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"Development on the margin"

Yield and Water Productivity of Quinoa (*Chenopodium quinoa* Willd.): A Potential Crop for Saline and Dry Marginal Lands

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Abstract

Quinoa is a facultative halophyte crop and can grow in extremely saline conditions. A field lysimeter experiment was carried out to investigate the effects of salt and drought on the seed yield, total biomass production (DM), harvest index (HI) and water productivity (WP) of quinoa (cv. Titicaca). Five irrigation water salinity levels (0, 10, 20, 30 and 40 dS m^{-1}) applied during flowering were combined with either full irrigation (FI) or progressive drought (PD) during the seed filling stage. Salinity did not significantly decrease DM production but had a negative influence on HI. Salinity between 20–40 dS m^{-1} decreased the seed yield by 33 % below the ca. 2300 kg ha^{-1} of the 0 dS m^{-1} treatment. PD significantly decreased both the seed yield and the HI by ca. 10%; when soil was dried to the wilting point. No significant effect of drought and salinity was observed on the ET-based water productivity of seed production, however; higher salinity levels significantly increased total biomass water productivity (WP_{DM}) compared to 0 and 10 dS m^{-1} salinity levels. In addition, drought treatment increased WP_{DM} significantly (3.36 g m^{-2} mm^{-1}) compared to FI treatment (2.80 g m^{-2} mm^{-1}).

In summary, increasing irrigation salinity levels, caused reduction in the seed yield and HI, but increased WP_{DM}. When the crop was subjected to severe soil drying, the seed yield decreased but WP_{DM} increased significantly. With respect to the seed yield and HI, no significant differences between 20, 30 and 40 dS m^{-1} salinity levels were observed, which shows that this quinoa cultivar (cv. Titicaca) acclimates to saline condition when exposed to high salt concentrations above 20 dS m^{-1}.

Keywords: Quinoa, salt stress, seed yield, soil-drying stress, water productivity

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