Breeding strategies in balansa clover (*Trifolium michelianum* Savi)

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Balansa clover (*Trifolium michelianum* Savi) is a self-regenerating annual pasture legume suited to the temperate pastures of southern Australia. Traits for genetic improvement include time to flowering, rate of hardseed breakdown, and nitrogen fixing capacity.

Hand pollination studies revealed that balansa clover is a highly self-incompatible species. There was no seed set in florets, which were not tripped and protected. Mean seed yield following selfing was 0.16 seeds per 100 florets, while cross-pollination resulted in 220 seeds per 100 florets. This implied that balansa clover is a highly outcrossing species.

Breeding methods employed include phenotypic recurrent selection and inter-specific hybridisation.

Phenotypic recurrent selection has been previously used to develop the early flowering cultivar Frontier. Presently, it is being used to select for increased rate of hardseed breakdown in late flowering cultivars, to ensure their reliable regeneration in permanent pastures. Significant differences in the trait have been measured amongst 54 half-sib families generated using this breeding approach. This method is also being used to improve nitrogen fixation by balansa clover with the populations of rhizobia that have naturalised in many Australian soils. Initial efforts focused on variation in symbiotic capacity occurring between 44 accessions of balansa clover, but with limited success. Hence efforts are now focused on recurrent selection within the cultivar Paradana. Dramatic differences in both nodulation (eg. red vs. white nodules) and in the nitrogen fixing capacity of individual plants have been observed within this cultivar, suggesting that considerable potential exists to improve this trait.

The alternative approach of inter-specific hybridisation is being used to select for reduced rate of hardseed breakdown in early flowering cultivars so that they are better able to persist through cropping phases in ley farming systems. Crosses were made between balansa clover cv. Frontier and an accession (hardseeded) of ball clover (*T. nigrescens* Viv.). The putative hybrids were confirmed using morphological leaf markers and GOT-1 isozyme banding patterns. Results from the preliminary evaluation of the hybrids are encouraging. Also, we suggest that it may be possible to hybridise between balansa clover and other *Trifolium spp*. namely white clover (*T. repens* L.) directly or to use ball clover as a bridging species to facilitate the transfer of other desirable traits.