

ESSENTIAL ELEMENTS OF PLANTS

These tables bring together the essential elements of plants, organized into macronutrients and micronutrients

MACRONUTRIENTS (needed in greater quantities)

ELEMENT (SYMBOL)	% OF THE DRY MASS OF THE PLANT	MAIN SOURCE	ABSORBED SHAPE BY THE PLAN	MAIN FUNCTIONS
C CARBON	45	Air	CO_2	Component of all organic molecules
O OXYGEN	45	Air, soil, water	CO_2 , O_2 , H_2O	Component of all organic molecules
H HYDROGEN	6	Water	H_2O	Component of all organic molecules; Protons used in osmosis and co-transport
N NITROGEN	1,5	Soil	NO_3^- , NH_4^+	Component of proteins, nucleic acids, chlorophyll, coenzymes and alkaloids





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K POTASSIUM	1,0	Soil	K^+	Essential role in cellular ionic balance
Ca CALCIUM	0,5	Soil	Ca^{2+}	Component of cell walls; messenger in signal transduction.
Mg MAGNESIUM	0,2	Soil	Mg^{2+}	Chlorophyll component; Activates some enzymes.
P PHOSPHORUS	0,2	Soil	HPO_4^{2-}	Component of nucleic acids, ATP, phospholipids and some coenzymes.
S SULFUR	0,1	Soil	SO_4^{2-}	Component of proteins (sulfur amino acids), some coenzymes and defense compounds.

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Note: Dry mass % values are typical and may vary depending on the species, stage of development and soil conditions.

MICRONUTRIENTS (needed in small amounts)

Cl CHLORINE	0,01	Soil	Cl ⁻	Required for photolysis of water in photosystem II; cellular ionic balance.
Fe IRON	0,01	Soil	Fe ³⁺ , Fe ²⁺	Enzymatic cofactor; component of cytochromes.
Mn MANGANESE	0,005	Soil	Mn ²⁺	Enzymatic cofactor.
B BORO	0,002	Soil	B(OH) ₃	Enzymatic cofactor; component of cell walls.
Zn ZINC	0,002	Soil	Zn ²⁺	Enzymatic cofactor.



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Na SODIUM	0,001	Soil	Na ⁺	It acts as cofactors or activators of reactions that regenerate phosphoenolpyruvate, allowing the initial fixation of carbon dioxide by phosphoenolpyruvate carboxylase to work efficiently in these plant types
Cu COPPER	0,0006	Soil	Cu ⁺ , Cu ²⁺	Enzymatic cofactor.
Mo MOLYBDENUM	0,00001	Soil	MoO ₄ ²⁻	Enzymatic cofactor.
Ni NICKEL	0,000005	Soil	Ni ²⁺	Enzymatic cofactor.

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