



Soil

Soil is a thin coating of broken down rock and other matter that coats the Earth's surface – that along with water and sunshine is the basis for all of life! The proportions and properties of the different constituents are what make different soils different.

Inorganic parts

Stones, sand, silt and clay particles are derived from rocks by erosion and the action of ice, water, wind, and chemical reactions with oxygen and plant breakdown products. Their chemical composition determines the minerals available to plants. The size of the particles helps determine how much water can be held in the soil and how quickly water flows through the soil. A good garden loam has a mix of sand, silt and clay.

Organic parts

Humus, manures and the decaying parts of plants and soil animals help make the minerals available to the plants, hold water in the soil and continually modify the chemical and physical properties of the soil. Bacteria, fungi, viruses, worms, insects and other small animals live in the soil, usually in the top 30-50cm, and on decaying matter on the surface. They help break down dead plant and animal matter and form humus, making minerals and nutrients available to plant roots. Some bacteria (*Rhizobium* and others) take nitrogen from the air and fix it on the nodules of legumes or directly in the soil, making it available to plants. For a productive garden, more organic matter needs to be added to replace that broken down. A soil rich in organics is black and crumbly, easy to dig, has lots of earthworms and their tunnels, and is moist but not wet. It will not require lots of digging, just addition of more organic matter to the surface as **mulch**, which will also conserve soil water in the summer months. This will help preserve the soil structure. Adding mulch will also keep the soil cooler, so that roots are not overheated.

Air and water are essential for plant life. Air spaces allow water to pass through the soil, roots to penetrate and grow and to breathe. **Gypsum** can be added to clay soils to help clump the fine particles, increase aeration and rid the soil of excess sodium (saline soils). Plants have varying water requirements depending on their place of origin and many have developed specialised ways to conserve water. Annual vegetables and flowers generally require consistently moist soils with good drainage, so that roots are not sitting in water for any length of time, nor allowed to dry out.

Correct soil **pH** is also vital. This is a measure of how acid or alkaline the soil is. pH is measured from 0 (acid) -14 (alkaline). Plants differ in their pH requirements, but generally require slightly acid to neutral soils, again depending on their place of origin: 5.5 – 7.5 range is usual. The soil pH can affect the availability of some of the minerals plants need e.g. very alkaline soils will not release their iron and manganese, and very acid soils may release toxic amounts of manganese, boron, copper and zinc, and make it difficult for plants to get enough calcium and molybdenum.

All of these nutrients are needed in tiny amounts for plant and animal health. If regular doses of **composts and aged manures** are added, these should be present in sufficient amounts for healthy plant growth. Adding lime, ground limestone, dolomite, or alkaline (hard) water, and composts that contain these materials will make soils more alkaline, and ammonium or iron sulphate fertilizers will make soil more acid, as will the breakdown of plant materials over time, or the leaching of carbonates and salts from the soil. Soil near new concrete can become alkaline. Wood ash and cement dust are very alkaline and should be used with care.

Plant nutrients

The three most important plant nutrients are **Nitrogen (N)**, **Phosphorus (P)** and **Potassium (K)**. Commercial fertilizers will have an N:P:K ratio printed on the bag, which gives the proportions of these elements in the contents, and can be a guide to value for money and the appropriate fertilizer for the plants you are wanting to grow.

Nitrogen is needed for plant growth – it is part of proteins, DNA, and other plant structures. Green leafy crops require lots of Nitrogen to thrive.

Phosphorus is needed for many of the chemical reactions involved in plant growth and reproduction. It is particularly important for crops where we want flowers and fruit. Plants of the *Proteaceae* family (e.g. Proteas, Banksias, Grevilleas, Dryandras etc) have adapted to low phosphorus soils, and can be killed by application of large amounts of phosphorus.

Potassium (Potash) is a part of plant sap, and is involved in stem growth and protection of the plant from disease. It promotes thick cell walls. It is not present in blood and bone, although many manufacturers add it to commercial products.

Sulphur is also needed for plant growth, being an essential part of proteins and DNA etc.

Calcium is needed for cell division, as part of cell walls and the salts inside cells. It is vital for root growth

Magnesium is needed for chlorophyll, and is vital for photosynthesis, as are **Iron** and **Manganese**.

Deficiencies (or toxicity) in these and other nutrients cause yellowing or other colours in the leaves, poor growth or fruiting, spots on the leaves, leaf drop, leaf distortions etc. Consult a nursery or good reference book for a diagnosis, or add a good complete fertilizer and/or a liquid fertilizer to the leaves or soil.

Artificial fertilizers

In the organic garden, these should not be needed, and may in fact harm the soil's living things and cause an oversupply of some nutrients, upsetting the balance needed for healthy growth. Highly soluble fertilizers can also leach out into rivers and streams, lakes and the ocean, killing fish and causing outbreaks of blue-green algae and the like. They are not to be used at Lochiel Park Community garden.

Plan of action for improving your soil

When you first set up your plot, test the pH and add lime or sulphur to bring to the right pH. Add lots of organic matter e.g. compost, animal manures (from different sources if possible), worm casings, and possibly gypsum. Between each season, add a couple of bags of horse poo or cow manure (pre-composted if possible – watch for imported weed seeds etc if *au naturel*, and check, if you can, for use of antibiotics etc in the animal since these would be undesirable in your soil). Wait a couple of weeks before you plant anything to let the soil microbial populations build up and manures to start decomposing so they don't burn tender roots. Whenever you plant a seedling add a sprinkle of blood and bone on the surface of the soil (not in the hole) and add handfuls of compost to the surface of the soil in between plants. Use pea straw or lucerne hay as mulch in the summer - bare soil in the winter lets the sun warm the soil as much as possible. Add pelleted manures, and liquid fertilizers particularly in the winter season, and mineral mixes if you detect problems. **Healthy soil makes healthy plants, and healthy plants resist pests and diseases better.**