QTL mapping of Aluminum Tolerance in Tetraploid Alfalfa

Dong-Man Khu[1], Joseph H. Bouton[1], E. Charlie Brummer[2], Rafael Reyno[2], Maria J. Monteros[1]
[1]The Samuel Roberts Noble Foundation, OK 73401 [2]Center for Applied Genetic Technologies, University of Georgia, GA 30602

Aluminum (Al) toxicity in acid soils is one of the constraints limiting alfalfa production worldwide. To date, no alfalfa germplasm with Al tolerance is commercially available. Phenotypic evaluation of alfalfa germplasm for aluminum tolerance can be laborious and time and cost intensive. The objectives of this study are to establish a fast and reliable phenotypic assay for Al tolerance and to identify molecular markers associated with the Al tolerance trait in tetraploid alfalfa. Altet-4, a tetraploid Al-tolerant alfalfa germplasm, has been crossed to the Al-sensitive tetraploid genotypes 95-608, 95-671, 95-653 derived from CUF101, and to the breeding line NECS141, originally developed in Iowa. The resulting F1 mapping populations consist of at least 190 individuals each. Progress in evaluating the parental lines and the progeny from selected mapping populations for Al-tolerance using a callus and a nutrient solution-based assay will be presented. The genotypes will also be evaluated in soil assays to confirm the effectiveness of these screening methods to identify germplasm with soil-based tolerance. EST-SSR markers (Sledge et al., 2005) and candidate gene-based markers (Narasimhamoorthy et al., 2007) are being used to genotype the mapping populations and to construct genetic maps. The long-term goal of this research is to use molecular markers linked to the Al tolerance trait to accelerate the development of Al tolerant alfalfa cultivars.

Reference

Narasimhamoorthy, B., J.H. Bouton, K.M. Olsen, and M.K. Sledge. 2007. Quantitative trait loci and candidate gene mapping of aluminum tolerance in diploid alfalfa. Theor Appl Genet 114:901-913.

Sledge, M.K., I.M. Ray, and G. Jiang. 2005. An expressed sequence tag SSR map of tetraploid alfalfa (Medicago sativa L.). Theor Appl Genet:980-992.