Restructuring Alfalfa through Introgression of *Medicago arborea* Traits

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Traits present in *Medicago arborea*, such as large seeds (400% over alfalfa), robust stature and drought tolerance would increase alfalfa's versatility. Work has been in progress in Wisconsin and Queensland Australia for the past ten years to introgress *M. arborea* genetic material into the *M. sativa* genome, through sexual reproduction using male sterile alfalfa as the seed parent in *M. sativa* X *M. arborea* crosses (1,2,3,) The hybrid products and their derivatives, are termed Alborea. Individual hybrids contain up to 8% of the *M. arborea* specific SSR markers; however, specific SSR markers are mostly different in respective hybrids. The molecular markers indicate that DNA from all *M. arborea* chromosomes was introgressed among the first ten hybrids, and 32 hybrids have been produced thus far. Hybrids were crossed in various combinations, and recurrent selection used to pyramid *M. arborea* traits in Alborea lines. Alborea selections also have been crossed and backcrossed with alfalfa for breeding purposes. Alborea crosses have been identified in Australia and Wisconsin that are at least as vigorous and productive in the glasshouse and field as the best commercial control lines. In a glasshouse pot experiment, the progeny of an Alborea genotype X Sequel (Australian cultivar) cross yielded 147% of Sequel, whereas the progeny of the dormant alfalfa parent X Sequel yielded 66% of Sequel. Families deriving from this Alborea have consistently yielded well over 4 years in the field at Gatton and Ballarat (Australia). Similarly, in a non-dormant background, Alborea X alfalfa produced families that yielded at least as well as Sequel both in the glasshouse and field (Gatton). These results could be explained by genetic complementation between the two genomes in Alborea, leading to heterosis for vigour and yield. Several other traits have been transferred from *M. arborea* to Alborea. These traits include winter activity, yellow flower colour, larger seeds, single coil flat pods, and several morphological changes including bush-like erect plant architecture. Seeds per pod of Alborea from hand crosses averaged 4.3, with range 1.8-7.3, while three alfalfa checks averaged 4.7. The work to date indicates that with further breeding and selection, alfalfa can be restructured into a more versatile and productive plant.

1. Armour et al. 2008. Theor. Appl. Genet. 117: 149-156.
2. Bingham 2005-2015. Medicago Genetic Reports. www.medicago-reports.org
3. Bingham et al. 2013. Plants MDPI (on line) 2(2): 343-353.