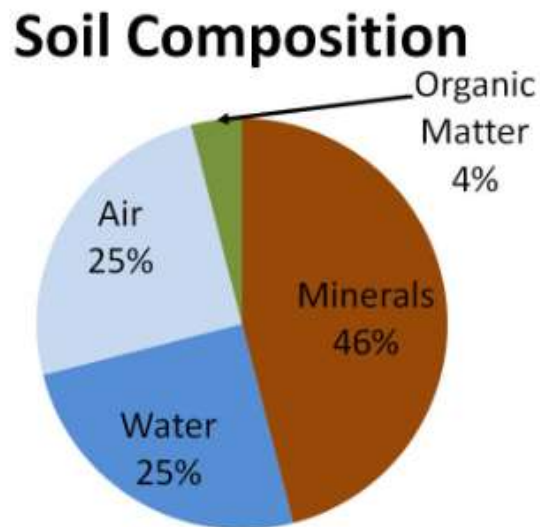


Mineral Nutrition

- Mineral nutrients: some 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.
- Soil is defined as a mixture of soil particles, decaying organic material, living organisms, air, & water.



- **The mineral nutrients are divided into three groups:**
 - 1- Basic Nutrients:** C, H, O constitute about 96% of the total dry matter of plants.
 - 2- Macronutrients:** Macronutrients can be broken into two more groups:
 - a- 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.

- b- Secondary 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.
- 3- Micronutrient:** are those elements essential for plant growth which needed in only very small quantities. These elements are sometimes called trace elements. The micronutrients are boron (B), Copper (CU), Iron (Fe), chloride (Cl), manganese (Mn), molybdenum (Mo) and zinc (Zn).

Element	Chemical symbol	Element	Chemical symbol
Obtained from water or carbon dioxide		Obtained from the soil	
Hydrogen	H	Micronutrients	
Carbon	C	Chlorine	Cl
Oxygen	O	Iron	Fe
Obtained from the soil		Boron	B
Macronutrients		Manganese	Mn
Nitrogen	N	Sodium	Na
Potassium	K	Zinc	Zn
Calcium	Ca	Copper	Cu
Magnesium	Mg	Nickel	Ni
Phosphorus	P	Molybdenum	Mo
Sulfur	S		
Silicon	Si		

- **What are the criteria of Essential element?**

1. Universal for all plants.
2. Absence prevents completion of life cycle
3. No other element can substitute for it.
4. Absence leads to deficiency.

- **Beneficial Nutrients:** Such elements at very low concentrations and often under specific conditions have been shown to stimulate the growth of certain plants e.g. Selenium (Se)

General functions of mineral elements

1. Framework elements: Carbon, Hydrogen and Oxygen are considered as framework elements because they constitute the carbohydrates which form cell walls.
2. Protoplasmic elements: Nitrogen, Phosphorus and Sulphur are considered as protoplasmic elements as they form part of protoplasm along with carbon, hydrogen and oxygen.
3. Elements involved in enzyme activation and electron transfer. Example: Fe and Mo.
4. Balancing elements: Elements necessary for charge balance for example Calcium, Magnesium and Potassium.

Nutrient deficiencies

Mineral nutrient deficiencies occur when the concentration of a nutrient decreases below this typical range. Deficiencies of specific nutrients lead to specific visual.

Deficiency symptoms of mineral nutrients

- Stunting: The growth is retarded. The Stem appears short.
- Chlorosis: It is the loss of chlorophyll resulting in the yellowing of leaves.

- Necrosis: Localized death of tissues of leaves.
- Mottling: Appearances of patches of green and non-green on the leaves.
- Leaf curls: Abnormal curling of leaves due to unequal growth.
- Abscission: Premature fall of flowers fruits and leaves.

