

Developing Molecular Markers for Enhancing Resistance to Drought and High Salinity in Alfalfa

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Enhancing drought and salt resistance of alfalfa is important to meet the challenges of finite available water resource. We developed advanced alfalfa populations in collaboration with scientists from ARS and universities and selected from more than 3,000 Individuals for evaluating for drought and salt resistance in field. We collected evaluation data on agronomic, physiological and quality traits as well as an integrated drought resistance index (DRI). Of these, eight new lines had a higher level of drought resistance than the known resistant control and are being used in alfalfa breeding. We used next generation sequencing technology and developed more than 10 thousands SNP markers for genome-wide association study (GWAS). Our study of marker-trait association identified genetic loci associated with drought and salt tolerance. Most markers loci associated with drought and salt resistance in this work overlap with the previously reported quantitative trait loci (QTL) associated with biomass under drought in alfalfa. Additional significant markers were targeted to several contigs with unknown chromosomal locations. A Basic Local Alignment Search Tool (BLAST) search (using their flanking sequences) revealed homology to several annotated genes with functions in stress tolerance. With further validation, these markers may be useful for marker-assisted breeding new alfalfa varieties with drought resistance and improved water use efficiency. The results have been reported at professional conferences and published in peer-reviewed journals.