

Comparison of the ionic and osmotic effects of salt stress on spearmint (*Mentha spicata* L. var. *crispa*)

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Due to improper irrigation practices, high soil salinity affects an increasing amount of arable lands worldwide, and thus represents an important challenge for agriculture. Salt stress has strong and complex effect on plant growth and reproduction. Due to increased osmolarity in the soil, high soil salinity inhibits water uptake and thus causes osmotic stress, while the Na⁺ and Cl⁻ ions entering plant cells also have direct ionic interactions with plant metabolism.

In this work we investigated salinity stress in spearmint (*Mentha spicata* L. var. *crispa* 'Moroccan') and compared the effects of ionic and osmotic components of salt stress on the photosynthetic activity and chloroplast structure of this medicinal and aromatic plant, and thus to assess whether it can be cultivated in salt or drought affected areas that are unsuitable for salt sensitive staple crops.

During 2 weeks of low concentration treatments (0, 5, 25 and 50 mM NaCl) we observed that the stem-derived adventitious root formation – a major mean for vegetative reproduction among mints – was completely inhibited at 50 mM NaCl concentration. No changes were observed in the 77K fluorescence emission properties of the chlorophyll-protein complexes of the photosynthetic apparatus, but the chlorophyll a and b contents of the leaves significantly decreased at high (25, 50 mM) concentrations, the Qy dark and Qy light values of PSII also significantly decreased and slight swelling of the thylakoid lumen was observed in chloroplasts at 50 mM treatment. In other experiments using 150 mM NaCl and isosmotic PEG treatments for 1 week on intact spearmint seedlings we observed chloroplast membrane disorganization, great alterations in the 77K fluorescence emission of the photosynthetic apparatus in plants exposed to salt stress, while plantlets only exposed to isosmotic PEG had photosynthetic activity and chloroplasts similar to control plants. These data indicate that the observed negative effects are associated with the ionic rather than the osmotic component of salt stress.

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