziVerm & GranoVerm) are more complex, long chain molecules, and as a result they are far more stable in the soil. Similarly the carbon molecules contained in Humic and Fulvic acids (BioGrow, Liquid Humate & Liquid Fulvate) are complex and stable. Some 'well made' composts will also offer more stable Carbon levels however care needs to be taken to ensure that the decomposition process has been aerobic and adequate to create a beneficial end product.

WHAT ABOUT HUMUS ?

Humus is a stable sponge like substance that results from the natural (microbial) breakdown of organic matter. Because it has been formed through decomposition by aerobic organisms, it is stable and contains complex Carbon molecules (Humic & Fulvic acids in their natural form). It has a high capacity to store nutrients (CEC between 300 & 1400), holds 20 times its weight in water and is a valuable habitat for beneficial soil biology.

There are a number of ways to improve Soil Organic Carbon levels, if adding organic materials to your soil use high quality compost or vermicompost that have been produced in an aerobic decomposition process. Regular additions of products rich in stable organic acids (BioGrow, Liquid Humate & Liquid Fulvate) can also increase organic Carbon levels gradually. The addition of beneficial 'aerobic' soil organisms (Soil and Plant Tonic) will also assist in the formation of stable organic carbon by assisting the decomposition of any dead or decaying plant material and thatch etc. Raw of poorly processed manures and anaerobic composts do not contain 'stable' organic Carbon or the correct soil organisms.

DEALING WITH COMPACTION

Soil compaction can lead to poor root development, excessive plant stress and increased water use. But what really happens to the plant when soils become compacted?

The most significant factor associated with compaction is a dramatic reduction in the Oxygen flow to the root zone, creating anaerobic conditions. Anaerobic conditions can also be created by any event which reduces the air flow to the roots, such as over watering. If you keep the pores spaces filled with water it will restrict Oxygen to the roots.

WHY DO ANAEROBIC CONDITIONS AFFECT PLANT GROWTH

Anaerobic conditions can induce a number of negative impacts on the health of any plant. Anaerobic conditions create an environment which favours disease causing organisms, such as Pythium, Fusarium, Anthracnose and others, and if these conditions are prolonged over a period of time they can result in a decline of beneficial nematodes and a dominance of root feeding nematodes, creating severe plant health problems.

The issue surrounding soil compaction and anaerobicity is really about soil porosity. Soil porosity is another way of describing the amount of air space there is in the soil. The release of carbon dioxide is a function of both the leaves and the roots of plants, it is necessary, therefore that adequate ventilation processes are in operation to facilitate air exchange both above and below the ground, in order to prevent the accumulation of unwanted respiratory by-products.

For the leaves of plants, this is accomplished through the action of winds and air currents. In the soil, the processes of ventilation are more complicated. Special attention must be given to enable the air in contact with the roots of plants to be renewed frequently. In other words, every effort must me made to keep the air spaces within the soil open and the air exchange process effective.

The pore space in the soil makes up from 30 to 50 percent of the total soil volume. Part of this space is taken up by water, and the remainder by air. As the quantity of water is increased, the rate of air diffusion between the atmosphere and the soil is reduced. A reduction of as little as 10% can have serious effects on plant health, and as conditions become progressively worse, a point is finally reached where the roots are no longer able to breathe. This puts the plant under stress and causes a slowing of respiration which in turn results in decreased root density and decreased root depth.

Anaerobic soils promote the growth of anaerobic microorganisms which produce metabolites detrimental to plant growth. As the biological population changes to an anaerobic group of organisms, which are predominantly pathogenic, the way that nutrients are made available to the plant is also modified and there are significant changes in both the form and solubility of nutrient elements.

In their reduced state, certain types of these elements are taken up by the plant more rapidly than they can be metabolised, thereby becoming toxic, whilst others become limited in availability. Ultimately, root systems become dysfunctional in anaerobic soils. As the result, their ability to absorb water and nutrients is reduced significantly, causing the plants to develop symptoms of nutrient deficiency even though adequate levels exist in the soil. As plants become increasingly stressed they also become targets for insect pests.

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