

Connection between aluminium exclusion and accumulation in the aluminium accumulator buckwheat (*Fagopyrum esculentum* Moench)

Benjamin Klug and Walter J. Horst
Leibniz University of Hannover, Institute of Plant Nutrition

Abstract

Aluminium toxicity reduces crop productivity on acid soils. Some plant species developed efficient resistance mechanisms excluding Al from accumulation in Al-sensitive root tissues by exudation of organic anions. Aluminium accumulators did not only evolve resistance but also tolerance mechanisms by sequestration of Al with organic anions within the plant tissue which enable them to grow well under extremely Al-toxic conditions. The aim of this study was to explore the interrelationships between Al exclusion and Al accumulation in the Al accumulator buckwheat. Using "micro rhizotrones" the 5 mm root apex was identified as main root zone involved in both Al accumulation and release of oxalate. The exudation of oxalate into the root apoplast was triggered by Al applied to the 5 mm root apex in a temperature-independent way suggesting a passive process. On the other hand, the uptake of Al into the symplast and the release from the symplast and thus loading of the xylem proved to be active processes. Equimolar concentrations of oxalate and Al in the water free space fluid of the root apex reducing Al rhizotoxicity and at the same time enhancing Al uptake and transport to the xylem is considered as circumstantial evidence that Al is transported into the symplast as (Al-Oxalate)¹⁺.