

Program of improvement in *Lotus corniculatus* L.: Base Germplasm characterisation

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Lotus corniculatus L. is a species that expresses many different agronomic adaptations compared with other temperate forage legumes. These adaptations include: tolerances to water-logging, drought, low levels of P, acid soils and to high levels of soil Al and Mn (Grant and Marten, 1985). In spite of this wide range of adaptations, it is very difficult to put an economic value on the species, due to the contribution given by naturalized *Lotus* material already existing in pastures. In general, the agronomic importance of *Lotus* has been decreasing due to the intensification of agriculture, although at present it is recovering in importance in some regions.

Even though the use of *Lotus corniculatus* is limited, the adaptative characteristics that it exhibits make it an important species to initiate an improvement programme. In 1997, AgResearch - Gentos S.A. began a joint programme aimed at developing *Lotus corniculatus* adapted to the conditions of the region and under cattle grazing.

The program was developed in two phases. Phase 1: Introduction and evaluation of material with a wide genetic base to ensure sufficient variability for the desired traits. Phase 2: Selection of the best genotypes to develop cultivars with high agronomic and forage quality potential.

In this study, we present the results of the first phase of the program. The initial evaluation consisted of 114 *Lotus corniculatus* accessions obtained from the Margot Forde Germplasm Center at Palmerston North, New Zealand. The evaluation trial was carried out at the "La Lucila " Farm, Pergamino, Argentina. The trial used a randomized complete block design with 5 replications. The trial was planted during the autumn of 1998, following establishment of accessions in trays in a green-house then transplanting to the field. The transplants were inserted in the space between furrows of tall fescue sown 3 months earlier. Every accession was represented by two rows of 10 plants, spaced 20 cm between plants in each of the replications.

During the period 1998-2000, the genetic material was characterized by visual measurements of the following traits: initial vigor (1 low - 5 high), habit of growth (1 prostrate - 5 erect), stem density (1 low - 5 high), and seasonal forage growth throughout the year (1 low – 9 high). After every measurement the plants were grazed by cattle. Intensity of

flowering was determined by a visual score (0 without flowers - 5 full flowering). The persistence of the materials was determined as percentage of surviving plants in each accession after 3 years.

The accessions used were collections of ecotypes and cultivars from different origins: South American cultivars (Group1), South American ecotypes from Argentina, Brazil, Uruguay and Chile (Group 2), North American (Group3), Mediterranean (Spain, Portugal, Italy, Israel, Greece, Ethiopia and Canary Isles) (Group 4), Central Europe (France, Yugoslavia, Hungary, Czechoslovakia) (Group 5), North European (Switzerland, Denmark, Ukraine and Russia) (Group 6) and New Zealand (Group 7).

The results showed high variation both between and among the different groups of origins for all characters. In a multivariate analysis using principal components, there was no clear separation between the groups, due to the high level of variability inside the groups. However, it is possible to observe the clustering of the materials into three main groups: the first was defined by very quick establishment with average herbage yield, and was composed by materials of Group 1. The second were slow establishers with low yield, and was composed by materials of Group 4. The third contained material of intermediate flowering and medium to high herbage yield and was composed by materials from most of the other groups.

The Group 1 material consists of the local South American cultivars and are characterized by rapid establishment vigor, good winter herbage production, erect growth habit and low numbers of stems. The Group 4 material was from the Mediterranean and had low winter vigor but average summer productivity, semi-erect growth habit and high numbers of stems. The remaining groups from North America, Central and Northern Europe, showed good production during the summer and autumn, but with slow establishment vigour, semi-erect growth habit and high stem numbers. The Group 7 material from New Zealand had good productivity throughout the whole year but particularly in summer and autumn, with a semi-prostrate habit and the highest numbers of stems compared to all groups. In general, the agronomic characterization of the different groups evaluated in Argentina was similar to the results described in New Zealand (Widdup *et al.*, 1997).

The South American cultivars making up the control Group 1 display the desirable traits of rapid establishment, good winter growth and high seed yield. However, overseas material from Central Europe and New Zealand show very good growth in summer and autumn, have high numbers of stems and more prostrate growth habit which was a factor in the improved persistence shown by these overseas material by the third year. The major weakness of the Europe and New Zealand material was slow establishment and late flowering resulting in lower seed yields.

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In Phase 2 following the characterization step, surviving plants with good agronomic features were selected and isolated into two polycrosses – the rapid establishing South American material in one polycross and the more summer-active, densely stemmed Europe and New Zealand material in the second polycross. Seed harvested from individual plants in the polycrosses were used in a progeny test to allow further selection of elite material to form

new cultivars.

In addition, the progeny material was also analyzed for the concentration of tannin in the leaves. Tannin helps reduce bloat in cattle and also improves the nitrogen metabolism in cattle. The objective has been to select material which displayed both good agronomic features and high tannin concentration in the leaves.

References

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