Tucson Organic Gardeners

soiling our hands since 1971

Soil is Alive

For more than 50 years, gardeners and farmers have used synthetic fertilizers. These fertilizers cause chemical changes in the soil, which damage its structure, kills beneficial macrobiotic life, and greatly reduces its ability to allow the nutrients that exist in the soil and water to be available to plants. Presently crop yields are on downtrends in many of our country's major farming areas due to damaged fertile soils. It is evident that the ammonia-type fertilizers foster pest population explosions, creating the need for ever increasing applications of toxic chemicals, and polluting land, water, and food crops. Many consumers have become apprehensive about the toxic residues in the food products. The few farmers and gardeners who refrained from using petro-chemicals are now joined by thousands of growers across the nation.

Soil is alive! Each square inch of soil contains billions of microorganisms, most of which cannot be seen unless under a microscope. Larger organisms in the soil are called macro-organisms. The most common is also the best friend to growers. An earthworm eats the soil through which it burrows and its digestive enzymes break down and dissolve bacteria, leaf mold, and other organic materials in the soil. What is not digested is called "castings". Earthworms are one of the most effective agents for loosening and aerating the soil. By careful observation of one acre of land, scientists estimated earthworms had moved 35,000 lbs. of subsoil to the surface in one year's time.

Roots of crops grow primarily in the spaces between the soil particles. As the earthworms penetrate the subsoil, it opens for root growth, and castings are left in the soil. These castings contain from five to ten times as much nitrogen, phosphorus and potassium as the surrounding soil, and have one-third higher beneficial bacteria. The tunnels allow rainwater to penetrate quickly throughout the topsoil layer, and runoff is lessened. To determine if soil needs more earthworms, dig out a chunk of soil one square foot across and seven inches wide. If this chunk contains at least ten earthworms, the population is large enough to be significant in the structural properties.

Deep rooting crops such as alfalfa, sweet clover, lupines and soybeans protect against erosion, retain nutrients that might be leached, suppress the germination and growth of weeds, cycle nutrients from the lower to upper layers, and leave a quantity of nitrogen. After the crops have decomposed the root channels remain, again allowing water to penetrate deeper. Alfalfa roots grow up to twenty feet, so this legume is not feasible in a garden. If the soil has been neglected or never been used, more than a year will be needed to restore the land to a fertile productive state using green manure crops.

Although buckwheat is not a legume, it will grow in sand, clay, and dry or wet areas. It produces much organic material very quickly. Also buckwheat has the ability to use phosphates in the soil unavailable to most other plants. Buckwheat is especially good for loosening up tough soil and killing weeds.

Compost is the most important addition a gardener can make to soil. This organic matter opens up heavy soils to make them more easily workable and binds sandy soil so that it has better water retention. Also compost allows the nutrients in the soil to become available to plants. When compost is used in planting beds, the earthworms have food available and will come to the surface.

Manure is the next best addition to any soil. However, manure contains nitrogen, which can burn plants if it is put directly into the planting bed. With the exception of melon type crops, manure should be composted before applying. But melon crops, such as squash, watermelon, cantaloupe, and cucumbers need heavy feeding. Dig a foot deeper for the bed, add six inches of manure, and then cover with dirt to the planting level. By the time the roots grow to that depth, the manure will be composted enough for the nitrogen to be available to the plants.

Acidity and alkalinity of soils are the result of two factors. One is the chemical composition of the rock from which the soil is derived. The second factor is the amount of decomposition of vegetation in the soil. In the Southwest deserts, the soil is dry, hard, thin, tan, and filled with salts and lime; therefore it is known

as alkaline. Sparse rainfall and lack of vegetation that sheds leaves for organic matter to be composted causes this alkaline condition.

Organic gardeners speak of adding nutrients or amendments rather than using fertilizer. When planting native vegetation, do not amend the soil. But the non-native crops that grow elsewhere need a balanced pH of 6.8 to 7. NPK is the abbreviation for Nitrogen, Phosphorus, and Potassium, the major plant nutrients. Nitrogen is the most important additive since it leaves this soil in less than a month. With a good supply of nitrogen, plants grow sturdily and mature rapidly, and the foliage is a rich, dark green. Defienicy of nitrogen is indicated by leaves, which are yellowish or light green and often very small. Excess of nitrogen is more harmful than not enough nitrogen. The plants tend to rapidly develop water tissue and are weak instead of stiff. To add nitrogen to the planting bed, use cottonseed meal, fish meal, alfalfa meal and pellets, and kelp meal.

Phosphorous is the “P” in the formula. It is essential for healthy growth, strong roots, fruit development, and greater resistance to disease. Deficiency is indicated by a red purple discoloration of stems, leaf veins, and leaves of vegetable plants. Soft-rock phosphate, cottonseed meal and bone meal are sources of phosphorus.

The “K” indicator means potassium, or potash, the third essential element. Strong stems, protection form cold and dry weather, and vigorous root systems are the results of plant sugar manufacture supplied by potassium. Kelp meal, granite dust and greensand are all available locally to add potassium.

Nitrogen can be applied on top of the soil, but plants best use potassium and phosphorous when applied in the bottom of the planting bed or hole. The roots will then have access to these nutrients throughout their life.

Some nutrients are needed in trace amounts, called micro-nutrients. These include Calcium, Magnesium and Sulfur. Plants need calcium for cell manufacture and tip growth. Alkaline soils are seldom lacking in calcium. If a supplement is needed, use gypsum. The chlorophyll that makes green leaves is supplied by magnesium, which is present in most soils. And it occurs where calcium is present. Soil sulfur works with nitrogen to create new cells, but the deficiency is not noted as quickly as nitrogen. The leaves turn yellow, but do not dry out as in nitrogen deficiency. Use soil sulfur in the bottom of the planting bed as it helps to soften the hard pan. Gypsum can also be used with sulfur to soften harsh soils.

Iron, Zinc, and Manganese are three lesser-known but essential nutrients. Lack of iron is very noticeable as the leaves turn yellow from the edges inward. This discoloration means the plant cannot produce chlorophyll. Iron is needed to process nitrogen and to reduce the nitrate in ammonia. If a spray of iron sulfate, iron oxide or iron chloride solution is used, salts are formed. Ferrous sulfate, a salt, is poison to many plants. Instead of these materials, use composted chicken manure, or apply heavy amounts of compost and greensand. Sometimes the pH is too high. Applying compost will then allow the plant to absorb the iron already present in the soil. Iron deficiency is often noticeable in desert soils. Also once a month during the growing season, use a spray of fish emulsion for quick relief.

Zinc is a necessary trace mineral, and usually not present in quantity in desert soils. Large amounts of NPK prevent zinc from being utilized; therefore using heavy applications of artificial fertilizer will result in a lack of zinc. Mixing a large amount of compost into the soil before planting the bed will correct the problem.

Another necessary trace element is Manganese. Again, it is deficient in alkaline soils. Planting legumes with the crop will overcome this problem, as legumes accumulate manganese. Although soybeans are an annual crop, the roots do not travel as deeply as clover or alfalfa and can be used in the home garden. Vetch is another crop that can be planted with a light touch to help preserve manganese.

The most reliable method for assuring an adequate supply of micronutrients is by thorough organic fertilization. Compost, composted manure, and natural ground rock fertilizers provide a complete balanced ration. These products will assure the pH is slightly acid to neutral for growing non-native crops. Also the plants will feed slowly and continuously rather than have a huge quantity of food at one time. Keep your soil alive and productive.

Lois H Lockhart December 1999 Resources: Down-to-Earth Vegetable Gardening, by Dick Raymond. Encyclopedia Of Organic Gardening, staff of Rodale Press. How To Grow Move Vegetables, by John Jeavons. New Organic Grower, by Eliot Coleman