ECONOMIC ASPECTS OF BIODIVERSITY

LOCAL ACACIA SEEDS FOR HUMAN CONSUMPTION

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WITH a flora as diverse as ours in southern Western Australia, there must be some plant species which could be commercially adapted to produce food for humans. After all, the Noongars survived here for tens of thousands of years eating the local plants and animals. All the plants that provide food for modern humans came from the wild, and most, like wheat, have been developed for human use from humble beginnings over thousands of years. Development of wheat still continues, and in WA wheat yields have risen 100% over the last 70 years and half of that increase occurred in the last ten years!

Narrow leaf lupin (*Lupinus angustifolius*) however, is an example of a species adapted from the wild to a major production variety in less than one human generation. The work to select non-toxic seeds and non-shattering pods was carried out here in WA! The attitude of scientists at the Agriculture Department in Albany was that selection and breeding would achieve huge improvements in production from wild plants if enough research effort was applied. They suggested if we wanted to develop native seed producers for agriculture, we should look for characters such as non shattering pod, suitable form, non toxic seed, high protein, high oil, large seed, consistent fruiting, desired life span, harvestable form and disease resistance.

Traditional agricultural species are dominated by grasses and legumes. Our acacias are legumes and are conspicuous in the landscape and many species visibly produce masses of seed from time to time. We have over 500 species of *Acacia* in southern WA. It seemed worth a look to see if we could eat any of them.

So, in 2002, a small Chemistry Centre WA/NHT funded project was undertaken to look at the possibility of using our own native species of *Acacia* to produce seed for human consumption. We were aware that certain species of central Australian wattles were exploited by Aboriginal people for food and that some of these were actually being used commercially in the bush food industry. However, very little information could be found about the use and edible seed value of our south west species. Only *Acacia acuminata, A. microbotrya* and A. *saligna* have received published mention.

The poor knowledge of the south-west acacias as food may be because Noongar knowledge has been lost. However, grinding stones that may have been used to grind *Acacia* seeds have been found in the south west.

The project began by asking a group of experienced seed collectors which of our local species they recognised as having potential for commercial harvest. The result was a short list of *A. microbotrya, A. redolens, A. cyclops, A. saligna, A. harveyi, A. acuminata*. The species selected could be considered the "obvious" ones as they are most frequently used in revegetation and are more likely to be available for seed collection than other less well known species. This initial selection did not imply that other species were not suitable but it was important to ***start the investigation somewhere***. The next step was to simply go out into the field and collect some seed of these species for nutritional analysis and also gather some rough base-line data on production per tree, so that some sort of scale could be placed on eventual production in tonnes or kg per hectare.

In January 2002, wild populations of all species except *A. saligna* were located between the Porongorup and North Stirlings area. Seed from selected plants was harvested and possible production estimated (based on density of 1250 plants per ha). Percentage of plants within the population producing seed, and seed drop were taken into account when calculating production. A stand of *A. saligna* cultivated near Borden was also harvested. The rough production estimates were:

A. microbotrya	87.5	kg/ha
A. *redolens*	187.5	kg/ha
A. cyclops	206.25	kg/ha
A. saligna	33.8	kg/ha
A. harveyi	55	kg/ha
A. acuminata	21.45	kg/ha

Although some of these production figures appear quite low, this data is from non-selected, unimproved wild plants which have had no agronomic development and were harvested in a poor season. Breeding could make them competitive with current lupin production. Bruce Maslin's book on *Edible Wattle Seeds of Southern Australia* identifies a potential yield of 1.25 tonne per hectare under cultivation.

Samples of these seed collections were then sent to Chemistry Centre WA for analysis. Seeds were also analysed at Melbourne University for cyanogenic glycosides (toxins).

The results for all species investigated are, on all counts, very encouraging. Generally the protein is high in comparison with existing legume crops, a little behind Lupins except *A. saligna*. This is a positive sign, as it provides evidence that improved *Acacia* species may rival lupins as a protein source.

Our acacias appear to be slightly higher in oil content on average compared to existing legume crops

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and the type of fatty acids in the oil tends to differ slightly. Acacias have comparable saturated fatty acid levels (palmitic acid) but have more polyunsaturated (linoleic acid) rather than monounsaturated (oleic acid) fatty acids. *A. saligna* actually has around half the saturated fatty acid content of lupins, suggesting superior quality fats for human consumption.

Many forms of carbohydrate exist and each has its own properties. Fibre and cellulose (indigestible carbohydrate) and other structural components of acacia seed are relatively high. Presumably this reflects the thickness of the seed coat and a breeding program aimed at reducing this component of the seed would increase digestibility. However, from a human food perspective, increased fibre in the diet has been associated with positive health outcomes. Indeed, some dietary studies have shown that replacement of wheat flour with acacia seed flour can induce a lower blood glucose concentration and insulin response – valuable characteristics given the incidence of diabetes and heart disease.

The mineral content of the natural acacia seeds appears to be comparable or slightly higher than in current fertilised legume crops.

Anti-nutritional entities are those which reduce the nutritional value of the food. Of greatest concern are the relatively high levels of lignin in acacia seed, most likely from the seed coat. Lignin reduces the availability of carbohydrate for digestion, probably by binding to it and making it unavailable for enzymatic breakdown. Polyphenolics, which behave similarly to lignins but tend to reduce protein digestibility, are present but the levels detected in acacia are not considered high. The levels of phytate (a compound which binds minerals such as zinc, calcium and magnesium and reduces their availability for absorption) in the acacia samples is similar to, or slightly lower than, the levels in conventional legume crops.

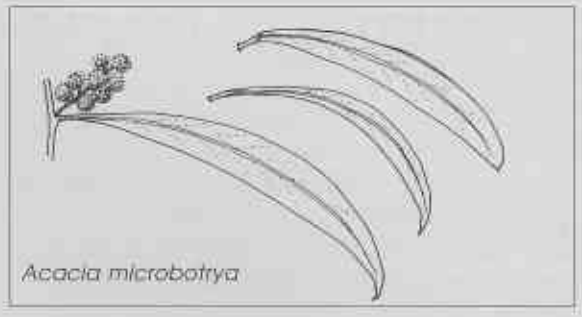
No alkaloids or lectins were detected in the acacia seeds. Alkaloids are potentially toxic or bitter constituents while lectins are proteins which bind to red blood cells and cause agglutination (clotting). In contrast, lupins contain an appreciable content of alkaloid (hence the need for a breeding program before human consumption) and most of the other legumes contain lectins to some extent.

It is also important to bear in mind that this data is from wild plants and therefore demonstrates the worst quality of seed likely to be encountered. Further study of the carbohydrate portion is required to quantify the metabolisable material and the oligosaccrahides (not discussed above). No study of protein quality has yet been undertaken nor has there been any work done to quantify the vitamin content of the seeds.

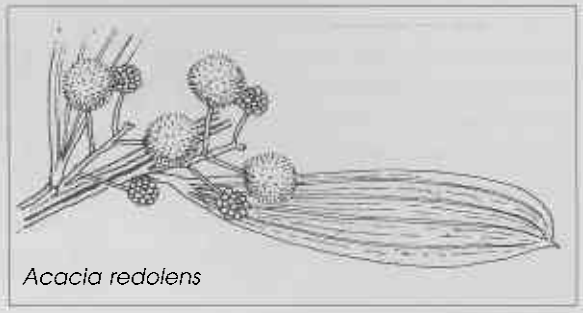
In general however, the acacias sampled appear well suited to human consumption without further improvement, although palatability and physical characteristics of the flour will need to be assessed prior to incorporation into food products. (It should be noted that Aboriginal knowledge identifies some highly toxic *Acacia* seeds. The authors do not recommend use of any *Acacia* seed for human or animal food, except when sold by reputable bush food dealers.)

As an animal feed, it would be desirable to reduce the seed coat thickness. However, it is perhaps more beneficial to screen for high oil-yielding *Acacia* varieties and subject these seeds to processing for higher value end-products which would be suitable for both the human and animal food sectors. Other than this, all we need is an economically viable production strategy.

We are currently collaborating with other interested parties to develop a more comprehensive project which should identify the best species for food production.



Acacia microbotrya



Acacia redolens

Acacia harveyi

Can you help?

Please contact Dr. Lincoln Morton (Chemistry Centre WA 9222 3037) or Chris Robinson (Greening Australia 9892 8486) if you know of any *Acacia* species that grows in your area that may be worth investigating as a commercial seed crop.