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"Development on the margin"

Adaptation of the First Filial Generation of Quinoa to Salinity after Parental NaCl Treatment

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Abstract

At present, many regions are not available because of soil salinity. Irrigation with saline water increases soil degradation and result in further losses of cultivation areas. Utilisation of halophytic plants is an option for land reclamation and recovery. Quinoa (*Chenopodium quinoa* Willd.) is an important crop in the South American highlands that is increasingly utilised in Europe as an organic food product. Because of its high-quality nutrient content as well as resistance against diverse abiotic stresses, the FAO suggested quinoa as a future candidate in food security programs. Persistence to drought and salinity distinguish quinoa for cultivation in arid regions.

During development, seed and seedling are dependent on the parental deposited reserves, before the root system can assimilate nutrients. Quinoa seed germination rate and seedling viability were increased after parental NaCl treatment. Advanced seed swelling cannot completely be explained by increased ion content for osmotic regulation, because the amount of carbohydrates was decreased. Rather, the suction pressure was improved by low levels of matrix potential in the seed hull. By exclusion of Na and Cl at the level of the seed coat ion homeostasis was mostly maintained.

High salinity (500 mM NaCl) increased the protein content in embryo and perisperm. We assume that increased parental effort of N plays a crucial role for the viability of the filial generation under extreme stress. As a main source of N metabolites, seed storage proteins are major reserves in most common crops. It was observed, that the production of this protein class was increased during grain filling at the presence of vitiating circumstances. Thus, the source of basic nutrients for the filial generation was enhanced, resulting in increased stress resistance and viability. When affected by salinity, improved germination of quinoa might therefore be conditioned by an increased seed N reserve, such as seed storage protein.

Because development of genotypes with improved salt tolerance for common crops evolves very slowly, comprehension of naturally present mechanisms gains in importance. Targeted breeding for crops with high salinity tolerance, fertility and productivity, such as quinoa, is therefore an increasing option towards reclamation and recovery of barren area.

Keywords: *Chenopodium quinoa*, NaCl treatment, salt stress, seed morphology

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