

# Ch. MINERAL NUTRITION

## HYDROPONICS

(1860)

### Julius Von Sachs

Growing plants in nutrient rich water medium.

tomato, Seedless Cucumber lettuce.

### Macronutrients:

Excess of 10 mmole of dry wt. kg

CHIMPONKS Ca

### Essential Elements:

more than 60 elements of 105 discovered elements are found in plants.

① Support normal growth & Reproduction.

② Requirement of Element must be Irreplaceable.

③ must be directly involved in plant metabolism.

### micronutrients

less than 10 mmole dry wt. kg

Fe, Mn, B, Zn Cl

Beneficial Elements  
Na, Si, Co, Se.

Structural Elements  
CH, O, N

Mg<sup>2+</sup> → activate PEP

Zn<sup>2+</sup> → activate alcohol dehy.

### Deficiency Tricks:

#### NECROSIS:

CaCu killed Maggie

Calcium Copper magnesium

#### Inhibition:

MONKS

Mg, O, N, K, S

#### Delayed Flowering:

N, S, Mo

#### BioFertilizer:

N, P, K

#### Chlorosis:

Monks with yellow leaves  
Mg, O, N, K, S. ch Cl, Fe

Reached Zantax Mantax  
Zn Mn

### Nitrogen Cycle

Atmospheric =  
N<sub>2</sub>  $\xrightarrow{\text{UV Ray}}$  NO<sub>2</sub>, N<sub>2</sub>O

Industrial =  
NH<sub>3</sub> + CO<sub>2</sub> → Urea

Biological Fixation =  
Prokaryotes

Bacteria  
leguminous - Rhizobium  
non-leguminous - Frankia  
Cyanobacteria  
Anabaena - Nostoc

|                                                                                                               |                                                                                                                  |                          |
|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Nitrogen</b><br>NO <sub>3</sub> <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NH <sub>4</sub> <sup>+</sup> | Formation of protein, nucleic acids, vit. hormones. chl.                                                         | Chlorosis                |
| <b>Phosphorus</b><br>H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> , HPO <sub>4</sub> <sup>2-</sup>             | DNA/RNA Formation, cell mem. nucleic acid, nucleotides.                                                          | Chlorosis                |
| <b>Potassium</b><br>K <sup>+</sup>                                                                            | anion-cation balance, protein synthesis, opening and closing of stomata, turgidity of cell.                      | Inhibition of cell divi. |
| <b>Calcium</b><br>Ca <sup>2+</sup><br>(Immobile)                                                              | cell division, cell wall formation middle lamella, Calcium pectate                                               | neurosis                 |
| <b>Magnesium</b>                                                                                              | Enzyme activator in respiration photosynthesis, synthesis of DNA & RNA, helps in maintaining Ribosome structure. | neurosis                 |
| <b>Sulphur</b><br>(Immobile)                                                                                  | 2AA - Cysteine & methionine, constituents of Co-enzymes, vit (Thiamine, Biotin, Co-enzyme A) Ferredoxin          | delayed flowering        |
| <b>Iron</b>                                                                                                   | transfer of e <sup>-</sup> like Ferredoxin activates Catalase Enzyme. format <sup>n</sup> of chlorophyll         | Chlorosis                |
| <b>Manganese</b>                                                                                              | Enzyme activator in photosynthesis Respiration, nitrogen metabolism. Splitting of water                          | Chlorosis                |
| <b>Zinc</b>                                                                                                   | Enzyme activator (Carboxylase) Synthesis of auxin                                                                | Chlorosis                |
| <b>Copper</b>                                                                                                 | overall metabolism associated with Enzymes                                                                       | neurosis                 |
| <b>Boron</b>                                                                                                  | uptake and utilization of Calcium pollen germination, cell elongation                                            |                          |
| <b>Molybdenum</b>                                                                                             | Enzyme Reductase and nitrogenase Nitrogen metabolism                                                             | delayed flowering        |
| <b>Chlorine</b>                                                                                               | water splitting Rx <sup>n</sup> oxygen evolution                                                                 |                          |

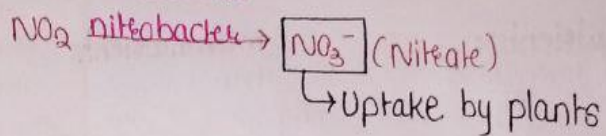
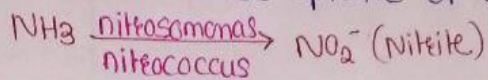
- Free living
- Anaerobic - Rhodospirillum  
Clostridium  
Bacillus
  - Aerobic - Azotobacter  
Beijerinckia

## II. Ammonification :

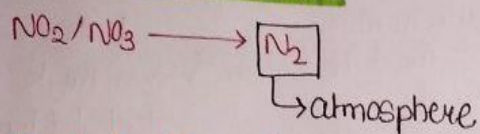
ammonia from dead and decaying part  
 $\beta$ -namosus ,  $\beta$ -vulgaris.

## III. Nitrification :

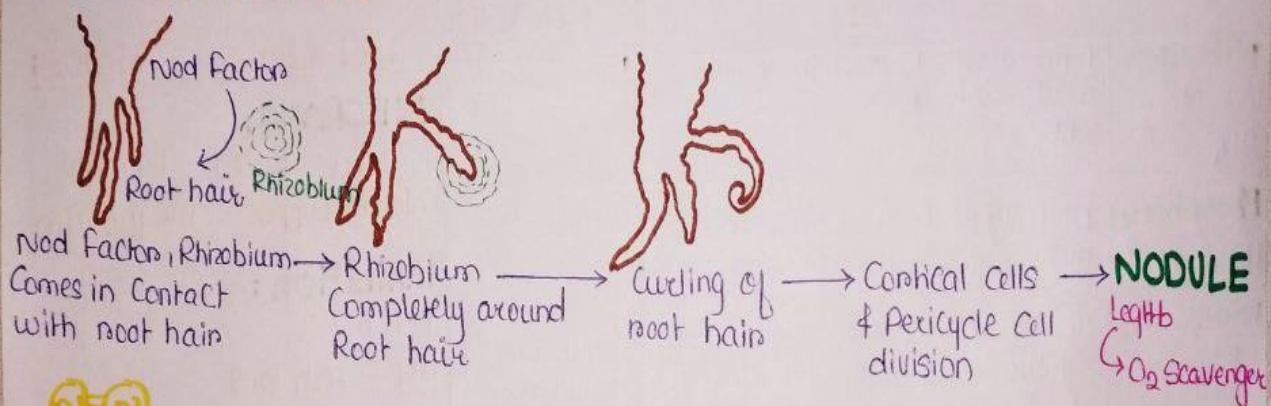
plants refuse uptake of ammonia



## IV. Denitrification :



## Nodule Formation :



## V. Ammonia Assimilation :

