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Alleviation of Salt Stress in Common Bean (*Phaseolus vulgaris*) by Exogenous Abscisic Acid Supply

Mariam Khadri, Noel A. Tejera, and Carmen Lluch*

Departamento de Fisiología Vegetal, Facultad de Ciencias, Universidad de Granada, Campus de Fuentenueva s/n, 18071 Granada, Spain

Abstract

In this work the effect of abscisic acid (ABA) and 100 mM NaCl on common bean (*Phaseolus vulgaris* var. *Coco*) growth, nitrogenase activity, and nodule metabolism was studied. Experiments were carried out in a controlled environmental chamber and plants, at the vegetative growth stage (16 days old), were treated with ABA (1 μM and 10 μM) and 48 h later were exposed to saline treatment. Results revealed that plant dry weight, nodule dry weight, nitrogen fixation (acetylene reduction activity and ureides content), and most enzymes of ammonium and ureides metabolism were affected by both ABA and NaCl. The addition of 1 μM ABA to the nutrient solution before the exposure to salt stress reduced the negative effect of NaCl. Based on our results, we suggest that ABA application improves the response of *Phaseolus vulgaris* symbiosis under saline stress conditions, including the nitrogen fixation process and enzymes of ammonium assimilation and purine catabolism.

Key words: Abscisic acid; Ammonium assimilation; N_2 fixation; Nodule metabolism; *Phaseolus vulgaris*; Salt stress

Introduction

Symbiotic nitrogen fixation in legume nodules is extremely sensitive to environmental stresses such as drought and salinity, which seriously limit legume yields in many arid and semiarid regions of the world. Nitrogen-fixing plants are more sensitive to salinity than N-fertilized plants (Cordovilla and others 1996; González and others 2001). Salt stress affects several physiological processes in root nodules. It affects the range of carbon substrate available to the bacteroids (Delgado and others 1993; Soussi and others 1998) and modifies the activity of enzymes related to carbon metabolism (Khadri and others 2001; Serraj 2003).

A critical question regarding N_2 fixation is whether the effect of the stress is first perceived in other physiological processes and the changes in N_2 fixation are a consequence of these other changes, or rather, the stress is directly and initially perceived by the N_2 fixation mechanism. Several studies have shown that N_2 fixation is more sensitive to salinity than to dry matter accumulation (Elsheikh and Wood 1990; Delgado and others 1994) and ammonium assimilation (Cordovilla and others 1994). Studies of Bekki and others (1987) and Soussi and

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*Corresponding author; e-mail: clluch@ugr.es