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Aluminium Toxicity in Plants - A Review

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ABSTRACT

Aluminium (Al) is the most abundant metal in the earth's crust, comprising about 7% of its mass. A large amount of Al is incorporated into aluminosilicate soil minerals and very small quantities appear in the soluble form. Aluminium toxicity is one of the major factors that limit plant growth and development in many acid soils which differs strikingly in their chemical form. Al has been shown to interfere with cell division in plant roots, decrease root respiration, increase cell wall rigidity and interfere with the uptake and transport of Ca, Mg, K, P and water supply to plants, alter cell-wall Donnan free space, the plasma membrane, membrane transport proteins etc. Al toxicity is mainly associated with severe changes in root morphology, resulting in curved, swollen, cracked, brownish, stubby and stiff root apices. It has been known that plants which exist in the presence of potentially toxic Al concentrations must be able to avoid direct contact of vital structures and metabolic processes with high activities of Al ions. The physiological mechanisms of Al resistance can either be mediated via exclusion of Al from the root apex or via intracellular tolerance of Al transported into the plant symplasm. The approaches like metal uptake and transportation in various plant parts, mechanism behind the interaction with mineral nutrients, specific genes responsible for tolerance levels and kinds of organic and amino acids which act as metal chelators and detoxifiers, level and forms of enzymes, and changes in root permeabilities to ions and molecules and their mechanisms are used to study Al toxicity in tolerant and sensitive plant genotypes.

Keywords: Aluminium toxicity, resistance, tolerance, exclusion, root morphology.
