**Exogenous proline supply improves growth, antioxidant defence system, and nutrient homeostasis in salt-stressed alfalfa (*Medicago sativa* L.)**

1,2,3EL MOUKHTARI Ahmed, 2SAVOURE Arnould, 1 FARISSI Mohamed\*

1Laboratory of Biotechnology & Sustainable Development of Natural Resources–B2DRN, Sultan Moulay Slimane University, Polydisciplinary Faculty of Beni-Mellal, Morocco.

2Laboratory of Ecology and Environment, Faculty of Sciences Ben M’Sick, Hassan II University of Casablanca, PB7955 Sidi Othman, Casablanca, Morocco

3Sorbonne Université, UPEC, CNRS, IRD, INRAE, Institut d’Ecologie et Sciences de l’Environnement de Paris, IEES, F-75005 Paris, France

*\*Corresponding author: Prof. FARISSI Mohamed, Polydisciplinary Faculty of Beni-Mellal, Mghila, PO Box. 592, Beni–Mellal 23000, Morocco.*

E-mail: [farissimohamed@gmail.com](mailto:farissimohamed@gmail.com) / [mohamed.farissi@usms.ac.ma](mailto:mohamed.farissi@usms.ac.ma)

**ABSTRACT**

Salinity is a severe environmental stress limiting agricultural production. Exogenous proline has emerged as a promising way to improve plant tolerance to salinity. A pot experiment was conducted using two Moroccan, *Ouad Lmaleh* (*OL*) and *Demnate* 201 (*Dm*), and one European, *NS Mediana ZMS V* (*NS Med*), alfalfa (Medicago sativa) varieties to investigate the effect of exogenous proline on physiological and biochemical responses under salinity stress. Results indicated that salt stress reduced shoot and root dry weight, plant height and leaf number, with *NS Med* being the most affected with reductions rates of 75%, 85%, 53%, and 65%, respectively. Salinity also reduced photosynthetic pigments, potassium (K+) and increased malondialdehyde (MDA) and sodium (Na+) contents. The injury impact of salinity stress on alfalfa plant growth was alleviated by exogenous proline treatment, as evidenced by increasing plant biomass and plant height and leaf number. Proline-treated salt-stressed plants also showed higher photosynthetic pigments and K+ and reduced Na+ contents. Proline treatment also effectively reduced MDA content under salt stress, particularly in NS Med variety, by 26%. The lower amount of MDA in the proline-treated plants seemed to be related to its capacity to modulate antioxidant enzymes activities such as superoxide dismutase, catalase, ascorbate peroxidase, and glutathione reductase. Furthermore, proline treatment boosted the accumulation of proline content, which positively correlated with improvement in plant growth and photosynthetic pigments. Our findings suggested that exogenous proline treatment could be a promising way to mitigate the effect of salinity on alfalfa plant.

***Keywords:*** *Medicago sativa*; Proline; Salinity; Photosynthetic pigments; Antioxidant enzymes.

***Acknowledgments:*** This work was supported by the *Hubert Curien Maghreb Partnership* - PHC Maghreb, No.19MAG41- governed by the agreement signed between the French Ministry of Europe and Foreign Affairs and the Algerian, Moroccan and Tunisian Ministries of Higher Education and Scientific Research.