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Hydroponic screening for salinity tolerance in quinoa (*Chenopodium quinoa*): Physiological mechanisms

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Abstract

Salinisation of agricultural land poses a significant threat to global food security. In arid regions, where agriculture relies on irrigation, increasing salinity particularly impairs production. Quinoa (*Chenopodium quinoa*) is a drought and salt-tolerant crop from the Andes, which is known for providing highly nutritious seeds. It naturally exhibits a broad genetic diversity and is adapted to various marginal environments. Therefore, it is a perfect a candidate to sustainably diversify cropping systems in saline and arid regions, to make them more resilient. Consequently, indentifiying quinoa accessions adapted to salinity and elucidating the respective tolerance mechanisms is important to enable quinoa breeding. This study aimed to screen 70 quinoa accessions for their salinity tolerance and investigate the underlying physiological mechanisms. In a randomised complete block design with six replications, plants were grown in a hydroponic system for 20 days until reaching six-leaf stage. They were then subjected to a 200 mM NaCl treatment for seven days. To assess physiological adaptions to salinity, leaf greenness, chlorophyll fluorescence and stomatal conductance were assessed one day before harvest. After harvest, biomass of roots and shoots, water content, osmolality and chlorophyll content of leaves were assessed. Furthermore, the content of Na^+ and K+ ions in roots and shoots was assessed. As a measure for salt tolerance, a salt tolerance index was calculated based on the retention of biomass under salinity, between control and treatment group. The quinoa accessions screened differed in their salinity tolerance. Salinity tolerance was found to be related to various physiological parameters, such as ion content, depending on the accession.The results lay a foundation for further investigation of the underlying molecular mechanisms of salinity tolerance in quinoa and may also serve as a basis for investigating the efficiency of phenotyping in hydroponic systems for selection purposes.

Keywords: Hydroponics, quinoa, salt tolerance, soil salinity

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