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ABA-mediated proline synthesis in cowpea leaves exposed to water deficiency and rehydration

Roberto Cezar Lobo da COSTA[1], Allan Klynger da Silva LOBATO[2],
Joaquim Albenísio Gomes da SILVEIRA[3], Haywood Dail LAUGHINGHOUSE IV[4]
[1]Laboratory of Advanced Plant Physiology, Universidade Federal Rural da Amazônia, Belém - BRAZIL

[2]Nucleus of Basic and Applied Plant Research, Universidade Federal Rural da Amazônia, Paragominas - BRAZIL
[3]Laboratory of Metabolism and Stress Plant, Universidade Federal do Ceará, Fortaleza - BRAZIL
[4]Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, DC - USA

Abstract: The aim of this study was (i) to evaluate the impact of water deficit and rehydration on nitrogen compounds and abscisic acid of Vigna unguiculata leaves, and (ii) to investigate the hypothesis that abscisic acid influences proline. The experimental design was entirely randomized in a factorial design, with 2 water conditions (control and stress) and 7 evaluation periods (0, 1, 2, 3, and 4 days under water deficit, followed by the 5th and 6th day under rehydration). The leaf relative water content presented significant reduction, presenting a lower value on the 4th day of treatment under water deficit. After rehydration, the plants reestablished the leaf relative water content. The correlation analysis suggested a significant relationship between the leaf relative water content and abscisic acid. The abscisic acid concentration of the plants under water deficiency were of 2.4, 45.9, 42.6, 47.9, 66.9, 9.2, and 5.5 mg kg^{-1} DM on days 0, 1, 2, 3, 4, 5, and 6, respectively. Rehydration quickly decreased abscisic acid. In addition, the correlation analysis indicated a significant relationship between abscisic acid and proline. The proline levels of the plants under stress showed significant increases by 67%, 354%, 423%, and 532% on the 1st, 2nd, 3rd, and 4th day, respectively, when compared with control plants. This study with Vigna unguiculata plants reveals negative consequence of water deficiency over nitrogen metabolism, and fast recovery after rehydration. The nitrogen compounds and enzymes presented direct and indirect responses in the osmotic adjustment of the plant, as well as increasing abscisic acid concentration with the intent to decrease water loss in Vigna unguiculata induced by the water deficiency. Furthermore, a positive relationship between abscisic acid and proline synthesis was confirmed.

Key words: Abscisic acid, nitrogen metabolism, osmotic adjustment, rehydration, Vigna unguiculata L. (Walp.), water deficit

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