

Main picture: a grindstone
scattered with acacia seeds.
Inset: Rosie Fleming Mangala from
Yuendumu in the Tanami Desert,
NT, with pod-bearing branches of
Acacia jennerae.



SEED saviours

***Australian acacias are flavour of the month,
both at home and abroad. Bryony Bennett
reports on an outback selection program
designed to cater for the rising demand. ►***

FOUR years ago a group of botanists, nutritionists and other researchers gathered at the tourist town of Glen Helen, 130 kilometres west of Alice Springs, to trade ideas about the use of Australia's tropical dry-zone acacias for human food.

Between talk of trials, toxicity and taxonomy, the group was treated to a demonstration of acacia-seed preparation by Aboriginal women from Utopia (about 250 km north-east of Glen Helen in the Northern Territory's Sandover River region). Gloria, Ada and Myrtle Petyarre, Maggie Pwerle, Wita Knwarraye and Gloria Ngale, had come to Glen Helen with Jeannie Devitt from Utopia's Urupuntja Health Service (see story on page 30).

As they winnowed, parched and ground mulga (*Acacia aneura*) seeds, the high level of traditional skills still possessed by the Aboriginal women became apparent. So too did the value of these skills and the importance of retaining and learning from them, both for Aboriginal people, and for indigenous people in other arid zones of the world whose diets are beginning to include Australian acacias.

The workshop participants recognized that traditional Aboriginal knowledge was central to the development of acacia seeds as human food and they resolved to involve Aboriginal communities as much as possible in future studies of dry-zone acacias. Seed collection, taxonomic studies, recording of traditional knowledge and establishing species trials with outback communities were considered areas where this involvement could be achieved.

The Glen Helen gathering was organised by CSIRO Division of Forestry's Australian Tree Seed Centre (ATSC) in response to mounting interest in adopting acacia seed for human food in sub-Saharan Africa. Acacias from matching climatic zones in Australia were introduced to this region in the 1970s to help combat desertification and the centre was assessing the trees' value for firewood, soil stabilization and windbreaks. After a visit to Niger in 1989, ATSC scientist Dr Lex Thomson recognised that Australia's dry-zone acacias also had potential as a food source for African people.

Trials at Maradi in Niger, established by Tony Rinaudo of the non-government organisation SIM International under the guidance of Dr Chris Harwood from ATSC, have identified three species ideally suited to food production in semi-arid Africa. These trees (*Acacia colei*, *A. cowleana* and *A. tumida*) are easy to establish, fast growing, high yielding and bear nutritious, easily-collected seeds. Villagers have even adapted traditional recipes to make a range of seed-based foods including pancakes, stews and pasta. It is likely that other species will prove more

appropriate in areas with different soil and climatic characteristics.

Harwood says that with Australian acacias poised to become a significant component of diets in Sahelian Africa, a scientific approach to their widespread adoption is crucial. This work, supported by the Australian Centre for International Agricultural Research, involves identifying species and provenances (geographical varieties) that produce the most edible seed in particular environments and devising ways of cooking seeds to maximise their food value. It also means ensuring that no toxicity or anti-nutritional problems accompany their increasing use.

Seeds are valued food items largely because they are typically more nutrient dense than other plant parts and they contain significant quantities of crude protein, oil and carbohydrate. Acacia seeds have high levels of nitrogen typical of leguminous plants, together with variable amounts of oil. *A. victoriae*, for example, contains nitrogen equivalent to 18% crude protein, significantly higher than wheat at 12%.

Rekindling old ways

Knowledge of acacia species, their use for food, and how eating them affects people, is deeply woven into the fabric of traditional Aboriginal culture. Before white settlement, acacia and grass seeds were eaten by Aboriginal people in central Australia probably mainly as a supplement to a preferred diet of large game, lizards, fruits and tubers. But because of the tedious and labour-intensive preparation required, seeds were among the first foods dropped from traditional diets when wheat flour was introduced by white settlers.

Profound changes in diet which accompanied white settlement all but eliminated the need for Aboriginal people to retain subsistence lifestyle skills such as plant knowledge and seed collection and preparation techniques. Despite these changes, much botanical knowledge and harvesting and processing skills still exist in many Aboriginal communities, particularly among older women in central Australia.

The challenge of gathering together some of this Aboriginal knowledge is being taken up by Jock Morse, a botanist with ATSC. Morse is assisting the centre's work in Africa by broadening its resource base at home. He is also helping to sow the seeds of a sustainable land-use system for remote communities; a system inspired by Australia's growing interest in traditional Aboriginal foods.

Morse says the burgeoning 'bush tucker' industry – of which acacia seeds are a significant part – is almost entirely based on traditional Aboriginal knowledge. He says the industry has been greatly assisted by the

Australian Tree Seed Centre, CSIRO Forestry



ATSC

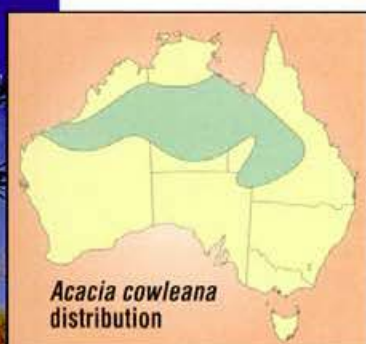
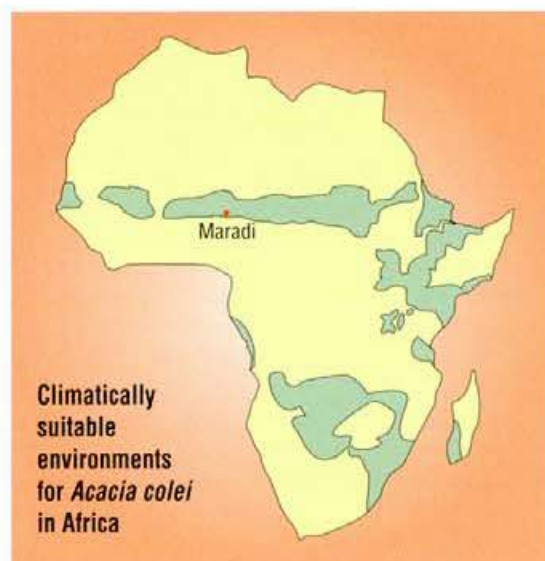




An *A. colei* tree in the Tanami Desert, NT.

Australian acacias were introduced to sub-Saharan Africa in the 1970s to help combat desertification. Three species (*A. colei*, *A. cowleana* and *A. tumida*) have since proven ideally suited to food production in semi-arid Africa. The natural geographic distribution of these species is outlined on the maps of Australia. The map of Africa shows areas that experience climatic conditions similar to those in which *A. colei* is found in Australia.

As more acacias are assessed, other species suited to different soil and climatic conditions are expected to emerge.



A. cowleana, an important food species throughout the Tanami and in Western Australia from Halls Creek to the Pilbara. The small seed is usually collected when ripe and ground to produce a flour.

transfer of this knowledge from Aboriginal society to commercial operators.

At present, virtually all acacia seed sold is collected from the wild. Aboriginal communities have an advantage as suppliers to the industry because they have access to natural stands of acacias and a strong tradition of harvesting the seed for food. As awareness of the trade in bush tucker products grows, however, interest by the broader farming community in growing acacias is also increasing (see story on page 29). This means Aboriginal communities will probably need to cultivate bush-tucker species in order to retain their industry involvement in the long-term.

'Aboriginal communities are very willing to help scientists and share their information and technology if they are involved as partners, appropriately acknowledged, and paid for their contribution,' Morse says.

'It is important that new information generated about these foods and new technologies be made available to them. In this way the benefits arising from research and the growth of the industry can accrue to those upon whose traditional knowledge it is based.'

Community seed collections and trials

Since 1992, with funding from the Australian Nature Conservation Agency (ANCA), Morse has worked with eight Aboriginal groups – in Western Australia and the Northern Territory – to collect seed and record the characteristics of about 30 acacia species traditionally used as food plants in central Australia. Based on this information and observations of the species in the field, 11 of the most promising seed producers have been selected. These will be assessed during field trials conducted with four Aboriginal communities, again with support from ANCA.

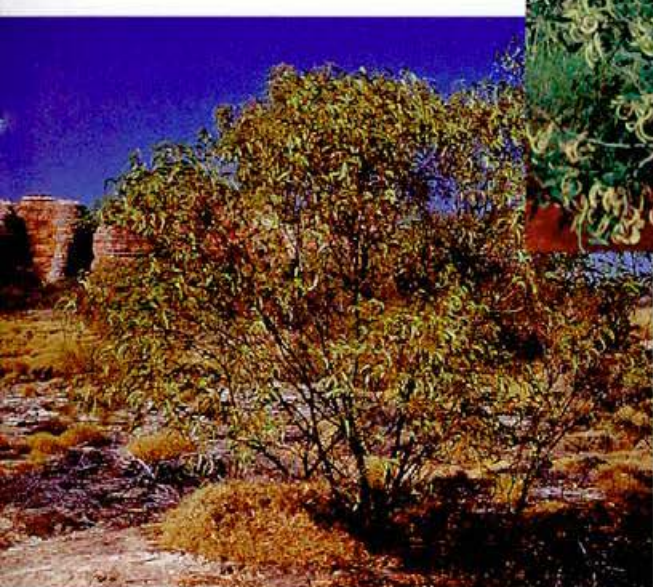
'Seeing how species perform in the wild under different climatic conditions has helped us to assess their suitability for cultivation,' Morse says. 'For example, in a drought year, nine out of 10 species might bear no fruit. The one that produces a good crop is most worthy of inclusion in field trials.'

Morse says Aboriginal people have names and uses for all their local flora, and detailed knowledge of how and when to harvest them, the preparation and processing required (see story on page 30), and their ecology and growth characteristics. Many plant species have special places in Aboriginal culture and ceremonial significance for particular groups of people within communities. He is concerned, however, that much of this knowledge is not being recorded and will probably be lost.

'The information we have is based on research by anthropologists,' Morse says. 'Until now, ethno-botanical work has not



These two forms of *A. tumida* illustrate the variation that can occur within a single species. The small tree form is pictured at Purnululu (Bungle Bungle) National Park, north of Halls Creek in northeast WA. The shrub form, displaying a good crop of ripe seed pods, is located in the Tanami Desert.



focused on the characteristics of particular species. Due to funding constraints, we can't really learn as much as we would like to from Aboriginal people in the short time we have available.'

Information about which acacia seeds are edible, and how each must be prepared, is extremely important. Some seeds are known to be toxic, and some are palatable only when processed in special ways. Aboriginal people have learned the properties and perils of the seed of each species through thousands of years of trial and error.

Traditionally, the small seeds of some species such as *A. cowleana* are ground into flour when raw or parched and ground then mixed with water to make a paste which is high in energy and carbohydrates. The large seeds of other species, such as *A. coriacea*, are eaten green like beans, or squeezed with water to produce a sweet drink, then dried and ground to make a kind of flour.

A battle of the species

Species-provenance trials, in which provenances from across the natural ranges of each of the selected species are raised and grown at a single site to observe growth and phenological differences (which reflect genetic differences), are fundamental steps in the 'domestication' of plant species for use in cultivation. ATSC's trials in collaboration with the four Aboriginal communities, will test 30 provenances of 11 of the most promising species (see table below).

For Morse, establishing the acacia trials involves covering a lot of ground. In June he travelled to a site north-east of Tennant Creek in the Northern Territory to help set up the first trial with the Pingala community. In September and October he will visit the second trial site at Nyuka, east of Newman in Western Australia's Pilbara region, then head back east to Yuendumu in the Tanami Desert, 300 km north-north-west of Alice Springs.



The fourth trial, at Titjikala, south-east of Alice Springs, will begin next year.

The sites have been chosen for their climatic similarities with the African regions that are adopting Australian acacias, and also because they represent the range of conditions under which acacias are likely to be cultivated in Australia. Their climates vary, although all have summer temperatures above 40°C while those in the south experience frosts in winter. Annual rainfall varies from 150 to 600 millimetres, falling mainly in the summer in the north, and in winter in the south. Another factor in site selection was the level of interest of the local community and the facilities available to plant and maintain the plots. Seeds for the trials were supplied by ATSC to nurseries linked with each community.

Each species being tested is well adapted to the harsh conditions of Australia's tropical arid zone and has shown its ability in the wild to produce good seed crops, even on very dry sites. For example, one popular food species, *A. colei*, grows throughout the Kimberley,

Tanami and Pilbara regions. Seed of this species has been collected from sites right across its distribution to give the best chance of identifying superior forms from which to breed.

The trials are designed to cover just over two hectares each and consist of 1800 plants divided into six, replicated plots. Each plot contains 10 trees from each of the 30 different seed lots. In each trial three of the replicated plots will be irrigated while the other three will rely on rainfall. The aim of this is to quantify the difference that irrigation makes to growth and seed production.

For at least four years, the seeds from each tree will be weighed and measured. Then they will be allocated a seedlot number and placed in the ATSC seed store.

After five years, when all the scientific information has been gathered, the plantings will provide shade, windbreaks, firewood, and a ready source of edible seed, as well as helping to reduce dust problems in the communities. They will also offer a resource for the communities to manage as they choose.

More about acacia seeds

Harwood CE (1994) Human food potential of the seeds of some Australian dry-zone *Acacia* species. *Journal of Environments* 27:27-35.

House APN and Harwood CE (1992) *Australian dry-zone acacias for human food*. CSIRO Australia.

Searle S (1995) Australian acacias; no longer the forgotten genus. *IFA Newsletter* Vol 36 No 2, April.

Rinaudo T Burt M and Harwood C (1995) Growth and seed production of Australian *Acacia* species at Maradi, Niger. *Forestry Newsletter* No 19, March. ACIAR.

Species included in the arid zone acacia trials

Species	Habit	Seeds	Habitat
<i>Acacia colei</i>	upright shrub to 4m	small	along creek lines
<i>Acacia cowleana</i>	shrubby/ small tree to 5m	small	sandplains, creek lines
<i>Acacia adsurgens</i>	upright shrub to 3m	small	sandplains, dunefields
<i>Acacia stipuligera</i>	upright shrub to 3m	small	sandplains
<i>Acacia dictyophleba</i>	bushy shrub to 2.5m	small	dunefields, sandplains
<i>Acacia victoriae</i>	bushy shrub to 3m	small	creek lines, sandplains
<i>Acacia tumida</i>	small tree or shrub to 6m	large	sandplains, dunefields
<i>Acacia eriopoda</i>	small tree or shrub to 5m	large	creek lines, sandplains
<i>Acacia coriacea</i>	small spreading tree to 3m	large	sandplains, dunefields
<i>Acacia jennerae</i>	upright small tree to 4m	large	creek lines
<i>Acacia torulosa</i>	small tree to 5m	large	dunefields



Australian Native Produce Industries

From seed to table. With treats such as wattle seed pavlova on the menu, who could resist the 'bush tucker' served up at Red Ochre? The restaurants are supplied by Australian Native Produce Industries, one of Australia's largest producers of bush-tucker products. The company's Roger Filke forges an expanding market for acacia seeds, including a potential for export. To satisfy the demand, there will be a need to farm acacias, he says.

Versatile, nutritious and good enough to export

PASTA, pavlova and ice-cream are among a long list of products now on the market or soon to be developed by promoters of Australia 'bush tucker'. Other products include bread, beverages, biscuits, salad dressing, cereals, salsas, jams, chutneys and musli bars.

One of the country's largest producers of bush tucker products is Australian Native Produce Industries. At its Adelaide kitchen, the company prepares a range of gourmet products based on native plants. The production kitchen is a major supplier to the Cairns and Adelaide Red Ochre restaurants where diners can taste linguine, damper, pavlova and ice cream, all containing acacia seed.

One of the company's directors, Roger Filke, says the company has tested the seeds of eight acacia species for taste and suitability for consumption. The seeds of elegant wattle (*Acacia victoriae*), readily available in the wild, are used most commonly at present.

Filke says although 'it is early days yet', the company is developing a range of native spices. Packs of roasted and ground wattleseed and ground native pepper leaf are already available.

'Wattleseed is versatile and high in protein,' Filke says. 'It adds a nutty flavour to damper and bread, savoury sauces, curries, porridge and ice-cream, and can be used as coffee substitute.'

Filke believes there is enough seed available in the wild to support the industry for the time being, but in future there will definitely be a need to farm acacias. He has supplied seeds to a few such enterprises already.

'We can't continue to take large volumes of seed from the wild,' he says. 'We'll have to plant crops and manage them to improve harvesting efficiencies.'

He sees the potential to export the seeds, roasted and ground, as a gourmet line to destinations such as the United States, Europe and Japan. 'The idea is still speculative, but with proper marketing it could be successful,' he says. The company is also looking at introducing acacia seeds into mass-market products such as cereals and muesli bars.



ATSC

Most of the acacia seeds processed by Australian Native Produce Industries are from elegant wattle (*Acacia victoriae*), a species that yields well in the wild. Dr Penny Butcher, a CSIRO scientist investigating genetic variation in human food acacias, found this *A. victoriae* in South Australia's Central Flinders Ranges. The tree is flowering heavily, despite severe drought conditions prevailing in the area (September, 1994). *A. victoriae* is one of the species being assessed in ATSC's outback trials.