FREE NOTES · NCERT + NEET LEVEL

Mineral Nutrition

Extra reading (purana NCERT chapter): hydroponics, essential elements (macro aur micro), unke kaam aur kami ke lakshan memory tricks ke saath, toxicity, nitrogen cycle aur biological nitrogen fixation.

01 Hydroponics aur essential elements
02 Elements ke kaam
03 Kami ke lakshan aur tricks
04 Nitrogen cycle
05 Biological nitrogen fixation
06 Important Q&A
07 Common mistakes
08 Practice (NEET style)
09 Quick revision

01 Hydroponics aur essential elements

- **Julius von Sachs** (1860): bina mitti poshak ghol me paudhe = **hydroponics**; tamatar, beej-rahit kheera, lettuce.
- Zaroori hone ki shartein: (1) normal growth aur prajanan ke liye, (2) zaroorat khaas (badla nahi ja sakta), (3) seedhe metabolism me.
- **Macronutrients** (>10 mmol/kg dry matter): C, H, O, N, P, K, S, Ca, Mg. Trick: "**C. HOPKiNS CaFe Mg**" (C, H, O, P, K, N, S, Ca, Fe*, Mg; *Fe asal me micronutrient).
- **Micronutrients** (<10 mmol/kg): Fe, Mn, Cu, Mo, Zn, B, Cl, Ni. Trick: "**Moby Cl Fe Mn ZnCu Ni**" (Mo, B, Cl, Fe, Mn, Zn, Cu, Ni).
- Faydemand elements: Na, Si, Co, Se.

02 Elements ke kaam

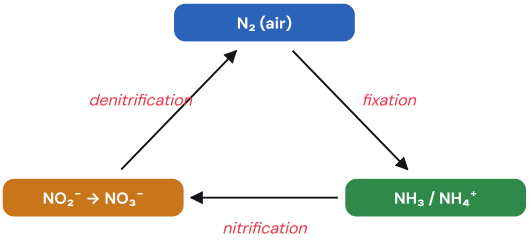
Element	Main role
N	Proteins, nucleic acids, chlorophyll, vitamins, hormones
P	ATP, nucleic acids, membranes (phospholipids)
K	Anion–cation balance, stomatal opening, turgidity
Ca	Middle lamella (calcium pectate), spindle, cell division
Mg	Chlorophyll ring; activates RuBisCO, PEP case; ribosome structure
S	Cysteine, methionine; coenzyme A, thiamine, biotin, ferredoxin
Fe	Ferredoxin, cytochromes; chlorophyll formation; activates catalase
Mn	Photolysis of water (O_2 evolution); activates many enzymes
Zn	Carboxylases; auxin synthesis
Cu	Enzymes of redox reactions
B	Ca uptake, pollen germination, cell elongation
Mo	Nitrogenase, nitrate reductase
Cl	Anion–cation balance, water splitting with Mn

03 Kami ke lakshan aur tricks

Lakshan	Elements	Trick
Chlorosis (peelapan)	N, K, Mg, S, Fe, Mn, Zn, Mo	"**MONKS with yellow flowers** Zn Mn Fe": Mo, N, K, S, Mg + Zn, Mn, Fe
Necrosis (tissue marna)	Ca, Mg, Cu, K	"**Calcium Copper Killed Maggie**": Ca, Cu, K, Mg
Cell division rukna	N, K, S, Mo	"**MONKS**": Mo, N, K, S (kam B bhi)
Der se phool	N, S, Mo	"**NSM**"

- Chalne wale elements (N, P, K, Mg) ⇒ lakshan pehle **purani** pattiyon me; ruke hue (Ca, S, Fe, B) ⇒ **nayi** pattiyon me.
- **Toxicity**: zyada matra se dry weight ~10% kam. Mn toxicity: brown spots aur chlorotic veins; Fe, Mg lene me takkar aur Ca ka transport rokta ⇒ Fe, Mg, Ca ki kami jaise lakshan.

04 Nitrogen cycle

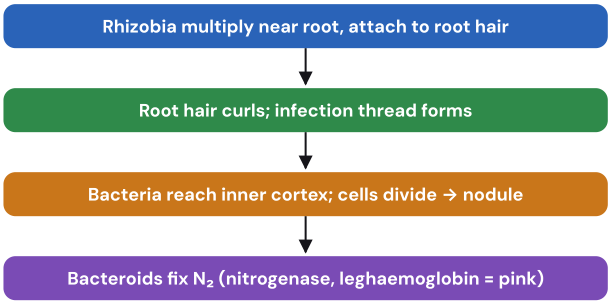


Nitrogen cycle (paudhe NO_3^- lete; mare padarth se ammonification se NH_3 wapas)

- **Nitrogen fixation**: $N_2 \rightarrow NH_3$ (bijli, industrial Haber process, biological).
- **Ammonification**: proteins ke tootne se NH_3 (*Bacillus ramosus*, *B. vulgaris*).
- **Nitrification**: $NH_3 \rightarrow NO_2^-$ (*Nitrosomonas*, *Nitrococcus*) $\rightarrow NO_3^-$ (*Nitrobacter*). Paudhe nitrate lete.
- **Denitrification**: $NO_3^- \rightarrow N_2$ (*Pseudomonas*, *Thiobacillus*).

05 Biological nitrogen fixation

- Sirf prokaryotes **nitrogenase** (Mo-Fe protein) se N_2 fix karte; ye O_2 se bahut sensitive.
- Free-living: aerobic *Azotobacter*, *Beijerinckia*; anaerobic *Rhodospirillum*; cyanobacteria *Anabaena*, *Nostoc*.
- Symbiotic: legume jadon ke saath *Rhizobium*; non-legume *Alnus* ke saath *Frankia*.
- Nodules ka **leghaemoglobin** (gulabi) O_2 hataakar nitrogenase bachata.
- Reaction: $N_2 + 8e^- + 8H^+ + 16\ ATP \rightarrow 2NH_3 + H_2 + 16\ ADP + 16\ Pi$.
- NH_3 ka upyog **reductive amination** (α-ketoglutarate + $NH_4^+ \rightarrow$ glutamate) aur **transamination** se; amides asparagine aur glutamine xylem me; soybean me ureides.



Root nodule banna

06 Important Q&A

Q1. Leghaemoglobin gulabi kyun aur kaam?

O_2 pakadne wala haem protein; nodule me O_2 kam rakhta taaki nitrogenase kaam kare.

Q2. Ek N_2 fix karne me kitne ATP?

16 ATP.

Q3. $NH_3 \rightarrow NO_2^-$ aur $NO_2^- \rightarrow NO_3^-$ ke bacteria?

Nitrosomonas/*Nitrococcus*; *Nitrobacter*.

07 Common mistakes

- Fe ko macronutrient kehna.
- Kehna ki paudhe seedhe N_2 lete.
- Nitrification aur denitrification bacteria mix karna.
- Sochna ki Ca ki kami purani pattiyon me.

08 Practice (NEET style)

1. Chlorophyll ring ka element?
2. Paani ke photolysis ka element?
3. N_2 fix karne wala enzyme?
4. Non-legume symbiont?
5. Hydroponics ke janak?

ANSWERS

1) Mg · 2) Mn (with Cl) · 3) Nitrogenase · 4) *Frankia* (in *Alnus*) · 5) Julius von Sachs

09 Quick revision: exam se 5 minute pehle

ELEMENTS

- Macro >10 mmol/kg
- Micro: Fe Mn Cu Mo Zn B Cl Ni

TRICKS

- Necrosis: Ca Cu K Mg
- Cell division: MONKS
- Der se phool: N S Mo

N CYCLE

- Nitrosomonas → Nitrobacter
- Pseudomonas denitrify

FIXATION

- Nitrogenase, 16 ATP
- Leghaemoglobin gulabi
- Rhizobium, Frankia

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.