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Breeding birdsfoot trefoil for Mediterranean-type environments in southern Australia

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Australia has a very short agricultural history which commenced with European settlement in 1788. During settlement native perennial vegetation was cleared from large parts of the landscape and replaced with annual crops and annual pastures, such as *Triticum aestivum* L. (wheat – annual crop) and *Trifolium subterraneum* L. (subclover – annual pasture). These annual species only use water significantly during the rainy season (autumn – spring), and moreover do not extract significant amounts of water below 1.2 m. In contrast, the native vegetation they have replaced use water all year round and to a much greater depth. The result is that this annual farming system has caused an imbalance in the water cycle and an excess of water leaches through the soil profile into groundwater aquifers. During the leaching process, salts in the soil are dissolved and in many regions the water table becomes saline and salt is deposited in the lower parts of the landscape causing the visual scalding of the land that is associated with salinity. In 2005, 18% of the cleared agricultural land in Western Australia was declared saline. This is predicted to increase to 33% by 2050 unless major changes to the current farming systems occur.

The problem of salinity can be dealt with in a number of ways and one of them is a plant-based solution using perennial species that mimic the water usage of the original native systems. Any new plant-based farming system needs to be profitable and the best example of

a plant for this Mediterranean-type system is *Medicago sativa* L. (lucerne). However, lucerne has several disadvantages: (a) it is not tolerant of acidic soils, (b) it is not waterlogging tolerant, (c) it is susceptible to Redlegged Earth Mite (RLEM: *Halotydeus destructor*), (d) it predisposes bloat in cattle, and (e) it drops its leaves during dry conditions experienced over summer, which restricts its contribution to the summer/autumn feed-gap. southern Australian (south of latitude 28^{o}S) therefore, requires new plants that have the water usage and drought tolerance capabilities of lucerne but have improved adaptation to its weaknesses identified above.

The search for perennial pasture legumes that can survive in Mediterranean environments in southern Australia and thus have the ability to cope with dry seasons, acidic soils, waterlogging or salinity is a challenge for plant breeders working for the CRC for Plant-based Management of Dryland Salinity (Salinity CRC) based in Perth, Western Australia. To address this problem, the funding body, Australian Wool Innovation has joined the Salinity CRC to fund a *Lotus* breeding project which will invest over a 5 year period (2003-2008) to develop new *Lotus* cultivars adapted to these Australian conditions.

One of the species being examined is *Lotus corniculatus* L. (birdsfoot trefoil) as it is more tolerant of acid soils and waterlogging than lucerne, hence, it will be developed for places in which lucerne is not well adapted. However, birdsfoot trefoil is not as drought tolerant as lucerne and with 5 to 7 months of dry conditions each summer, drought-tolerance is critical and hence this attribute will be targeted in a new breeding program, being managed by Dr. D. Real. As part of this program, Australian researchers by way of formal agreement will have access to breeding material selected for persistence of birdsfoot trefoil from Uruguay's well-established breeding program conducted by Mrs. M. Rebuffo since 1988 at the National Institute of Agricultural Research (INIA). Birdsfoot trefoil is a long-day species requiring a minimum daylength of 14.0 to 14.5 hours for flowering. Uruguay and Mediterranean Australia are located at similar latitudes; therefore the well adapted germplasm from Uruguay will flower profusely in Mediterranean Australia. This germplasm will be examined along with breeding lines developed by Dr. J. Ayres and Dr. W. Kelman for low latitude permanent pasture applications in Eastern Australia. In addition, the project leader Mr G. Sandral has selected lines which were characterised at the Genetic Resource Centre in south Australia with the assistance of the Curator Mr S. Hughes. The advanced status of these breeding lines from these sources provides an opportunity for this new Uruguay-Australia collaborative breeding program to reduce the normally extended breeding cycle required to produce new cultivars.