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Screening Potato for Drought Tolerance by Linking Physiological to Morphological Traits

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Abstract

Potato is after wheat, rice and maize the fourth most important food crop in the world. Potatoes produce more food per unit of water than any other major crop. However, even short periods of water deficit significantly reduce tuber yield in potato. Climate change renders rainfall patterns increasingly unreliable, particularly in potato growing regions in central Asia. Screening tools considering the multiple trait nature of drought tolerance in potato are urgently needed to identify genotypes suited for production under water limited conditions and to accelerate the breeding efforts.

An experiment was conducted between September 2012 and January 2013 at an arid coastal site in southern Peru. 30 potato clones were planted in split-plot design with three irrigation regimes: fully watered, alternate irrigation (resulting in a 50 % reduction of water input) and terminal drought (irrigation withheld 67 days after planting). Chlorophyll fluorescence, relative chlorophyll content (SPAD) and relative water content were determined thrice in 15 day intervals after withholding irrigation. Quantum Yield was measured once after 30 days of withholding irrigation. In addition, biomass accumulation, root architecture, yield, and harvest index were recorded.

Quantum yield was decreased under drought conditions but was not related to changes in SPAD values and no significant differences were found among the genotypes. In contrast, high and stable harvest index and a small reduction in root length under drought were preliminarily identified as promising traits for assessment of drought tolerance in 10 genotypes. For the development of an effective screening tool, the morphological traits identified need to be linked to physiological traits indicating plant water relations. Osmotic adjustment and relative water content in combination with chlorophyll fluorescence are promising candidates for linking physiological adaptation to drought with morphological traits. The effectiveness of such a screening tool will be discussed and preliminary results will be presented.

Keywords: Abiotic stress, monitoring, *Solanum tuberosum*, traits, water use

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