WEST AUSTRALIAN NUTGROWING SOCIETY • YEARBOOK -- 6 --1980

WANS YEARBOOK ISSN 0312-8997
Supplement to
QUANDONG ISSN 0312-8989

West Australian Nutgrowing Society Yearbook

Vol. 6 1980

West Australian Nutgrowing Society

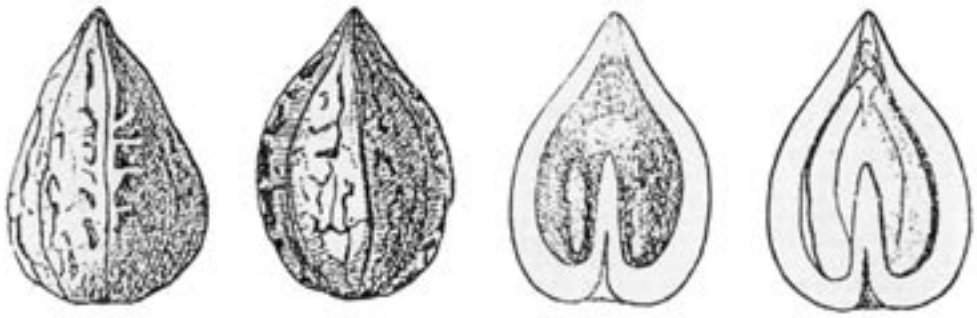
Yearbook

Volume 6 1980

TABLE OF CONTENTS

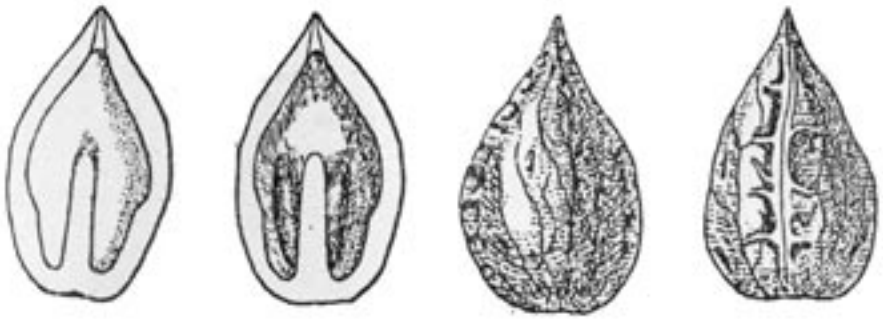
Cover Photo

Soil Management at the Stahmann Moree Pecan Plantation: Sod Culture with Weed Free Strips



Juglans sieboldiana

Juglans rupestris



Juglans cordiformis

Less common walnut species.

PRESIDENT'S REPORT

PETER GOOD

The Society experienced an effective and valuable year. Quarterly meetings at a fixed location were established, with the meeting dates set for the year.

LECTURES

Four separate lecture topics were featured at meetings. Member Alex Sas gave a talk and demonstration on propagation of nut trees. David Noel gave a talk on lesser-known nuts of Australia.

A firm specialising in trickle irrigation equipment presented a film on how the equipment was used for fruit crops in Israel. A valuable talk on tissue-culture propagation of nut and fruit trees was given by Dr. Jennie McComb of Murdoch University.

FIELD TRIPS

A field trip was made to Alex Sas's nursery property in Roleystone, and also to the property of Carolyn Clarke, the first WANS Secretary. Alex has built up a range of named varieties of nut species.

CARYETUM

Arrangements were made with the Subiaco City Council to set up a caryetum or nut garden on part of the Cliff Sadleir Memorial Park in Daglish. Ultimately the caryetum will form a mini botanic garden, displaying a wide range of nut plants. It will be under the joint care of the Society and the Subiaco Council.

CONGRATULATIONS

To members Milan Mirkovic and Alex Sheppard, on winning a $20,000 Rolex Award for Enterprise. This prize was awarded to allow them to continue their pioneering work on development of a method for establishing trees in arid areas, involving greatly reduced water needs.

EXPANSION OF ACTIVITIES

A formal decision was made to broaden the scope of our organization to include other tree crops in addition to nuts. In future our name will become the West Australian Nut And Tree Crop Association.

SECRETARY

Bethia Bryant, our efficient and constructive Secretary over the last few years, has retired due to other commitments. We owe her a large debt of gratitude for her stalwart efforts.

COMMERCIAL POTENTIAL OF NUT CROPS IN WESTERN AUSTRALIA *

NEVILLE SHORTER **

Over the last few years the W.A. Department of Agriculture has become more involved in a number of nut crops. Of the "Farmnote" series of leaflets issued by the Department, there are currently five which are directly concerned with nuts. At present it seems that the nut with the most immediate potential for this State is the pecan. Others which may hold some promise for small scale development are the pistachio, the macadamia, and the walnut. The Department is currently involved to a greater or lesser degree with all these.

PECANS

The pecan has the most commercial potential of the various nuts introduced into the Southwest of this State. A number of moderate size new plantings have been made.

The crop was pioneered by Bob Woodward of Sawyers Valley (in the Perth foothills). He has shown that yields, at least under good conditions, are comparable with those in the U.S.A. Some trees have already yielded 40 kg of nuts each, and the yield is expected to increase as the trees mature.

The Pecan is a moisture loving tree. The soil must therefore be naturally moist, or frequently irrigated. In the big Stahmann planting at Moree, New South Wales, water is applied at the rate of 100,000 litres per hectare per day.

In W.A., some 2000 trees have been planted near Cowaramup in the Southwest by the Development Division of the local stock company Wesfarmers. There are also plantings in the Preston Valley near Donnybrook, the Harvey Hills. Harvey river flats, and near Gingin (Machlin Brothers Property).

Last year, Neville Burton of the W.A. Department of Agriculture (Bunbury Office) was awarded a grant to visit the large Stahmann Plantation at Moree, New South Wales. He was informed that there is a virtually unlimited market for the nuts, in the United States, China, and Southeast Asia. To be efficient, plantings must be large enough (10 hectares upwards) to justify purchase of specialised equipment, or small enough to be handled on a hobby-farm basis.

The Department has been raising some Pecan seedlings at its Stoneville Research Station, and in the future an experimental block of trees will be laid out there.

---

* Based on a talk given to the West Australian Nutgrowing Society on November 11, 1980.

** Adviser, Horticulture Division, W.A. Dept. Agriculture, and Officer-in-Charge, Midland Office.

WALNUTS

Walnuts are something of an enigma in W.A. There are some quite old plantings, such as those on the Watson Property in the Bickley Valley near Perth, or the Fontanini orchards near Manjimup, which have yielded quite well.

The fruiting record of walnuts in many situations has been inconsistent.

This may be due to unsatisfactory pollination. The walnut has a higher chilling requirement than the pecan. There are some Californian selections with lower chilling requirements (Omega, Serr), which are at present in quarantine in the Eastern States. These should released in about a year.

Both pecan and walnut are susceptible to trace element deficiencies. Our W. A. soils are notoriously zinc deficient, which is particularly bad for pecans. At Moree eight zinc sprays are applied each Year (0.3% zinc). Similar treatment will be needed in Western Australia.

PISTACHIOS

The real pioneer in introducing pistachios to Australia has been Dr. Don Maggs of CSIRO Horticultural Research, at Merbein, Victoria. In WA. the Department of Agriculture has cooperated with the CSIRO in research work with this crop. An initial planting was made at Muresk Agricultural College several years ago. After a slow start, these trees are now making good growth.

A number of new varieties have been planted at the Stoneville Research Station. Successful propagation has turned out to be much more difficult with our male trees for some reason.

There are newly-established private plantings of Pistachios at Gingin, and at Mogumber.

We hope to produce a Farmnote on pistachio culture next year. We have found that the plants are not hard to bud: John Dick of the Department has chip budded pistachios very successfully.

Placement of the pistachio trees in correct pollinator groupings is a prerequisite to success.

ALMONDS

Almonds are the most familiar nut tree to most West Australians. The trees grow successfully throughout the Southwest. Many of the older suburban backyards have trees.

Almonds are subject to shot-hole disease and to bird attack. At present they appear to be a marginal economic crop.

MACADAMIAS

In the past, plantings of macadamias in W.A. have been limited to occasional individual trees. In general, such trees have grown and produced well with Valley, 80 km northeast of Perth, where trees have made promising early growth under relatively exposed conditions.

Some older isolated trees which have cropped well exist in the Perth Metropolitan area, near Harvey, and at Glen Iris near Bunbury. It has been commented that macadamias bear better when protected from wind.

CHESTNUTS

There are many good producing chestnuts in various parts of the Southwest. Chestnuts are more adaptable to different soils than are some nut trees, but still require reasonably fertile, well-drained conditions.

Chestnuts have an appreciable chilling requirement for healthy growth. They do not seem to do as well on the Coastal Plain, which could be connected with the milder winters there.

PEANUTS

Peanuts are an annual crop, and will grow down in the Southwest of the State during our summers. However, they are mostly a subtropical or tropical crop. They have potential at Kununnura, the irrigation area up in the Northwest.

Enquiries on peanut growing should be directed to Mr. Mike Hawson, Horticulture Division, Department of Agriculture, South Perth 6151.

AVOCADOES

Although avocadoes are not nuts. I know that they are of interest to members of the Society. They are currently a “glamour crop In this State. The Department has published a booklet written by Mike Hawson on avocadoes. Of course, avocadoes differ from the nut crops in that they have a fairly short keeping life and so a different market situation.

Avocadoes are very susceptible to the fungus disease Phytophthora cinnamomi, locally called jarrah dieback disease as it has markedly affected our jarrah eucalypt forests. However, there have been some successful local plantings which are now producing well.

Some of these plantings are at Wanneroo, Gosnells, Pickering Brook, and Gingin, all fairly close to Perth. Much further north, there is a successful new planting and nursery in Carnarvon.

****

LESSER-KNOWN AUSTRALIAN NUT PLANTS

DAVID NOËL *

When I first became interested in nut growing, like most people I was quite unaware of the range of species of nut plants. Most people can name only about eight different types, in the whole world; I knew better and could name about thirty species.

Of native Australian species, I knew only one, the macadamia. As I studied the subject more, I came to realize the number of unexploited and generally unknown species was much greater than usually assumed. After some years, it was apparent that there were hundreds of different nut plants, and at least ten of these were native in Australia.

Looking back now, I know these figures are themselves much too low. In fact, there are thousands of different nut species and it looks as if the number of Australian natives is in the hundreds. This article attempts to list all that I know about. Some of the information is incomplete, possibly inaccurate: particularly with rarer species, there is always some confusion and argument.

An interesting by-product of my investigations concerns the Expanding Earth theory. According to this theory, all the land masses of the Earth were once joined together, and covered the entire surface of a much smaller planet. Since that time, the core has greatly expanded, splitting apart the continents and leaving them separated by the newly-formed seas and oceans.

I am going into this in more detail in a separate article, but its relevance here is that the distribution of nut plants at the present day seems to strongly support the theory. In practice this means that if the world globe is re-assembled with Australia in contact with S.E. Asia to the north, South America to the east, Antarctica to the south, and Africa to the west (with New Zealand and India in gaps to the southeast and northwest), quite a good fit can be shown. More importantly, if Australian nut species and their relatives are plotted in their present distribution on this single land mass, many of the distributions are found to be continuous over the presumed original borders, even though the borders are separated by many thousands of miles now.

Each of the nut-bearing plant families which has representatives in Australia is dealt with here in alphabetical order.

---

* Member and Director, West Australian Nutgrowing Society

ADANSONIA.

The Australian representative is *A. gregorii*, the Boab. It is found in the Northwest and in the Northern Territory, and is noted for its enormous bottle-shaped trunk, as well as the large nuts resembling gourds, which were carved and decorated by the aborigines. This is the tree of which a hollow-trunked specimen was once used as a jail in Derby, Western Australia. The hard nut contains an edible flesh.

The boab has very close relatives, almost indistinguishable, in Madagascar and Africa, where it is called the Baobab. Adansonias are in the plant family *Bombacaceae*.

ALEURITES.

This genus includes about 5 species growing in China, S.E. Asia, and Indonesia. They include the tung nut and mu oil tree, sources of industrial oils, and the candle nut. The latter (botanically *Aleurites triloba* or *A. moluccana*) is also native in Queensland and the N.T. The nut kernels are so rich in oil that they will burn like a candle if ignited, whence the name. The kernels are edible, but the very high oil content can have a laxative effect if many are eaten.

Although a tropical nut, the candle nut will grow and fruit in the warm-temperate conditions of Perth. Tung nuts are from a subtropical region and grow well in much of the State. The Aleurites are members of the family *Euphorbiaceae*, and have the family characteristic of leaking a sticky white sap if cut.

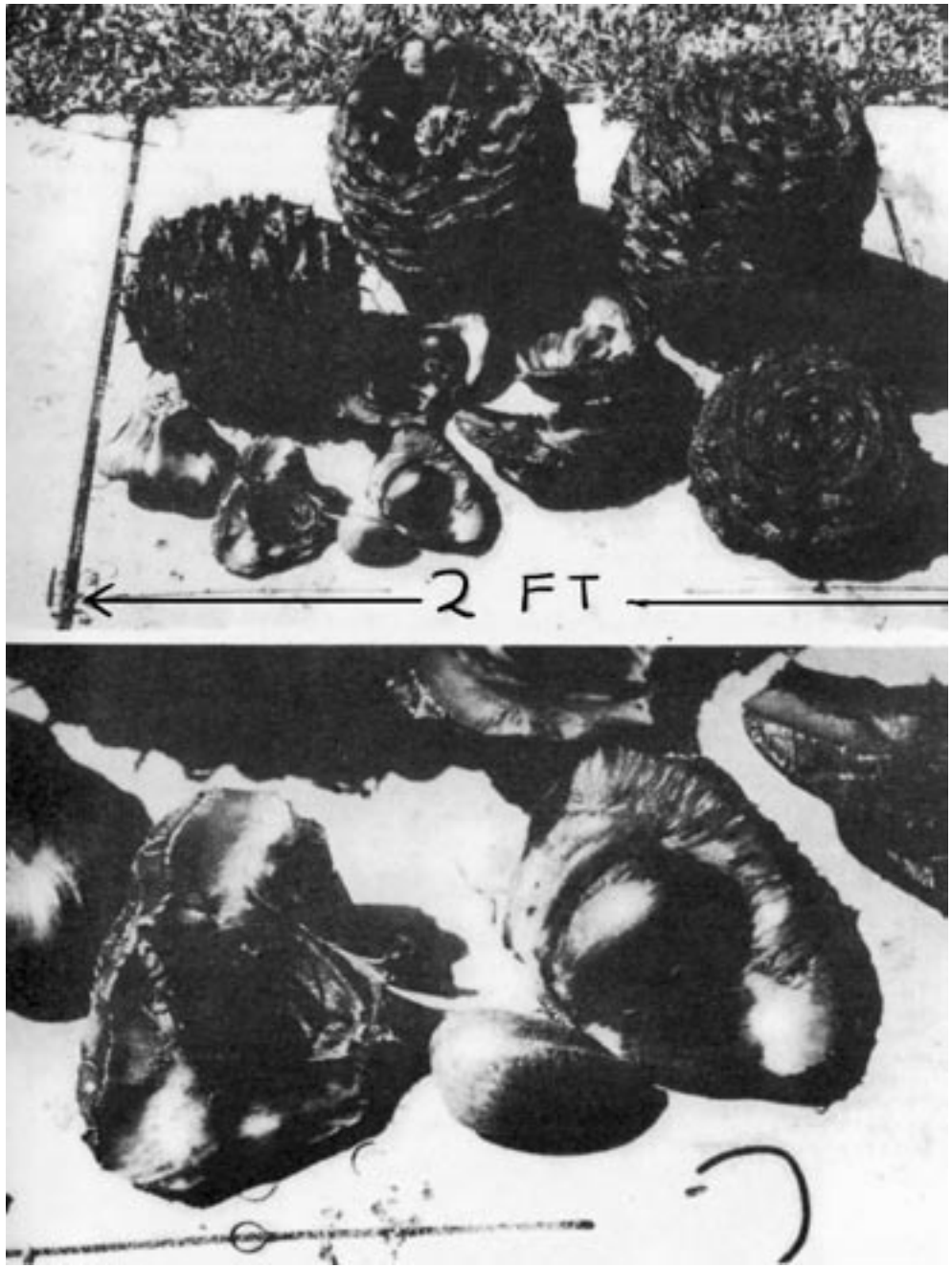
ARAUCARIA.

This impressive genus of southern hemisphere conifers includes two Australian species, the Bunya Pine (*A. bidwillii*) and the Hoop Pine. The Bunya Pine is my favourite nut tree.

The distribution of the Araucarias (in the family *Araucariaceae*) is interesting. Their main focus appears to be in New Guinea, where there are several species. The genus divides quite neatly into two groups, those with large edible nuts, and those with small seeds valueless for food. The latter includes the native hoop pine, and also the Norfolk Island pine, from the south Pacific island of that name, widely grown as an ornamental.

There are three nut-bearing species, the Bunya Pine from two areas in north and south Queensland, the Chile Pine (*A. araucana*), and the Parana Pine (*A. brasiliensis* or *A. augustifolia*) from southern Brazil. Push Australia against the matching hole of South America, and the three distributions are almost continuous.

The three species are very similar and quite unlike others in the genus. The nut-bearers have small, triangular leaflets attached like scales to the branches, while the others have more needle-like leaves. In their seedling stages, the three nut bearers are almost indistinguishable. All have succulent large starchy nuts in big cones. with a very pleasant flavour something between that of a good sweet chestnut and that of a pignolia (pine kernel from *P. pinea*, the European stone pine)



Bunya pine cones and nuts

There is so much to say about the Bunya Pine that it will have to go in a separate article. Here I will only mention that it is a spectacularly beautiful tree, producing first-class timber and first-class nuts, that it is the focus of a whole area of Aboriginal cultures and practices (the "Feasts of the Bunya-Bunya"), and that it has an incredibly complex and versatile series of germination mechanisms which is matched by no other plant in the world.]

The Bunya Pine is the subject of an article in the WANS Yearbook No. 1 [7].

BARRINGTONIA.

The Barringtonias are in the family *Lecythidaceae*, and so are allied to the Brazil nut. There are a great many species, mostly in S.E. Asia, Indonesia, and New Guinea. At least three species are native to Australia, being found in the three tropical states (Western Australia, Northern Territory, and Queensland).

Most are large trees with showy flowers, often with beautiful nuts. Some of the kernels are widely eaten, others are inedible. Typically they are rain-forest trees, not especially common. The Australian species do not appear to have common names one, *B. acutagnula*, is just called "Barringtonia".

BEILSCHMIEDIA.

A very large genus of at least 200 species, in the Laurel Family (*Lauracea*). There are 4 or more Australian species, such as *B. bancroftii* (Yellow walnut), all Queensland rainforest trees. Typically tall, massive trees, usually with plum-like fruits, some of which are believed to have edible kernels. Although some species have common names including the word walnut', this is because of similarity in the timbers, not the nuts.

BLEPHAROCARYA.

The genus contains only two species, both Australian natives (Queensland and N.T.), in the family *Anacardiaceae*, which also includes the cashew nut. One species, Rose Butternut (*B. involucrisera*), is said to have kernels which are edible after treatment.

CALOPHYLLUM.

A large genus, with about 100 species in the S.E. Asia/tropical Australia area, and also 8 species in Madagascar and Mauritius. plus 4 species in tropical America. The genus name means "beautiful leaf", and most species have prettily coloured young leaves. Only one species, *C. inophyllum* (India-Oil nut) is Known in Australia, extending from the N.T. through the Northwest. S.E. Asia, to southern India. The nut kernels are a source of high-quality, fragrant oil. Family *Guttiferae*.

CANARIUM.

A genus of about 100 species in the family *Burseraceae*, spread through tropical Africa and Asia, Australia and the Pacific. Two species are Australian. *C. muelleri* (Elemi tree), growing in Queensland, and *C. australasicum* (Melville Island White Beech is one common name). The latter grows in the Northwest. N.T., Queensland. and right down the east coast into New South Wales, well into the sub-tropics.

The genus *Canarium* includes many first-class nut producers, such as the Pili and kenari nuts of the Philippines and Indonesia. Occasionally these can be bought in Australia. Very little is known about the Australian species, but they could have considerable potential as nut trees.

CASTANOSPERMUM.

There is only one species in this genus, *C. australe*, the Moreton Bay Chestnut. This tree, a native of Queensland, is not a chestnut at all, but a legume like peas and beans (*Leguminosae*). In fact an alternative name is Black Bean. Certainly the large glossy brown nuts, usually two or three in a large pod, look much like chestnuts -- or even more like horse chestnuts or buckeyes.

A most beautiful evergreen tree, producing long streamers of orange or yellow flowers direct from the trunk or large limbs, the Moreton Bay Chestnut is used as a street tree in some areas of New South Wales. In Perth it seems harder to grow, but there are some flowering and fruiting trees in the Darling Range foothills. There may be some essential element lacking in our soils.

Edibility of the nuts is a matter of dispute. I have eaten a number, boiled, without any ill effects. They tasted quite good. There were certainly eaten by the Aborigines, perhaps after treatment. To some extent their bad reputation may be based on the fact that the Aborigines also used them as a fish poison; however, the effect is believed to be one on exposed fish gills, which does not apply to land animals. Cribb [8] reports stomach pains after eating the nuts.

I have noticed that if the hard brown shell of these nuts is broken, the kernel inside turns green like a potato. I suspect that these nuts are, in fact, indigestible or purging under certain conditions of treatment, which is true also of the potato.

CLAUSENA.

The 30 or so species of *Clausena*, scattered through the Old World tropics, include one which is native to Australia. This is *Clausena lansium*, the wampee or wampi, which grows in the N.T. and Queensland. Often described as a nut, the Wampee is really a good edible fruit in a thin brittle shell, rather like a lychee.

Clausena is in the family *Rutaceae*, and so is distantly related to the orange and other citrus fruits.

Top: Boab tree in the Kimberleys, Northwest Australia

Bottom: Bunya Pine about 18 m tall in Hyde Park, Perth, W.A.

CORDIA.

Another large tropical family of 250 species, many producing good timber and medical products. Two species are native to Australia, *C. dichtoma* (sometimes called Sebastan), growing in Queensland, and *C. subcordata*. Both species produce edible nut kernels. Family *Ehretiaceae*.

CRYPTOCARYA.

Of the more than 200 species of *Cryptocarya* growing in tropical and sub--tropical regions, at least 23 are native to Australia. They are in the Laurel family (*Lauraceae*), and are mostly large trees. Like their relatives the *Beilschmedias*, the *Cryptocaryas* (the name means hidden nut) mostly have edible plum-like fruits, containing a single large seed. The kernels are thought to be edible, in some cases after treatment.

One example, which grows in Queensland and New South Wales, is *Cryptocarya erythroxylon*, from the rain forests.

CUPANIOPSIS.

The genus is not well defined, but includes some 60 species distributed from Australia across the Pacific, where they merge into the closely-related or identical genus *Cupania*, of the *Sapindaceae* family. At least 5 species are native to Australia, including *C. anacardioides*, growing in N.S.W. and Queensland. The black or brown seeds are about 2 cm across, and have red or orange arils, enclosed in a capsule. The seeds are probably edible although the arils may need discarding.

CYCAS.

These are members of perhaps the most ancient and primitive family of seed plants, the Cycads. They resemble tree ferns to some extent, but bear giant cones like those of the *Araucarias*; female and male plants are distinct. The 20 or so species of the genus Cycas are distributed from Madagascar across through tropical Asia and Australia into Polynesia, where they include species used to produce sago (sago-palms). In Australia there are at least 5 species in the tropical North-West, including *Cycas media*. All cycads have quite large nuts, up to 5 cm long, but the majority of them are poisonous unless treated.

ELAEOCARPUS.

Another very large genus, with over 200 species, scattered over east and southeast Asia, Australia, and the Pacific islands. The genus gives its name to the family, the *Elaeocarpaceae*. Australia has at least 20 native species, all large rain-forest trees, extending down from Queensland through to Victoria.

The genus is likely to have considerable potential as a source of nut crops. One species, *E. bancroftii*, the Johnstone River Almond, has achieved some local recognition in Queensland. Another interesting species is *E. grandis*, the Silver Quandong, sometimes just called Quandong. Although unrelated to the true Quandong (*Santalum acuminatum*), the nuts produced by the two species, like pitted brown spheres about 1-2 cm across, are extremely similar in appearance.

ENDIANDRA.

A genus of over 80 trees in the Laurel family (*Lauraceae*), spread across Malaysia, Australia, and Polynesia. Australia has at least 13 native species, in New South Wales and Queensland. Typically the trees are tall, with large fruits containing a single seed. Little is available on how edible the nuts are. An example is *E. palmerstonii,* the Queensland Walnut.

GEVUINA.

This is another genus with a very interesting distribution. The best-known member is *G. avellana*, the Chile Hazel, growing in the southern Andes under quite cold conditions. It is well regarded as a source of nuts in Chile. However, there are two other species, one growing in New Guinea, the other in Queensland.

The Queensland species, *Gevuina bleasdalei*, is not well known, but is known to have edible nuts. A common name applied to the plant is 'silky oak, although this is usually reserved for the grevilleas. The Gevuinas have roundish red-coated nuts about the size of a hazel. They are in the *Proteaecea* family, like the Macadamias.

GREVILLEA.

Most of the 200 plus members of this genus are Australian, but some are found in Malaysia and the New Hebrides. Western Australia alone has over 150 species. The Grevilleas, often called Silky Oaks, are in the *Proteaceae* family and so are relatives of the Macadamia.

Many of the Grevilleas have seeds or nuts too small to be of interest for food, but a few have edible nuts. An example is the Prickly Plume Grevillea, *G. annulifera*, which has large seeds tasting like almonds. The plant, a small tree or large shrub, is a West Australian native.

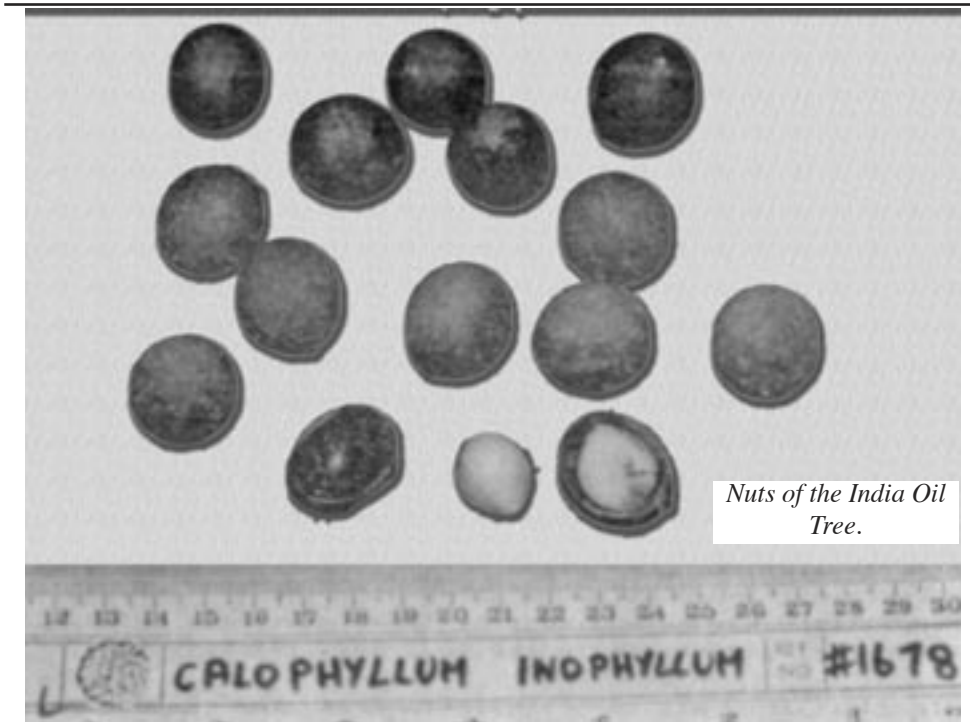
HELICIA.

Another genus in the *Proteacea* family, with about 90 species in Indonesia, S.E. Asia, and northeast Australia. About six species are native in Queensland and New South Wales. They are little known, although the nuts are resorted to be blue in colour, and edible. Perhaps the best-known species is *Helicia diversflolia,* a Queensland native.

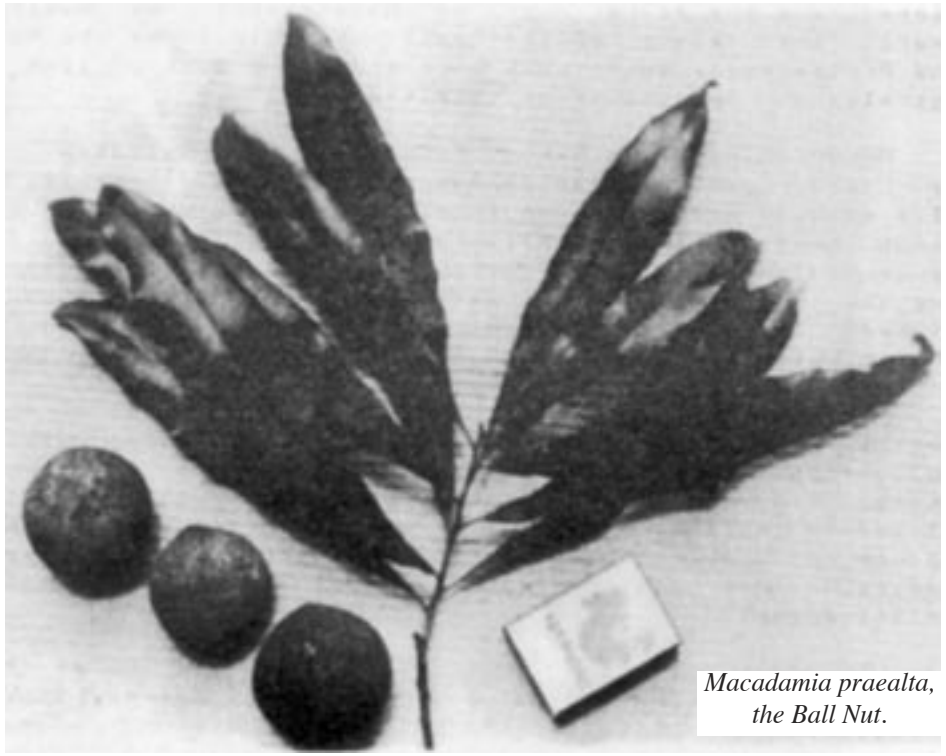
HICKSBEACHIA.

An interesting genus with a single species, *H. pinnatifolia*, native to northern New South Wales. The plant is very decorative, with large divided leaves and bright red nuts which grow from the trunks of the small trees. The best source of information is an article written by Noel Thies for the WANS Yearbook [9].

This is a plant which deserves greater recognition, although it is not easy to grow. It is a relative of the macadamia (family *Proteaceae*), and could have economic potential. A common name applied to the species by Rumsey in his early book on Australian nuts [10] is the Rose Nut, because of its similarity to a rose hip.



Nuts of the India Oil Tree.



Macadamia praealta, the Ball Nut.

HORSFIELDIA.

A family of large trees in the Nutmeg family (*Myristicaceae*), spread over Indonesia, south China, S.E. Asia, and northern Australia. One Australian species (*H. australiana*) is mentioned by Hearne in his article on nuts of the Northern Territory [11]. I have tasted the nuts, and agree with Hearne that the species could have commercial possibilities.

LEPIDOZAMIA.

A genus with only two species, growing in Queensland and the N.T., related to Macrozamia. The family, *Zamiaceae* or Zamia Palms, are in the Cycad group and have the typical nuts borne in large cones on female plants. The nuts are likely to be poisonous unless treated. One species, *L. hopei*, is grown to some extent as a decorative plant.

MACADAMIA.

This genus includes Australia's best-known nut species, often said to be our only commercially exploited native food plant. However, as well as *M. tetraphylla* and *M. integrifolia*, the commercial species, there are at least three other species in Australia. One of these, the Ball Nut (*M. praealta*), has nuts almost as large as tennis balls; it was the subject of an article in the 1977 WANS YearbooK [13].

In addition, and of interest from the Expanding Earth viewpoint, there are 3 more species in New Caledonia, one in the Celebes, and one as far away as Madagascar! As Australia is clearly the origin of the family which includes the Macadamias (the *Proteaceae*), there must have been some sort of link between Australia and Madagascar at some time.

MACROZAMIA.

This genus, found only in Australia, includes the Cycads most familiar to Australians, the 14 species of Zamia Palms growing across the south of the country. In W. A. the common species is *M. reidlei,* just called Zamia Palm. In N.S.W. the common species is the Burrawong, *M. spiralis*. Both species have the typical *Zamiaceae* family nuts which are poisonous unless treated; the Aboriginal treatment was to crush and soak in running water for a few days, giving a sort of flour.

MYRISTICA.

This is the Nutmeg family, a genus of about 120 species scattered across the Old World tropics. Australia has two species, the most common being *M. meulleri*, the Australian Nutmeg, growing in Queensland and the N.T. This is closely related to the true Nutmeg, *M. fragrans*, of Indonesia, and does produce a usable nutmeg spice, but inferior to the commercial species. The genus gives its name to the family, the *Myristicaceae*.

NELUMBO.

There are two species of the Lotus. *Nelumbo nucifera* ('nucifera' means 'nut-bearing') is the Sacred Lotus of much of southern Asia (it is the flower in which Buddha sits). *Nelumbo pentapetala* grows from the southern U.S.A. down through Central America and as far as Columbia. These beautiful water plants have pea-sized seeds which have been widely used as food. The Asian species extends to Queensland and the Northern Territory.The botanical family is *Nelumbonaceae*.

Leaf of Rose Nut, Hicksbeachia pinnatifolia, about 50 cm long.

NOTHOFAGUS

This genus, collectively called the Southern Beeches, is in the *Fagaceae* family and so is related to the true Beech genus (*Fagus*) of the northern hemisphere. It includes some 35 species, the majority of which grow in New Guinea and New Caledonia, although there are several species in Australia,New Zealand. and temperate South America. The most common of the 3 Australian species is *Nothofagus moorei*, the Australian Beech, found in Queensland, N.S.W., Victoria, and Tasmania.

Although the Nothofagus nuts are believed to be edible and nutritious, they are even smaller than the normal beech nuts and so not important for human food.

NYPA.

The Nypa Palm, *N. fruticans* (Family *Palmae*), is a tropical Plant with an unusual growth habit. It is a water plant, growing in warm salt-water estuaries, lakes, and bays, sometimes choking them completely and reclaiming them as land. There is only the one species, which is found in Ceylon, India, Malaysia, the Solomon Islands, and right across tropical Australia. The characteristic large edible nuts are in a fibrous husk which allows them to float. They can sometimes be found on Perth beaches, washed down from the North West.

OMPHALEA.

Another promising genus of nut plants, in the *Euphorbiaceae* family. There are 2 species noted as nut producers in the West Indies, and another species in Columbia. The single known Australian species, *Omphalea queenslandiae*, is found in North Queensland and is known as the Russell River Nut.

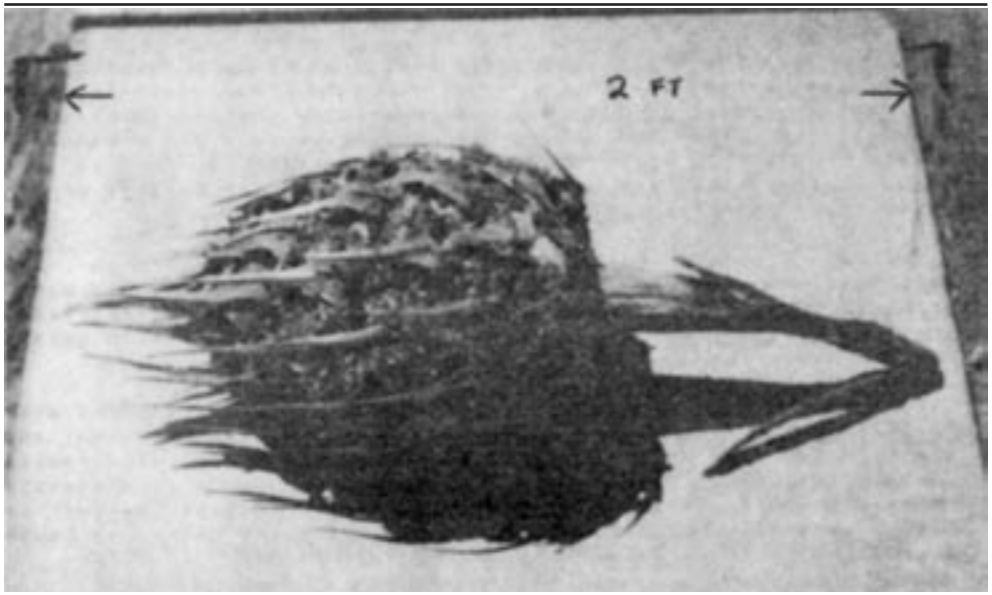
Until recently these 4 species, again with an interesting distribution, were all that I knew about. However I now find that there are at least 20 species, existing in Africa, Madagascar, Indochina, West Malaysia, and the Celebes, as well as in South and Central America. All may have potential as nut producers.

OWENIA.

This all-Australian genus of 8 species is distributed over tropical Australia and down through Queensland to New South Wales. It is in the *Meliaceae* family, like the familiar Cape Lilac. There is a West Australian species, *Owenia reticulata*, called the Desert Walnut.

PANDANUS.

These, the Screw Pines, form, a very large genus of over 600 species, including many which are only imperfectly described or known. In spite of their common name they are not pines or even conifers at all, but are palm-like in nature. Almost all have a very characteristic feature of stilt roots, where the whole trunk of the plant becomes raised above the ground, supported on a wormlike mass of small roots.



Top: Fruit cone of Zamia Palm, Macrozamia reidlei, on 2 ft slab.

Bottom: Macrozamia moorei tree in Queensland.

The striking stilt roots make the Screw Pines a subject for decorative horticulture, but many are useful food producers too. The fruits are borne in large pineapple-like structures, and In some species the individual segments or carpels are worthwhile edible fruits. In many species the nuts within the fruits are good eating, and are still used for food by the natives of New Guinea and Australia.

The biggest concentration of species is in the Malaysia/Indonesia area but they extend throughout the Old World tropics. Australia has at least 10 species; the West Australian species include *Pandanus aquaticus*, a beach tree with edible nuts. Family *Pandanaceae*.

SANTALUM.

This genus includes the two native nut trees most familiar to West Australians, the Quandong (*S. acuminatum*) and the Sandalwood (*S. spicatum*). All members of the genus (family *Santalaceae*) are semi-parasitic, and in fact are distantly related to mistletoe. Of the 25 species, 4 are native to Australia, all growing in W.A. although some extend to South Australia, Queensland, and the Northern Territory.

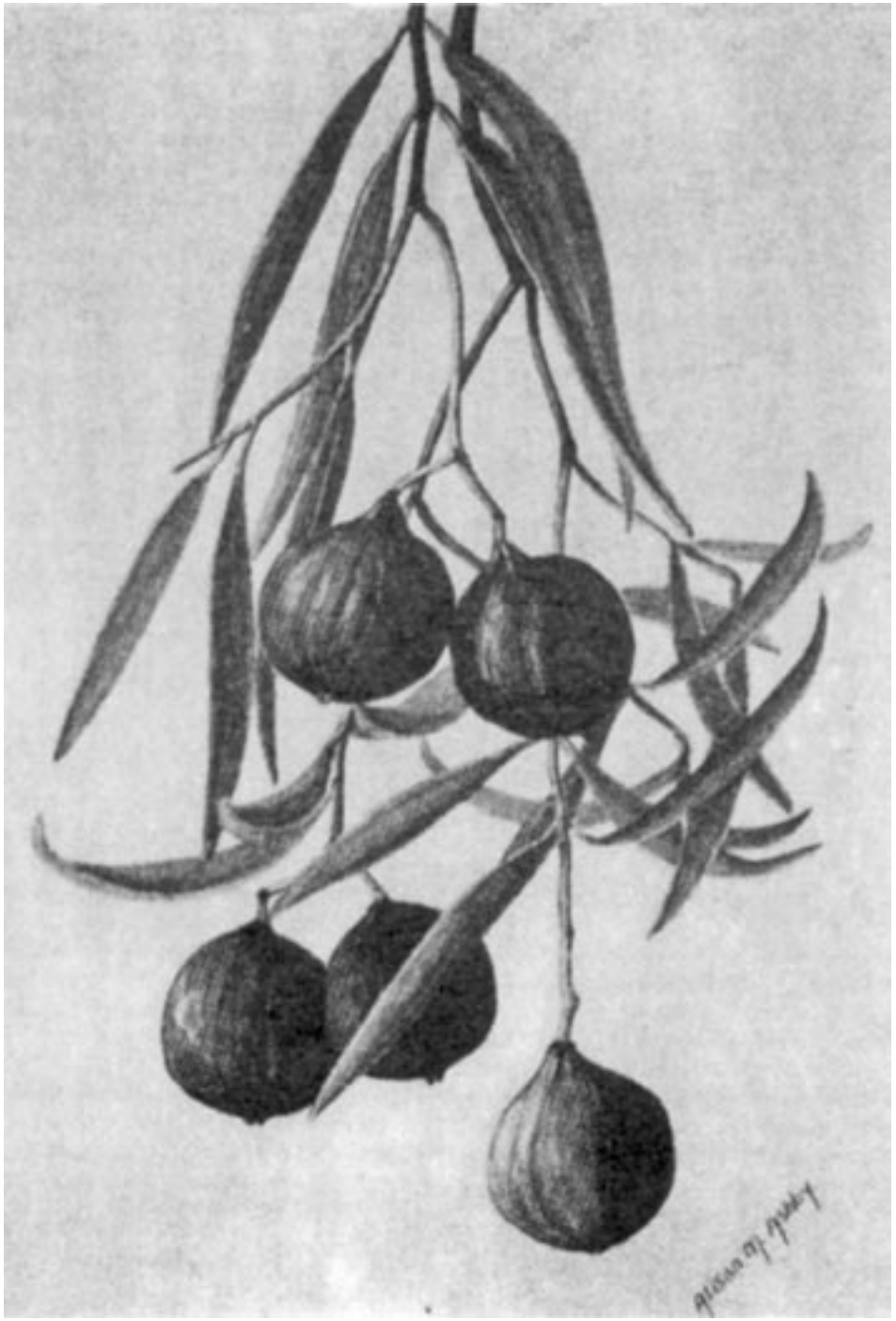
The Quandong is used as the symbol of the West Australian Nutgrowing Society. The spherical nuts contain a good edible kernel up to 1 cm across, and are enclosed in an attractive bright red fruit which is used for jam making. The 1977 volume of the WANS Yearbook has some articles on the Quandong; some selection of plants has been undertaken by CSIRO workers, both for fruit and for nuts.

The Sandalwood also has edible nuts, but the fruit is not used. This tree was once common over much of the Southwest and Wheatbelt areas of the state, but the valuable timber, used to make incense, was heavily cut and exported in the early years of colonization. The earliest sources of Sandalwood were the non-Australian *Santalum* species growing in eastern Malaysia and across to eastern Polynesia.

SEMECARPUS.

This genus of 50 species in the family *Anacardiaceae*, which includes the cashew nut (*Anacardium occidentale*) of South America. The relationship is quite close, and at one time some of the known *Semecarpus* species were included in *Anacardium*. There is one Australian species, *Semecarpus australiensis*, sometimes called the Australian Cashew. Like the true Cashew, the Australian Cashew nut is enclosed inside a shell which contains a powerful blistering oil. The kernel is described by Hearne [11] as “edible, but not palatable”, although a very similar Indian species is recorded as being a good food source. Perhaps some selection from wild occurrences is needed.

Apart From the Australian occurrence in the Northern Territory (apparently noted by Leichardt, the early explorer) *Semecarpus* species are found in Malaysia, India, Micronesia, and the Solomon Islands.



Fruit and leaves of Quandong, Santalum acuminatum, from Dumbleyung, W.A, Courtesy: South Australian Museum

SLOANEA.

The *Sloaneas* are closely related to the *Elaeocarpus* species already mentioned, both being in the *Elaeocarpaceae* family. There are about 120 species, mostly in tropical America and Asia, but with at least 4 in Australia (Queensland). An example is the White Carabeen, *S. langii*.

STERCULIA.

A very large and complex genus scattered through the tropics (300 species) and southern Africa and Australia. Closely linked (and in some cases identical) to the genus *Brachychiton*, which contains the various Australian Kurrajong trees. Also related to Cola (source of the Kola nut).

Most *Sterculias* have seeds borne in boat-shaped pods, sometimes with bright red arils (seed covers). The seeds are edible, but the arils are not and must be removed. The best-known nut source of the 6 Australian species is *S. quadrifida*, the Peanut Tree of Queensland and the N.T. Another unusual species is *S. diversifolia*, the Bottle Tree, so-called because of its bizarre swollen trunk.

TERMINALIA.

Another giant tropical family (250 species), including a number of nut producers, in the family *Combretaceae*. Most, are found in India. Africa, and Indonesia, with at least one in Mauritius. Western Australia has at least 18 species, in the north, and there at least 15 species in the N.T. Some of the local species are mentioned by Crawford in the 1976 WANS Yearbook [15).

Many of the species have edible nuts, though often too small to be of value for human food. The West Australian species are interesting in that some of them are adapted to arid desert conditions, and have thick tough shells. The normal *Terminalia* habit is to grow in jungle, and the nuts there often have spongy or fibrous shells which allow them to float.

Examples include *T. catappa*, the Indian or Sea Almond, growing near many seashores, including those of the Northern Territory and Queensland and *T. langanda*, the Langanda Nut of our Aborigines. No doubt there are other valuable species awaiting discovery and exploitation in the North West.

XYLOMELUM.

The last genus dealt with here is confined to Australia and contains 4 species. Commonly known as Woody Pears, the trees have most, interesting pear-shaped fruits, mostly woody tissue but with a thin flat edible kernel, rather bitter in taste. In the family *Proteaceae*, I suspect that the genus may be identical to that of the Van Riebeeck Almond of South Africa (*Brabejum stellatifolium*), since both share an unusual germination habit, with the seed shoot passing along a germination channel in the nut which emerges near the seed stalk.

The West Australian species is *X. occidentale*, locally called Woody Pear, found in the Southwest of the state. Other species occur in New South Wales and Queensland.

I hope that this long list will not frighten people off, but instead will inspire them to tackle the fascinating, work of learning to know and cultivate our native plants for one of the most laudable of all purposes -- feeding ourselves.

LITERATURE CITED

1. Flecker, H.:- “Edible Plants in North Queensland”. North Queensland Naturalists’ Club: Cairns; 1948 (Publication No 4).

2. Wrigley, J.W,:- “Australian native Plant;”. Collins: Sydney; 1979.

3. Erikson, R.:- “Flowers and Plants of Western Australia”. Reed; Sydney; 1979.

4. Francis,W.D.:- “Australian rain-forest trees’. Australian Govt. Publ. Serv. Canberra; 1970.

5. Swain, E.H.F.- “Timbers and Forest Products of Queensland”. Queensland Forest Service; Brisbane; 1928.

6. “Rainforest Plants - Descriptions”. Australian Plants/ 9(76):347, Sep 1978.

7. ‘Queco’- “Bunya Pine in Queensland: grafting, pollination, seeding, and related species”. WANS Yearbook/1:39-43, 1975.

8. Cribb, A.B. :- “Wild food in Australia”. Collins; Sydney; 1975.

9. Thies, N.:- “*Hicksbeachia,* a neglected native Australian nut”. WANS Yearbook/ 2:46, 1976.

10. Rumsey, H.J.:- “Australian nuts and nut growing in Australia”. Rumsey; Dundas; 1927.

11. Hearne, D.A.- “Some nut trees of the Northern Territory”. WANS Yearbook/ 2:43. 1976.

12. Beard, J,S,- “West Australian plants”. 2nd ed. Kings Park Board; Perth; 1970.

13. Thies,N, - “The Ball nut, *Macadamia praealta*. WANS Yearbook/3:34, 1977.

14. Willis, J,C,- “A dictionary of the flowering Plants and ferns”. 7th ed. University Press: Cambridge; 1966.

15. Crawford, I.M.:- “The langanda nut, *Terminalia langanda*, of North-West Australia”. WANS Yearbook/ 244, 1976.

16. Hearne, D.A. “Trees For Darwin and Northern Australia”. Australian Govt. Pub!. Serv.; Canberra; 1975.

NUT SPECIES OF NORTHERN QUEENSLAND

TONY IRVINE *

North Queensland tree species are attracting increasing interest, with the result that we find it hard to keep up with requests for information. However, the following notes on some of the local native nut species may be of interest.

BLEASDALEA

There is one species only of this genus, *Bleasdalea bleasdalai* (*Gevuina bleasdalei*).

Bleasdalea bleasdalai has a round nut about 20 mm diameter. As to its edibility, little is known. Fruiting specimens are poorly represented in Herbariums and there may be less than three such collections in Australian Herbaria.

Mature fruit has been collected in February and the seed took two months to germinate.

Its distribution is on mid-upland to upland areas (800 to 1700m above sea level) between Eungella Rangeat 21 deg. 12 min. S (S.W. of MacKay) and the Lamb Range near Tinaroo Dam on the Atherton Tablelands at 17 deg. 5 min. S. This is as far as Herbarium collections show at our station. I suspect that it may extend as far north as the Windsor Tableland and Big Tableland areas around 16 deg. 0 min. S latitude.

Flowers are whitish and are present between June and December, with the main period seeming to be between August-December. Immature buds may be noticed in May.

The tree tends to be a small tree usually, less than 9 metres tall and 30cm diameter, but some specimens may be as large as 16 metres.

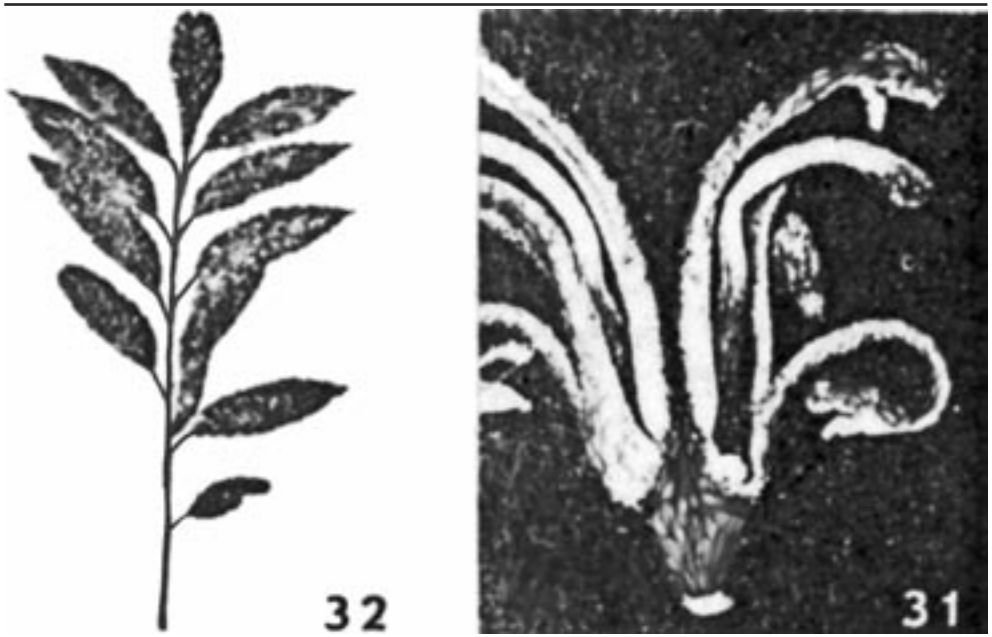
Botanical descriptions of this species may be found in the references cited [1.2].

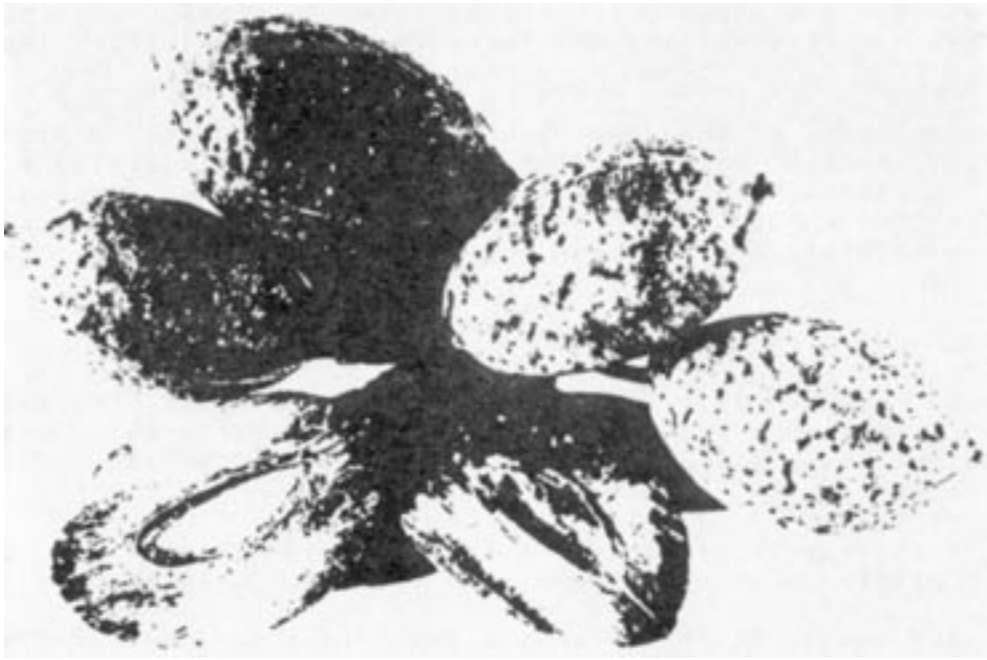
OMPHALEA

One species is Known in Queensland, *Omphalea queenslandica,* the Candoo Nut. It is a vine which produces a large greenish, fleshy, globose, tending to three-lobed mature fruit in late April-June, 10-12cm in diameter. Within this fruit are usually three globose, thin-shelled nuts, each about 3-3.5cm diameter. There is 1 nut per lobe, if all develop.

---

* CSIRO Division of Forest Research, Queensland Regional Station,
PO Box 273. Atherton, Queensland 4883





Top: Leaf and flower of Bleasdalea bleasdalei (Ref. 1).

Bottom: Nuts of Elaeocarpus bancroftii (natural size).

The flesh of the nut is white, tending slightly soft, rather than firm and hard. It tastes very pleasant when eaten fresh, and one nut provides a fair amount of eating. One problem concerning its edibility, is that it usually sends the eater to the toilet rapidly in about 40 minutes, with mild stomach pains.

These symptoms of course, vary with individuals and one nut, or several nuts, way be needed to be eaten to produce the rapid release effect from the bowels.

I have roasted the nut in a hot oven at 450-500 deg. F. (oven dial) For 30 minutes. This process tended to scorch the nut brown. There is a thin parchment around the nut flesh, which tends to add a slight bitterness to the nuts flavour and is best removed prior to eating.

Alter eating the above roasted nut, (one nut only) the need to so to the toilet did not occur until 5 hours later, when mild stomach pains occurred. The flavour of the nut was acceptable, perhaps not as nice as the fresh nut.

Another nut was boiled for 30 minutes and then roasted at 450 - 500 deg. for 30 minutes. This nut did not produce any stomach pains or diarrhoea after being eaten. There certainly was a loss of flavour and the taste was more bland after this process.

The vine grows in the very high rainfall rainforest regions immediately to the east of the Atherton Tableland (Tully - Innisfail - Babina area) up to about 600 metres altitude. Rainfall is 3600 - 5000 mm per annum. The plant may perhaps occur in the high rainfall area between the Daintree River and Cape Tribulation.

ELAEOCARPUS

A local representative is *Elaeocarpus bancroftii* (Kuranda Quandong). This is a rainforest tree up to 35 metres tall, with a relatively large whitish flower (2.5cm across), appearing in February or March.

The fruit is a large globose green fleshy structure, 6-8 cm diameter. Within is a very hard pitted shell nut with 4 faces.

The seed inside is thin, about 4-6mm diameter and 20-25mm long. Some nuts are illustrated. They were collected about 18 months ago and the flesh may have gone off. Clear white flesh indicates good condition as against an off-white colour in bad nuts.

The species occurs on the wetter coastal low-lands up to about 500 metres altitude between Tully and Cape Tribulation.

ALEURITES

Aleurites moluccana (Candle Nut) is a rainforest tree 20-30 metres tall, fast-growing, with heart-shaped leaves, occurring from Ingham northwards into S.E. Asia. It has white flowers and the new leaves are initially pale brown, turning white and then green.

The fruit is a large green fleshy structure tending to be 3-lobed (9-12 cm diameter). It has up to 3 globose nuts (2.5 cm diameter) with a relatively thin shell. Flesh of the nuts is white and relatively firm.

The taste is pleasant, but again a few nuts can result in a rapid race to the toilet and with some people result in expulsion at the mouth end as well (vomiting). Stomach pains may also occur.

The effects seem to vary with different populations of the trees, and the Care York Peninsula and South East Asian trees are reported to be less toxic in this respect. Cooking nullifies the diarrhoea effect apparently, as well. Fruit is present around March - April - May and another crop may be present in October-November, on the Atherton Tablelands. They appear to be a prominent food resource for local rodents, possums and perhaps tree kangaroos.

ATHERTONIA

This genus includes *Athertonia diversifolia*, the Cream Silky Oak. It is one of the *Proteaceae* family. It is a rainforest tree, 10-20 metres tall, with attractive large lobed leaves in young trees, which develop entire margins in older trees. Old leaves turn orange before shedding. Flowers are cream. relatively inconspicuous. The fruit is flattish, roundish, with a light blue thin skin over the flat, rounded almond-like nut. The flesh is reported to be quite tasty. Local rodents and marsupials relish the nut as well, and it is often difficult to collect seeds in any quantity.

CULTIVATION AND USE

There could be problems attempting to grow material from the humid north Queensland region, in the much drier conditions of the Perth region. Copious water may be needed at the driest time of the year, when demands on water supplies are greatest.

The Candle Nut would Probably stand up fairly well, as it is quite hardy on this side of the continent.

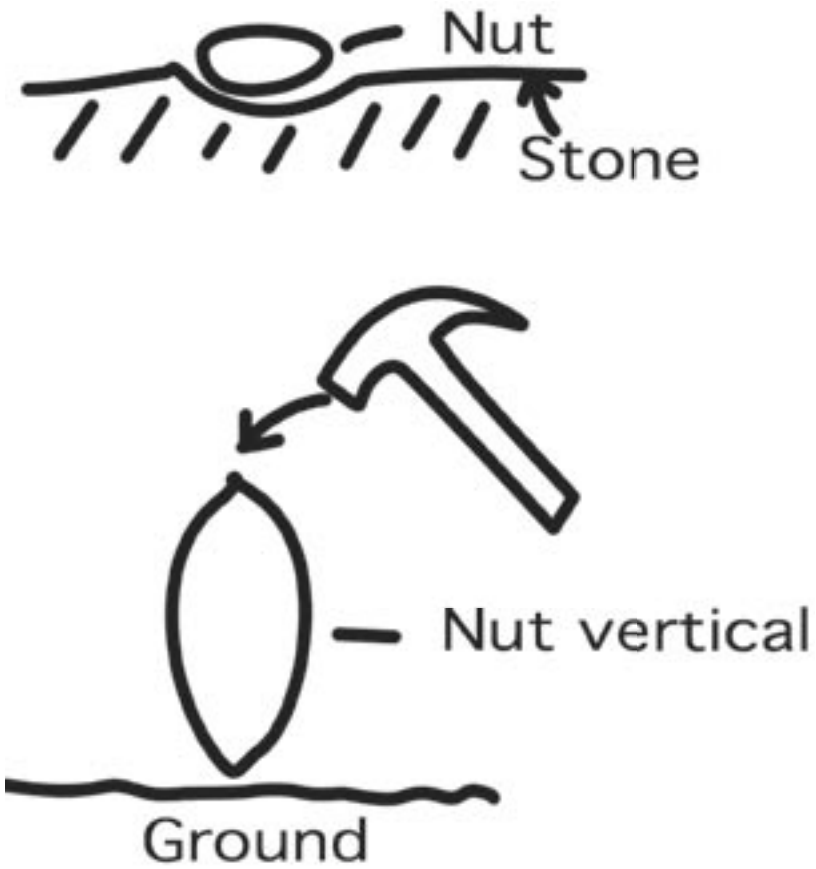
Very few southern western Australian plants stand up to conditions here in north Queensland. Most rapidly succumb to the summer wet or mature very quickly and die within two or three wet seasons.

The best way to crack the quandong nuts seems to be with a stone, or two stones. The lower stone should be flattish with a slight indentation to take the nut shape scooped in it. Some people use a hammer, hitting the end of the nut, a method I have not tried.

LITERATURE CITED

1. Smith, A.C. & Haas, „J.E. "Bleasdalea and related genera of Proteaceae". American J. of Botany/ 62(2):133-47, Feb 1975.

2. Sleumer.H.: "Studies in Old World Proteacea". Blumea/ 8(1): 5-6, 1955.



Cracking Kuranda Quandongs

THE SUBIACO CARYETUM PROJECT

DAVID NOËL *

Western Australia has very few specialised botanic plantings under public control and care. In the centre of Perth, Kings Park includes a Botanic Gardens which has sections featuring plants of several continents and of certain areas of this State. While this Garden, which includes annual and perennial plants as well as trees, will one day be a valuable resource, it is of fairly recent establishment.

Kings Park also includes a number of interesting mature plants in the general Park area. The Perth Zoological Gardens also has a selection of exotic plants, scattered among the animal displays. The Perth City Council has a number of interesting plants within its parks, in particular the Supreme Court Gardens and in Queens Park.

None of the plantings mentioned are specialised in the type of plant represented. Probably the only such are a number of tree plantings (arboreta) set up by the Forests Department, largely to check on timber yields. There is an arboretum at Dwellingup set up by the Department, for example, which includes mostly eucalypts and true pines (*Pinus* species).

A functioning arboretum is a long-term project by its very nature, as the trees it contains may take several generations to mature. For this reason, ones set up by individuals seldom survive to the same degree of maturity as ones under public care of some sort. In overseas countries there have been some lovely gardens of country estates which have survived through a National Trust type of sponsorship, but I know of none of any stature here in Western Australia.

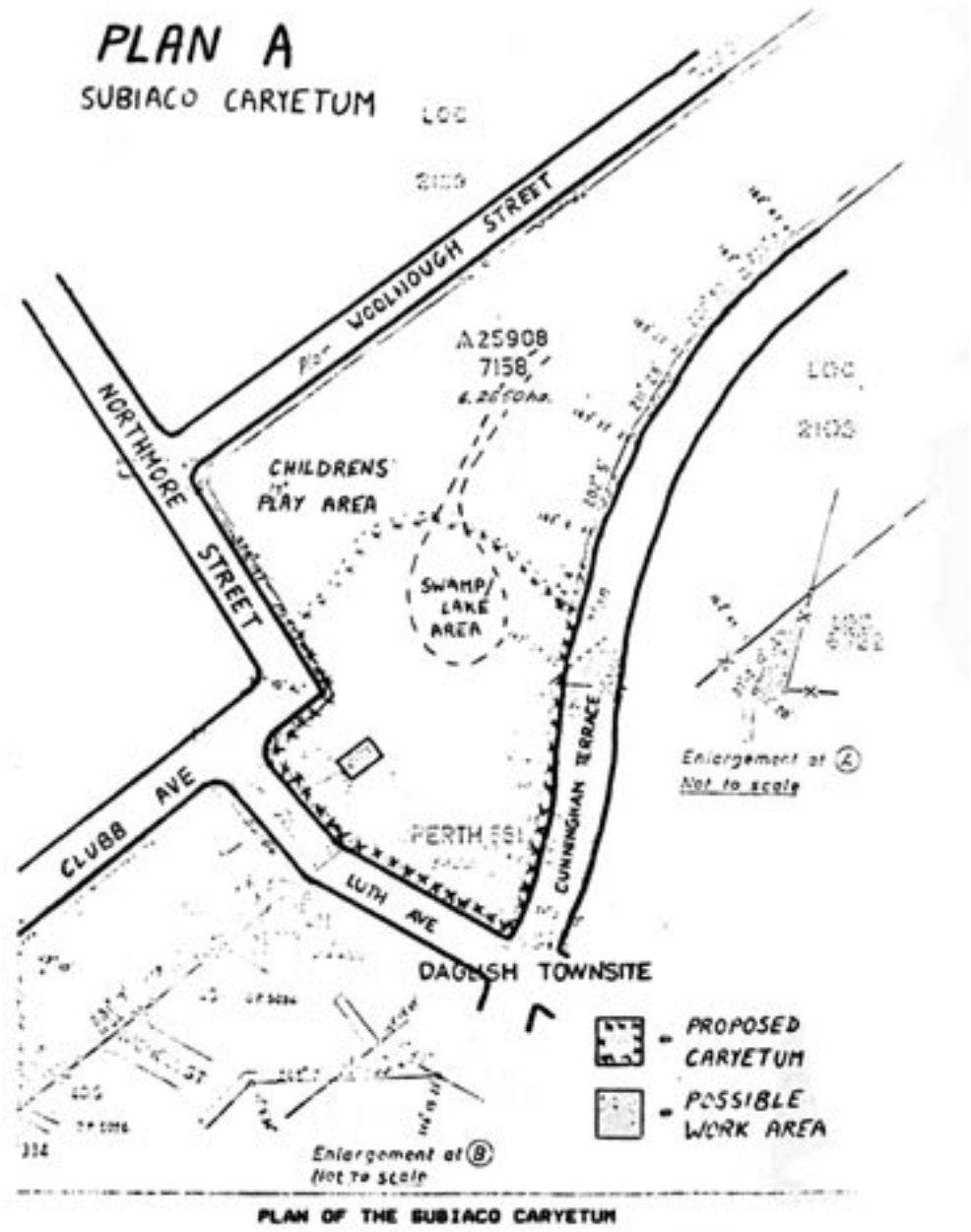
The opportunity to develop a garden of nut plants as a cooperative venture between the Subiaco City Council and our Society therefore seemed to be one to pursue with vigour. It should be a project with a very worthwhile future.

Early in 1980 I had a casual call from the Council's Superintendent of Parks and Gardens, Sam Morrison, enquiring about the suitability of nut trees for street plantings. Because many of the Society's activities have been centred in Subiaco, the Council have gradually become aware of the value of nut plants.

It seemed to me at the time that, although some nut trees could be used as street trees, there were many other species which would be better for this purpose under the hot dry summers experienced here.

---

* Member and Director. West Australian Nutgrowing Society



PLAN OF THE SUBIACO CARYETUM

At Mr. Morrison's request, I gave a summary of this reasoning to the Council, but suggested that instead of street plantings scattered over the area, they might like to think about devoting part of one of their public areas to a specialised planting of nut trees. The technical term for such a planting is a caryetum (from a Greek word '*karuon*' (nut) plus the ending *-etum* used in arboretum. pinetum, etc.).

This suggestion was received enthusiastically by the Council. They accepted the view that such an area could combine the conventional park assets of pleasant passive recreational use and visual attractiveness, with very real horticultural and botanic value.

Having accepted the idea in principle, the Council looked at various sites in conjunction with Society representatives, to assess their long-term suitability. The best long-term possibilities seemed to exist in an area called the Daglish Basin.

The Daglish basin is a relatively low-lying area in the Daglish district to the west of the Subiaco City Council area. On typical sand-plain country, about 7 km from the sea, its surrounds have been built on over cleared scrub and bush in the 1950's and 1960's.

The gently-sloping site of the basin itself forms one of the nodes in the Perth Metropolitan Water Board surface water drainage scheme. Heavy surface run-off in the winter leads to mild flooding in the centre.

As the site is somewhat exposed to winds, and had relatively few mature trees already present, it was decided to first plant some shelter belts of fast-growing native species. This was arranged for the winter of 1981.

Hardier nut trees will be progressively added in the early years, and more fragile species added later when sufficient shelter is established.

TREE CROPPING IN AUSTRALIA *

IAN MANNERING **

This is a brief report of studies undertaken while supported by an ANZAC Fellowship in 1979.

An ANZAC Fellowship awarded during 1979 allowed me to visit most of the states of Australia to examine cool temperate tree cropping activities. I excluded subtropical tree crops from my programme as I could allow myself five months only. I believe it would be more appropriate for a subtropical enthusiast supported perhaps by a further fellowship to examine the macadamia industry and other tropical fruits in detail.

The benefit of a study tour lies as much in the long term influence on one's attitude and ideas as in the more immediate impact of the facts and techniques observed. Here I will give my impressions of Australian tree cropping compared to our activities in New Zealand.

Firstly, there is no organisation in Australia with identical terms of reference to those of N.Z.T.C.A. The Forestry Commission in each State and the Federal Forestry agencies research and promote farm forestry in addition to large scale forestry. These groups are the principal sources of information on shelter planting. Work with stock fodder trees and trees for bees is promoted by the Victorian Natural Resource Conservation League, various Permaculture groups and farm forestry associations.

With a small number of notable exceptions the level of tree cropping expertise is no higher in Australia than in New Zealand. No elite tree registration schemes were operating even though individual growers were making their own selections. Most potentially commercial plantings are from selected seed (chestnuts), grafting of named cultivars, both American and local (walnuts and pecans), and rooted suckers of named varieties (hazels, of which over 30 varieties are available).

The almond industry has developed over the last 35 years from relatively small farms of 30-40 acres in the vicinity of Adelaide. Large scale plantations are now established at Boundary Bend, Victoria. and "Simarloo" near Lyrup S.A, where availability of irrigation water from the Murray River allows the cultivation of almonds, prunes, apricots and citrus trees. The Almond Producers Cooperative in Adelaide markets 70% of the almonds grown in South Australia.

---

* A report prepared for the New Zealand Tree Crops Association

** Member, West Australian Nutgrowing Society

While considerable interest is shown in pecans the only large plantation I visited was at "Trawalla" in N.S.W. Here nearly 500 tonnes of Wichita and Western Schley are harvested annually. Most of the crop is exported to U.S.A. Although only briefly examined, the macadamia industry is clearly well established with hundreds of hectares of young trees approaching cropping age in the area north of Lismore, N.S.W. Other macadamia growing areas in Queensland were not visited.

Reference is frequently made to high prices for fresh chestnuts in some Australian produce markets. New Zealand growers must appreciate that the peak demand and largest return is associated with various religious festivals. Precise timing of delivery is crucial and grading for size and quality is essential. The market potential is recognised in Victoria, N.S.W. and South Australia and large areas of young trees have been established mainly from high quality seed rather than named cultivars.

Tree management for honey production is scarcely practised at all. Bee keepers tend to be itinerant, moving by truck with hives and mobile processing equipment from region to region, following the honey flow as each of the numerous native trees shrubs and herbs comes into flower.

Only in Tasmania are special efforts made to replace Tasmanian Leatherwood destroyed during logging operations. This distinctive honey can be harvested because logging roads provide access to the otherwise remote forests. Beekeepers are allocated special lay-bys on the roads on which to set up their hives. Inevitably honey production is affected as logging proceeds in each area but the Forestry Commission is concerned with the need to promote regeneration.

People are experimenting with pistachio. jojoba and carobs as these are potential cropping species adapted to the extensive arid regions of Australia. Honey Locusts, although widely used as street and highway ornamentals, are neglected as fodder trees.

Trees and shrubs available for browsing are usually limited to naturally regenerating native species but interest in species like tree lucerne is developing in some areas.

Propagation and cultural research directly or indirectly relevant to tree crops is proceeding at various research stations. At Knoxfield Horticultural Research Institute experimental grafting of chestnuts and walnuts is in progress. Some varieties imported from Europe and North America are included. The advantages of close spacing and trellis training of fruit trees is being assessed. Grafting trials are also under way at. Lenswood Research Station in South Australia.

Field grafting of walnuts is practised in West Australia, Victoria, and South Australia by skilled growers. In each case a combination of vigorous rootstock, timing and suitable weather appears to be important with temperature the most important of all. So crucial is microclimate that one successful propagator cannot produce the same results outside his own nursery. I do not have much hope that field grafting will be generally practicable in New Zealand. We must persist with refinements of the hot box technique.

As in New Zealand there is an increasing interest in nuts and tree crops in general from people in all walks of life. This "grass roots' enthusiasm is stimulating greater activity from State Departments of Agriculture, several of which have low key development programmes in operation. The organisation of this interest into associations like NZTCA is gaining momentum.

In West Australia the West Australian Nutgrowing Society was established in the same year that NZTCA began. An active membership of over 500 people spread throughout the state embraces work on hazels in the south to cashews and brazil nuts in the Tropics. A Yearbook is produced containing original material and articles reprinted from many sources, including NZTCA Journal.

Supplementing this useful publication is a quarterly newsletter, "Quandong", containing information of society administration and activities. In spite of the immense area of the state and the wide distribution of members the organisation is centred an Perth and no branch structure exists.

Members of the Society have formed a registered company, West Australian Nut Supplies Cooperative Ltd., which aims at facilitating trading between members and provides a cooperative outlet for commercial production. A shop was for a period operated in conjunction with the Society's office enabling seed, nut products, and literature to be promoted to the public in general.

The Tasmanian Nut Producers Association is a small group centred on the north coast of Tasmania. They have been awarded a Federal grant to investigate the re-establishment of a hazel nut industry which existed in Tasmania In the early part of the century. Only isolated remnants of those early plantations have survived competition frost the apple industry.

The Victorian Nut Growers Association, initiated in 1978, is growing rapidly. A periodic newsletter. "The Victorian Nutgrower" provides information on current activities while the Annual Report is planned on a journal style format. Each of these organisations draws most members from its home state but all accept members from further afield.

Inevitably association activities cover more than the purely nut growing interest indicated by their titles. While some specialist bodies exist, e.g. the Macadamia Society there is also a newly established section of the wide ranging International Tree Crops Institute. This group plans to provide "umbrella" activities such as studies of the potential of the carob and a seminar on fuelwood as well as maintaining links with its sister organisations in U.K. and U.S.A.

Only time will show how this variety of organisations can communicate and operate for the promotion of tree growing with all its benefits, from annual cropping, terminal timber production and environmental improvement -- of which the major target is salination control and soil conservation.

****

The KEI APPLE
(Dovyalis caffra)
from South Africa

FERTILIZER TRIALS ON WALNUTS AND CHESTNUTS: A PROGRESS REPORT

PAUL BAXTER *

In 1973 the Victorian Department of Agriculture began a fertilizer trial on 24 walnut and 24 chestnut trees which had been planted the previous winter. The aim of the trial was to study the effect; of 2 rates of nitrogen and 3 rates of phosphate fertilizer on the growth and eventual cropping of nut trees.

The treatments were combined (factorially) so that there were a total of 6 treatments for chestnuts and 6 for walnuts. We chose to apply rather high rates of superphosphate because a previous trial had shown that high rates of phosphate applied to young trees could induce earlier fruit bearing in chestnuts, plums and to a lesser extent in apples.

The trial plot was situated in a valley in the heart of the Australian Alps, where many of our nuts are grown. The soil is alluvial, well-structured, deep and quite fertile; its reaction was almost neutral - it had ample calcium and potassium, but was somewhat low in phosphorus and presumably nitrogen. The trees were trickle-irrigated and weeds were controlled at first by mulching with black plastic, and later with a contact herbicide.

The walnut trees are Franquettes on *Juglans nigra* stock, the chestnuts are seedling trees.

The following fertilizers were applied:

The LOW NITROGEN (Low N> trees received no nitrogen fertilizer until 1978 and thereafter received 100 g nitrogen per year, rising to 300 g nitrogen per year in 1981.

The HIGH NITROGEN (High N) trees received 100 g nitrogen the first year rising to 300 g nitrogen for chestnuts and 900 g nitrogen for walnuts in 1981.

The NO PHOSPHATE (P-0) trees received no phosphate fertilizer until 1980 and thereafter the walnuts only received 150 g phosphorus yearly.

The LOW PHOSPHATE (low P) trees received 100 g phosphorus yearly.

The HIGH PHOSPHATE (high P) trees received 300 g phosphorus yearly until 1980.

---

* Member, West Australian Nutgrowing Society; Horticultural Research Officer, Horticultural Research Institute, Department of Agriculture, Victoria.

The above amounts refer to the active ingredient in the fertilizers used. The fertilizers were mainly ammonium nitrate (33% N) and superphosphate (10% P).

RESULTS

Vegetative Growth

This was measured as trunk circumference and then converted to trunk cross sectional area and also as tree height. The trunk cross sectional area is a very good measure of total tree volume and particularly of the fruit or nut bearing potential of the tree.

During the first three years the trees grew slowly despite excellent management. The WALNUT trees which had received no nitrogen fertilizer were considerably smaller both in trunk girth and in tree height and as we did not intend to stunt the trees they were then given N fertilizer, their rate of growth increased at once.

Phosphate fertilizer also improved tree growth, but the trees grew just as well with the low phosphate level as with the high one. Those walnut trees which received BOTH nitrogen and phosphate grew better than those receiving nitrogen only.

In the fourth and fifth year the walnut trees grew very strongly and after five years the high N trees were considerably larger than those receiving only the lower rate of N. Superphosphate, particularly when applied together with nitrogen also improved tree growth.

The CHESTNUT trees responded quite differently. All the chestnut trees grew well, but neither nitrogen fertilizer nor phosphate fertilizer had any effect on their growth. The trees which had received no fertilizer for five years wire just as large as those which were heavily manured.

Nut Bearing

The trees started to bear nuts in their fifth year, and we expected that the number of nuts borne would be related to tree size. However ever, here there were some surprises.

In the WALNUTS, a count of the nuts which had set by January 1981 showed that the trees which had received nitrogen at the high rate had more than twice as many nuts as those at the low rate, there was also an increase due to phosphate. However, as only a few nuts set, and set was very variable due to pollination problems, these results should not be taken too seriously.

In the CHESTNUTS I counted the number of burrs which had set in January 1980 and was surprised to see that both nitrogen and phosphate appear to have increased their number, despite the fact that tree size was the same. Again the figures themselves must not be taken too literally due to the large variability between trees, since the trees are seedlings, there is also a large genetic factor influencing nut production. Nevertheless it is clear that both N and P fertilizers increased the number of chestnuts per tree;

TRUNK CROSS-SECTION IN SQ. CM.

	Nitrogen		Nitrogen	
	None	High	Low	High
	1978		1980	
Walnuts				
No Phosphate	4.1	9.0	21.8	44.2
Phosphate	5.8	13.5	38.1	61.3
(av. of 2 levels)				
Chestnuts				
No Phosphate	9.2	8.1	42.7	39.5
Phosphate	7.4	10.2	40.7	41.2
(av. of 2 levels)				

NUMBER OF NUTS OR BURRS PER TREE

	Walnuts (1981)		**Chestnuts** (1980)	
	Nitrogen		Nitrogen	
	Low	High	Low	High
No phosphate	2.0	6.8	4.0	13.3
Phosphate	7.0	11.4	23.9	178.0
(av. of two levels)				

This year I will be harvesting and weighing the nuts. It is already clear that many of the chestnut trees which had received phosphate carry many more burrs, but only harvesting them will tell whether they also carry more nuts.

The preliminary results from this trial confirm overseas experience that walnuts, but not chestnuts grow better with nitrogen fertilizer. It is interesting to find that phosphate fertilizer, when applied in addition to nitrogen, increases the growth of walnuts and appears to increase greatly the fruitfulness of chestnuts.

However the trees now in their sixth year are only now bearing their first worthwhile crop, and are variable in size and nut production. This means that we may have to obtain another five years' results before we can finally say whether the increases in growth and production due to N and P fertilizers are economically worthwhile and statistically significant.

My thoughts are that fertilizers are particularly important during the early stages of tree growth and might well have shown larger responses on soils which are not as fertile as the one used in the trial. We would have preferred to apply the phosphate fertilizer before planting -- probably at the rate of 10 Kg superphosphate per tree site 4 x 4 m. - cultivated well into the soil - and applied no further phosphatic fertilizer for the next 10 years or so, as P remains in the soil for long periods. Nitrogen fertilizer would have to be applied yearly.

It is also important to realize that good responses to fertilizers are only likely where the trees are adequately watered and weeds are controlled. In most situations some potash fertilizers will also have to be applied to balance the large amounts of N and P used.

And finally it occurs to me that one should start fertilizer trials with chestnuts and walnuts while one is still young. since it will take 10 years and maybe 15 years before we can hope to obtain a final verdict.

****

SCREW PINES (PANDANUS) IN WESTERN AUSTRALIA

G.J. KEIGHERY and I.R.DIXON *

INTRODUCTION

The Pandanaceae are a monocotyledon family of some 220 species distributed in three genera (*Freycinetia, Pandanus* and *Sararanga*). Members of the family are distributed in tropical and subtropical Africa, Madagascar, Asia, Pacific Islands and Australia. Generally favoured habitats are coastal, riverine or marshy areas.

The largest genus is *Pandanus* which are generally large slender trees from 4 metres, mostly having large aerial roots. The stems and leaves are spirally twisted, hence the common name "screw pines". The leaves are large, linear and usually with a spiny margin.

Plants are dioecious (male and female flowers are borne on separate plants). The individual flowers are inconspicuous, consisting largely of an ovary (female; fig 2, c) or a stamen (male - fig 2, e). These flowers are organized into large complex inflorescences (Fig 2).

Pollen is mainly transferred by the wind from the male flowers on the male trees to the stigmas of the female flowers on the female trees. The fruit is a berry or multilocular drupe, containing small seeds with fleshy endosperm (fig 1, b-c).

The taxonomy of the genus is in a state of considerable confusion, and many species are known under several names.

USES

Members of the genus *Pandanus* are used for matting, roofing, wood, perfume (*P. odoratissimus*), in salads (*P. odoratus*) or even or making paper. Several species (*P. edulis* and *P. boulletii*) have soft sweet fruit which can be eaten fresh.

In New Guinea one species *P. utilis* has fruits weighing up to 27 kilos, which are eaten fresh or smoke cured and stored.

Pandanus julianetii is commonly used for its large kernels, and may prove to be the best "nut tree".

Pandanus spiralis was extensively used by Aboriginals for its fruit and kernels, which were eaten raw or roasted.

---

*Both of Kings Park and Botanic Gardens, West Perth, WA 6006, Australia

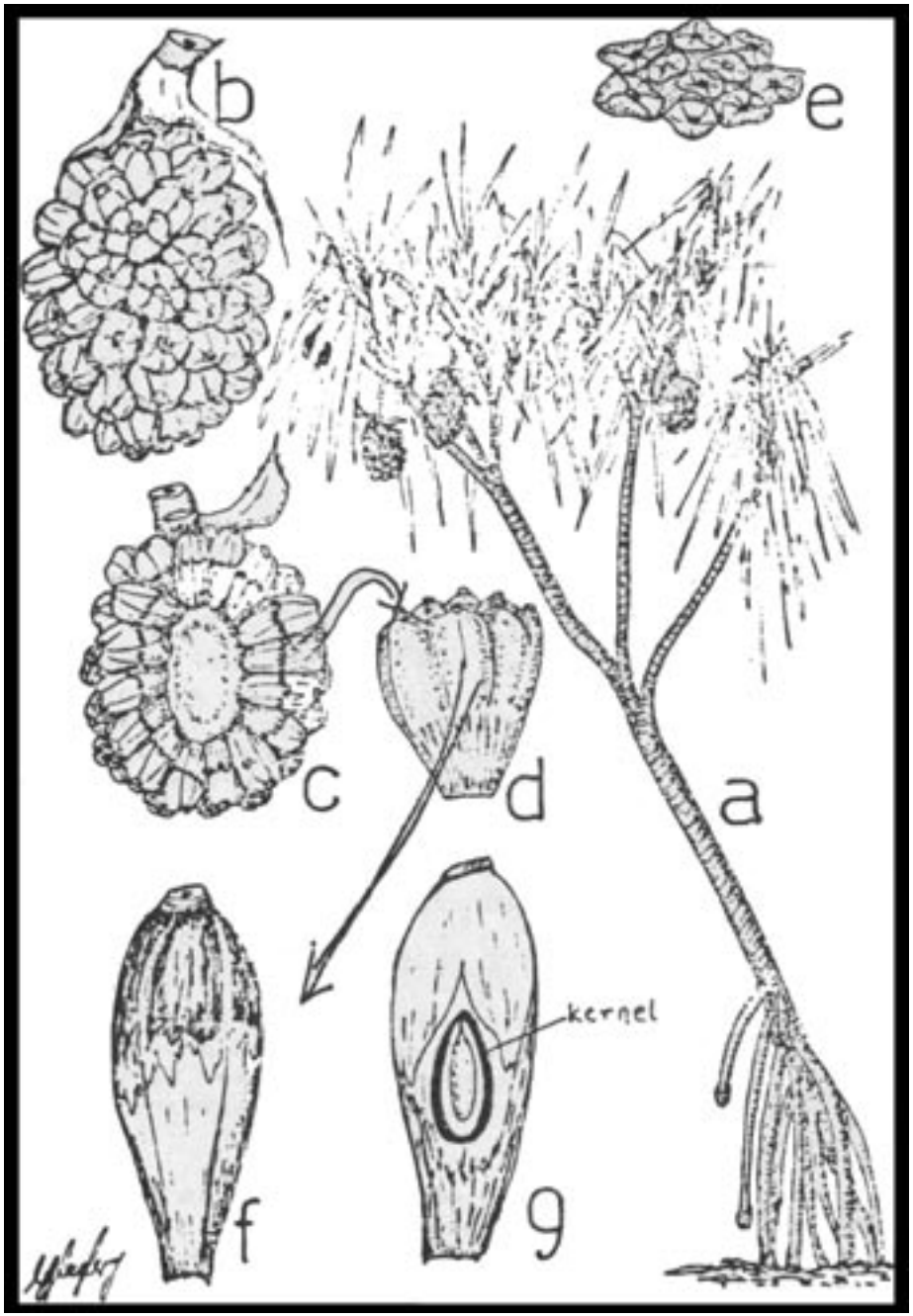


Fig. 1. Pandanus: habit and fruit. a: Female plant with fruit. b: Cephalium (compound fruit) in profile. c: Longitudinal section of cephalium. d:Side view of a phalange (12 drupes). e: Surface view of a phalange - showing fused drupes. f: A single fruit (drupe) in profile. g: Longitudinal section of a drupe.

PANDANUS IN WESTERN AUSTRALIA

There are 5 species of Pandanus in Western Australia (P. *aquaticus, P. darwinensis, P. oblatus, P. semiarmatus* and *P. spiralus*).

All species are found only in the Kimberley Region in Western Australia (i.e North of 19 deg South latitude).

Generally all species are found along watercourses or in swamps. Flowering occurs during the wet (December to March) and mature fruits in July to September. Rich soils are preferred (loams, peaty sands and clays).

The most widespread and usefulspecies is *P. spiralus* which is divided into 5 varieties. Selection of some of these varieties may lead to high yielding plants.

PROPAGATION

SEED: Fresh seed is required for good germination, as older seed germinates very erratically. Split the mature fruit into phalanges (Fig 1,d) which contains 4--6 seeds.

SOWING: Sow in late spring to mid summer using a free draining but moisture retentive mixture, such as John Innes mix or University of California mix. Place several segments into a large pot and transplant when large enough or sow a segment (drupe) in individual smaller pots. The fruit should be pressed slightly below the top of the potting mix, sowing too deep can lead to the fruit and seed rotting.

Germination from fresh seed occurs 5-7 weeks after sowing.

VEGETATIVE PROPAGATION

During late spring and early summer, side shoots form at the base of the seedling or plants, these can be removed and treated as cuttings. A semi-hardwood hormone powder may be used to dip the cutting in, but this is not generally necessary as they form roots very readily.

A good cutting mix is 50/50 washed river sand and sphagnum peat moss, or 50/50 perlite and sphagnum peat moss.

Cuttings should be placed in a propagating frame as they require a high humidity and a temperature of at least 25 deg C to succeed.

When roots have formed at the base of the cuttings, gradually expose to more air to harden them off. Now pot up as for seedlings.

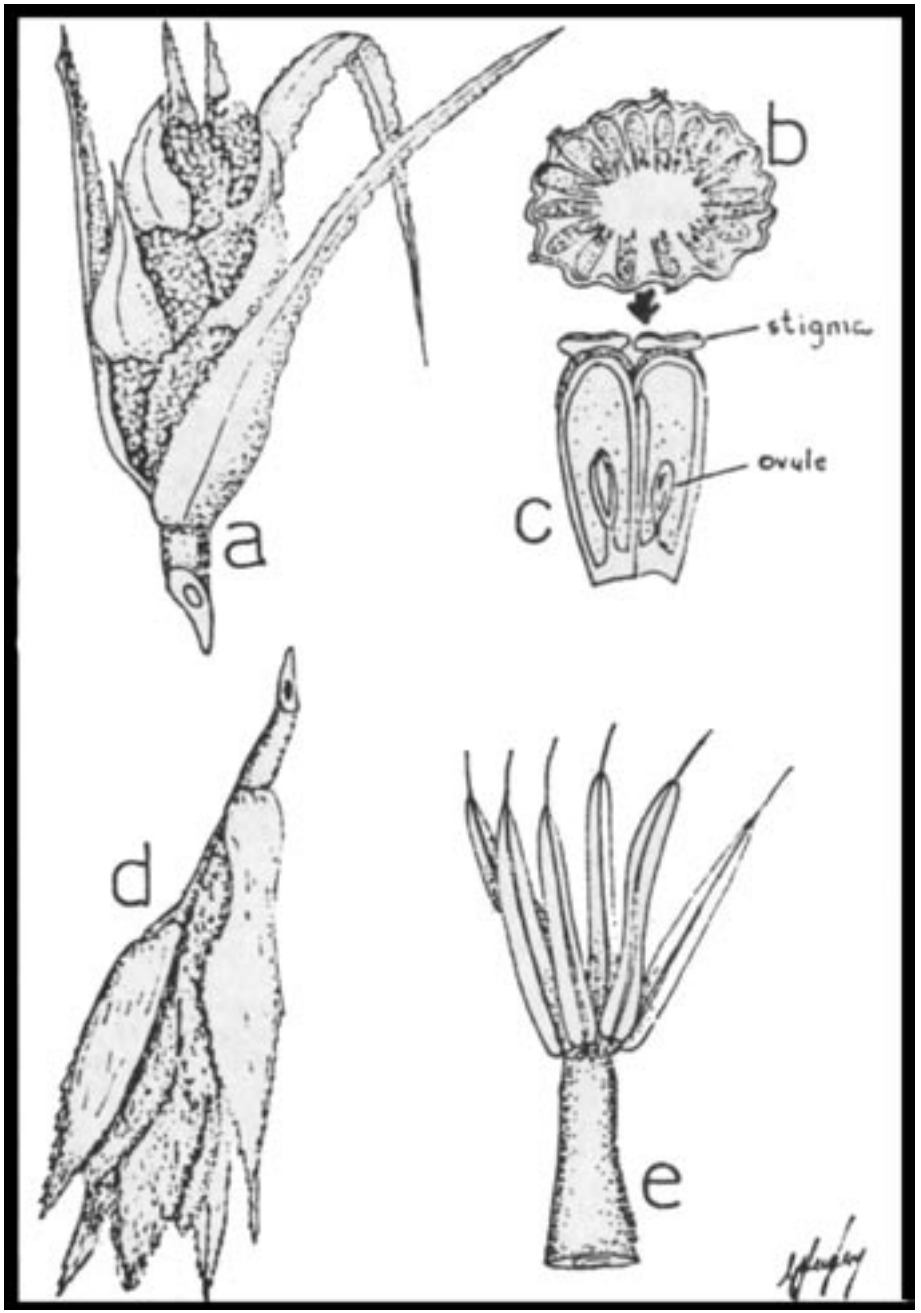


Fig. 2. Pandanus flowers. a: Female inflorescences. b: Cross section of female inflorescences. c: Longitudinal section of two female flowers. d: Male inflorescences. e: Male flower (a whorl of stamens).

CULTIVATION

Grow on in a glasshouse or shadehouse during the winter, and keep dry, as the plants will rot if exposed to rain and made too wet. The plants require a lot of water during the summer growing season, but a dry winter (they naturally occur in summer rainfall areas).

Eventually the plants form stilt-like roots which raise them above the level of the potting mix, this greatly lessens the problems of rotting of the base of the plant.

Although most species respond well to liquid fertilizer, over-enthusiastic applications will lead to weak root systems and lush top growth.

Plants are occasionally attacked by mealy bug and red spider, however, these are easily controlled by suitable insecticides and miticides.

Pandanus are relatively slow growing in Perth, but adapt well to pot culture even in an unheated shadehouse. However, plants do not grow well out in the open in the Perth region.

It takes several years for Pandanus species to flower, as they are dioecious, and seed produces as many male plants as female. Vegetative propagation from axillary buds or basal side shoots of known female trees is recommended if you wish to have mainly fruit-bearing trees.

We do not know if Pandanus will produce fruit in Perth, as the only mature tree at the Zoo is a male.

FUTURE

Almost no breeding or selection of Pandanus species for fruits or kernels appears to have been undertaken. This is surprising as several species are known to be important food sources for indigenous peoples in the tropics.

Some selections for horticultural purposes, via cuttings, have occurred and a number of variegated leaved forms are grown.

Pandanus veitchii has leaves with a silvery margin, *Pandanus baptistii* and *Pandanus sander*i have golden margins. These selections are frequently grown as pot plants in colder regions or as garden plants in the tropics.

Growing Pandanus for fruit and seed production is still very much in its infancy, and due to their tropical nature perhaps best tried north of Perth.

TERMINOLOGY

The terminology of the fruit in Pandanus is complex and needs some explanation. The mature fruit (called a cephalium: (Fig. 1b) is composed of many individual fruits (drupes: Fig 1. f-g) which are fused in groups of 4 - 12 (Fig 1. d-e) into phalanges. These phalanges are then combined to complete the Cephalium (Fig 1.c).

Hence the mature fruit resembles a super large blackberry, which may be soft or woody.

The fruits are bright scarlet or red on maturity and may be dispersed by birds or by water.

FURTHER READING

1. Burkill,I.H.:- “A Dictionary of the Economic Products of the Malay Peninsular”. Vol. 2 (I-Z). Crown Agents for the Colonies; London; 1935.

2. Maiden, ‚J.H. The Useful Native Plants of Australia”. Facsimile Edition. Compendium Press; Melbourne; 1975.

3. Menninger.E.A. “Edible Nuts of the World”. Horticultural Books; Florida; 1977.

****

Good Litchi Fruit x 1/2.
Some seedless varieties are known.

INTERESTING INTERSTATE INSIGHTS

PAUL SINCLAIR *

This short article gives some of the relevant highlights of a motoring holiday on which I took my family to the Eastern States last April-June. I do this not from the point of view of an expert/grower but from that of a layman/consumer, where I see my main role on the Society's Board of Directors. The article is not limited to nuts alone, but also mentions other interesting tree crops. Being a vegetarian helps!

Our first "interesting" stop was Adelaide, Australia's almond heartland. The setting and climate are very similar to those of Perth but the virtual absence of the fruit fly has resulted in the proliferation of fruit and nut trees in home gardens.

Passing through Dubbo, in central western N.S.W., we noted some magnificent carob trees in the main park. Their fruit tasted equally magnificent.

East of Moree, near the Queensland border, we skirted "Trawalla", Dean Stahmann's large pecan orchard, which figured in the illustrated talk given by Neville Shorter at the Society's 1980 Annual General Meeting. We only had time to buy some nuts, which were very tasty.

Soon we were in far northeastern New South Wales, where macadamias, avocados and pawpaws abound. Near Lismore is the Alstonville Tropical Fruit Research Station.

South Eastern Queensland offers the same produce, and, of course, pineapples. This is very evident at the Big Pineapple, just south of Nambour, where a miniature train conveys tourists through groves of exotic plants. Next door is a C.S.R. factory which processes macadamia nuts from nearby plantations. The entire process can be viewed through observation windows, accompanied by an excellent recorded commentary. All manner of macadamia products are on sale.

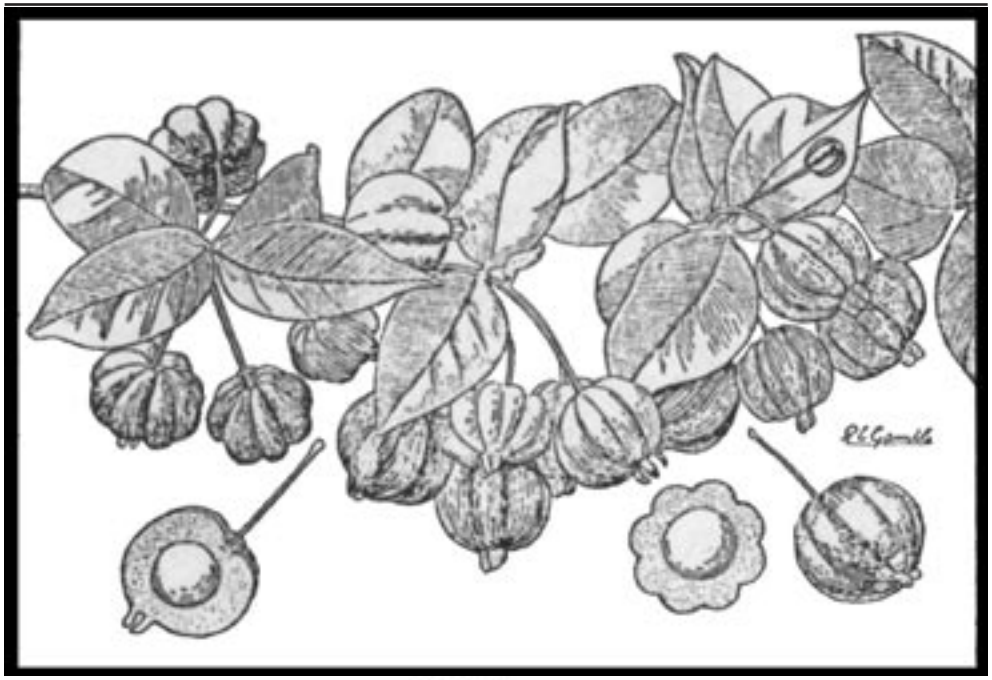
Proceeding north, we encountered increasing numbers of coconuts, the only food that, taken alone, can sustain a man indefinitely. (It also provides clothing, shelter and other requirements.) As the nuts almost always fall at night, the early bird gets the "worm".

The Cairns district is, perhaps, the most interesting. On the nearby Atherton Tableland, almost anything grows, and with astonishing rapidity. Alongside the usual vegetables and citrus trees, one finds many avocadoes, together with a host of exotic plants, for example, soursop (a giant relative of the custard apple, prickly in appearance and with the texture and

---

* Vice-President, West Australian Nutgrowers Society

The Breadfruit



Top: the Brazilian Cherry, Eugenia uniflora (x 3/5)
Bottom: Jujube growing in California.

taste of raw fish), mangoes (many varieties), Brazilian cherry, Feijoa (a relative of the guava), jakfruit and litchi.

At sea level, near Cairns and north, one encounters also purple mangosteen, rambutan and naranjilla (From South America). The Cairns Botanical Gardens are a veritable home away from home: one can "graze" on golden mangosteen and breadfruit. There are also cashews (poisonous unless first processed) and interesting inedibles like elephant apple and the African Sausage tree, on which fruit hang like gigantic salamis on vines.

I visited Mr. Watson, at the nearby Kamerunga Tropical Research Station, where I was shown a wide range of young experimental plantings, using material from many parts of the world.

A couple of interesting plants suggested as possible for cultivation in the Perth region were jujube ("Chinese Date") and Jaboticaba.

Finally, I attended a meeting in Cairns of the Rare Fruit Council of Australia, with exhibits of plants and fruit, the latter for subsequent sampling by those present. I shall probably never see or taste anything like it again!

The journey showed how many people are interested in these tree crops, and how much work is being done not only by individuals but also by organisations staffed by people dedicated to the cause of tree crops and, thus, to their propagation, using those varieties most appropriate to the areas concerned. It is a shame that plant quarantine regulations in Australia have to be so strict, not only for imported material but also for its inter-state movement.

****

CASHEW PROPAGATION AND PLANT SELECTION *

R.P. O'FARRELL **

This investigation of propagation in the cashew plant was undertaken as part of a comprehensive review of all aspects of cashew culture and trade, and in particular with regard to their relevance in Australia. Cashews form a significant part of the world nut trade, and their production in Australia could be of great interest.

This work was done up to 1977, since which time there have been some important changes in the world situation affecting cashews. Some of the information which follows is thus subject to update.

Propagation by seed is the principle method used in all areas of production. The alternative, vegetative propagation, which can be achieved by marcotting, budding, grafting, and cuttings, is more expensive and complex. The standard of development of the industry has not yet reached that level of sophistication, where the advantages of vegetative propagation are demanded on a large scale.

In the past, little consideration has been given to the propagation of high yielding clones or to efficient planting methods. Unselected seed of extreme genetical variation was planted in situ. Inherent variability resulted, compounding the result of failure to germinate, variation in germination, poor post-germination growth, and damage by rodents, insects, and disease.

The trend at the moment is towards the planting of better quality seed, the propagation of high yielding types, and the employment of more efficient establishment techniques. It is also being recommended that low yielding types are culled during thinning operations. The potential for vegetative propagation methods have been viewed in most areas of production to maintain uniform types, and thus ensure that desirable features will be carried by progeny.

Ohler (1) in his review (section on varieties and selection) states that Cashew trees when propagated from seed, because of the heterozygous nature of the plant, exhibit a wide variation in characters such as yield, shape, size and share of nuts and apples, colour of apple, and time of flowering.

---

* Based on part of an internal report prepared in 1977 for the Department of Primary Industry, Queensland. Published by permission of the Director (Horticulture).

** Experimentalist, D.P.I. P0 Box 105. Innisfail, Queensland 4860.

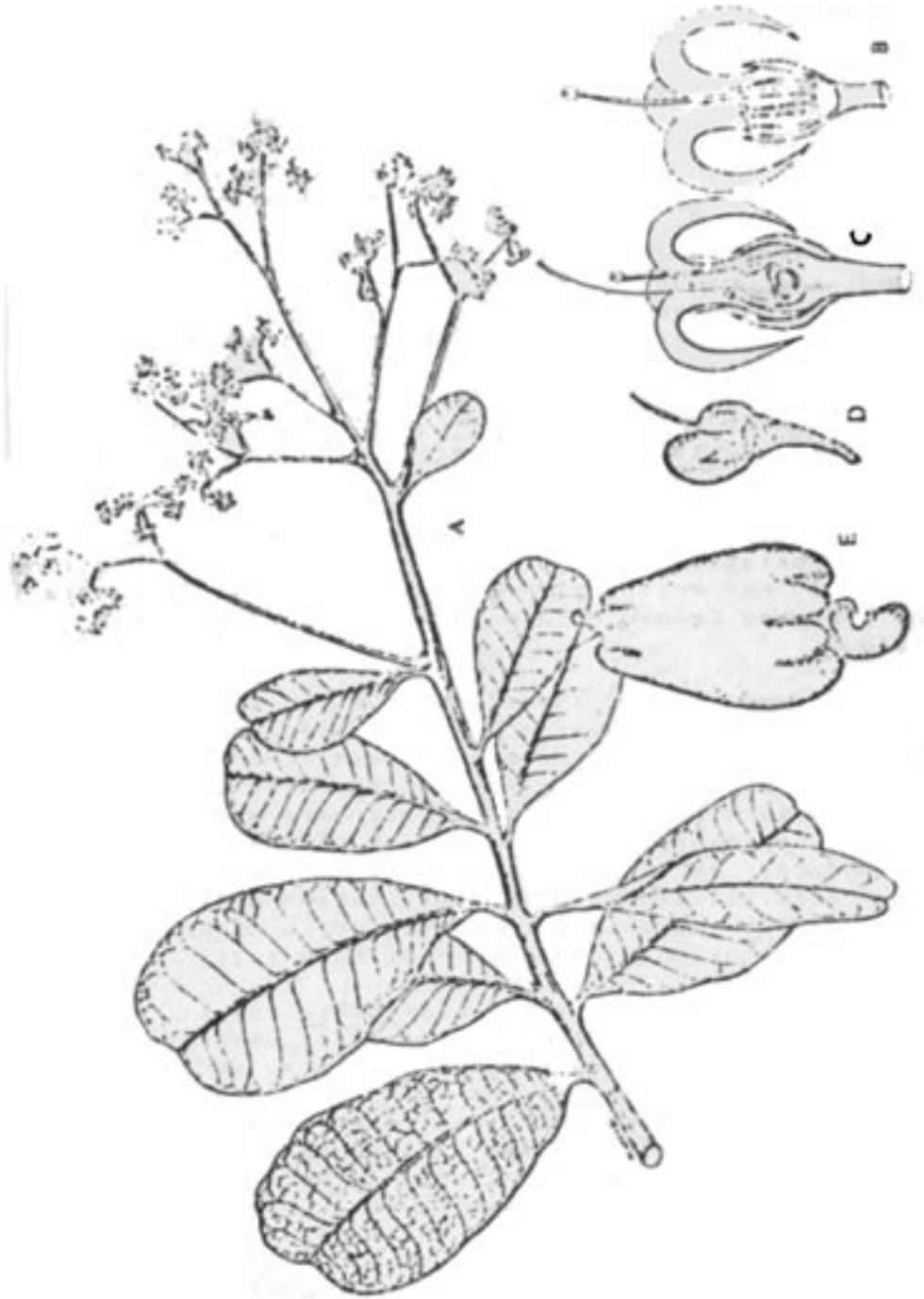


Fig. 1. Parts of the cashew plant; A) Branch with flowers; B) Complete flower; C) Cross-section through flower; D) Fertilised ovary; E) Cashew apple and nut.

He also states, that the use of vegetative planting material is time and labour consuming and has been considered unsuitable for large-scale operations. However, no consideration was given to the possibility that higher yields, greater responses to rational management, and a uniform product, which could be obtained by planting early producing, high-yielding clones of good types, might pay off the higher cost of planting.

The extreme variation existing in tree populations in Tanzania, and its value as a source of material for selection work, was noted by Northwood [2]. A large recording and selection programme aimed at finding superior trees for breeding purposes is presently underway in Tanzania. Northwood [3] initiated a programme (as part of the above) to monitor yields from a number of three-year-old trees over a period of four years. and verified facts stated above.

Northwood [1], stimulated by the need to maintain types selected as superior in selection work, investigated the feasibility of vegetative propagation of Cashew by marcotting.

Madhava Rao [4] had previously recommended its use in India in establishing improved Cashew holdings. Northwood's work is described below.

Healthy, current seasons shoots about 8 to 10 inches long and about 2.5 inches in diameter were selected for layering. A ring of hard bark 1/2 inches wide was removed from the shoots, and a piece of twine tied over the cut surfaces to prevent the bark from growing back over them. The cuts were made at nodes as there was some evidence (Madhava Rao et al [5)], that earlier rooting is induced by layering at this position. Moist horticultural vermiculite was used as a rooting medium, and this was retained around the shoots by a length of 6 inch diameter, 150 gauge alkathene tubing, tied firmly at both ends.

The layers were ready for separation when roots could be seen through the alkathene from the outside. Separation of the marcots was undertaken in three stages. First a strip or bark 1/2 inch wide was removed for one-third of the distance round the shoot just below the layering position; three days later this was increased to two-thirds, and after three more days, the layers were cut from the tree and planted in pots under the shade for two to three weeks prior to planting out. Some of the leaves were removed to reduce transpiration, the exact number depending on the apparent strength of the root system.

This method proved very successful, but he suggested that it was a time consuming and expensive operation, and would be unsuitable for use on an industry basis, its use being limited to experimental studies.

Northwood observed that layers rooted much more easily on some trees than on others, but could not analyse a reason for this. Trees with a high proportion of successful layers generally matured them in a shorter period than those with a poor total performance (Trees used in his trials were all three-year-olds selected at random).

Subsequent growth or marcots produced in Northwood's work revealed the following points.

(1) They have a more spreading habit of growth than seedling trees, and will therefore need to be pruned to develop a reasonable tree shape.

(2) They tend to mature earlier than seedling trees, and fruiting took place on most of them in the first year.

Ohler [1] states that the best time for layering and inarching is the pre-flush period before flowering. The plants will then be ready for planting at the beginning of the following rainy season. He also suggests that side grafting seems to be more successful at the end of the fruiting period.

Rooting of cuttings is not always successful. Peixote [6] recommends ringing of the bark of the shoots about 40 days prior to the removal of the cutting. The shoots should be one to two years old and still be light coloured and flexible.

Several researchers [7,8.9] investigated the germination characteristics of Cashew seed as influenced by the specific gravity of the seed. Post-germination growth and yield performance was also studied in relation to this parameter.

Turner's work [7] was directed at establishing a simple method of selecting viable seed with the capacity for rapid germination. His work was stimulated by observation of poor and slow germination, and subsequent unthrifty seedling growth. Using specific gravity as the basis for grading Cashew nuts he found:~

(1) Nuts of high density germinated more quickly than nuts of lower density.

(2) Total viability was greater with grades of higher density.

(3) Very large nuts were all of relatively low density. Their viability and rate of germination was poor.

He examined Cashew nuts from low and high density classes and found that with the former, considerable air spaces existed between the seed proper and the shell, and between the two cotyledons, with nuts of high density, the air spaces were smaller. He suggested that it would be expected that nuts of very low density would have very small or defective kernels and would germinate poorly.

All of the very large nuts in the sample fell into the two lowest density grades. The density grades he used were-

Less than 1.000

1.000 to 1.025

1.025 to 1.050

1.050 to 1.075

Greater than 1.075

These nuts germinated slowly and poorly. He observed that immature nuts on trees are usually larger than ripe nuts, and that during the process of ripening considerable shrinkage takes place. It was suggested that the poor performance of the very large nuts in the sample, may be the result of arrested development due to premature harvesting.

This suggestion is supported by Rao, Dasaradhi, and Rao [10], who found that nuts with immature kernels floated when placed in water, and it wasn't until completion of the development of the kernel (and the climacteric stage), the 40th day after pollination, that the nut sank. The nut experienced shrinkage after the 30th day, and gradually shrank by 10% during the adolescent and senescent stages before harvest.

Auckland [8] followed on from Turner, and found that nuts of high density grades gave better germination, and seedlings which were more vigorous, had thicker stems, were taller, and had more leaves. He also suggested that perhaps trees from high density nuts would be heavier yielding.

Northwood [9] found that high density seeds produced trees with a better initial growth rate, and a greater flower production in the first harvest year. Nut production in the first harvest year was best from the trees grown from the high density seed, and this fact was evident in the second and third harvest years. By the fourth year, recovery of seedlings from low density seed had eventuated and no real differences in yield existed.

Northwood surmised that it was the larger food reserves and (presumably) cotyledonary area of the high density seed, which gave the young trees a better start, and so were able to yield better in the early years.

Shetty and Bhatkal [11], in India, recommended the raising of seedlings in pots, followed by transplanting into the field, rather than the usual method of seeding in situ.

Seeding in situ at the beginning of the monsoon period (June-July) does not allow seedlings to derive the full benefit of favourable conditions during this period as germination and root development will have to be effected. Early seedling growth (cotyledon leaves) are frequently eaten by rodents which results in a further setback, or, more serious, death of the plant.

Pot raising of seedlings commences with sowing during early April, which allows sufficient growth to be attained before planting in June. Individual pots are used to overcome the risk of root damage during transplanting. Optimum levels of soil moisture and nutrients are provided to encourage maximum and healthy plant growth, as are plant protectants if the need arises.

The seedlings are planted intact with the pots, if the pots are of a decomposable material. Shading and staking is provided.

Northwood and Kayumbo [12] state a method similar to that of Shetty and Bhatkal is used in Tanzania. Seedlings are raised during the dry season and are planted out at the beginning of the wet season at 6 to 8 weeks of age. Better use is made of the rainfall and there is more chance of higher yields in the early life of the trees since they should be further advanced. They state that the planting of seedlings is more reliable than seed in areas where trouble is experienced with rodents.

Viswanathan [13], in Malaya, recommends a method similar to that of Shetty and Bhatkal [11].

Northwood's tabulation of yields [3], provided a poor correlation between years for yield, and he suggested that there may be a tendency for alternate bearing to occur in Cashew. Under these conditions he recommends it would be wise to record the yields of apparently superior trees for at least six years and preferably longer before using them in a breeding programme.

TRANSPLANTING

Research undertaken by Tai and Toppen in 1947, and Yazir Hassan and Madhava Rao [14]. cited by Ohler [1], suggests that seedlings grown in containers should be transplanted within a few weeks after germination when damage to the tap root can be avoided. The alternative is planting after about eight months, when the lateral root system is sufficiently developed to compensate for the effect of damage to the tap root; in this case, however, the seedlings should be cut back to between one-half and one-third of their height.

Because seedlings in containers develop less vigorously, seedbeds are preferable to containers, if the seedlings are to be transplanted after eight months.

GERMINATION

Under ideal conditions. Cashew seed will germinate approximately seven days after planting.

Shetty and Bhatkal (11] suggests placement of the seed at one inch depth in the soil with the stalk end up. They also mention a presoaking treatment prior to germination.

As noted earlier in this paper, considerable work into the relationship between the density of seed and germination performance has been undertaken.

LITERATURE CITED

1. Ohler, J.G.:- "Cashew growing". Tropical Abstracts/ 22:1-9, 1067.

2. Northwood, P.J. 'Vegetative Propagation of the cashew by the air-layering method". East Afr. Agric. For. J./ 30:35-37. 1964.

3. Northwood, P.J.:- 'Some observations on flowering and fruit-setting in the cashew". Trop. Agric., Trinidad/43:15-42, 1966.

4. Rao, V.N.M.:- "Multiplying the better-yielding cashewnut". Indian Farming/ 6(3):15-17, 1956.

5. Rao, V.N.M. & Hassan, M.V.:- "Studies on the vegetative propagation of the cashew'. Indian J. Agric. Sci. /27:453-65, 1957.

6. Peixote, A.R.:- "Caju". Serv. Inform Agric. Prod. Rur./ 13. 1960.

7. Turrer, D.J.:- Some observations on the germination and grading of cashew nuts'. East Afr. Agric. J./ 22:35-9. 1956.

8. Auckland, A.K.:- 'The influence of seed quality on the early growth of cashew". Trop. Agric., Trinidad/38:57-67, 1961.

9. Northwood, P.J.:- "The effect of specific gravity of seed on the growth and yield of cashew". East Afr. Agric. J./ 3:1:159-162, 1967.

10. Rao, C.B. et a1:- "Studies on fruit development in cashew". South Indian Hort./10:18-21, 1962.

11. Shetty, K,T. & Bhatkal, R.:- "Cashew: note on raising seedlings and plantings". Lal-Baush/ 10(3):34-35,1965.

12. Northwood, P.J. & Kayumbo, H.Y.:- "Cashew Production in Tanzania". World Crops/ 22(2):88-91. 1970.

13. Viswanathan, P.R.:- "Cashew nuts". Planter, Kuala Lumpur/ 37:543-544, 1961.

14. Hassan, M.V. & Rao, V.N.M.:- "Studies on the transplantation of seedlings of cashew". Indian J. Agric. Sci./ 27:177-84. 1957.

ASSESSING THE YIELD OF NUT AND FODDER TREES

IAN MANNERING *

Evaluation of existing nut trees in New Zealand is the primary purpose of our tree registration scheme. In the absence of long term records, the value of our current selections will depend on the accuracy of our present observations. Of all the parameters required for tree registration, yield is perhaps the most difficult to express in a comparative way.

The yield of a commercial plantation of nut trees can be expressed as: (1) weight per hectare (2) average weight per tree or (3) average weight per tree per year of age. These measures can be used to plot the performance of an economic plantation, but give no indication of the productive capacity of individual trees.

By separately weighing the total crop from individual trees, high and low producers can he identified and compared with the plantation averages given by (2) and (3). These statistics may be sufficient for documenting known--age or clonal groves, but are inapplicable when an assessment is required of isolated trees of unknown age and ancestry.

Most of the trees currently being surveyed for potential value as commercial varieties are in this second category. We cannot grade a tree for yield unless we know its age or have some measure of its physical bearing capacity or size.

Height alone is not adequate, as solitary and grouped trees differ widely in their growth form. The development of fruitful branches is an annual event and correlates to the increase in girth of the bole of the tree. The most practical estimate of bearing capacity could be a tree-cropper's version of the forester's D.B.H. (diameter at breast height).

I suggest that we record the diameter at knee height (D.K.H. if you wish) i.e. at 0.5 metres, of all trees proposed for registration. A circumference measurement in the field would suffice for later calculation to a standard index. Our comparison of yield could then take the form:

YIELD INDEX = ANNUAL CROP WEIGHT / BOLE DIAMETER

where the crop weight is measured in kilograms of inshell nuts, air dried for 14 days, and bole diameter is expressed in centimetres, at D.K.H.

---

* Member. West Australian Nutgrowing Society

Why measure D.K.H. and not D.B.H? Mary trees of interest, especially walnuts, are multistemmed with major forks below the forester's D.B.H. level. Even with grafted trees permanent scaffold branches may be established below 1.5 metres from the ground.

The factors affecting tree growth are varied, but annual diameter increments of the bole reflect the yearly growth capacity of the tree as a whole. While a yield index based on D.K.H. will enable us to assess older established trees for their merit for propagation, the same index will enable us to compare the performance of grafted trees from a given scion source.

Variations of tree growth and yield can then be related to soils and climate. Records of this nature will greatly assist future planning and evaluation of both old and new varieties.

The usefulness of any index depends on repeated observations over a period of years to allow for variation of yield due to the biennial cropping tendency of many nut types. Multi-stemmed hazel trees surrounded by a thicket of suckers cannot be measured by this index, but where the tree has been trained to a single stem minor suckering can be ignored.

****

THE MOREE PECAN VENTURE *

K. PROSSER

The Northwest slopes of New South Wales have been farmed for one hundred and twenty years. For most of this time it was rich grazing country, but today big areas have been converted to cotton. In the Moree district, until recent years. huge flocks of sheep provided the basis for rural prosperity. But where hundreds of thousands of sheep once grazed along the Gwydir River, comparatively few can be found these days. The graziers have almost disappeared, their place taken by farmers of grain and the new boom crop. cotton.

Irrigation pumps drawing water from the Copeton Dam on the Gwydir have dramatically changed the rural lifestyle of this region. But there is one property where the water is used for the farming project which was for years regarded around Moree as the craziest rural enterprises the locals had ever heard of - PECAN NUTS.

In the entire history of this part of Australia, trees have never grown so thickly or so productively as they do today on Trawalla Station, 37 km East of Moree, and nowhere else in Australia are there as many Pecan trees as on Trawalla.

Trawalla is now a showplace, tourist buses bring curious visitors from all over the country and there's a steady procession of farmers through the gates to look at a project which staggers their imagination. No one calls it crazy any more, instead they talk about the enterprise and determination that brought it about.

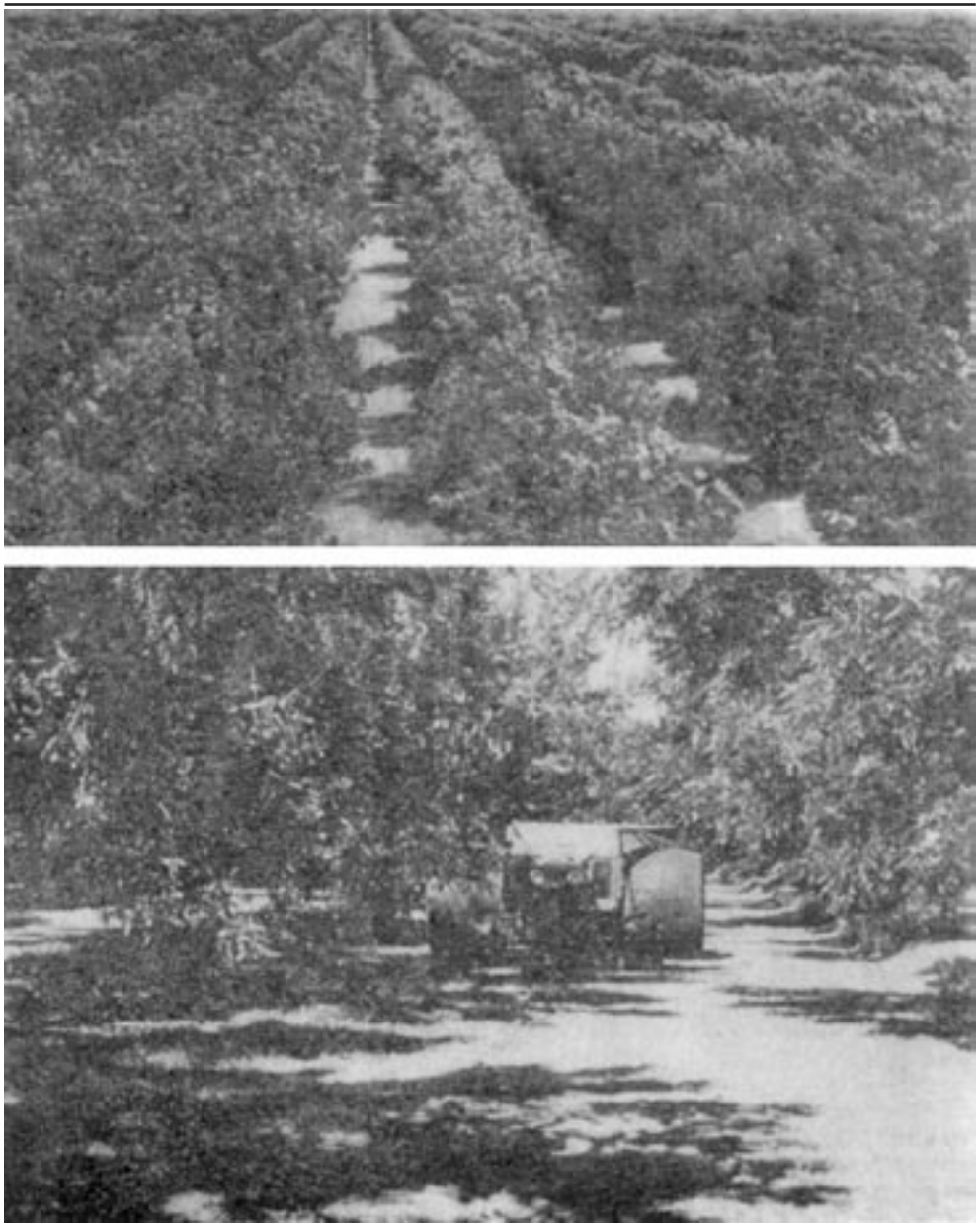
Twelve years ago this was little more than a tract of dry scrub country running a few sheep. Today there are more than 70,000 Pecan trees growing on a property of 750 ha, and the nuts now coming off the tree in millions are about to hit the Australian market.

From the air Trawalla looks like the proverbial oasis in a harsh land. While surrounding country was baked brown by a drought earlier this year, the Pecan plantation stood out. lush and green.

The mathematical precision that dictated the layout of the plantation had its origin in the American state of New Mexico, one of the first irrigated Pecan areas of the United States. The story of the success of Trawalla is the typical story of American knowhow and big thinking. The money behind this is American. and the machinery, too. is developed overseas.

---

* Based on an ABC Television program screened on "Weekend Magazine" in 1979 and 1980, and on material supplied by Neville Shorter of the W.A. Department of Agriculture.



Top: The landscape of pecans (from the cleaning tower).

Bottom: Sod cover is mown every two weeks.

One machine is used only for cutting grass along the irrigation canals, so that water flows freely. It's typical of the attention to detail that marks the entire Project.

All year round the custom made grass mowers rear up and down the rows of trees, keeping the grounds as neat and trim as a suburban lawn. All the machines have huge balloon tyres, to avoid compacting the soil.

This ensures maximum flow of irrigation water to the trees, and reduces water loss to growing grass. The drivers travel in air-conditioned cabins.

Behind the project is the Stahmann family, Americans who have been growing Pecans in Texas and New Mexico for almost 50 years. Their American plantations produce almost 4 million kg of nuts per year. Total American production of Pecans is now running at the rate of about 125 million kg/yr.

The nut is an all-American favourite and now the Stahmanns hope to make it as popular among Australians as the peanut.

All the trees on the plantation were initially grown from nuts brought in from America. But onto half the seedlings were grafted buds from Pecan trees found near Bundaburg in Queensland. They had been brought in from America at the turn of the century and have adapted well to Australian conditions.

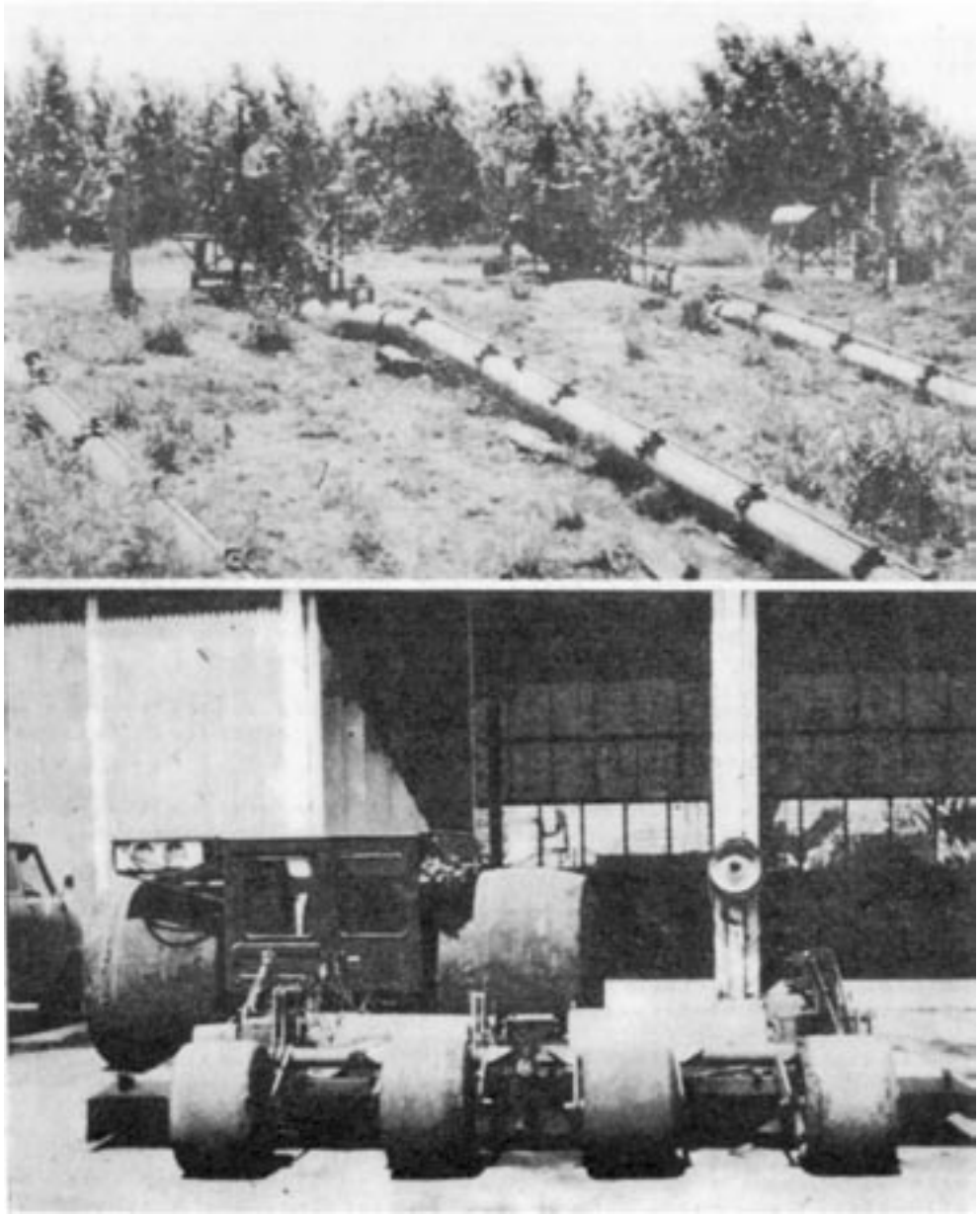
The grafting of buds of new and improved varieties onto well-established trees is a continuous and essential feature of plantation management.

Apart from the enormous investment in preparing the land for irrigation and developing the 70,000 trees, the plantation uses machines seldom seen on Australian properties.

An essential item is a big mobile hydraulic lift which enables pruning staff to reach the highest branches. Pruning helps to develop a tree with a strong central trunk carrying natural branches properly angled to hold a heavy load of nuts and withstand high winds without breaking.

Establishing a Pecan plantation as huge as this demands endurance and a lot of money. American Dean Stahmann has both.

He lives with his family in Toowoomba in Queensland, and commutes to Trawalla in his own twin engine aircraft. Early each morning he's on his plantation, running around its many kilometres of road. He says the exercise, and a diet rich in Pecans keeps him fit and also enables him to monitor progress in every section of the sprawling property.



Top: Irrigation by four D 6 motors pumping 100 m litres/day.

Bottom: Machines have wide tires to reduce soil compaction.

Dean Stahmann is the son of a man recognised in America as the pioneer of renewal pruning, high density planting of pecans, and modern management practices on pecan plantations.

The Australian-grown nuts he now enjoys are the result of twelve years hard work and an investment of millions of dollars. He also had to overcome masses of local scepticism and come to terms with the fact that most Australians don't know what a pecan nut looks like. Indeed they don't even pronounce its name correctly.

Dean Stahmann: "Here they call it 'Peekan nuts', over in the States we call them 'Pecarns'. In the States Pecarns automatically includes the nuts, they don't need to add the nut to the end of the nuts."

Reporter: "What would you say?"

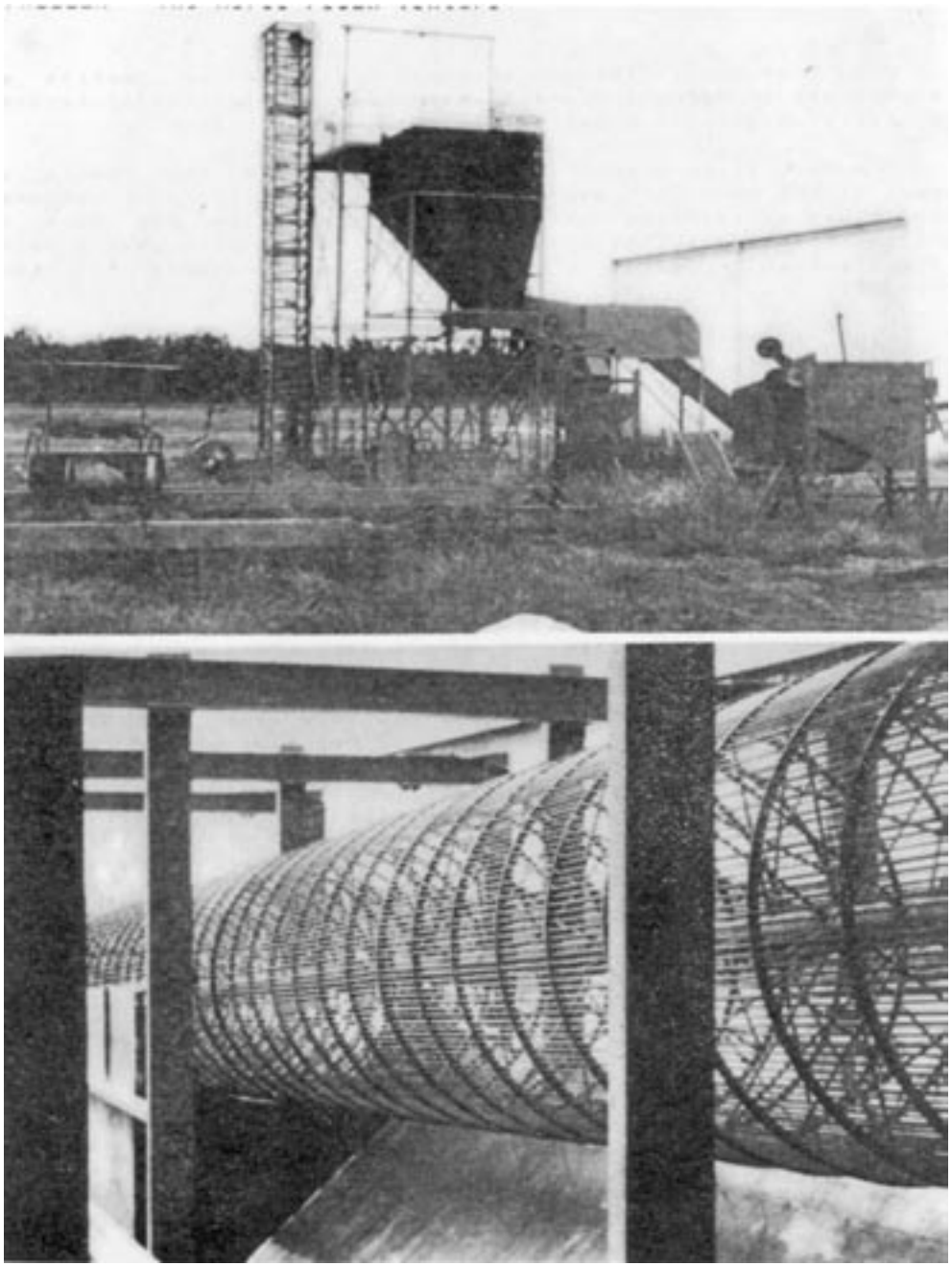
D.S. "Pecarns. OF course it doesn't really matter whether we call them Pecan nuts or Pecarns as long as people buy them, and that's what counts."

Stahmann had to personally train all his staff in the pioneering days of Trawalla, but there were other problems in developing a plantation that he hadn't anticipated.

D.S. "One of them was floods. We had about four or five big floods here since we got here and I've never had any floods in my life till I got to this country. One time we had a flood down there when we had our third nursery, the flood came along and knocked over all the trees, covering them with dirt. We got about 20 men and went out there and stood 'em all up about a day after the flood went down and I went home and prayed for about 30-40 points of rain in order to wash the mud off, and darned if we didn't get another flood. We had to go out about a week later and do the same thing over again. It almost broke every back on the place.

"And then we had trouble with these cockatoos coming in a little bit early and trying to take the nut off the tree before it was ripe, and crows also liked the nuts, but we had the same trouble in the States and used an airplane over there to chase them off. So we bought a little Piper Cub and put the Piper Cub over here on the place and let it establish its territory and now we don't have any bird problems. The birds know where the Piper Cub is supposed to be and they know where they are supposed to be and we have no more troubles."

Dean Stahmann has behind him the financial resources and expertise of the family's American plantation. The Stahmanns were originally cotton farmers in the deep south before deciding to grow pecans in the early 1930's. The change-over was initiated by a grandmotherly whim.



Top: Small scale dehusking and cleaning plant.

Bottom: Dehusking and cleaning for full scale.

D.S. "My grandmother liked Pecarns, we were in the cotton farming business and she seemed to think we ought to have another crop so she pushed these Pecarns. and finally in about 1933-34 my daddy decided to go ahead and try."

Rep. "And they took over the cotton?"

D.S. "And they took over the cotton and shaded it out."

Rep. "When you came to this district and bought this property a lot of the farmers in the area thought you were mad."

D.S. "I probably was."

Rep. "But do you believe so today?"

DS. "No. I think we've got a good situation here and these trees have found a home that they like."

BY May each year the plantation has lost its green summer lushness and the colour tones of Autumn leaves signal the approach off harvest time.

The timing of the harvest was significant in the decision to establish the Australian Branch of the Stahmanns' Pecan empire. The family reasoned that by growing Pecans in the southern hemisphere, they would have fresh nuts for the American Christmas market when all the American trees were dormant.

The nuts are ready for harvest when the fibrous outer husks have dried and peeled back. The Pecan belongs to the walnut family, and is native to North America. The trees sometimes reach a height of 50 m and live to a great age. It is claimed there are Pecan trees in America 600 yrs old.

The Pecan has always been a popular food with the American Indians and until recent times whole tribe, would migrate to areas of wild pecan trees to live for months on a basic diet of Pecans.

Harvesting of Pecans at Trawalla means setting into motion dozens of strange looking machines. including one which grabs the tree and gives it a good shake. The ripe nuts fall to the ground.

The tree shaker is another American idea, but it requires fine judgement by the driver. Too rough a shaking could cause branches to break, not enough shaking and too many nuts stay on the tree. Revolving brooms behind and in front of all wheels sweep fallen nuts out of the way so they won't be damaged. It takes nine years for a Pecan tree to bear fruit. Half the plantation began yielding three years ago, and this year was the first time that all 70,000 trees had been harvested. They yielded more than 1 million kg of nuts in shell and every nut was taken from tree to factory without being touched by hand, swept up by discriminatory machines that reject most of the leaves and sticks, but don't miss a nut.

Two varieties of Pecan grow at Trawalla - Western Schley and Wichita. These are grafted onto seedlings of the variety Riverside. The trees are planted in alternate rows, and as they mature within a few weeks of each other, this enables harvesting to be spread out. During the harvest there's a constant procession of loaded bins to the tower at the processing plant.

From the top or the tower the nuts gravitate through a series of revolving sieves which remove residue rubbish.

In the processing plant sorters pick out the broken nuts just before they reach the drying shed. The broken nuts are fed to cattle in pens on a nearby property and manure from the feed lot is used for fertilizing the plantation.

It will take another eight years to reach full production of about 2 million kg of nuts annually, At the moment most of the nuts are shipped to America for shelling, but a $2M shelling plant will be built in Australia for future crops. Current production is packed in Queensland.

Individual yields for the 9-year old trees. planted about 10 m x 10 m apart, are around 20 kg/year. These yields should eventually double as the trees mature.

The plantation lies in deep fertile soils of the 'Darling Downs' type, naturally rich in phosphate. Nitrogen fertilizer is applied regularly. Zinc, an essential trace element for Pecans, is supplied by 8 foliar sprays each year.

Because of their extraordinary high food value, Pecans were the only fresh food taken to the moon by American spacemen, and in Australia too, according to the Stahmanns, the sky is the limit for pecans.

FURTHER READING

I. Gillin, E.F.: "A large commercial Pecan Planting in New South Wales". WANS Yearbook/2 : 71-78, 1976.

ADDRESS BOOK -- USEFUL ORGANIZATIONS

This list of useful addresses will be reprinted each year in the Yearbook. It Includes Societies. Associations, and Government or Quasi-government departments. Please notify the Editor of errors or omissions.

The next Yearbook will also include a separate list of Nurseries, Seed Suppliers, and other relevant commercial organizations. Please send information on this to the Editor.

Australia: CSIR0 Division of Horticultural Research, GPO Box 350 Adelaide SA 5001

Australia: CSIR0 Horticultural Research Station, Merbein, Victoria 3505, Australia

Australia: Rare Fruit Council of Australia. P0 Box 707, Cairns, Oueensland 4870, Australia

Australia: Society For Growing Australian Plants, 860 Henry Lawson Drive. Picnic Point, NSW 2213

Australian Macadamia Society, P0 Box 445. Caboolture. QLD 4510

California Macadamia Society, P0 Box 666. Fallbrook, California 92028. USA

California Rare Fruit Growers, Fullerton Arboretum. California State University, Fullerton. California 92634. USA

Connecticut Nut Growers Association. 27 Baldwin Rd, Manchester, Connecticut 06040. USA

Costa Rica: Institute Interamericano do Ciencias Agricolas de la DEA (P.G.Sylvain). Turrialba. Costa Rica

Illinois Nut Tree Association. 1498 Urbandale Dr., Florisant, Missouri 63031. USA

Indiana Nut Growers Association (Merna Dicoff), 9805 E.100 St., Zionsville, Indiana 46077 USA

International Association for Education. Development, and Distribution of Lesser Known Food Plants and Trees. P0 Box 599, Lynwood, California 90262. USA

Iowa Nut Growers Association, Stewart Road, RR 6. Iowa City Iowa 52240, USA

Israel Department of Subtropical Horticulture, Volcani Centre, PO Box 6. Bet Dagan, Israel

Korea: Institute of Forest Genetics, Seuna Kul Park. Swan. Kyunssi-Do, Korea

Michigan Nut Growers Association, 199 Strongwood. Battle Creek, Michigan 49017, USA

Nebraska Nut Growers Association, 207B Miller Hall 8N. University of Nebraska, Lincoln, NE 68583. USA

New South Wales: Department of Agriculture, 157 Liverpool St, Sydney NSW 2000

New Zealand Tree Crops Association. PO Box 1542. Hamilton, New Zealand

North American Fruit Explorers (Ray K Walker), P0 Box 711. St Louis. Mo. 63188. USA

Northern Territory: Department of Northern Australia. Animal Industry & Agriculture Branch, PO Box 146. Katherine NT 5780

Northwest: CSIRO Division of Tropical Crops & Pastures. Kimberley Research Station, Kununnura WA, 6743

Ohio Nut Growers Association, 1807 Lindbergh NE. Massillon. Ohio 44646, USA

Ontario : Society of Ontario Nut Growers (R.D.Campbell), RR 1. Niagara-on-the-Lake, Ontario L0S 1J0, Canada

Oregon: Nut Growers Association of Oregon, Washington, and British Columbia, P0 Box 23126, Tigard. Oregon 97223. USA

Pennsylvania Nut Growers Association (Albert Magee). RR 3: Box 78, Duncannon, PA 17020, USA

Queensland: Department of Primary Industry, William St. Brisbane QLD 4000

South Australia: Department of Agriculture and Fisheries. 25 Grenfell St. Adelaide SA 5000

Spain: Centro De Experimentia Agraria, Apartado 415, REUS, Tarragona, Spain

Tasmania Department of Agriculture. GPO Box 192B, Hobart. TAS 7001

USA: Agri-Silviculture Institute, P0 Box 4166, Palm Springs, California 92263 USA

USA: Friends of the Trees Association. P0 Box 587. Moyle Springs, Idaho 83945, USA

USA: International Tree Crops Institute USA Inc.. Route 1, Gravel Switch, Kentucky 40328, USA

USA: International Tree Crops Institute USA Inc., P0 Box 1272, Winters, California 96594, USA

USA: Northern Nut Growers Association, RR 3. Bloomington, Illinois 61701, USA

USA: People of the Trees, 1102 Snyder, Davis. California 95616. USA

USA: Rare Fruit Council International, 3280 South Miami Avenue, Miami, Florida 33129. USA

USA: Tree Crops Research Project, 230 East Roberts, Cornell University, Ithaca, New York 14853. USA

United States Pecan & Field Station, USDA-ARS. P0 Box 579, Brownwood, Texas 76801, USA

Venezuela: Fundacion para el Desarrollo de la Region Centro Occidental de Venezuela, Apartado 523. Borquisimeto, Venezuela

Victoria: Department of Agriculture, Scoresby Horticultural Research Station, P0 Box 174, Ferntree Gully, VIC 3156

Victorian Nut Growers Association (A.D. Allen), P0 Box 69, Wangaratta, VIC 3677

West Australian Nutgrowing Society, P0 Box 27, Subiaco. WA 6008, Australia

Western Australia: Department of Agriculture, Jarrah Rd. South Perth WA 6151

Western Australia: Permaculture Association of W.A., P0 Box 430, Subiaco. WA 6009

****

MEMBERSHIP REGISTER - 1980

This year the membership list is presented in alphabetical order. If you want to look up a member by his address, consult the 1976 membership list, which is in postcode order.

389 Mr A Abbot P0 Box 170 Collie 6225

138 Accessions ISSN 0312-8989 State Library 102 Beaufort St, Perth 6000

718 P Adam; 3 Elizabeth Cres Bunbury 6230

487 R M Adams P0 Box 19 Boronia Vic. 3155

788 Mr W J Aitken 6 Wroxton St Midland 6056

763 G Ajani 23 Hawthorn Rd Kilsyth VIC 3137

794 Z Al-Barazi MCR Wye College Wye near Ashford Kent U.K.

733 M R Albany 6 Etna Place Rossmoyne 6155

412 Mr A A Albuquerque 64 Victoria Ave Claremont 6010

629 G Aldridge 40 Mackie St Victoria Park 6100

317 Mr A D Allen Hortic. Adviser PO Box 69 Wangaratta Vic 3677

39 Mrs J Ambrose Post Office Denmark 6333

810 P Anderson 116 Holland St Fremantle 15160

809 W L Andrew 14 Lyons St Cot.tesloe 6011

744 P C Annison 106 Third Ave Mt Lawle 6050

377 Mr T D Anthoine RMB 217A Mandurah Rd Medina 6167

50 Mr R Armfield P0 Box 145 Wanneroo 6065

739 R K Ashon 115 Victoria Ave Chatswood NSW 2067

26 Mr D E Bailey 58 Lyons St Cottesloe 6011

787 C Bailey of Baileville 15 Dutton St Bankstown NSW 2200

201 Mr L A Balmer Rock Lyn Maldon Vic. 3463

841 D Barker Beyond the Black Stump RMB 412 Gidgegannup 6555

351 G Barnard Jandakot Field Nursery 15 Muriel Rd Jandakot 6164

118 Mrs J Barrett RMB 399 Jingalup 6395

383 Mrs D M Barrett-Lennard Woonderlin Beverley 6304

547 L & A Bazzani RMB 44 West Manjimup 6258

198 Bbidecud Pastoral Co Boyannup 6237

374 Mr L K Beeck PO Box 176 Katanning 6317

10 Mr P Bell P0 Box 43 Harvey 6220

578 K J Bellairs RMB 2428 Margaret River 6285

42 Mr J G Bennett 30 Hobbs Ave Dalkeith 6009

713 C Bennett 5 Carew St Dee Why NSW 2099

803 H Bernard P0 Box 425 Youville Stn, Montreal Quebec H2P2V6 Canada CAN

762 F & J Berteaux RMB 964 Mount Barker 6324

271 Mr F W Betts 10 Morago Cres Cloverdale 6105

755 J Betts Address unknown
695 D & R Bicknell RMB 13 Manjimup 6258
450 Biol Abstracts Service, 2100 Arch St Philadelphia Pa. 19103 USA
747 P W Bird 14 East St Guildford 6055
354 Mr J Blacklock 11 Moat St Mandurah 6210
332 Mrs E Blair 61 Helena St Guildford 6053
648 P Bloomer RSM 463 Busselton 6280
817 IN Bragg 698 Yambla Ave Albury NSW 2640
732 P Bridgewater 17 Third St Bicton 6157
793 M Briley 10 High St South Perth 6151
420 Mr P F Brinsden 89 Victoria Ave Nedlands 6009
343 D H Brown 61 Charles St Northam 6401
385 M Brown 145 Barker Rd Subiaco 6008
772 D Bruce 4 Powell St Magill SA 5072
813 R Bruce P0 Box 49 Nannup 6275
568 M Bruekers 127 Glen Rd Lesmurdie 6076
386 A V Bryant P0 Box 98 Gosnells 6110
256 Mr R M Buehrig Scarp Road North Dandalup 6207
616 R F & J R Bunney PO Box 1418 Geraldton 6530
767 E C Burt 30 James St Kingaroy QLD 4610
278 Mr D Burtenshaw 169 Taylor St Dumbleyung 6350
608 N J Buters 12 Westfield St Maddington 6109
1571 Mrs M A Butler PO Box 23 Bruce Rock 6418
819 J A Byatt 8 Edgefield Way North Beach 6020
104 Mr P J Byles 644 Pilkena St Tom Price 6751
337 CWA Bodallin Branch 1 Bodallin 6424
234 L Campbell P0 Box 23 Bell Qld 4408
734 M Cann 14 Hume Rd Thornlie 6108
635 R F Cantley P0 Box 232 Denmark 6333
769 L R Capill 125 Kalamunda Rd Kalamunda 6076
542 Mr N V Carew-Hopkins Broadview Bodallin 6424
416 R D Carter O'Brien Rd Gidgegannup 6555
510 Dr G Cartmel 666 Beach Rd Hamersley 6022
731 Central Library CSIRO 314 Albert St East Melbourne VIC 3002
720 Central Library Dept Agriculture 3 Treasury Pl Melbourne VIC 3002
746 C & P Chapelle PO Box 58 Denmark 6333
34 Dr W N Chin 1027 Nepean Highway Moorabbin Vic. 3189
98 Mr W R Chislett PO Box 743 Orange NSW 2800
277 Mr K E Clarke 126 Connell Ave Gosnells 6110
166 Mrs E Clements 7 Warton St Mosman Park 6012

418 H L Clifford Pearce's Creek Road, Alstonville NSW 2477
339 W M Clough 93 Stanley St Nedlands 6009
735 J S Cockerill 61 Westmacott St Esperance 6450
677 P A Cogan 155 Bridge St Port Melbourne VIC 3207
674 L L Collar P0 Box 40 Telfer 6762
402 Mr N C Collins Cudlee Creek SA 5232
825 N P Collins Forestell Pine Farms Ltd PO Box 92 Balwyn VIC 3103
258 Mr B P Connell 111 Marmion St Kelmscott 6111
330 Mr C Cook 'Kyno' Dandaragan 6507
258 Mr B R Connell 111 Marmion St Kelmscott 6111
330 Mr C Cook 'Kyno' Dandaragan 6507
682 G Cook 3 Lilika Rd City Beach 6015
499 Mrs V Cooper 44 Kennard St Kensington 6151
195 Mr W R Cooper PO Box 116 Broome 6725
654 D B Cortis Vet. Studies Murdoch University Murdoch 6153
7 Mrs L Cox PO Box 274 Bunbury 6230
627 D L Crawford CMV Group (Asric Div) GPO Box 2238 Adelaide SA 5001
482 A W Crompton PO Box 5 Mt Barker SA 5251
603 G M Crook 9 Dixon St Kardinya 6163
6 Mr E Czechowski PO Box 1097 Darwin NT 5794
463 Mr J C Daley 2 Peace St Glen Iris SA 3146
479 E J Dalrymple Gobur via Yarck Vic 3719
839 Mrs 14 Damen Lot 188A Albany Hwy Armadale 6112
689 Mrs F Davey 133 Gooseberry Hill Rd Gooseberry Hill 6076
9 Mrs G Davies 26 Crowtherton St Geraldton 6530
63 Mr I Davies Post Office Babakin 6377
409 Mr G Dawson 49 Livingstone St East Coburg Vic 3058
692 H P De Vries Olympic Ave Mt Clear Ballarat VIC 3350
716 N Delamare 22 Aberdare Rd Shenton Park 6000
636 W & V R Den Engelsen EMR Esperance 6450
494 B J Denney 67 Duchess St Busselton 6280
33 Mr B G Dent Underwood Tasmania 7254
139 Deposit Sectn National Library Canberra ACT 2600
593 Dr S P Derham 12 Altona St West Perth 6005
784 Mr C Dimase 78 Commercial St Merbein VIC 3505
297 Mr I Downie Lot 198 Sexton Rd Mt Helena 6555
588 R Downie PO Box 160 Koorda 6475
631 Ms L Dyke Post Office Jerramungup 6337
209 Mr R B Eardley Carbunup River 6282
71 Mr K Edel Kalamunda Senior High School, Kalamunda 6076

220 Mr C S Edwards 87 Gloster St Subiaco 6008
205 Mr P Enever 20 Burt St Boulder 6432
630 N & N Epis Nyamba Stud Kojunup 6395
702 E J Ey 5 Hamilton Ave Pt Lincoln SA 5606
736 Ferret Cycle Co PO Box 229 Victor Harbour SA 5211
651 Dr I Fett Richardson Hall Monash University Clayton VIC 3168
837 W & J Fey P0 Box 213 Tolga OLD 4882
410 Mr G Finch PO Box 5 Forest Grove 6287
653 J Fleming Jarrahdale Rd Mundijong 6020
371 Mr N Fontanini RMB 313 Manjimup 6258
311 D Forbes-Wilson PO Box 1 Cabarita via Mildura Vic 3505
130 Mrs N F Foulkes-Taylor Attunga Bindoon 6502
298 Mr M J Francis 'Merrie-Lea' Mogumber 6506
170 Mr J E Franklin 16 Goode St Port Hedland 6721
444 W Funk Mt View Dunkeld Vic 3294
655 K L Gallaher 387 Turner Way Karratha 6714
575 N W Gamble 54 Martin St Heidelberg Vic 3084
580 P Garbin PO Box 50 Muntadgin 6420
366 R D Garcia 7 Ruby St Bassendean 6054
300 Mr S G Garrod 34 Karel Ave Willeton 6155
745 W W Geddes 15A Fourth Ave Maylands 6051
679 G H & Genders RMB 9030 Sth Coast Highway Albany 6330
628 L F Gibbney 22 Hindmarsh Ave Yokine 6060
476 L & M S Gillam RMB 209B Margaret River 6285
289 Mr J Gilmour 14 Edward St Bunbury 6230
19 Mr C J Glands Post Office Mundijong 6202
24 Mr P Good 8 Norman St Wembley Downs 6019
454 'Goodness Gracious' PO Box 222 Denmark 6333
447 Mrs L Gow Darwinia Pl Greenwood 6155
222 Mr W T Grady 'Greenslopes' O'Grady's Ridge Rd Foster Nth, Vic 3960
318 R Gray La Mancha 9 Pacific Highway Berowra NSW 2081
400 D J Grealy 4 Coral St Gosnells 6110
750 E D Green 2 Cornwall St Swanbourne 6012
668 J Griffiths Treeton Organlc Farm Post Office Cowaramup 6284
368 Mr J A Gurney Lot 6 Stoneville Rd Mundaring 6073
656 Dr T B Hall 44 Cooper St Cootamundra NSW 2590
30 Mr G R Hambleton RR 2 Niagara-0n-The-Lake Ontario L0S 1J0 Canada
188 Mr A D Hamersley 'Haseley' Toodyay 6566
626 I Hamilton 11 Gill St East Fremantle 6158

812 D Hanna P0 Box 1491 Neutral Bay NSW 2089
827 S Hansen 137 Duffy Ave Westleigh NSW 2120
753 E S Hansen Lot 257 Rose St Upper Swan 6056
560 M Harding & D. Foreman Post Office Jailem Bend SA 5260
155 Mr A Hardy PO Margaret River 6285
691 Mr R P Harrington P0 Box 124 Armadale 6112
696 Mr C Harrison 49 Edinbridge St Kenwick 6107
197 Mr L Hart 1 Molloy St Augusta 6290
574 R Hart 18 Violet Grove Shenton Park 6008
826 A J Harvey "Gilgai" Bonalbo NSW 2740
399 Mr J Harvey PO Box 21 Golden Grove SA 5125
239 Mr D A Harvey RMB 87 Donnelly Mail Service Manjimup 6258
287 Mr T Hawthorne 8 Bretby Close Carine 6020
680 Mr M J Haxell @ RAAF Base Fairbairn ACT 2600
670 B Hayne Tilsmore Lodge Kilburn Rd Parkerville 6553
299 Mr R P Herrman Lot 29 Allpike Rd Darlington 6070
544 Mrs W Heys PO Box 805 Orange NSW 2800
161 Mr L Higgins 'Rhonda Park' PS 1637 Jimboomba Qld 4200
363 D Hill Lot 149 Bailey Rd Glen Forrest 6071
808 P N Hill PO Box 81 Bundanoon NSW 2578
759 J M Hillier 1A Windarra Ave Burnside SA 5066
415 J T Hillis Lot 6 Helena Valley Rd Helena Valley 6056
315 Mr R Hilton 62 Vicwway Nedlands 6009
175 Mr L C Hodge 118 Preston Point Road East Fremantle 6158
304 Mr F J Holman 82 Rupert St Subiaco 6008
493 Hortico Ltd 10 Raymond Rd Laverton North Vic. 3026
227 Mr P Houlahan PO Box 140 Wanneroo 6065
521 H F Howell Officers Mess RAAF Base Fairburn ACT 2600
563 G & L Hubbard Darlaston Grange Burkes Flat Bealiba Vic 3475
699 M J Hudson 44 Grant St Cottesloe 6011
515 M Hudson 96 McKenzie St Wembley 6014
328 J T Hughes 16 Central Rd Rossmoyne 6155
799 Illinois Nut Tree Association 1498 Urbandale Dr Florissant MO 63031 USA
806 International Tree Crops Institute Route 1, Gravel Switch KY 40328 USA
836 D Inverarity Agery RMD Kadina Sa 5554
805 Iowa Nut Growers Dept Agriculture Wallace Bldg. Des Moines Iowa 50319 USA
555 B Jack 29 Morgan St Shenton Park 6008
671 V Jackon Outreach Centre Kress Rd-MSF624 Gympie Qld 4570
660 P F Jacobsen 8 Broome St Nedlands 6009

134 Mrs M James 12 Mattram St Manjimup 6258
821 Mrs J James 26 Albert St Claremont 6010
686 I James 79 Derby Rd Shenton Park 6008
652 R & S Jemerson Post Office Clackline 6564
586 A Jenkins Papunya Alice Springs NT 5750
61 Mr P Jennings 14 Stone Court Kardinya 6163
661 R D Johnson 13 Cuthbert St Shenton Park 6008
780 V Johnston 1 Graelou St Lesmurdie 6076
566 B E Jones 14 James St Shenton Park 6008
766 G J Jones Address unknown
706 Mr C W Jones PO Box 24 Wiluna 6646
352 Mr D L Jones PO Box 261 Palm Beach Qld 4221
145 Mr A B Joyce PO Box 350 New Norfolk Tas 7450
470 Mr R Judd 12 Robyn St Morley 6062
684 T Judge @ 26 Alexander Cres Bayview NSW 2720
703 A C Kalotas PO Box 213A Alice Springs NT 5750
701 Mrs E Kammerman PO Box 26 Minnipa SA 5654
752 N Kell 'Kia Ora' Lacmalac Tumut NSW 2720
776 Dr R E Kemm Physiology Dept Melbourne University Parkville VIC 3052
545 Mr J Kenworthy 3 Kirkham St Pinjarra 6208
646 A W Kerr PO Box 730 Albany 6330
600 D Keynes 21 Prince St Busselton 6280
640 S Knorles PO Box 443 Armidale NSW 2350
171 Mr H E Knox PO Box 424 Subiaco 6008
754 S Korecki 4 Onslow St South Perth 6151
664 P Korsten 25 Madeline St Glen Waverly VIC 3150
376 Mrs K L Kowald Canna 6622
384 Kroy Investments Ltd 185 York St Subiaco 6008
789 Lakkari Native Plant Nursery 477 Redland Bay Rd Capalaba QLD 4157
25 Mr R A Lancaster 13 Rome Rd Melville 6156
584 J M & E J Laszlo 2 Spowers Circuit Holder ACT 2611
609 K Lavery 18 Waterloo St Camberwell VIC 3124
224 T N Lawrance 7 Brolga Promenade Willeton 6155
621 R A Lawson 1 Wharf St Brisbane Qld 4000
741 B Lebbins Post Office Wokalup 6221
643 J Leggat 70 Lionel Rd Darlington 6070
319 Mrs M Lehmann 53 Spencer St Bunbury 6230
714 W Lehre 23 Elfreda Ave Sorrento 6020
142 Mr G C Leigh 457 Great Eastern Highway Greenmount 6056
625 Lenzo Bros Lot 39 Pinjar Rd Wanneroo 6069

797 Mrs S Lethbridge 7 Maritime Ave Kardinya 6163
535 I R & M A Lewis Gunyulara Farm Carbanup River 6282
458 Librarian ARS Scoresby PO Box 174 Ferntree Gully Vic 3156
375 Librarian Botanic Gardens North Terrace Adelaide SA 5000
795 Librarian Dept of Agriculture Jarrah Rd South Perth 6151
796 Librarian Dept of Agriculture PO Box K220 Haymarket NSW 2000
16 Librarian Public Library Cathedral Ave Geraldton 6530
798 Librarian Queensland Agricultural College Lawes QLD 4345
650 Librarian Roseworthy Agric. College Roseworthy SA 5371
681 Librarian Subiaco City Library Bagot & Rokeby Rds Subiaco 6008
218 Librarian WES 60500 CSIRO Hortic Research Merbein Vic 3505
648 D & H Lindsay Smith 183 Glendower St Parkerville 6553
783 M Linehan @ 31 Hampden Rd Nedlands 6009
472 Mr R Little Lot 93 Allison Rd Mount Helena 6555
346 D C Livermore Phillip Rd Avonsleigh Vic 3159
822 A C Lobo 19 Parkway Rd Bibra Lake 6163
791 N Lycos Lot 71 Wattagan Rd Wattagan NSW 2550
113 Mr T J Lynn-Robinson 1 Alice Drive Mullaloo 6025
370 Mr R MacDougall Fernlea Rd Denmark 6333
680 B E MacPherson "Kilbeg" Baerami Creek NSW 2333
727 Mr S Macey 'Nereman' Towamba Bega NSW 2550
290 Mr R Magnus Waltons Rd Ranelagh TAS 7108
212 Mr C S Maloney Watervale South Australia 5452
742 I & RA Mannering RD1 Kaikoura New Zealand N.Z.
422 P F Margetic PO Box 29 Geraldton 6530
462 Mr G Martin Belay Farm Walkaway 6528
467 G R Mason Lot 316 Bernard St Mt Helena 6555
186 Mrs A J Matulich 50 Cleveland St Dianella 6062
843 D McClure Self-Reliance Seed Co PO Box 96 Stanley TAS 7331
637 C J McDermott Post Office Yallingup 6282
715 A J McConald "Kaleno" Cobar NSW 2835
786 Mr P McFadden 174 Forrest Rd Hamilton Hill 6163
391 H McNally 80 Falls Rd Lesmurdie 6076
473 B A McNamara 9 Central Rd Rossmoyne 6155
645 T G McQueen 'Braemar' Girgarre Vic 3624
748 Mrs J M Mell PO Box 83 Brunswick Junction 6224
27 Mr J Mercer 45 Bridgewater Drive Kallaroo 6025
484 L J Messenger PO Box 72 Brookton 6306
518 B & J Middleton 33 Searle Rd Ardross 6153
68 Mr Z Mielens Giblett St Bridgetown 6255

539 Mrs G R Miller 2 York St Sandy Bay Tas 7005
345 D C Minnis PO Box 174 Ferntree Gully Vic 3156
191 Mr M Mirkovic PO Box 69 West Perth 6005
730 K & R Moller MS 221 Maryborough QLD 4650
326 K Monney Lot 135 Alice Rd Mt Helena 6555
606 A R Morcom PO Box 179 Keith SA 5267
505 P A Morey 8 Cudliss St Eaton 6232
835 A P Morris PO Box 28 Dongara 6525
511 C S & J M Morrison RMB 351 Bridgetown 6255
704 M F Morrow 75 Oswald Crt Portland VIC 3305
284 Mrs M R Morton 3 Claud St Katanning 6317
404 H M Morrissey Thundelarra Station Wubin 6612
460 Mr D Mossenson 24 Carnarvon Cres Coolbinia 6050
349 Mrs A Mueller 7 Hamer Ave Wembley Downs 6019
834 G Murray @ Bowie Wilson & Co 1 York St Sydney NSW 2000
380 W Napier 86 Heath Rd Kalamunda 6076
802 Nebraska Nut Tree Growers Assoc PO Box 4486 Lincoln Nebraska 68504 USA
590 E & N Neuman PO Box 289 Geraldton 6530
816 Niwen (B J Milan & K Wenman) PO Box 181 Broome 6725
1 Mr D G Noel PO Box 27 Subiaco 6008
663 P S Nolan Post Office Jabiru East NT 5796
583 J & M Nugent PO Box 10 Nannup 6275
751 Nutland Nursery Lot 6 Carabooda Rd Wanneroo 6065
466 T C O'Neill 42 Lawley St North Beach 6020
710 W O'Rafferty Post Office Balingup 6253
357 Officer in Charge Dept. Agric. Research Centre Lenswood SA 5240
14 Mr A C Orton 210 Mandurah Rd Baldivis 6167
372 G L Orton 23 Searle Rd Applecross 6153
591 C W Owen RMB 317 Kojonup 6395
665 R W Paech 208 Adelaide Rd Murray Bridge SA 5253
717 R A Palme 7 Seaborne St Parkerville 6553
347 A J Papps PO Box 149 Wagga NSW 2650
639 G Parata Resident Manager Poon Bros Shay Gap 6761
507 G J Parlevliet Dept. Agriculture Bridgetown 6255
364 J Pascoe PO Box 57 Kojonup 6395
193 Mr R Patterson Address unknown
534 R Paulin 13 Duffield St Manjimup 6258
179 Mr G Paust 15 Hawkins Rd Mount Pleasant 6153
723 J Payne Cockmannings Box 185 Denmark 6333

41 Mr A T Pearce 21 Davies Cres Kalamunda 6076
408 W E Pearce P0 Box 133 Mundaring 6073
824 Mrs J Pearce PO Box 171 Ravensthorpe 6346
777 C & M Peaty 80 Gloster St Subiaco 6008
804 Pennsylvania Nut Growers Assoc RR3, Box 78 Duncannon PA 17020 USA
546 Mr KW & EM Perry 27 Highland Close Charlestown NSW 2290
40 Mr G Pfaff 38 Headland St Hamilton Hill 6163
52 Mr C Piesse 10 Tarbet St Wagin 6315
111 D Pottinger P0 Box 150 Wyalkatchem 6485
612 A & J Povey Cedar Heights Parryville Denmark 6333
675 U Pretl 205 Hamersley Rd Subiaco 6008
168 Mr A Price Red Gully Nannup 6275
760 T A Priest Priest Rd Wanneroo 6005
659 F M Prochazka P0 Box 41 Ravenshoe Qld 4872
694 Mr N P Psarros Ministry of Agriculture 2 Achamon St Athens Greece GRE
394 Mrs M E Puckridge Coomahl Park Jurien 6516
719 R Purt 4 Glyde St South Perth 6151
815 T B & E J Quain PO Box 67 Wanneroo 6065
611 D Quin PO Box 17 Wyndham 6740
779 Mrs N Randall 4 Mt Pleasant Ave Mona Vale NSW 2103
662 L & M R Rattigan 13 Roseberry Ave South Perth 6151
569 R Rayner PO Box 7 Flaxley SA 5153
270 Mr R M Raynes K.K.Terrace Taipo Rd, Shatin Hong Kong H.K.
552 M F Read 56 Jinda Rd Koongamia 6056
446 W H Reay 21 Linsfield Way Morley 6060
757 R V Redhead 139 Pitt Town Rd Kenthurst NSQ 2154
761 G Reed RMB 278 Doghill Rd Baldivis 6171
633 D W Rees Booth St North Collie 6225
597 J Rennie RMB 112 Deeside Mail Manjimup 6258
729 J Reynolds Orana House Parker St Northam 6401
832 A J Rhodes Stoke Farm Heighbury 6313
658 Ricardo Nursery PO Box 577 Carnarvon 6701
106 Mr D C Roberts PO Box 400 Fremantle 6160
536 D P & G Robinson 53 Kalamunda Rd Kalamunda 6076
524 C A Robinson Lilydale Gidgegannup 6555
725 S S Robson 28 Matong St Hendra QLD 4011
571 G A Roche PO Box 73 Maryborough Vic 3465
615 Miss E Rosenberg PO Box 135 Broome 6725
20 Mr R L Routley 1 Overton Gardens Cottesloe 6011

151 Mr K Rouw P.O. Cowaramup 6284
773 M Russell-Croucher 11 Sandgate Ave Frankston VIC 3199
325 A J Ryan 92 Drummond St Bedford 6052
724 Mr P C Ryan PO Box 65 Broom 6775
67 Mr J Saggers 'Morning Glory' Kendenup 6323
842 I Salmon PO Box 1022 Griffith NSW 2680
73 Mr R Salt Camms Rd Monbulk VIC 3793
673 D Sandilands PO Box 945 Civic Square ACT 2608
240 Mr B Sargent 71 Dorothy St Gosnells 6110
32 Mr A T Sas 52 Croydon Rd Roleystone 6111
785 Mr F Savage Signo Nominees Pty Ltd 51 Nollamara Ave Nollamara 6051
272 Mr G R Scarrott Currawong Rd Berowra NSW 2082
790 Mr Schindler PO Box 9 Halls Creek 6770
774 I J Scholes @ 88 Kenmare St Boxhill VIC 3129
213 Mr M Schultz P0 Box 328 Katanning 6317
530 W & P Scott Environ. & Life Sci. Murdoch University Murdoch 6153
764 Secretary Michigan Nutgrowers Assoc 8215 Hartland Rd Trenton MI 48430 USA
423 Mr A F Separovich Main St Silvan Vic 3795
647 Serials Librarian P2062 Old Agricultural College Lawes Qld 4345
8 Mr J C Serventy PO Box 16 Bridgetown 6255
838 R N Shelton 28 Alexandra St North Ward Townsville QLD 4810
638 A J & L A Shera Jones 145 Blackburn Rd Blackburn VIC 3130
121 Mrs H I Sheridan PO Box 119 Carnarvon 6701
94 Mr J H Sherman & Son RMB 242 Man]imup 6258
453 S Sherwin 12 Canton St Carlton Vic. 3053
683 M Shorten 43 Ann St Malandan QLD 4885
316 Mr N Shorter Horticulture Dept. Agriculture Bunbury 6230
814 Miss R Simmons 95 Park Rd Byford 6201
21 Mr P Sinclair 70 Viewway Nedlands 6009
206 Mr R A Sippe P0 Box 433 Albany 6330
800 W D Sirope 785 Beeson Mill Rd Leetonia Ohio 44431 USA
712 R W Skinner 6 Hart St Lesmurdie 6076
492 C Slavik 15 Saltbush Rd Kambalda 6444
669 N E Smith 33 Beaufort Rd Albany 6330
246 Mrs V Sobon 145 Rochdale Rd Mt Claremont 6011
548 Mr P Sommerville 32 Marshall Ave Kew Vic 3101
17 Mr T H Speer P0 Box 71 Bridgetown 6255
708 Mr R D Spence 1 Drew Rd Ardross 6153
359 M Spencer 36 Violet Grove East Kew Vic 3101

486 E Spencer Brown 208 B Rosebrook Rd Margaret River 6205
823 P M Stanley Kalgoorlie Garden Centre PO Box 485 Kalgoorlie 6430
672 N Staton 14 Helen St Applecross 6153
726 L Steel PO Box 536 Southport QLD 4215
698 S Stepan PO Box 44 Yarloop 6218
196 Mr T M Stone 20 Croydon Rd Roleystone 6111
666 L D Strange "Pine Ridge" Cobar NSW 2835
700 Dr J A Streeton 376 Albert St Melbourne VIC 3002

==========

***This page in Yearbook 6 was missing (faulty printing).

==========

231 Mr R S Woodward Lacey St Sawyers Valley 6074
711 S A Wynniatt PO Box 8 Inman Valley SA 5211
620 Dr C K Yeap 72 Sutherland Dr Thornlie 6108
455 Mr R W Young P0 Box 183 Penola SA 5277
167 Dr L Zaninovich PO Box 21 Osborne Park 6017
474 Mr B Zec Lot 2973 Hamersley Rd Caversham 6055
551 Mr E Zotti 27 North St Henley Beach SA 5022