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Short-Term Memory Induction, a Method for Improving Drought Stress Tolerance in Sweetpotato Crop Wild Relatives

Fernando Guerrero-Zurita[1], David A. Ramírez[1], Javier Rinza[2], Johan Ninanya[2], Bettina Heider[1]

[1] *International Potato Centre (CIP), Genetics, Genomics and Crop Improvement, Peru*
[2] *International Potato Centre (CIP), Crop and Systems Science Division, Peru*

Abstract

Sweetpotato crop wild relatives (*Ipomoea* series Batatas (Choisy) D. F. Austin) are a group of species whose physiological potential for drought stress tolerance is very high but poorly studied. In the present study, short-term memory induction was tested in 59 sweetpotato crop wild relatives (SP-CWR) accessions with the aim of improving drought stress tolerance. For this purpose, accessions were subjected to two treatments, i) non-priming: full irrigation up to field capacity, and ii) priming: three drought stress periods with no irrigation of increasing length. The priming process started after flowering onset with drought stress periods of 8, 11, and 14 days followed each by 14 days of recovery with full irrigation. Senescence delay (S), foliar area (FA), leaf-minus-air temperature, and leaf carbon isotopic discrimination were the eco-physiological indicators measured to determine short-term memory induction in all accessions. Drought stress tolerance was evaluated in terms of resilience capacity index, and production capacity index; both were calculated per accession based on yield performance. An increase in S, improved leaf photosynthetic performance, efficient leaf thermoregulation and increased FA were the memory mechanisms identified in 81.4, 50.8, 28.8 and 23.7 % of the total number of accessions, respectively. Under a severe drought stress scenario, a resilient response included more long-lived green leaf area with a concomitant higher aerial biomass development while a productive response was related to optimized leaf thermoregulation and gas exchange. The results of this study highlight the potential to improve sweetpotato resilience in dry environments in introgression breeding programs that include *I. triloba* and *I. trifida*. Moreover, since *I. splendor-sylvae, I. ramosissima, I. tiliacea*, and wild *I. batatas* were the most productive species in this study, further genetic and metabolic studies should be conducted in this species looking forward to increasing sweetpotato drought stress tolerance. This study proposes a new model of drought stress tolerance improvement based on short-term memory induction. It highlights the importance of including crop wild relatives due to their outstanding physiological response (higher than sweetpotato cultivars) in limited water conditions.

Keywords: Carbon isotopic discrimination, foliar area, leaf temperature, productivity, resilience, senescence delay

Contact Address: Fernando Guerrero-Zurita, International Potato Centre (CIP), Genetics, Genomics and Crop Improvement, Av. La Molina 1895, Lima 51 La Molina, Peru, e-mail: f.guerreroz13@gmail.com