

Chenopodium quinoa as a model plant to study salt stress

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Chenopodium quinoa is an important crop that is known for its salt tolerance. Salinity is an osmotic stress and accumulation of ions in the root zone causes a reduction in soil water availability, which negatively affects the uptake of essential nutrients, changes seed composition, and reduces biomass. Therefore, there is a need to develop crops that are highly productive under poor soils. This research examines the effect of salt stress on quinoa photosynthetic efficiency and chloroplast development. Sensitive and tolerant quinoa lines were examined under salt stress conditions when a concentration of 155mM NaCl was applied. Electrical soil conductivity was monitored during the experiment to assure salt stress and at approximately two months old, CropReporter images, which are used to estimate photosystem II efficiency, non-photochemical quenching (NPQ), chlorophyll content, and anthocyanin content were captured and analyzed using PlantCV. The analysis showed that the salt treatment did not negatively affect the plant photosynthetic efficiency (no changes in Fv/Fm, NPQ, Fq'/Fm') but leaf area and chlorophyll content was statistically negatively affected by the treatment when comparing genotypes. Leaf tissue was sampled and chloroplasts were imaged using super-resolution microscopy. Salt-sensitive lines showed swelling of the chloroplast lamellae, starch accumulation, and unrecognizable grana structure. A comprehensive understanding of the quinoa salt tolerant mechanisms by employing multidisciplinary approaches is necessary for their effective incorporation into salt-sensitive crops for better crop yields under stressful environments.