Development of rough-seeded lupins for agriculture

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The large, rough-seeded lupin species', L.cosentinii;L.atlanticus, L.pilosus, L.digitatus, L.palaestinus and L.princei, have the potential for development as cultivated species which may complement and expand the range of enviroments in which lupins are grown. Recent efforts to domesticate these species have concentrated on the introgression of domestication genes (shatter resistance, soft seededness, low alkaloid content, white flowers and seeds, and early flowering) from L. cosentinii cv. Erregulla, on development of techniques (such as embryo rescue) to cross widely separated species, and on mutation breeding.

Interspecific crosses.

Several F4-F6 lines from crosses of *L.*atlanticus and L.cosentinii have low alkaloids, white seeds and white flowers derived from Erregulla. Shatter resistance and soft seededness has been found only in two lines that were backcrossed to Erregulla. A cross of L.atlanticus / L.digitatus was very fertile and flowered much earlier than either parent. Crosses of L.pilosus / L.atlanticus resulted in sterile Fl plants. Crosses between L.atlanticus / L.palaestinus and L.atlanticus / L.princei have produced Fl plants which are now being grown in the glasshouse. Embryo rescue techniques have been developed which may aid the production of F2 plants from these crosses between species that are widely separated in chromosome number and geographic origin.

Embryo rescue.

Embryos from self-pollinations of L.atlanticus were successfully grown to the seedling stage in culture. F2 embryos will now be rescued from crosses between widely separated species.

Mutation.

Mutant lines of L.atlanticus with low alkaloids, white flowers and white seed were developed by J.S. Gladstones. Recent mutations of L. atlanticus, L. pilosus and L. digitatus are now being tested for shatter resistance and soft-seededness.

Yield.

L.atlanticus and L.pilosus grew more vigorously and yielded more seed at Chapman Valley than at Wongan Hills, Western Australia in 1988. This corresponds to their adaptation to heavier soil types in the Mediterranean region. Yields of many of the accessions of L.pilosus and L.atlanticus were equal to or better than those of cultivars of L.angustifolius, L.albus and Erregulla. L.digitatus appears to be poorly adapted to both environments, but may perform better in drier areas where the deep tap root and propensity to stay green late in the season may be an advantage. Most of the interspecific lines from L.atlanticus / L.cosentinii yielded less than the parental lines. Further backcrossing to L.atlanticus may improve the vigour and yield of these lines.

Flowering time.

L.pilosus and L.digitatus did not require vernalization, but L.atlanticus and L.cosentinii required 2-4 weeks of vernalization at 5?C to induce flowering. Fl plants from the cross between the hybrid (L.digitatus / L.atlanticus) and an advanced line of the hybrid (L.atlanticus / L.cosentinii cv. Erregulla) flowered in 39 days in the glasshouse (without vernalization), far shorter than any other rough-seeded lupin. Early flowering, which is essential for adaption to Western Australian conditions, may be transfered to L.atlanticus by this Method.

Wide scale testing of the rough-seeded lupins awaits the development of non-shattering, soft-seeded lines. However, they have already demonstrated great potential for expanding the range of domesticated lupins in southern Australia.