

Classification, Roles & Sources of Plant Nutrients

Classification	Elements/ Symbol	Forms absorbed by plants	Essential for	Deficiency Symptoms	Toxicity Symptoms	Primary Source	Available Source
Primary Nutrients	1. Carbon / C	CO ₂ ⁻ CO ₃ ²⁻ HCO ₃ ⁻	Carbohydrates / CHO Basic component of all the physical parts of a plant – stem, leaves, flowers, fruits, seeds, etc.	Poor growth	NIL	Carbon dioxide	Air
	2. Hydrogen / H	H ⁺ OH ⁻		Plant parts droop, wither & die	Wilting & suffocation	Water	Surface water & humidity in the air
	3. Oxygen / O	O ₂					
Macro-Nutrients	4. Nitrogen / N	NO ₃ ⁻ NH ₄ ⁺	Chlorophyll, amino acids/proteins enzymes and co-enzymes	Stunted growth, strong chlorosis of leaves	soft elongated stems, few flowers & roots	As part of natural minerals of rock / soil deposits and in the form of animal manures & decaying plants as in soil farming (fertile soil)	Sold as purified mineral deposits from the rock / soil are refined, packed & sold as direct fertilizers for use in smart /modern farming (fertilizers) or sold as composted solid or liquid plant or animal wastes as in organic farming (chemical-free organic nutrients which are eventually converted to in-organic forms by the microbes) or sold as convenient & handy formulated nutrients like LUSHGro for use in hydroponic farming & for use in the nutrition of planted tanks and also as handy & user-friendly formulations for use in home farms, potted plants & garden plants (effective, environment-friendly & safe nutrients for plants)
	5. Phosphorous/ P	PO ₄ ³⁻ H ₂ PO ₄ ⁻	Nucleic acids, ATP energy transfer enzymes, proteins, cell formation in roots, flowers & seeds	Dark green & purple leaves, few roots	NIL		
	6. Potassium / K	K ⁺	Enzymes for flower & fruit setting & development, anion, cation & osmotic balance, co-factor in photosynthesis & respiration	Leaf curling, mottling & soft stems	NIL		
	7. Calcium / Ca	Ca ²⁺	Cell wall	Buds inhibited, root tips die, leaves curl	NIL		
	8. Magnesium/Mg	Mg ²⁺	Chlorophyll & enzymes for seed development, oils, fats & juice	Chlorosis, leaves mottle & dry	Large light coloured leaves		
	9. Sulphur / S	SO ₄ ²⁻	Cell wall, proteins & flavors	chlorosis	NIL		
Micro-Nutrients or Trace-elements	10. Iron / Fe	Fe ^{2+ / 3+}	Synthesis of plant hormones & plant pigments Carotenoids – chloroplasts & chromoplasts	Chlorosis, leaves dry, blossoms drop	Necrosis / leaf burn		
	11. Copper / Cu	Cu ²⁺	Catalysts for enzymes	Drying of shoot tips			
	12. Zinc / Zn	Zn ²⁺	Growth hormones	Specks on the leaves			
	13. Manganese/Mn	Mn ²⁺	enzymes	Root, flower & fruit tips turn brown			
	14. Boron / B	BO ³⁻	Cell division, protein synthesis, pollination & seed setting	Retarded growth			
	15. Molybdenum / Mo	MoO ₄ ²⁻	Protein synthesis, fix atmospheric N	Defense mechanism	Plants look sick & unhealthy		
	16. Chlorine / Cl	Cl ⁻	Similar to K but restricted	Leaf curling			
17. Sodium / Na	Na ⁺						

All nutrients in the form of natural rock deposits or organic source like sea weed/blood meal/bone meal/feather meal/neem cake meal/soy meal etc... or straight complex/compound/mixture/slow-release fertilizers or specially formulated LUSHGro range of plant nutrients are available at various retail outlets. Log on to our website at <http://www.singaporehydroponics.com> or e-mail or call us for retailers addresses and contact numbers.

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