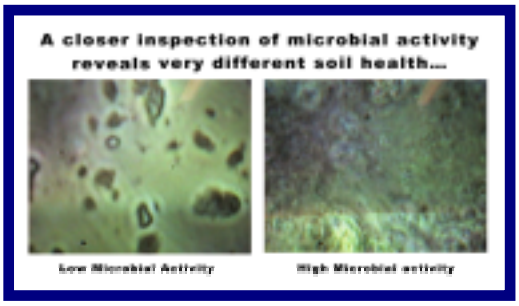
EARTHLIFE MINERALS

SOIL ENHANCEMENT SYSTEM

MAXIMISING NUTRIENT USAGE IN PLANTS, ANIMALS AND HUMANS

Intensive cultivation and erosion caused by wind and water, has caused significant soil degradation that has had an adverse impact in the agriculture arena (**Senate Document No. 264, 1936.**), which will continue unless addressed. Some of the soil properties that have been lost include organic matter, soil structure, nutrient availability, and populations of micro-fauna and micro-flora have been reduced.



Rising water tables, salt scalds, hard setting soils, reduced water infiltration, increased disease risks and rising insect pressure are all impacting on the health of the crops or pastures that are grown on these soils.

Agriculture in general, has steadily changed the nutrition programs for crops with the use of chemical fertilisers. Plant varieties have continually been selected or genetically engineered to increase their resistance to diseases and insects.

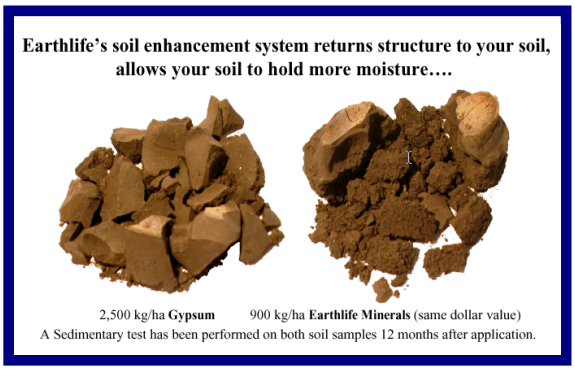
Significant achievements have occurred, but at what cost. Chemical fertilisers have little or no effect on rebuilding the soil structure, organic matter, organic carbon, humus and **micro organisms** that has been lost. The selection of plant varieties and genetic engineering of plants is costly and reduces biodiversity which will lead to the total reliance on patent protected plants for our food source.

In the quest for truly sustainable agriculture, **Earth Life Pty Ltd** in conjunction with an independent Soil Scientist, Crop Consultants, Department of Primary Industries and co-operative growers has developed a **"Soil Enhancement System"** based on **Earthlife Minerals**.

Identifying the production problem is the first and most important factor in finding a solution to improve plant production. The agriculture industry has identified **declining soil fertility** as the biggest problem. Therefore, the answer lies in improving soil fertility – Healthier Soil, Healthier Plants, Healthier Animals, Healthier People… Could it be that simple, after all - you are what you digest.

Earthlife Minerals contain minerals and trace elements that are known to assist in improving soil structure, plant growth and disease resistance. This results in yields being increased due to the improved health of the plant. A range of products based on Earthlife Minerals is manufactured for the broadacre, horticulture and gardening sectors.

Given that each sector has different requirements, a combination of Earthlife products are utilized to best meet the needs for each situation. Understanding individual requirements through **soil and leaf testing** allows Earth Life Pty Ltd to manufacture "Special Blends" to provide appropriate solutions.



Earthlife Minerals has specific advantages in that it can address several of the above soil or plant problems before, or during the cropping cycle while providing beneficial micro flora that enhance nutrient availability to the plants.

Other benefits of **Earthlife Minerals** include the ability to increase root structure, improve soil moisture retention and enhance utilisation of applied fertiliser. By improving the root structure of plants, their ability to access nutrient is increased and they are more able to withstand adverse conditions.

After the cropping cycle, the enlarged root structures promote higher organic matter levels in the soil profile, which in turn enhances the nutrient and moisture holding ability of the soil. This is achieved by the increased activity of the micro-fauna and micro-flora in breaking down the higher levels of organic material in conjunction with the minerals and trace elements supplied by the **Earthlife Minerals**.

In trials, where crops and pastures were grown utilising **Earthlife's Soil Enhancement System** in combination with artificial fertiliser programs, they have demonstrated greater responses than those grown with artificial fertiliser only (read grower testimonials). When broadcast, the Earthlife Minerals disperse into the soil under the influence of rain, irrigation or cultivation.

WHAT ARE THE MINERAL ELEMENTS? - There are 20 mineral elements necessary, or beneficial for plant growth. Carbon (C), hydrogen (H), and oxygen (O) are supplied by air and water. The six macronutrients, nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulphur (S) are required by plants in large amounts. The rest of the elements are required in trace amounts (micronutrients). Essential trace elements include boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), sodium (Na), zinc (Zn), molybdenum (Mo), and nickel (Ni). Beneficial mineral elements include silicon (Si) and cobalt (Co). The beneficial elements are not essential for all plants, but may be essential for some.

The following is a brief guideline of the role of essential and beneficial mineral nutrients that are crucial for growth. Eliminate any one of these elements, and plants will display abnormalities of growth, deficiency symptoms, or may not reproduce normally.

MACRONUTRIENTS - Nitrogen is a major component of proteins, hormones, chlorophyll, vitamins and enzymes essential for plant life. Nitrogen metabolism is a major factor in stem and leaf growth (vegetative growth). Too much can delay flowering and fruiting. Deficiencies can reduce yields, cause yellowing of the leaves and stunt growth.

Phosphorus is necessary for seed germination, photosynthesis, protein formation and almost all aspects of growth and metabolism in plants. It is essential for flower and fruit formation. Low pH (<4) results in phosphate being chemically locked up in organic soils. Deficiency symptoms are purple stems and leaves; maturity and growth are retarded. Yields of fruit and flowers are poor. Premature drop of fruits and flowers may often occur. Phosphorus must be applied close to the plant's roots in order for the plant to utilise it.

Potassium is necessary for formation of sugars, starches, carbohydrates, protein synthesis and cell division in roots and other parts of the plant. It helps to adjust water balance, improves stem rigidity and cold hardiness, enhances flavour and colour on fruit and vegetable crops, increases the oil content of fruits and is important for leafy crops. Deficiencies result in low yields, mottled, spotted or curled leaves, scorched or burned look to leaves.

Sulphur is a structural component of amino acids, proteins, vitamins and enzymes and is essential to produce chlorophyll. It imparts flavour to many vegetables. Deficiencies show as light green leaves. Sulphur is readily lost by leaching from soils and should be applied with a nutrient formula.

Magnesium is a critical structural component of the chlorophyll molecule and is necessary for functioning of plant enzymes to produce carbohydrates, sugars and fats. It is used for fruit and nut formation and essential for germination of seeds. Deficient plants appear chlorotic, show yellowing between veins of older leaves; leaves may droop.

Calcium activates enzymes, is a structural component of cell walls, influences water movement in cells and is necessary for cell growth and division. Some plants must have calcium to take up nitrogen and other minerals. Calcium is easily leached. Deficiency causes stunting of new growth in stems, flowers and roots. Symptoms range from distorted new growth to black spots on leaves and fruit. Yellow leaf margins may also appear.

MICRONUTRIENTS - Iron is necessary for many enzyme functions and as a catalyst for the synthesis of chlorophyll. It is essential for the young growing parts of plants. Deficiencies are pale leaf colour of young leaves followed by yellowing of leaves and large veins. Iron is lost by leaching and is held in the lower portions of the soil structure. High pH (alkaline) conditions render iron unavailable to plants.

Manganese is involved in enzyme activity for photosynthesis, respiration, and nitrogen metabolism. Deficiency in young leaves may show a network of green veins on a light green background similar to an iron deficiency. In the advanced stages, the light green parts become white, and leaves are shed. Brownish, black, or greyish spots may appear next to the veins. In neutral or alkaline soils plants often show deficiency symptoms. In highly acid soils, manganese may be available to the extent that it results in toxicity.

Boron is necessary for cell wall formation, membrane integrity, calcium uptake and may aid in the translocation of sugars. Boron affects at least 16 functions in plants, including flowering, pollen germination, fruiting, cell division, water relationships and the movement of hormones. Boron must be available throughout the life of the plant. It is not translocated and is easily leached from soils. Deficiencies kill terminal buds leaving a rosette effect on the plant. Leaves are thick, curled and brittle. Fruits, tubers and roots are discoloured, cracked and flecked with brown spots.

Zinc is a component of enzymes or a functional cofactor of a large number of enzymes, including auxins (plant growth hormones). It is essential to carbohydrate metabolism, protein synthesis and internodal elongation (stem growth). Deficient plants have mottled leaves with irregular chlorotic areas. Zinc deficiency leads to iron deficiency, causing similar symptoms. Deficiency occurs on eroded soils and is least available at a pH range of 5.5 - 7.0. Lowering the pH can render zinc more available to the point of toxicity.

Copper is concentrated in roots of plants and plays a part in nitrogen metabolism. It is a component of several enzymes and may be part of the enzyme systems that use carbohydrates and proteins. Deficiencies cause die back of the shoot tips, and terminal leaves develop brown spots. Copper is bound tightly in organic matter and may be deficient in highly organic soils. It is not readily lost from soil, but may often be unavailable. Too much copper can cause toxicity.

Molybdenum is a structural component of the enzyme that reduces nitrates to ammonia. Without it, the synthesis of proteins is blocked and plant growth ceases. Root nodule (nitrogen fixing) bacteria also require it. Seeds may not form completely, and nitrogen deficiency may occur if plants are lacking molybdenum. Deficiency signs are pale green leaves with rolled or cupped margins.

Chlorine is involved in osmosis (movement of water or solutes in cells), the ionic balance necessary for plants to take up mineral elements and in photosynthesis. Deficiency symptoms include wilting, stubby roots, chlorosis (yellowing) and bronzing. Odours in some plants may be decreased. Chloride, the ionic form of chlorine used by plants, is usually found in soluble forms and is lost by leaching.

Nickel is required for the enzyme urease to break down urea to liberate the nitrogen into a useable form for plants. Nickel is required for iron absorption. Seeds need nickel in order to germinate. If nickel is deficient plants may fail to produce viable seeds.

Sodium is involved in osmotic (water movement) and ionic balance in plants.

Cobalt is required for nitrogen fixation in legumes and in root nodules of non-legumes. The demand for cobalt is much higher for nitrogen fixation than for ammonium nutrition. Deficient levels could result in nitrogen deficiency symptoms.

Silicon is a component of cell walls. Plants with supplies of soluble silicon produce stronger, tougher cell walls making them a mechanical barrier to piercing and sucking insects. This significantly enhances plant heat and drought tolerance. Silicon may be deposited by the plants at the site of infection by fungus to combat the penetration of the cell walls by the attacking fungus. Improved leaf erectness, stem strength and prevention or depression of iron and manganese toxicity have all been noted as effects from silicon.