New Insights Into the Salt Tolerance of Alfalfa

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Salinity is a major abiotic stress that significantly impacts crop production and food security. It is imperative to link the biochemical and physiological responses to salinity stress with the underlying genetic determinants, which will be the key to developing genetic material tolerant to salinity. Our results showed that selections based on total biomass and ion composition in alfalfa were highly effective. The genetic analyses led to the identification of various genes involved in salt tolerance, including genes involved in ion transport, ion partitioning, and tissue tolerance. Gene expression analyses allowed us to classify genotypes based on their ability to regulate different components of the salt tolerance mechanisms. The root and leaf transcriptome analyses of a salt-tolerant and a salt-sensitive genotype suggested that the low salt tolerance index (STI) transpiration rate and stomatal conductance of the salt-tolerant genotype may be due to its reduced salt uptake under salinity. Differential expression of genes regulating shoot number explained shoot biomass difference between the salt-tolerant and salt-sensitive lines. Various differentially expressed genes involved in hormone-, calcium- and redox-signaling, displayed genotype- and treatment-specific differences and can be potential candidates for improving salinity tolerance in alfalfa.