Plant Nutrients

Sixteen chemical elements are known to be important to a plant's growth and survival. The sixteen chemical elements are divided into two main groups: **non-mineral** and **mineral.**

Non-Mineral Nutrients

The **Non-Mineral Nutrients** are **hydrogen (H), oxygen (O),** & **carbon (C).**

These nutrients are found in the air and water.

In a process called **photosynthesis**, plants use **energy from the sun** to change **carbon dioxide** (CO_2 - carbon and oxygen) and **water** (H_2O- hydrogen and oxygen) into starches and sugars. These starches and sugars are the plant's food.

Since plants get carbon, hydrogen, and oxygen from the air and water, there is little farmers and gardeners can do to control how much of these nutrients a plant can use.

Mineral Nutrients

The **13 mineral nutrients**, which come from the soil, are dissolved in water and absorbed through a plant's roots. There are not always enough of these nutrients in the soil for a plant to grow healthy. This is why many farmers and gardeners use fertilizers to add the nutrients to the soil.

The mineral nutrients are divided into two groups: **macronutrients** and m**icronutrients**.

Macronutrients

Macronutrients can be broken into two more groups: **primary** and **secondary nutrients**.

The **primary nutrients** are **nitrogen (N)**, **phosphorus (P)**, and **potassium (K)**. These major nutrients usually are lacking from the soil first because plants use large amounts for their growth and survival.

The s**econdary nutrients** are **calcium (Ca)**, **magnesium (Mg)**, and **sulfur (S)**. There are usually enough of these nutrients in the soil so fertilization is not always needed. Also, large amounts of Calcium and Magnesium are added when lime is applied to acidic soils. Sulfur is usually found in sufficient amounts from the slow decomposition of soil organic matter, an important reason for not throwing out grass clippings and leaves.

Micronutrients

Micronutrients are those elements essential for plant growth which are needed in only very small (micro) quantities. These elements are sometimes called minor elements or trace elements, but use of the term micronutrient is encouraged by the American Society of Agronomy and the Soil Science Society of America. The micronutrients are **boron (B), copper (Cu), iron (Fe), chloride (Cl), manganese (Mn), molybdenum (Mo)** and **zinc (Zn)**. Recycling organic matter such as grass clippings and tree leaves is an excellent way of providing micronutrients (as well as macronutrients) to growing plants

Macronutrients

Nitrogen (N)

- Nitrogen is a part of all living cells and is a necessary part of all proteins, enzymes and metabolic processes involved in the synthesis and transfer of energy.
- Nitrogen is a part of chlorophyll, the green pigment of the plant that is responsible for photosynthesis.
- Helps plants with rapid growth, increasing seed and fruit production and improving the quality of leaf and forage crops.
- Nitrogen often comes from fertilizer application and from the air (legumes get their N from the atmosphere, water or rainfall contributes very little nitrogen)

Phosphorous (P)

- Like nitrogen, phosphorus (P) is an essential part of the process of photosynthesis.
- Involved in the formation of all oils, sugars, starches, etc.
- Helps with the transformation of solar energy into chemical energy; proper plant maturation; withstanding stress.
- Effects rapid growth.
- Encourages blooming and root growth.
- Phosphorus often comes from fertilizer, bone meal, and superphosphate.

Potassium (K)

- Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and, in some cases, calcium.
- Helps in the building of protein, photosynthesis, fruit quality and reduction of diseases.
- Potassium is supplied to plants by soil minerals, organic materials, and fertilizer.

Calcium (Ca)

- Calcium, an essential part of plant cell wall structure, provides for normal transport and retention of other elements as well as strength in the plant. It is also thought to counteract the effect of alkali salts and organic acids within a plant.
- Sources of calcium are dolomitic lime, gypsum, and superphosphate.

Magnesium (Mg)

- Magnesium is part of the chlorophyll in all green plants and essential for photosynthesis. It also helps activate many plant enzymes needed for growth.
- Soil minerals, organic material, fertilizers, and dolomitic limestone are sources of magnesium for plants.

Sulfur (S)

- Essential plant food for production of protein.
- Promotes activity and development of enzymes and vitamins.
- Helps in chlorophyll formation.
- Improves root growth and seed production.
- Helps with vigorous plant growth and resistance to cold.
- Sulfur may be supplied to the soil from rainwater. It is also added in some fertilizers as an impurity, especially the lower grade fertilizers. The use of gypsum also increases soil sulfur levels.

Micronutrients

Boron (B)

- Helps in the use of nutrients and regulates other nutrients.
- Aids production of sugar and carbohydrates.
- Essential for seed and fruit development.
- Sources of boron are organic matter and borax

Copper (Cu)

- Important for reproductive growth.
- Aids in root metabolism and helps in the utilization of proteins.

Chloride (Cl)

- Aids plant metabolism.
- Chloride is found in the soil.

Iron (Fe)

- Essential for formation of chlorophyll.
- Sources of iron are the soil, iron sulfate, iron chelate.

Manganese (Mn)

- Functions with enzyme systems involved in breakdown of carbohydrates, and nitrogen metabolism.
- Soil is a source of manganese.

Molybdenum (Mo)

- Helps in the use of nitrogen
- Soil is a source of molybdenum.

Zinc (Zn)

- Essential for the transformation of carbohydrates.
- Regulates consumption of sugars.
- Part of the enzyme systems which regulate plant growth.
- Sources of zinc are soil, zinc oxide, zinc sulfate, zinc chelate.

In general, most plants grow by absorbing nutrients from the soil. Their ability to do this depends on the nature of the soil. Depending on its location, a soil contains some combination of sand, silt, clay, and organic matter. The makeup of a soil (soil texture) and its acidity (pH) determine the extent to which nutrients are available to plants.

Soil Texture (the amount of sand, silt, clay, and organic matter in the soil) Soil texture affects how well nutrients and water are retained in the soil. Clays and organic soils hold nutrients and water much better than sandy soils. As water drains from sandy soils, it often carries nutrients along with it. This condition is called leaching. When nutrients leach into the soil, they are not available for plants to use. An ideal soil contains equivalent portions of sand, silt, clay, and organic matter. Soils can vary in their texture and nutrient content, which makes some soils more productive than others.

Sometimes, the nutrients that plants need occur naturally in the soil. Other times, they must be added to the soil as lime or fertilizer.

Soil pH (a measure of the acidity or alkalinity of the soil)

Soil pH is one of the most important soil properties that affect the availability of nutrients.
- Macronutrients tend to be less available in soils with low pH.
- Micronutrients tend to be less available in soils with high pH.

Lime can be added to the soil to make it less sour (acid) and also supplies calcium and magnesium for plants to use. Lime also raises the pH to the desired range of 6.0 to 6.5.

In this pH range, nutrients are more readily available to plants, and microbial populations in the soil increase. **Microbes** convert nitrogen and sulfur to forms that plants can use. Lime also enhances the physical properties of the soil that promote water and air movement.

http://www.ncagr.gov/cyber/kidswrld/index.htm