

Breeding Lotus for temperate and subtropical pastures in Australia.

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Introduction

New perennial pasture legumes are needed to increase the legume content of pastures growing on acid, infertile soils in south-eastern Australia. The genus *Lotus* contains several potentially useful species, particularly *L. pedunculatus* and the more drought tolerant *L. corniculatus*. These tannin-containing species should complement the existing legume species and displace some of the Tow quality grasses and broad-leafed weeds that dominate many high-rainfall pastures. A breeding and evaluation program for *Lotus* is based in Canberra, Australia with specific objectives to breed cultivars of

1. *L. pedunculatus* as productive as the cv. Grasslands Maku on the east coast, but able to set seed from S.E. Queensland to Tasmania, having lower and stable condensed tannin levels and able to germinate and establish rapidly at low temperatures.
2. *L. corniculatus* with better drought tolerance and seedling re-establishment than white clover

Germplasm evaluation and breeding

96 accessions of *Lotus* from US, New Zealand and Australian sources were grown as spaced-plant nurseries under irrigation in 1988-89 and with no supplemental water in the following two seasons on limed and unlimed soils near Canberra, Australia, in a representative sample of accessions scored for dry matter production under irrigation, *L. pedunculatus* accessions were more tolerant of the acid soil than other *Lotus* species and the white clover standard (Kelman and Oram, 1989; Fig. 1), whereas *L. corniculatus* was more persistent at the end of the dry seasons. At the end of this period surviving *L. corniculatus* crowns and seedlings were transplanted to another site near Canberra on a mildly acid soil. A further selection of 59 accessions of *L. corniculatus*, mostly of Mediterranean origin and prostrate habit were included in this trial and evaluated for herbage productivity and quality, winter growth and seed production. Selected individuals from this population will be progeny tested in the formation of synthetic cultivars of *L. corniculatus*.

For *L. pedunculatus*, a selection of 40 of the more promising entries from the first evaluation trial and standard cultivars and breeding lines from New Zealand have been planted at sites in subcoastal and coastal eastern Australia. Evaluation in this higher rainfall environment will be for herbage productivity on acid and low phosphorus soils, good seed production and low and stable tannin content.

A series of two-way crosses have been made between the early flowering, high tannin producing Portuguese accessions of *L. pedunculatus* and the late flowering, productive diploid progenitors of cv Grasslands Maku. Bulk populations of these crosses will be subjected to selection to produce populations combining early flowering with low and stable condensed tannin levels.

Condensed tannins

Condensed tannins are an important aspect of the forage quality of *Lotus* and an optimal concentration of tannin will balance the positive effects of bloat prevention against the negative influences on ruminant carbohydrate digestion and palatability. Measurements of tannins in the germplasm collection (Kelman and Tanner 1990) indicated that *L. corniculatus* accessions had concentrations generally less than 5% of dry weight, whereas the variability of the *L. pedunculatus* accessions was more extreme (Table 1) and promising accessions will require selection and breeding for lower tannin levels.

Condensed tannin concentrations appear to be higher on soils of lower fertility (Kelman and Blumenthal, 1992). Experiments are planned to investigate more thoroughly environmental influences (e.g. light intensity, moisture stress) on condensed tannin production so that conditions can be set to quantify the tannin-producing potential of genotypes.

References

Kelman W. M. and Oram R. N. 1989. Responses of perennial *Astragalus* and *Lotus* accessions to acid soils. Proc. 5th Aust. Agron. Conf., Perth. p. 628.

Kelman W. M. and Tanner G. J. 1990. Foliar condensed tannin levels in lotus species growing on limed and unlimed soils in south-eastern Australia. Proc. NZ Grasslands Assoc. 52: 51-54.

Kelman W. M. and Blumenthal M. J. 1992. *Lotus* in south-eastern Australia: aspects of forage quality and persistence. Proc. 6th Aust. Agron. Conf., Armidale. (In press).

Figure 1: Dry weights of *Lotus* species growing on limed and unlimed soils near Canberra, Australia.

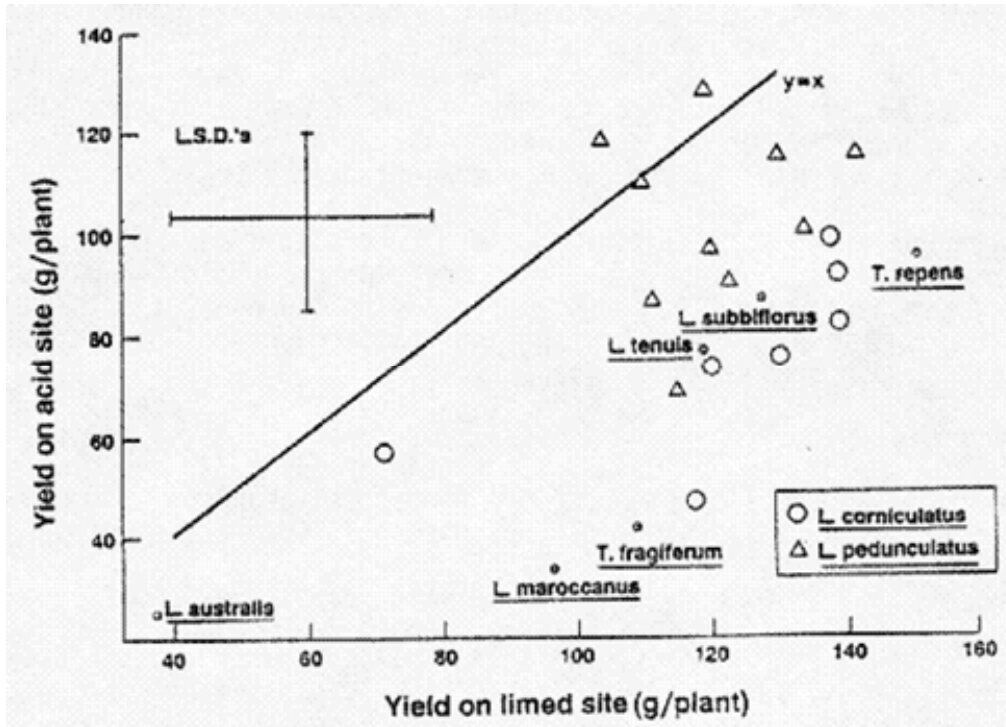


Table 1: Plot means for concentrations of condensed tannins (% of dwt) in leaves of *Lotus* on limed and unlimed soils.

Species/cultivar or accession number	Origin	Condensed tannin conc.	
		Limed	Unlimed
L pedunculatus			
CPI 67677	Portugal	8.59	9.98
CPI 67678	Portugal	7.82	10.72
P15302		8.75	8.21
CPI 67676	Portugal	7.20	7.73
Grasslands Maku	New Zealand	4.88	5.57
Marshfield	USA	3.37	6.25
CPI 114248	Chile	5.80	2.92
CPI 114246	Chile	5.42	2.53
G4704	New Zealand	2.57	5.32
Columbia	USA	3.75	2-63
Species mean		5.82	6.19