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Identification of Gene Resources of Drought Resistance and Enhanced Water Use Efficiency in Alfalfa (*Medicago sativa* L.)

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Enhancing drought resistance and water use efficiency of alfalfa varieties are important to meet the challenges of finite available water resource. However, no rapid and precise methods have been developed to identify the resistance resources for the alfalfa breeders. Development of molecular markers associated with drought resistance and improved water use efficiency would be helpful for improving the accuracy in detection, accumulating the major and minor genes, and accelerating the breeding process. Toward this end, in this study, a panel of accessions comprised of 202 alfalfa cultivars and landraces with potential drought tolerance were selected from the USDA-ARS National Temperate Forage Legume Germplasm Resources Center (http://www.ars-grin.gov). They were evaluated for drought resistance in field and greenhouse in dry season of 2013 and 2014. Agronomic and physiological traits including relative leaf water content, osmotic adjustment, canopy temperature, and biomass and forage quality under water deficit were measured. A greenhouse procedure for phenotyping drought tolerance index was established. The index of individuals were scored a scale of 1 to 5, with 1=susceptible with plant death, 5=high resistant with minimal damage and. Generally, the frequency stem of phenotypic data exhibited a trend of normal distribution with the mean of 3.10 and variance of 1.17. And the p-values of the Shapiro-Wilk (2.382e-09) and Kolmogorov-Smirnov (8.654e-05) tests were far less than W (0.915) and D (0.158) values, respectively, conforming a normal distribution of drought resistance scores of this panel. Using this protocol, we have identified a group of accessions with high resistance scores. With further characterization, they can be used as gene resources for breeding and developing populations for mapping QTLs for drought tolerance and enhanced water use efficiency.