NEW ERA AGRICULTURE MAGAZINE

Plant Nutrient: Vital Substance for Plant Growth and Classification of Plant Nutrients

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Introduction

Any chemical compound which supplies plant nutrient or nutrition after application in soil is called plant nutrient.

Any elements which are absorbed by plant from soil, air, and water for their growth and development.

Essentiality of Plant Nutrient: Essentiality of plant nutrient was given by Arnon and Stout in 1939, stated that plant contain about 90 elements or more than 90 elements for their protoplasmic composition.

- 16 elements are essential for growth and development of plant according to Arnon and Stout.
- Nickel (Ni) element is introduced as essential plant nutrient by – Brown in 1987.
- New 17 essential elements are required for growth and development of plant.
- 17 essential elements – Carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), zinc (Zn), iron (Fe), manganese (Mn), copper (Cu), molybdenum (Mo), chlorin (Cl) and nickel (Ni).

Criteria of Essentiality Plant Nutrient: Criteria of essentiality was given by - Arnon and Stout in 1939.

Arnon and Stout are given three criteria for Essentiality of Plant Nutrient.

1. The deficiency of any essential element plant can't complete their life cycle.
2. Role of plant nutrient is specific it can't be replaced by any other plant nutrient.
3. Essential element is directly involved in metabolic activity or process of plants.

According to Criteria of essentiality 17 elements are essential for the growth and development of plant.

Beneficial / functional elements: Criteria or concept of functional elements was given by – Nicholus (Nicholson) in 1961.

Na, Si, Co, and V are functional elements but not essential for plants.

Classification of Essential Elements

1. Classification of Essential Elements on the basis of availability

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2. Classification of Essential Elements on the basis of amount
3. Classification of Essential Elements on the basis of mobility
4. Classification of Essential Elements on the basis of function
5. Classification of Essential Elements on the basis of chemical properties
6. Classification of Essential Elements on the basis of availability

Classification of essential elements on the basis of availability

Classification of essential elements on the basis of availability are two types-

A. Found in soil – mineral elements

Example- All essential elements except C, H, O

B. Found in air and water- Basic structure elements.

Example- non-mineral elements – CHO = 95%

Classification of essential elements on the basis of amount

Classification of essential elements on the basis of amount are three types-

i. Macro elements – Nutrients required in large quantities (Use in > 1 ppm).

A. Primary elements – N, P, K

B. Secondary elements – Ca, Mg, S

ii. Micro elements - Nutrients required in small quantities (Use in < 1ppm)

Example- Cl, B, Fe, Cu, Ni, Zn, Mn

iii. Ultra micro nutrient – Nutrients required in very small quantities (Use in < 1ppb)

Example- Mo, Co.

Classification of essential elements on the basis of mobility

Classification of essential elements on the basis of mobility are two types-

1. Mobility of essential element in soil.
2. Mobility of essential element in plant.

Mobility of Essential Element in Soil

Mobility of nutrient in soil give the help of method of application of fertilizer and nutrient availability of the plant.

Mobility of plant nutrient in soil are three types-

a. Mobile element

b. Less mobile element

c. Immobile element

Mobile element –

a) Mobile elements are more soluble in water.

b) Do not absorbed by clay colloids or particles.

c) All elements which have negative charge are mobile in soil except Phosphorus

d) Nitrate form of nitrogen is a mobile.

Example- NO^{-}_{3}, SO_4^{--}, BO_3^{---}, Cl, MO_4^{-}, Mn^{++}

Less mobile element

a) Less mobile element is soluble in water.

b) Absorbed by clay colloids or particles.

c) All elements which have positive charge are less mobile in soil except Mn^{++}, Zn^{++}

d) Ammoniacal form of nitrogen is a less mobile.

Example- NH_4^+, K^+, Mg^{++}, Ca^{++}, Cu^{++}, Fe^{++}, Ni^{++}

Immobile element –

a) Immobile element is insoluble in water.

b) Absorbed by clay colloids or particles.

c) Organic form of nitrogen.

Example- $H_2\ PO^-_4$, HPO^{--}_4, PO^{---}_4, Zn^{++}

Mobility of essential element in plant

Mobility of nutrient in plant give the help to indicate deficiency symptoms occurs on which part of plant.

Mobility of nutrient in plant are four types-

a. Mobile element – Old or lower leaf (N > P > K > Mg > Mo)

b. Moderate mobile element – Middle leaf (Zn)

c. Less mobile element – New leaf (S > Fe > Mn > Cu > Ni)

d. Immobile element – Terminal bud (Ca, B)

Classification of essential elements on the basis of function

a) Basic structure elements- C, H, O

b) Energy storage and transfer elements – N, P, S

c) Cation balancing elements- Ca, Mg, K, Na

d) Electron transferring elements- Fe, Mn, Mg, Cu

e) Oxidative and reductive elements- All micro nutrients

f) Catalyst (Regulator) elements- Cu, Fe, Mn, S

Classification of essential elements on the basis of chemical properties

i. Cation or metallic elements– Elements which have positive charge (+)

Example- NH_4^+, K^+, Mg^{++}, Ca^{++}, Cu^{++}, Fe^{++}, Ni^{++}, Mn^{++}, Zn^{++}

ii. Anion or non-metallic elements – Elements which have negative charge (-)

Example- NO^-_3, SO_4^{--}, BO_3^{---}, Cl, MO_4^-, $H_2\ PO^-_4$, HPO^{--}_4, PO^{---}_4

NOTE- Phosphorus mobile elements in plant but immobile element in soil and nitrogen elements has both anion and cation charge.

References

1. Rajendra Prasad (2021) Soil Fertility and Nutrient Management, New India Publishing Agency

2. https://pubmed.ncbi.nlm.nih.gov/26085375/.