



FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

Crop nutrition, manures and fertilizers

Crop nutrition

Proper nutrition is essential for satisfactory crop growth and production. The use of soil tests can help to determine the status of plant available nutrients to develop fertilizer recommendations to achieve optimum crop production. There are at least 17 elements known to be essential for plant growth.

Essential elements

Plants need 17 elements for their growth and completion of their life cycle. They are

1. Carbon
2. Hydrogen
3. Oxygen
4. Nitrogen
5. Phosphorus
6. Potassium
7. Calcium
8. Magnesium
9. Sulphur
10. Iron
11. Manganese
12. Zinc
13. Copper
14. Boron
15. Molybdenum
16. Chlorine
17. Nickel

- In addition, four more elements , sodium, cobalt, vanadium, and silicon are absorbed by some plants for special purposes.
- The elements C, H, O are not minerals. The rest of the elements are absorbed from the soil and these are called mineral elements since they are derived from minerals. These mineral elements are mainly absorbed in ionic form and to some extent in non ionic form.

Classification of essential elements On the basis of quantity of nutrient required

1. Basic nutrients

These constitute 96% of total dry matter of plant.

Name of basic nutrients

Carbon

Hydrogen

Oxygen

Among these, carbon and oxygen constitute 45% each and hydrogen is 6%

2. Macro nutrients

The nutrients which are required by plants in large quantities are called macro or major nutrients. These are nine in number.

- i. Nitrogen
- ii. Phosphorus
- iii. Potassium
- iv. Calcium
- v. Magnesium
- vi. Sulphur
- vii. Carbon
- viii. Hydrogen
- ix. Oxygen

Macro nutrients have again 2 categories.

- a. Primary nutrients- N,P and K
- b. Secondary nutrients- Ca, Mg and S

3. Micro nutrients

These nutrients required by plants in small quantities and also known as minor or trace elements. These are eight in number.

- Iron
- Zinc
- Manganese
- Copper
- Boron
- Molybdenum
- Chlorine

- Nickel
Sometimes cobalt .

Functions of essential nutrients in plants

| Nutrients | Functions |
|------------------|--|
| Carbon | Basic molecular component of carbohydrates, proteins, lipids and nucleic acids. |
| Oxygen | Oxygen is somewhat like carbon is that it occurs in virtually all organic compounds of living organisms. |
| Hydrogen | Hydrogen plays a central role in plant metabolism, important in ionic balance and as main reducing agent and plays a key role in energy relation of cells. |
| Nitrogen | Nitrogen is a component of many important organic compounds ranging from proteins to nucleic acids. |
| Phosphorus | Central role in plants in energy transfer and protein metabolism |
| Potassium | Helps in osmotic and ionic regulation. Potassium functions as a cofactor or activator for many enzymes of carbohydrates and protein metabolism. |
| Calcium | Involved in cell division and plays a major role in the maintenance of membrane integrity. |

| | |
|------------|---|
| | |
| Magnesium | Component of chlorophyll and a cofactor for many enzymatic reactions. |
| Sulphur | Somewhat like phosphorus , involved in plant cell energetic |
| Iron | An essential component of many heme and non heme Fe enzymes and carries, including the cytochromes (respiratory electron carriers) and the ferredoxins. Involved in N fixation, photosynthesis and electron transfer. |
| Zinc | Essential component of several dehydrogenases, and peptidases, including carbonic anhydrase, alcohol dehydrogenase, glutamic dehydrogenase and malic dehydrogenase, among others. |
| Copper | Constituent of a number of important enzymes |
| Boron | Involved in carbohydrate metabolism and synthesis of cell wall components. |
| Molybdenum | Required for normal assimilation of N in plants. |
| Chlorine | Essential for photosynthesis and as an activator of enzymes involved in splitting water. It also functions in osmoregulation of plants growing on saline soils. |
| Manganese | Involved in the O ₂ - evolving system of photosynthesis and is a component of the enzymes. |

Manures and fertilizers

Plant requires food/nutrients/elements for its growth and development which are absorbed through soil. The nutrient supplying resources are manures and fertilizers. Application of manures and fertilizers to the soil is one of the important factors which help in increasing crop yield and to maintain the soil fertility. N, P and K are the major 3 elements required for the crop growth.

Manures- it is a well decomposed refuse from the stable and barn yards including both animal excreta and straw or other litter.

Fertilizers- these are industrially manufactured chemicals, containing plant nutrients.

Differences between manures and fertilizers

| S. No. | Characteristics | Manures | Fertilizers |
|---------------|----------------------------|---|--|
| 1 | origin | Plant or animal origin | Chemically synthesized or manufactured |
| 2 | nature | Organic in nature | Inorganic in nature |
| 3 | type | Natural product | Artificial product |
| 4 | Concentration of nutrients | Less concentrated | More concentrated |
| 5 | material | Supply organic matter | Supply inorganic matter |
| 6 | Nutrient availability | Slowly available | May or may not be readily available |
| 7 | nutrients | Supply all the primary nutrients including micro nutrient | Supply specific type of nutrients one, two or 3. Micro nutrients may or may not be |

| | | | |
|---|------------------------|--|--|
| | | | present |
| 8 | Effect on soil health | Improves physical condition of soil | Do not improve physical condition of soil |
| 9 | Effect on plant growth | No bad effect when applied in large quantities | Adverse effect on plant whenever there is deficiency or excessive application. |

Roles of manures and fertilizers

1. Organic manures bind the sandy soil and improve its water holding capacity.
2. Organic manures open the clayey soil and help in aeration for better root growth.
3. Organic manures add plant nutrients in small percentage and also add micronutrients, which are essential for plant growth.
4. Manures increase the microbial activity which helps in releasing plant nutrients to available form.
5. Organic manures should be incorporated before the sowing or planting because of slow release of nutrients.
6. Fertilizers play an important role in crop production as they supply large quantities of essential nutrient to crops.
7. Fertilizers are manufactured in forms that are readily utilized by plants directly or after rapid transformation.
8. Fertilizers dose can be adjusted to suit the requirement as determined by soil testing.
9. Balanced application of nutrient based on crop requirement is possible by appropriate mixing of fertilizers.
10. Fertilizers applied as straight fertilizers (providing single nutrient) or complex and mixed fertilizers (supplies 2 or more nutrients) based on crop requirement.