

MINE RAL NUTRIENTS

S.No.	Element	Function	Deficiency Effect of	Required Region	Absorbed As.
1.	NITROGEN (N ₂)	Growth and Metabolism. Constituent of - Protein - Hormones - Coenzyme - Vitamins - Nucleic acids - ATP - Chlorophyll.	Stunted Growth Stalks slender as well as short Chlorosis (Starts from older leaves) Prolonged dormancy Early senescence In certain plants - stem, petiole & vein turns purple or red	Entire plant Mainly in Meristematic Zone	Nitrite → NO ₂ ⁻ Nitrate → NO ₃ ⁻ NH ₄ ⁺ → Ammonium
2.	POTASSIUM (Kalium) K	Maintain anion (-) Cation (+) Balance (Osmotic rigidity of cells) Key role in opening & closing of Stomata i.e. Stomatal movement Activator of many enzymes Involved in → Protein Synthesis Photosynthesis, Respiration Cell membrane Formation Transpiration, Nucleic acid, Chlorophyll, Translocation Photophosphorylation etc. . . .	Acute - Die back shoots - stunted with numerous tillers - little or no flower Mild - Thin, restricted growth of shoot. Intervenal Chlorosis Tip burn, leaf scorch (older one) Reduced - Internode - Grains Cereals bend to ground easily by rain and by wind.	Meristems Buds, leaves Root tips. Redistributed from mature (older) to younger (new) regions.	Potassium ion → K ⁺ .

3	<u>PHOSPHORUS</u> (P)	Constituent of — Cell membrane — Nucleic acids, — Proteins — certain co-enzymes — ATP, ADP, AMP, — NAD ⁺ , NADP ⁺ — Nucleotides	Poor, stunted growth, Premature leaf fall, Prolonged dormancy Cambial activity is checked Delayed seed germination Dull green leaves Necrosis in older leaves.	Younger tissue, Meristem, seed, fruit Formation Movable, hence withdrawn from older tissue.	Per Biphosphate $H_2PO_4^{-2}$ Phosphate PO_4^{-3}
4	<u>SULPHUR</u> (S)	Formation of Chlorophyll, nodules in legumes Constituent of some of proteins, ferredoxin, vitamins (Thiamine, biotin CoA) Growth and Metabolism	General Chlorosis Firstly in younger leaves Stunted growth Leaf curl (Similar to Nitrogen)	Meristems, Root & Stem tips. Young leaves	SO_4^{-2} Sulphates SO_2 from Air. Sulphur (Sulphur dioxide gas)
5	<u>CALCIUM</u> (Ca)	Chief constituent of middle lamella related to cell wall as calcium pectate — Enzyme activator — Controls cell permeability of cell — Spindle Formation during Mitosis — Prevents Mineral & Organic Toxicity.	Deformities, Twisting Stunted growth More pron in young tissues Necrosis, Chlorosis Degeneration of leaves, flowers & fruits.	& Differentiating Meristematic Regions, of Root, Stem & Leaves	Calcium ion $\rightarrow Ca^{++}$

6. MAGNESIUM
(Mg)

Constituent of - Chlorophyll
Magnesium Pectate
Carrier of - phosphorus
Nodule Formation in legumes
Essential in metabolism of -
Carbohydrate,
- Fat & - Phosphorus
Activator of several Enzymes.
Formation of - Chlorophylls,
- Carotenoids,
- Nucleic acids.
Growth.

Chlorosis (Intervascular)
of older leaves
→ Tips and margin of leaves
turn upward
→ Growth inhibition
→ Premature leaf abscission
→ Under developed phloem and
pith.

Leaves
→ Meristems →
Root, Stem & Seed

Mg⁺⁺
magnesium ions