CROP NUTRIENTS

Plants contain small amounts of 90 or more elements but 16 have been shown to be essential for their growth and development.

These essential elements are: Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur, Iron, Manganese, Zinc, copper, boron, molybdenum and chlorine.

Four more elements such as cobalt, Vanadium, Sodium and Silicon have been found essential for one plant or other but not required for all plants.

Basic Nutrients: Carbon, H and Oxygen are called basic nutrients and they are primarily ~~absorbed~~ from air and water.

The remaining 13 elements are normally absorbed from the soil by plant roots. These 13 elements are divided in to three groups on the basis of their amounts required for plant growth.

1. Primary Nutrient :- N, P & K are required in relatively large amounts and ~~are provided by fertilizers & manures.~~ are called primary nutrients.

Secondary Nutsients :- Ca, Mg, S called Secondary
nutsients as they are required
primary nutrients.

Micro Nutsients :- Micronutsients are those elements as which
are used by plants in very small amounts. They are as essentia
to plant growth as the primary & secondary nutrients.
These are Mn, Fe, Zn, Cu, Chlorine (Cl), Mo, ~~Be~~ B
Manganese, Iron, Zinc, Copper, Molybdenum, Boron.

Table:- FORMS OF UPTAKE OF ESSENTIAL NUTRIENTS

Nutsient & Symbol	Principal form of uptake
Basic Nutsients	
Carbon (C)	CO_2
Hydrogen (H)	H_2O
Oxygen (O)	H_2O, O_2 (oxygen)
Primary ~~Macro~~ Nutsients	
Nitrogen (N)	NH_4^+, NO_3^-
Phosphorus (P)	$H_2PO_4^-$, HPO_4^-
Potassium K	K^+
Secondary Nutsients	
Calcium Ca	Ca^{++}
Magnesium Mg	Mg^{++}
Sulphur S	SO_4^{2-} (Sulphate ion), SO_2 (Through leaves) Sulphur dioxide)
Micro Nutsients	
Iron Fe	Fe^{++} (Ferrous) or Ferric Fe^{+++}
Manganese Mn	Mn^{++} (ion)
Boron B	~~H_3BO_3~~ or ~~B^{3+}~~ $H_2BO_3^-$ or BO^{---} (Boron)

P_2O_5 = Phosphorus pentoxide.

Nutrient
Zinc (Zn)
Copper (Cu)
Molybdenum
Chlorine (C

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Nutrient & Symbol	Principal form of uptake
Zinc (Zn)	Zn^{++} (ion)
Copper (Cu)	Cu^{+} or Cu^{++} (ion)
Molybdenum (Mo)	MoO_4^{2-} (Molybdate)
Chlorine (Cl)	Cl^{-} (ion)

CRITERIA OF ESSENTIALITY OF AN ELEMENT

1. An element is said to be essential if its deficiency does not allow the plant to complete its life cycle
2. Deficiency of the element in question can be corrected by supplying that particular element.
3. The element must extend its effect directly on growth or metabolism.

FUNCTIONS OF PLANT NUTRIENTS

1. NITROGEN:- Nitrogen is utilized to synthesize amino acids which in turn form proteins.
2. Phosphorus:- phosphorus is present in all living plant cells and is utilized to form nucleic acid and energy rich compounds such as ATP and ADP. ATP= Adenosine Tri-phosphate ADP= Adenosine Diphosphate
3. Potassium:- It is not synthesized into compounds but tends to remain in ionic form with in cells and tissues. It is essential for translocation of sugars for starch formation. It plays important role in osmotic regulation in plant body.

Calcium:- It is an essential part of cell wall structure and must be present for the formation of new cells.

Magnesium:- It is an essential constituent of chlorophyll and hence important for photosynthesis & sugar production.

Sulphur:- Sulphur is constituent of three amino acids namely cystine, methionine, and cysteine and therefore essential for protein synthesis

Zinc:- It is essential constituent of important enzyme systems plants. It controls the synthesis of indole acetic acid and impo hormone for plant growth.

Iron:- It is required for formation of chlorophyll in plant It activates biochemical processes such as respiration, photosynthesis symbiotic N fixation

Manganese:- It activates several enzymes involved in growth p proteases, Amylases, Lipases, cellulases

Plant enzymes are:-

Copper:- It is an activator of several enzyme systems in p It is essential for chlorophyll formation & production of vitamin A

Boron:- It is involved in cell division, protein synthesis, ch metabolism, floral initiation & plant formation.

Molybdenum:- Plants can not transform nitrate nitrogen i without molybdenum.

Chlorine :- It is required in photosynthetic reactions in plants It help plants to resist drought stress.

Carbon, H and O are all components of carbohydrates. The major groups of carbohydrates are sugars, starches and cellulose The sources of C, O, H in plants are derived from CO_2, O_2 and water. These elements are not ~~listed~~ included in the listings of plant fertilizers.

MANURES :- Manures are defined as bulky natural substances which are derived from plant and animal wastes and are applied to soil to fulfill plant nutrient needs.
for providing plant nutrients.

SOURCES :- The source of ~~soil organic matter~~ manure are crop residues, farm yard manure, animal manure, green manure, compost, sewage sludge etc. Dead remains of animals and micro-organisms form the secondary source of organic matter in the soil.

Chemical Composition of Manures (O. matter) :-

The chemical composition of soil organic matter is characterized in three major groups

1. Polysaccharides 2- Lignins 3- Proteins

Besides these groups, a variety of other substances such as fats and waxes occur in plant residues.

1. Polysaccharides are cellulose, hemicellulose, sugars, starches, and peptic substances.
2. Lignins are complex substances derived from woody tissues of plants.

3. Proteins are principal N- containing compounds of organic matter and exist in all life form These three classes of materials are sources of food for soil micro-organisms.

Decomposition of Organic Matter

Organic matter is decomposed by living organisms in the soil such bacteria, fungi and actinomycetes. These microorganisms and larger organisms such as earthworm insects ingest organic residue and soil thereby ~~affects~~ ~~the binding~~ bind soil particles in to stable aggregate practically all soil properties are affected by soil organic matter.

"The dark coloured organic residue which resists further decomposition is called humus."

It improves soil tilth and facilitates aeration and water penetration.

The more common simple products that result from the activity of soil microorganism are C, N, S, P and others.