Lupins in Western Australia. 1. Species and varieties

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LUPINS IN WESTERN AUSTRALIA

1. SPECIES AND VARIETIES

By J. S. GLADSTONES, Department of Agronomy, Institute of Agriculture, University of Western Australia

First in a series of articles on the varieties, cultivation and uses of lupins in Western Australia.

Lupins are ideally suited to the climate and soils of many districts of Western Australia and their cultivation here dates from the early years of the century. However, although there were some 500,000 acres of lupins growing in the State in 1968, their cultivation in recent years has been largely limited to infertile sandplain soils where other legumes usually fail.

Farmers' past reluctance to grow lupins has resulted from—

- High alkaloid content, leading to bitterness and unpalatability.
- Frequent stock losses from lupinosis.
- Occasional poor nodulation in the first year, leading to poor establishment.
- Rapid shedding of the seeds at ripening.
- Difficulty in eradicating lupins when they are to be replaced with other pasture plants.

The introduction of new varieties which are suitable for grain cropping is changing this situation and lupins may in future find much wider use.

This article describes the various species of lupins grown in Western Australia and discusses the new crop varieties that have been developed or are in the process of development.

The sandplain lupin
(Lupinus cosentini*)

The sandplain, or Western Australian blue, lupin is believed to have been present in Western Australia for more than 100 years. It is naturalised on sandy soils in west coastal districts from the mouth of the Murchison River to south of Busselton, and has been cultivated for summer sheep feed and soil improvement in the Geraldton, West Midlands, Dandaragan, and Gingin districts for over 50 years.

It is characterised by sky-blue flowers, which grow in whorls of four or five on a stout flower stalk, dense, short white hairs which cover all parts of the plant, and moderately broad leaflets. The seeds are medium-sized, flattened, and brown or pale brownish-grey with black markings. They have a slightly rough surface.

The sandplain lupin grows naturally in coastal districts of Morocco, with limited occurrences in coastal areas of Tunisia, southern Spain and Portugal, Sicily, Corsica and possibly Sardinia. How it was

*The sandplain lupin has been known by several botanical names, principally Lupinus varius L., L. digitatus Forsk. and L. pilosus Murr. Recent research has suggested that none of these names is correct and that the species is in fact identical with L. cosentini Guss.
The sandplain lupin grows luxuriantly on sandplain soils in coastal districts. This picture was taken at the Erregulla Springs property of Sir Eric Smart, who did much to popularise the wider use of lupins in the years following World War II.

introduced into Western Australia is not known, but it appears that there were at least two separate introductions.

Populations naturalised north of Perth are predominantly of a brown-seeded type which appears to have been present in the Geraldton district from the earliest years of settlement. Evidently the lupins quickly became established, for it is recorded that a Mr. Hazelden fattened 200 sheep on a paddock of pure lupins near the Geraldton racecourse in February, 1894.

Despite early misgivings about possible toxicity (at one stage a number of farmers petitioned Parliament to have lupins gazetted as noxious weeds), extensive plantings were made for grazing in the Geraldton-Northampton district between 1900 and 1910. Mr. Ross Drage, at Northampton, is credited with having been the first to use a stripper to harvest lupins. After 1910, lupins were carried from Geraldton to a number of other districts. The popular name “Geraldton lupin,” which until recently was a common alternative to “W.A. blue lupin,” attests to their origin there.

Naturalised populations of the sandplain lupin from Pinjarra southwards nearly all have pale brownish-grey seeds. This type is quite distinct from the brown-seeded lupin of the Geraldton district and in tests it has regularly flowered a few days later. At least in seed colour it corresponds with botanical descriptions of *L. cosentini* from Sicily, whereas the brown-seeded type corresponds more with specimens seen from North Africa, Spain and Portugal.

Early settlements in the Australind and Busselton districts are likely points of dispersal for the southern population. From living memory, lupins are known to have been present at Australind in the

Dr. J. S. Gladstones, Senior Lecturer in Agronomy at the Institute of Agriculture, University of Western Australia, has a world-wide reputation for his work on the breeding, selection and cultivation of lupins in Western Australia. He bred the recently-released variety Uniwhite and was responsible for the introduction, testing and release of other sweet lupin varieties now cultivated in Western Australia. Little published information is available to guide farmers in the cultivation and uses of lupins in Western Australia and the “Journal of Agriculture” has invited Dr. Gladstones to contribute this series of articles to fill an important gap in the State’s agricultural literature.
1880s and 1890s. As in the northern districts the slightly calcareous sandy soils of these districts particularly suit the sandplain lupin, which, as a result, has become widely naturalised.

The common commercial variety of sandplain lupin, originally from Geraldton, has now been named "Chapman." An early-flowering selection from Chapman, discovered and propagated by Mr. H. W. Box at Northampton, has been available commercially since about 1960. It flowers two weeks or more earlier than Chapman and in northern agricultural districts has extended lupin growing to the driest limits of cultivation.

Breeding of crop varieties of the sandplain lupin is in progress. Breeding lines with non-shattering pods, freedom from alkaloids, and varying items of maturity have been selected, and current work aims to combine these characteristics into a series of varieties suitable for grain cropping. However, it will be at least several years before they can become commercially available.

**Narrow-leafed lupin**

(*Lupinus angustifolius*)

The narrow-leafed, or New Zealand blue lupin* is readily distinguished by its narrow leaflets, relative lack of hairs, and smooth, almost round seeds. The common cultivated bitter variety was first imported as commercial seed from New Zealand during the late 1920s and 1930s. It is grown in Western Australia for green manure in vineyards and orchards. In the late 1940s and 1950s it was also used to some extent in South-West districts as a pioneer crop on newly-cleared land and for summer grazing, but this use has subsequently diminished because of outbreaks of lupinosis in stock.

At least one wild type of narrow-leafed lupin, with small, impermeable seeds, has been present in Western Australia since the 1880s or earlier. It is common by roadsides in the Swan Valley and at scattered other points in the Perth metropolitan area. Other wild or semi-wild types of narrow-leafed lupin may have been introduced in the past. The species is much more limited in its distribution as a naturalised plant than *L. cosentini*, probably because of its higher soil fertility requirement.

The narrow-leafed lupin is native to the whole of the Mediterranean basin, where it is the commonest and most widespread of all wild lupins. Although it is not recorded as having been cultivated to any extent, local popular names such as "lupino salvatico" recorded by Italian botanists in the 17th and 18th centuries suggest that seed may in the past have been harvested for food and other purposes in times of want. There are also frequent references in early literature to the use of this species as a coffee substitute in regions as far apart as Morocco, south-west France and the Tyrol.

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*The popular name "New Zealand blue lupin" is unfortunate, firstly because the species is not native to New Zealand, and secondly because most of the newer cultivated varieties have white rather than blue flowers. "Narrow-leafed lupin" is more truly descriptive, and corresponds with popular names for the species in most other languages.*
The first alkaloid-free or "sweet" variety of narrow-leafed lupin was selected by Dr. R. von Sengbusch in Germany in 1928, and was released to German farmers in 1934.

Although introduced into Western Australia before and after World War II, it was not successful here because of its hard (impermeable) seeds, together with the fact that it could not be distinguished visually from the commercial bitter variety, and so readily became contaminated.

A second sweet variety, Borre, was bred in Sweden by crossing the German variety with a local soft-seeded but bitter variety, and combines soft-seededness with sweetness. Borre was released to Western Australian farmers in 1960 by the Institute of Agriculture after testing and bulking pure seed. Borre still cannot be distinguished on appearance from the commercial bitter narrow-leafed lupin, and like all sweet and bitter varieties until recently, it sheds its seeds rapidly at maturity.

The variety Uniwhite, bred at the Institute of Agriculture, was released in 1967. This variety is sweet, with white flowers and seeds which allow it to be distinguished readily. It has markedly reduced shattering of the pods at maturity, but is still by no means fully non-shattering and can shed fairly quickly under heatwave conditions.

Further breeding has been directed at improved non-shedding characteristics to allow more efficient harvesting, and earlier maturity to allow extension of lupin growing into drier districts. A crossbred line similar to Uniwhite but with fully non-shattering pods has been named Uniharvest, and is at present being bulked and may be available in small quantities for farm increase in 1970. A further crossbred (WAU-11), combining the characteristics of Uniharvest with substantially earlier flowering, has now been obtained and is undergoing preliminary bulking and testing.

**Yellow lupin**

*(Lupinus luteus)*

The yellow lupin is characterised by its golden-yellow, sweetly-scented flowers. The scent of its flowers has led to the wrong belief in some places that all yellow lupins are "sweet." In fact, all but the recently-developed grain and fodder varieties are bitter, like other naturally-occurring lupins. The seeds of yellow lupins are smooth, somewhat flattened and usually slightly smaller than those of sandplain or cultivated narrow-leafed lupins.

The yellow lupin is native to Portugal, Western Spain, and wetter parts of Morocco and Algeria. There are scattered minor occurrences in other Mediterranean countries, but it is uncertain whether these are truly native, or merely relicts of past cultivation. Undoubtedly cultivation as an ornamental has played an important part in the spread of this species even in its native habitat, and could have been responsible for its introduction and spread in Western Australia. Many of the limited occurrences in Western Australia can be traced to escapes from gardens, although some are over appreciable areas and clearly of long standing. There are also a few relicts of field plantings in districts south of Perth, some of which may be quite old.

Bitter yellow lupins are occasionally grown for green manure, or more rarely for cattle fodder, for example in the Yarloop area.

Bitter yellow lupins have been extensively cultivated since the mid-19th century in the sandy soils of northern Germany, Poland and western Russia, mainly for green forage and green manure.

They were responsible for the widespread outbreaks of lupinosis in sheep reported there during the 1870s and 1880s. Subsequent use of the bitter varieties has been confined mainly to green manuring, but substantial areas have continued to be grown.

Breeding of the modern sweet yellow lupin varieties began in 1927, when von Sengbusch in Germany isolated the first alkaloid-free plants. Later German breeding during the 1930s and 1940s was successful in incorporating soft-seededness, white seeds (to distinguish the new types from the older, speckled-seeded bitter varieties) and non-shattering pods.

* See Department of Agriculture Bulletin 3502.

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The first variety to combine all these characteristics was Weiko II, which was approved for release in Germany in 1943. Weiko III, which incorporated a more erect growth habit and slightly earlier flowering, was approved in 1951. It was distributed to Western Australian farmers in 1960, following testing and pure seed increase by the Institute of Agriculture.

White lupin

(Lupinus albus)

The white lupin (not to be confused with white-flowered varieties of the narrow-leafed lupin) is occasionally seen in Western Australia, always in small-scale cultivation or as a volunteer from recent cultivation, mainly in the Waroona-Brunswick and nearby districts. It has not yet been cultivated commercially in this country, apart from experimental farm sowings in the Donnybrook and Boyup Brook districts.

This is the species of lupin referred to in classical Greek and Roman writings. It has been cultivated as a peasant staple crop in the Mediterranean region for perhaps 4,000 years, being still widely used for human consumption in parts of Portugal, Spain, Italy, the Middle East, Egypt, the Sudan and North-West Africa.

Prolonged treatment by boiling and steeping in water is needed to rid the seeds of their bitter alkaloids and make them edible.

Wild types of *L. albus* occur in Greece, Albania, and southern Yugoslavia. These have blue flowers, dark-coloured impermeable seeds, and shattering pods, but under cultivation and conscious or unconscious selection by cultivators through several millenia they have evolved to the modern type of *L. albus* which has white flowers (sometimes tinged with blue), white or pinkish-white, permeable seeds, and non-shattering pods.

The types found in Western Australia resemble those cultivated in Italy and Spain, and were doubtless introduced by Italian settlers. The seeds are distinguished from those of other white-seeded lupins by their flat, square shape, pinkish tinge, and very large size, which approaches that of a broad bean seed.

Alkaloid-free strains of *L. albus* were selected in Germany during the 1930s, but so far have achieved only limited cultivation. This has been partly because *L. albus* requires rather more fertile soils than other lupin species, and so comes more directly into competition with established crops.
Most sweet introductions tested in Western Australia have proved disappointing, lacking the conspicuous vigour and yielding capacity of the bitter type and being apparently more susceptible to fungal leaf-spot diseases. Moreover, all lines have proved to be badly contaminated with bitter plants, owing to previously unsuspected natural crossing. Nevertheless one sweet line has been outstanding whenever sown, and appears equal to most bitter lines in both vigour and disease resistance. It has been established as a pure line, and is being bulked for field testing.

**ORNAMENTAL LUPINS**

Many lupin species make attractive ornamentals. Apart from *L. luteus* and the more rarely cultivated *L. pilosus*, the lupins so grown all originated in North or Central America. They grow well on light to medium-textered acid to neutral soils, and in suitable climates are very easy to grow. The main ones cultivated in Australia are:

**RUSSELL LUPINS**

Russell lupins are perennials, and are adapted to cool climates. Most of Western Australia is too warm for satisfactory results, although with care they may be grown in south coastal districts.

Russell lupins were bred as a retirement hobby by the late Mr. George Russell at Stillington, Yorkshire. Some doubt attaches to their parentage, but they are believed to be derived predominantly from crosses between two species native to North-Western America: the common perennial blue lupin (*L. polyphyllus*) and the yellow-flowered “tree lupin” (*L. arboreus*). The latter is in fact a large, perennial shrub.

Russell lupins do not always breed true from seed, and clumps are often divided vegetatively. Under suitable conditions the long spikes of bright, variegated flowers can make a spectacular show, which has made the Russell lupin the best known of all ornamental lupins.

**“PEARL” LUPINS**

(*L. mutabilis*)

*L. mutabilis* originated in the Andean highlands of South America, where it is believed (like *L. albus* in the Mediterranean) to have been grown as a food crop for 2,000 years or more. The known type probably evolved under cultivation, being unique among American species in having large, permeable seeds, and non-shattering pods. No wild ancestor is known.

### LUPIN CULTIVARS AVAILABLE IN WESTERN AUSTRALIA, 1969.

<table>
<thead>
<tr>
<th>Species and Cultivars (varieties)</th>
<th>Hard Seededness</th>
<th>Alkaloids</th>
<th>Shedding</th>
<th>Flower Colour</th>
<th>Seed Colour</th>
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</thead>
</table>
| Sandplain lupin—  
(Lupinus cosentini):  
cv. Chapman | Hard | High | Shedding | Blue | Brown |
| cv. Box’s Early | Hard | High | Shedding | Blue | Brown |
| Narrow-leafed Lupin—  
(L. angustifolius):  
cv. Commercial bitter | Soft | High | Shedding | Blue | Grey |
| cv. Borre | Soft | Low | Reduced shedding | Blue | Dark grey |
| cv. Uniwhite | Soft | Low | Non-shedding | White | White* |
| Yellow lupin—  
(L. luteus):  
cv. Weiko III | Soft | Low | Non-shedding | Yellow | White* |

* Seeds on Uniwhite can be distinguished from those of Weiko III by their round shape and faint brown markings. Weiko III seeds are pure white, generally a little smaller, and flattened or sometimes slightly pinched at the sides.
L. mutabilis is an annual and is well adapted to Western Australian conditions, growing 2 to 5 ft high and flowering in spring. The plants are almost hairless. The flowers are relatively large and variously coloured, and have an attractive musky scent. The seeds are large, egg-shaped, and smooth. Those of strains with light-coloured flowers have a pearly appearance, which is responsible for the species’ local popular name.

HARTWEG LUPINS
(L. hartwegii)

The Hartweg lupin is a native of Mexico, and is easily recognisable by the long, coarse hairs which cover all parts of the plant, giving it a shaggy appearance. It is a spring-flowering annual which grows erectly to a height of 2 to 4 ft., bearing long spikes of variously coloured flowers. There is no scent. The seeds are flattened and very small. Hartweg lupins grow well in Western Australia, and appear relatively hardy.

DWARF GARDEN LUPINS
(L. pubescens)

The dwarf annual garden lupins are a heterogeneous group. Probably several closely related species contributed to their ancestry, but the group seems best referred to L. pubescens, an annual species which is native to Mexico and Guatemala. Dwarf garden lupins are well adapted to Western Australian conditions, and deserve to be grown more widely. The best known type grows 9 to 15 in. high, and bears short, dense spikes of blue, pink, and white flowers which have a pleasant musky scent like that of L. mutabilis. This type makes an excellent border plant. Other varieties grow a little taller. Sown in autumn, L. pubescens will flower for two to three months in spring, provided the spent flowers are removed promptly. As with all ornamental lupins other than L. mutabilis, the seeds are impermeable and must be scarified to obtain satisfactory germination.

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