



Tropentag, September 17-19, 2014, Prague, Czech Republic

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Foliar Application of Soluble Forms of Calcium Alleviates Boron Toxicity in Pistachio Seedlings

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Abstract

A great portion of pistachio growing regions in Iran is affected with boron toxicity. Increasing calcium to boron (Ca/B) ratio in plant tissues may alleviate the boron toxicity. Calcium by stabilising cellular membranes and control of ion channels activities prevents influx of excess boron to the cells. In the present study, foliar application of calcium amino-chelate and chloride in two concentrations were evaluated in alleviating boron toxicity in two pistachio species including ‘Badami’ (*Pistacia vera* L. ‘Badami’) and ‘Atlantica’ (*P. atlantica* subsp. ‘atlantica’). The concentrations of CaCl₂ applied were 1.1 and 2.2. g l⁻¹ and the corresponding concentrations of Ca-amino-chelate were 0.5 and 1%. Boron was also added to the irrigation water as boric acid in concentrations of 20 and 40 mg l⁻¹. Based on the obtained results, foliar application of Ca amino-chelate at 1% concentration and CaCl₂ in 2.2 g l⁻¹ showed the highest alleviation effect on the boron toxicity in the leaf tissues. The Ca amino-chelate were found to be more effective in reducing boron toxicity than CaCl₂. Foliar sprays of soluble forms of calcium resulted in plants with higher height, more leaf number and area, and longer roots. However, there were no significant differences found between the treatments for proline content, relative water content and osmotic potential of the leaves. In aggregate, foliar application of soluble forms of calcium, reduced boron contents in the leaves, stems and roots of pistachio seedlings. Comparing two species indicated that the ‘Atlantica’ is less sensitive to boron toxicity than ‘Badami’.

Keywords: Boron excess, Ca amino-chelate, calcium chloride, *Pistacia atlantica*, *Pistacia vera*