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Sodium chloride–ABA interaction in two common bean (*Phaseolus vulgaris*) cultivars differing in salinity tolerance

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Abstract

The involvement of exogenous abscisic acid (ABA) concentrations in common bean responses to saline stress was studied in two cultivars differing in NaCl tolerance. To examine this, salt-sensitive (cv. Coco) and salt-tolerant (cv. Africa) plants in symbiosis with *Rhizobium tropici* CIAT899 strain were grown under controlled conditions and treated with ABA previously to the saline treatment. Plants decreased the shoot and root growth, nitrogenase activity and ureides content of nodules and nitrogen percentage of shoot and increased root to shoot ratio and amino acids and proline content of shoot with individual treatments of ABA and NaCl. The ABA pre-treatment to salinized plants improved the growth parameters and normalized nodule weight of Coco and induced recuperation or a lower nitrogenase activity inhibition in both cultivars. Since the salt-tolerant cultivar Africa was the main Na accumulator in shoot of salinized plants grown in absence of ABA, our results support the hypothesis that sodium exclusion in shoot is a strategy of common bean to limit Na toxicity under our experimental conditions. Besides, the ABA treatment in these plants seems to limit sodium translocation to shoot resulting in the maintenance of high K/Na ratio. Finally, results found here support roles of ABA and proline in the alleviation of salt stress and osmotic adjustment of common bean plants respectively.

Keywords: Abscisic acid; Legumes; N_2 fixation; *Phaseolus vulgaris*; Salt stress; Symbiosis

1. Introduction

Salinity is considered a significant factor affecting crop production and agricultural sustainability in arid and semi-arid region of the world, reducing the value and productivity of the affected land (Flowers and Yeo, 1988; Munns, 1993). Soil infertility is often due to the presence of large quantities of salt, and the introduction of plants capable of surviving under these conditions is worth interesting (Yeo et al., 1991; Soussi et al., 1998). The identification of tolerant genotypes that may sustain a reasonable yield on salt affected soils has been a strategy adopted by scientists to overcome salinity (Kingsbury and Epstein, 1984). In addition, a better understanding of physiological responses under salt conditions can be of value in programs conducted to breed salt tolerant crop varieties.

Salt tolerance in plants is a complex phenomenon that involve morphological and developmental changes as well as physiological and biochemical processes. Two components have been identified as the probable cause of salinity toxicity, osmotic stress and ion toxicity. The osmotic stress is associated with lack of cell-wall extension, and cell expansion leading to cessation of the growth. The ionic effect includes interference with nutrient imbalance, nitrogen uptake, interference with the transport of essential ions within the plant and a lowering of net photosynthetic rates in the affected plants (Greenway and Munns, 1980).

There is now considerable experimental evidences that the physiological effects induced by salinity might be modulated by abscisic acid (ABA). Different results have been reported regarding the effect of applied ABA showing an inhibitory effect of ABA on the shoot and root growth on sunflowers seedlings (Lenzi et al., 1995); on the contrary ABA promotes the growth of excised soybean roots (Yamaguchi and Street, 1977). In addition, Guak and Fuchigami (2001) have shown that the application of foliar ABA can enhance growth cessation and leaf senescence leading to an improved efficiency of nitrogen withdrawal from senescing leaves into woody tissues and cold acclimation in apple plants (Guak and Fuchigami, 2002). ABA supply largely inhibited Cl^- and Na^+ transport to shoot in intact bean seedlings (Karmoker and Van Steveninck, 1979),

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