

Downregulation of high-affinity potassium and sodium symporter gene, EcHKT1;1, in Eucalyptus roots enhances salt tolerance

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Abstract

Engineering for restricted root Na⁺ uptake could potentially enhance salt tolerance in Eucalyptus. High-affinity K⁺ transporters (HKTs) have been implicated in Na⁺ uptake from the external medium as in the case of TaHKT2;1 or in the unloading of Na⁺ from xylem like in AtHKT1;1. To rapidly determine the in planta role of EcHKT1;1, composite transgenics in which EcHKT1;1 was specifically downregulated via RNAi in the roots were generated. Compared to the controls that failed to survive at 350 mM NaCl, 33 % of the composite transgenic plantlets generated using the EcHKT1;1 silencing construct were able to tolerate up to 400 mM NaCl. In these composite transgenics, EcHKT1;1 downregulation ranged from 37 % to 74 %. The average shoot to root ratio of sodium was 4.9 folds lower than the controls indicating restricted translocation of Na⁺ to the shoots. Relative expression analysis in the leaves of two non-transgenic genotypes contrasting for their salt tolerance also showed downregulated EcHKT1;1 expression in the tolerant clone. The study thus determined that EcHKT1;1 is a major gene determining Na⁺ transport from the roots to shoots. This study also demonstrated the utility of the composite transgenic approach for screening genes conferring salt tolerance in tree species.

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