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The mediterranean white lupin

J. S. Gladstones,
Senior Plant Breeder

"Both these unhappy soils the swain forbears,
And keeps a Sabbath of alternate years,
That the spent earth may gather heart again,
And bettered by cessation bear the grain,
At least where vetches, pulse and tares have stood,
And stalks of lupines grew (a stubborn wood),
The ensuing season, in return, may bear
The bearded product of the golden year."

From Virgil, the first book of Georgics (Dryden's translation).

"If you want to bring in a good lupin harvest, thrash your wife soundly before you go out sowing in the field".

Old Syrian proverb.

Lupin breeder Dr. John Gladstones does not beat his wife as recommended in the Syrian proverb above. Nor is he known to use ground-up lupin seeds for the diverse cosmetic and medicinal purposes recommended in ancient Roman and other texts on lupins.

But his modern work on lupin breeding and development has undoubtedly been influenced by his detailed study of such writings.

In this article he discusses the history of the Mediterranean white lupin and presents some highlights gleaned from early texts.

Release of the variety Ultra marks the first commercial cultivation in Australia of the Mediterranean white lupin, Lupinus albus. Unlike previous commercial lupin varieties in Australia, all of which belong to species only recently domesticated, Ultra belongs to a lupin species with a long history of cultivation.

The first cultivation of L. albus was probably in the Balkan Peninsula, where wild ancestors still exist.

However, recent genetic studies have shown that the two forms cross readily, and that they differ only in a few simply inherited genetic factors.

The cultivated forms undoubtedly arose from the wild types by ancient but deliberate selection of desirable agronomic features, such as non-shattering pods, permeable seed coats, larger seeds, more erect growth, and earlier flowering—precisely as is being repeated in the 20th Century for other lupin species.
However, they remained bitter. Sweet, crop forms such as Ultra were not selected until the 1930's; or if selected, they were lost again.

Reference has been made to the finding of *L. albus* seeds in Egyptian tombs of the 12th Dynasty (about 2,000 B.C.), but according to Hanelt*, who has studied the subject thoroughly, the species was not present in Egypt until about the start of the Christian era. At that time it was already well established in Roman agriculture and had been cultivated in Greece for at least several hundred years. However, Hanelt also cites literary evidence of Löw (1881) that lupins were mentioned on Assyrian cuneiform tablets, and that they had probably been imported into Babylon.

The Greek word for the species was "thermos", which means hot, perhaps in reference to the extreme bitterness of the seeds. All names for it throughout the Middle East appear to be derived from this, for example termis in Egypt, turmus in Arabic and in India, turbusa in Aramaic, and Furmesa in Syrian. This further indicates a Greek origin for the crop as cultivated.

*L. albus* in Ancient Greece and Rome

The earliest extensive published reference is that of the Greek physician Hippocrates (400-356 B.C.), who spoke of lupins in human nutrition along with lentils, beans and peas.

Theophrastus (372-288 B.C.) referred at length to lupins in his "Natural History of Plants", a botanical work regarded as authoritative until the Middle Ages and later. Among other things, Theophrastus noted that lupins sought poor and sandy soils and would grow on rough, even uncultivated land, and that they should be sown immediately after threshing of the previous crop; further, "they should not be harvested before the rain, otherwise they burst open and lose their seeds". The latter points suggest that the crop at that time may still have been hard-seeded, and that the non-shattering pod characteristic may not have been as fully developed as now.

Cultivation of the white lupin was well established in Rome and throughout the Roman Empire, and was extensively described by Roman writers on agriculture. The characteristics and value of the crop were well known. Columella, who lived in Cadiz in Spain, wrote as follows in his book "De Re Rustica", published about 60 A.D.: "First consideration belongs to the lupin, as it requires least labour, costs least, and of all crops that are sown is most beneficial to the land. It affords an excellent fertilizer for worn-out vineyards and ploughlands; it flourishes even in exhausted soil; and it endures age when laid away in the granary. When softened by boiling it is good fodder for cattle during the winter; in the case of humans, too, it serves to ward off famine in years of crop failure. It is broadcast direct from the threshing floor, and it is the only one of all the legumes which does not require a rest in the bin, whether you sow it in unbroken fallow in the month of September before the equinox, or immediately after the Calends of October; and whatever way you cover it, it withstands the carelessness of the farmer. Still it needs the mild temperature of autumn to become quickly established, for if it has not taken a strong hold before winter it is greatly injured by the cold . . . The lupin likes lean ground, as I have said, and especially reddish soil; it has an intense dislike of chalky ground, and does not come up at all in a miry field."

Elsewhere (Book 2. XV. 5) Columella states: "if (the farmer) will scatter lupin on lean ground about the middle of September, plough it in, and at the proper time cut it up with a ploughshare or mattock, it will have the effect of the best manure. The lupin should be cut in gravelly soil when it is in second flower and in sticky soils when it is in third flower. In the former case it is turned under while still tender, so that it may rot quickly and be mixed with the thin soil; in the latter when it has grown stronger, so that it may hold up the more solid clods longer and keep them suspended, to be broken down by the summer sun."

It is an interesting commentary on soil types that the Greek and Roman writers always speak of lupins for growing on the poorest soil types.
In Western Australia, *L. albus* succeeds only on relatively fertile soils, which, however, are probably no better than equivalent to the poorest soils farmed by the Romans. The really poor soil types on which we now grow lupins in Western Australia are not only rare in the Mediterranean; they could not be farmed at all without our modern knowledge of plant nutrition and fertilizers. This is probably the reason why lupin species more adapted to poor sandy soils than *L. albus* had to await the 20th Century to be properly exploited for agriculture.

All Roman writers stressed that artificially de-bittered lupin seed, in addition to being used for stock feed, was widely used for human consumption—but only among the poorer classes and in times of particular need. The extreme bitterness of the seeds, whose alkaloid content can exceed 2-0 per cent, is hard to get rid of completely, and this and perhaps other factors did not commend lupins to the wealthier classes.

Many cosmetic and medicinal uses were described for lupin seed. Writers as early as Hippocrates mentioned the use of lotions prepared from the powdered seeds for beautifying the face; with a high protein and relatively high oil content, such a function is believable.

It is less clear how much the medicinal role stemmed from a real pharmacological effect of the alkaloids (or other constituents?), and how much from the abominably bitter taste of the seeds if unleached of their alkaloids.

Certainly the range of ailments supposedly helped by lupin medication, as described by the Greek writer Dioscorides (1st Century A.D.) and widely quoted by the herbalists of the 16th and 17th Centuries, was quite remarkable. To quote the English writer Parkinson (1640)*.

“Lupins by reason of their bitterness do open, digest, dissolve, and cleanse, being steeped some daies in water, until they have lost their bitterness, they may be eaten, and so are, as Galen saith, for necessities, but they breed grosse and crude humours... the same being so steeped, and afterwards dried, beaten and taken with some vinegar, taketh away the loathing of the stomache to meate and provoketh the appetite: the decoction or infusion of Lupines taken with hony and vinegar killeth the worms in the belly, but if you mixe Rue and Pepper thereto, you shall make it the more effectuall: the meale or pouder taken with hony or vinegar or in drinke doth the same: the said decoction taken openeth the obstructions of the liver and spleane, provoketh urine and womens courses if it be taken with mirre, and expeleth the dead childle: the decocotion of them clensecth all scabbes, morphew, cankers, tetter, and creeping or running ulcers and sores and boyled in lyce it clensecth the head from ulcers, scurfe, & c. breeding therein: it also clensecth the face, and taketh away the markes that the Poxe doe leave after their healing, and all other markes, and black and blew spots in the skinne: and to clear the face, and make it more amiable, many women do use the meale of Lupines mingled with gall of a Goate, some juyce of Lemonds, and a little Alumen saccharium, made into a forme of softe ointment... the meale therof being boils in vinegar and applied, taketh away pimples, and scattereth the nods or kernells that rise in the body, and breaketh carbuncles and imposthumes: the burning of the huskes driveth away Gnats, Flies, & c. whatsoever.”

Other writers refer to lupins as a cure for inflammation of the middle ear and for sciatica. According to the South American agronomist A. Burkhart (personal communication), seeds of bitter white lupins are used as a sciatica cure there today.

White lupin seeds also had social uses and significance in Rome. They were used as counters or counterfeit money (aurum comicum, or “funny gold”) in plays and games—for which their smoothness and square, flattened shape made them well suited. The term “nummus lupinus” came to mean money which was fictitious or of little value. Generals who had been accorded a triumph, or citizens who aspired to office and power, also distributed lupins (presumably debittered) to the assembled crowds of public occasions. The catchcry “Lupins for the people!” belongs in history as well as in contemporary television comedy.

With the collapse of Roman civilisation, white lupins continued to be grown around the Mediterranean and in the Middle East, although perhaps not on the same scale as previously.

Mention is made of lupins in the 15th Century Persian-Arabian “Tales of the Thousand and One Nights”. On the 947th night: “As the girls turned away, an old woman entered the hamman, bearing a bowl upon her head, filled with fried earth nuts and roast lupins. Some of the young women bought her goods for a penny, a half-penny, or two pence; and Dalal, wishing to forget her trouble, called to her, saying: “Give me a pennyworth of lupins, good aunt”. The old women sat down by the bench and filled a horn measure with lupins...”

### Lupins in Northern Europe

European botanical works of the 16th and 17th Centuries give common names for the white lupin in many languages, showing that it was widely known. Botanists continued to use the Latin *Lupinus*, a name whose ultimate origin is uncertain but is thought to be derived from *lupus*, Latin for wolf. Perhaps this “wolf bean” was so named because it grew in rough and wild places, and had the wolves for company. Another origin suggested is that it was thought to prey on the soil because the soils on which it grew were nearly always poor, but the Romans’ knowledge of its benefits to soil...
fertility would seem to rule out this confusion of cause and effect.

Hanelt reports that the first reference in the German literature is that of Hildegardis von Birgen (1098–1178), who called it vichbona (Old High German for cattle bean). Later equivalents were feigbonen (Middle High German) and fyckboin (Middle Low German).

Parkinson in 1629 wrote: “In English we usually call them after the Latine name, Lupines; and some after the Dutch name, Figge-beanes, because they are flat and round as a Figge that is pressed; and some Flat-beanes for the same reason”. Clearly Parkinson was mistaken in his etymology.

Other names were diijchboonen in Brabanti, lupino domestico in Italian, lupin in French, and a variety of names including entramocos, altramuz or chuchos in the Spanish dialects, and tremoco in Portuguese. The English lupine, applied to all the species of the genus, gave way to lupin only in the 20th Century, and is still the standard spelling (and pronunciation) in the U.S.A.

Botanically, the white lupin was known usually as *Lupinus sativus* (cultivated lupin), or just *Lupinus*, in contrast to a variety of names including *Lupinus sylvestris* (lupin of the woods) which covered both narrow-leaved and yellow lupins. When Linnaeus reformed the botanical nomenclature in 1753 he called the white lupin *Lupinus albus*, and this name has remained the recognised botanical name since.

Returning to the development of the white lupin in agriculture, Piero de Crescenzi (about 1300) wrote that in Tuscany, expert farmers still used lupins for green manuring. However present day cultivation in most regions of the Mediterranean seems to be confined to small areas on poorer farms, grown mainly as a subsistence crop for direct human consumption.

Narrow-leaved or occasionally yellow lupins tend to be used for green manuring, where this is done at all. A small amount of white lupin seed enters commerce, and after de-bittering and salting is served in bars and cafés as an appetiser, or is used in the preparation of bean-type dishes. Such cultivation can be seen occasionally among communities of Italian origin in the south-west of Western Australia.

Attempts were made to introduce commercial white lupin growing into Northern Europe in the late 18th Century. The Prussian emperor Frederick II took a personal interest in the experiments, but they failed due to the extreme poverty of the Baltic soils and the late maturity of the Italian lupin types introduced. Later, in 1817, Karl von Wullffen made new introductions from the south of France, and grew them with some success for green manure on his Brandenburg estates.

After about 1850 white lupin cultivation declined and its place as a green manure plant taken largely by bitter narrow-leaved lupins (*L. angustifolius*) and especially bitter yellow lupins (*L. luteus*), which were much better suited to the climate and the sandy, acid soils.

**Sweet white lupins**

Early in the 20th Century, commercial breeders in Germany attempted to develop better adapted varieties, using introductions from the eastern Mediterranean which were earlier flowering than the previous introductions from southern Europe. The first such varieties appeared in the 1920’s.
Following his success in isolating sweet (alkaloid-free) strains of *L. luteus* and *L. angustifolius*, the German breeder von Sengbusch turned his attention to *L. albus*, and in 1930 succeeded in finding several sweet plants among the many thousands of plants individually tested. Unfortunately they were selected from bitter stocks of French and Italian origin, and were too late maturing for northern European conditions. Later, in 1935, he selected sweet plants from earlier-maturing bitter types of Palestinian origin.

Meanwhile, a number of other German breeders had become active in white lupin breeding, most notably Prof. Heuser at Landsberg. As well as making further selections for sweetness, Heuser succeeded in finding natural mutants among early flowering bitter types which were less lanky in their growth, and gave better seed production.

This material was continually given to other breeders, and formed the basis of most of the varieties subsequently bred in Germany, including “Ultra” which was developed by Schultz and Velsen in West Germany and approved for release in 1950. Ultra combines sweetness, due to the gene *pauper*, with early maturity and “short” growth habit.

**L. albus in W.A.**

Ultra proved to be the best under most W.A. conditions of the Mediterranean white varieties introduced during the 1950’s and 1960’s, on the basis of observation and the limited plot testing possible at that time.

In subsequent field trials it has given good seed yields on well drained loamy (e.g. York gum) soils in medium rainfall areas such as the Avon Valley and especially the Chapman Valley. However, the trials have confirmed earlier indications that the Mediterranean white lupin—whether bitter or sweet—grows very poorly and is highly subject to brown spot disease on the sandy soil types where most Western Australian lupins are now grown.

Because of their inability to grow well on light sandy soils, Ultra and other Mediterranean white lupin (*L. albus*) varieties are unlikely to become the predominant lupin type grown in Western Australia. They may find a greater role in Eastern Australia where the soils are in general heavier and more suitable. Nevertheless locally they could become a useful adjunct to the present sweet narrow-leafed varieties, by extending lupin growing on to heavier soils than hitherto.

Particular advantages of the Mediterranean white lupin include higher protein and oil contents and a lower fibre content in the seeds compared with narrow-leafed lupins. Field trials by the CSIRO in conjunction with the Department of Agriculture have also suggested that *L. albus* varieties are less susceptible to the *Phomopsis* fungus than narrow-leafed lupin varieties, and less liable to cause lupinosis in grazing stock.

With these advantages in mind, further selection and breeding has been started to develop varieties better suited to a low rainfall areas, and particularly to high rainfall areas of the south-west where lupinosis is now a major barrier to lupin cropping.

A stand of cv. Ultra in 3rd flowering. Note the sturdy, erect growth. *L. albus* is less liable to lodging on fertile soils than *L. angustifolius*.

Branching occurs in an ordered sequence, with about three branches developing immediately below each inflorescence as it comes into flower. Three or more generations of flowers may develop if the growing season is long enough.