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كلية الزراعة
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Article title	Exogenously Used Proline Offers Potent Antioxidative and Osmoprotective Strategies to Re-balance Growth and Physio-biochemical Attributes in Herbicide-Stressed <i>Trigonella foenum-graecum</i> .
Participants	Chaima Ould said ¹ ; Kerima Boulahia ¹ ; Mohamed A. M. Eid ² ; Mostafa M. Rady ³ ; Reda Djebbar ¹ ; Ouzna Abrous-Belbachir ¹ ¹ Laboratory of Biology and Physiology of Organisms, Faculty of Biological Sciences, Algiers, Algeria ² Agronomy Department, Faculty of Agriculture, Fayoum University, Egypt ³ Botany Department, Faculty of Science, Fayoum University, Faiyum, Egypt
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Abstract

In this study, we wanted to verify that exogenous application of proline as an efficient antioxidant could reduce the herbicide Basagran® damage to fenugreek (*Trigonella foenum graecum*). The study demonstrated the potential impacts of proline applied at 7mM as a seed soaking solution on the growth and physio-biochemical behavior of fenugreek seedlings subjected to 10⁻⁴ M of Basagran®. Herbicide-stressed seedlings showed suppression of growth efficiency and, as a result, yield loss, which could be due to reduced plant height, accumulation of hydrogen peroxide (H₂O₂) coupled with an increase in malondialdehyde (MDA) level, and electrolyte leakage (EL). As a consequence, proline metabolism, including the activity of proline dehydrogenase (PRODH) and pyrroline-5-carboxylate synthetase (P5CS), and level of pyrroline-5-carboxylate (P5C) and proline (Pro), in addition to glutathione (GSH) level, total antioxidant capacity (TAC), and activity of catalase (CAT) and glutathione-s-transferase (GST) were affirmatively affected. However, the exogenous application of proline attenuated the Basagran® negative effects by improving growth performance, total chlorophyll, and GSH levels. It also reduced lipid peroxidation level and detoxified the excessive reactive oxygen species (ROS) by regulating the enzymatic and non-enzymatic defense systems. Principal component analysis showed that increased oxidative damage and water imbalance were the most important contributors to herbicide stress injury, however, the proline-mediated antioxidant defense was the crucial determinant of herbicide tolerance in fenugreek. Our findings revealed, collectively, that externally-used proline protects against herbicide stress

through enhancing cellular defense mechanisms. These results indicate the capacity of proline to improve the tolerance of fenugreek plants subjected to herbicide constraints.