



Quandong

magazine of the
West Australian Nut & Tree Crop Association (Inc)

Second Quarter 1996 • Vol 22 No 2
ISSN 0312-8989 • \$2.50



Red Boppel Nut
Hicksbeachia pinnatifolia

NEXT MEETING: Wednesday May 15: 7.30 pm sharp

At our next meeting we will have as our guest Dr Harrie Hofstede of Murdoch University. Dr Hofstede will be talking with us about

Worms, Compost, Trees

Dr Hofstede is an environmental engineer who has many years experience with municipal waste management, and we look forward to hearing about how this is now being tied in with the ecology of plants.

NEW VENUE. WANATCA meetings for 1996 will be at the Kings Park Theatre Room, Fraser Avenue, Kings Park. **Full details on the attached leaflet.**
No charge to attend. Visitors Welcome. Queries to Tree Crops Centre on 385 3400.

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About the Cover

The cover illustration shows an under-exploited Australian nut, the Hood Nut, *Hicksboachia pinnatifolia*. The illustration is from the *Hainforest Seed Collective Newsletter*, Vol. 9, 1996. This publication also contains the information that Red Nut 'seedlings

respond well to a teaspoon of iron chelate in 10 litres of water. Avoid disturbing roots when potting up and planting'.

See also the article 'The Great Avellano Mystery' on page 5 of this issue of *Quandong*.

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[Countryman / 1995 December 7]

Lychee set to be focus of study

The Chinese fruit lychee is thriving in a small sub-tropical orchard at Gingin [about 50 km north of Perth] and providing important study links between Indonesia and Australia.

University of WA agriculture faculty student Agus Ramdani has spent the past two years studying the small white-fleshed fruit in WA as part of a three-year exchange from the Mataram University in Lombok.

He is looking specifically at overcoming poor yields and low fruit set on the 400 trees at John and Mary Verheyen's Gingin property as part of his master's degree in plant sciences.

Mr Ramdani said he would use valuable information from the project to try to overcome similar problems with lychees in Indonesia. It could also help expand production in WA.

Lychees originated in subtropical southern China, where they had been grown for centuries. They were introduced to Australia by the Chinese in 1840.

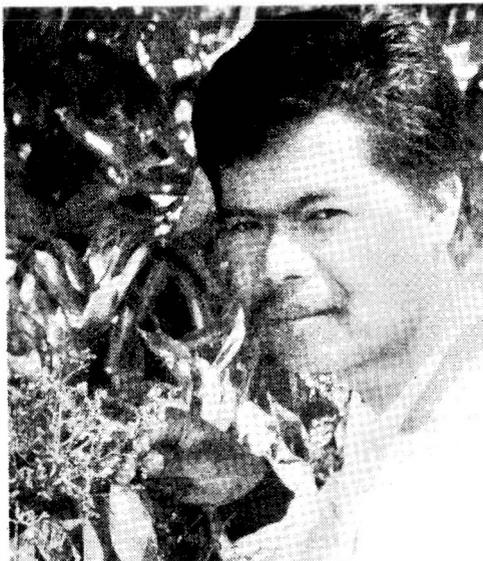
The fruit thrives in regions with short, dry, cool winters and long hot summers with high rainfall and humidity.

This is not the case at Gingin, which experiences cool wet winters and hot dry summers. But Mr Verheyen is confident of success with the fruit.

His lychee trees were planted 13 years ago by the previous owner of the property and the first commercial harvest of four tonnes was picked last year. In China the trees bear fruit after eight or nine years.

The Verheyens are the only commercial lychee growers in WA and cater for a big base of Indonesian and Indian buyers in the local market.

They are growing four varieties, including



Agus Ramdani checks lychee set at Gingin
two from India which they hope will be more suited to the WA climate and increase their annual yields.

They also grow mangos, avocados, guava, casimiroas, peaches and nectarines in the orchard and run 2000 head of cattle on their 100 ha property.

Mr Ramdani said lychee trees were very temperamental in setting fruit and needed the climate and temperature to be "just right".

Hazelnut Varieties

Hazelbrook Nut Farm, Balingup WA
(Members of WANATCA)
PO Box 15, Subiaco WA 6008
Phone 09-388 1121 (after hours).

During his project he will look at tactics such as delayed flowering, the use and timing of plant growth regulators and reducing fruit drop and fruit split to increase production.

Mr Ramdani said he had been approached in Lombok by UWA senior plant sciences lecturer - now his project supervisor - David Turner, to come to WA and study these problems.

"I thought it was a good idea because it is close to home," he said. "There are also sophisticated microscopes and other technology here that we don't have at home for looking at things like pollen variability and count".

Each day the temperature, rainfall and humidity in the lychee orchard has to be measured and recorded, which means Mr



Orchardist John Verheyen, left, and Agus Ramdani check humidity and temperature in the lychee orchard.

Ramdani spends a lot of his study time out in the field, another advantage he finds about studying in WA.

— *Melissa Vaisey*

Pat Page in new Northam post

WANATCA member Pat Page has taken up the position of *Program Manager: Natural Resource Development* with the C.Y. O'Connor College of TAFE in Northam, 80 km east of Perth.

Pat was previously with Agriculture WA in Merredin, where his duties included Chair of AgTernatives, an AgWA project to promote new agricultural industries in the Wheatbelt. A very successful Seminar put on last year by AgTernatives was *Tree Crops for the Eastern Wheatbelt* held at Bruce Rock.

Pat believes that his new post is a great opportunity to pursue his interest in new agricultural industries, without the limitations of his previous position.

¥

Sandalwood, Quandong germinated seed available

Ken Gerschwitz of PO Box 139, Wudinna SA 5652 has notified us that he can supply germinated seed of Quandong (*Santalum acuminatum*) and Sandalwood (*Santalum spicatum*).

Germinating these seeds is a relatively difficult and complex process (see article page 15). Buying germinated seeds offers a way to establish tracts of these useful plants without this problem or the need to establish seedlings. However, Ken also offers straight seed and seedling plants for those preferring these routes.

Ken's phone is 086-802127, or fax 086-802935.

The Great Avellano Mystery

There has long been interest worldwide in possible commercial development of an interesting nut species from Chile, the Avellano or Chile Hazel (*Gevuina avellana*). However, development has been virtually halted by the unsolved problem of 'sudden death' in raising seedlings.

We have recently gained a valuable new contact in Chile in Daniel Vera J., Laboratory Chief at CESAF: Centro de Semillas de Arboles Forestales [Forest Tree Seed Centre] in Santiago. I used the opportunity to describe the problem affecting Avellano, and the related Australian species *Hicksbeachia*, in a letter asking Mr Vera for advice. Here is an extract:

The Problem

"For years we have been trying to establish plants of Avellano, *Gevuina avellana*. Unfortunately, all attempts of which I know have been unsuccessful in Australia, due to 'Sudden Death' of the plants.

Seeds can be germinated fairly easily and grown on without major problems, in pots or in the ground. Plants have sometimes reached over a metre tall, and appear to be doing well. Invariably, however, 'Sudden Death' occurs at some stage — the leaves turn brown and in a few days the plant dies.

We have had tests run on affected plants and have been unable to find any significant pathogens, such as *Phytophthora*. We are wondering if these plants lack some required symbiotic partner such as a mycorrhiza or bacteria.

Can you throw any light on this problem?

You may be interested to know that a similar problem occurs with a closely-related Australian plant, *Hicksbeachia pinnatifolia* (also from the Proteaceae). This grows naturally in northern New South Wales, but has proved very hard to establish elsewhere as it is liable to the same 'Sudden Death' problem.

I know from my work on Expanding Earth/Continental Drift that it appears that Chile and eastern Australia were once in physical contact, so these two problems may well have the same cause,

and hence the same answer. Any suggestions you can give would be much appreciated."

A Vital Clue From Chile

Mr Vera responded with extracts from a thesis on Avellano which contained a vital clue to solving this problem. **Avellano seedlings are very sensitive to levels of organic matter in their growth medium.**

In fact, Avellano growth and survival is



The Avellano, *Gevuina avellana*

much better in a red loam low in organic matter than it is in a richer medium. Such a toxic effect of organic matter is in total contrast to the case for most plants.

Proteoid Roots

The thesis subject was actually on a special type of root which grows on plants of the Proteaceae family (which includes Macadamia and Banksia as well as the two nuts already mentioned).

Here is an extract from the thesis which gives an interesting run-down on Avellano, and also points out that Avellano is a plant suited to quite dry conditions, and even a candidate for soil reclamation work:

The Thesis

Introduction. *Gevuina avellana* Mol, the Avellano, is the only species in its genus. It grows only in Chile, from in the north the Teno river in the Andes Mountains, in the south to the Mataquito river in the Coastal Ranges, and on the Guaitecas Islands.

It is a species of the under-forest, sometimes reaching into the mid-level canopy, found in association with species from the Fagaceae, especially Roble (*Nothofagus obliqua*) and Raulí (*Nothofagus alpina*).

According to Rodriguez, Avellano is a species of high economic interest. Its timber has a beautiful grain, is hard, light, and elastic, of special interest for veneer and in making furniture, musical instruments, boats and oars, and popular craft items. The leaves and flowers have an interesting commercial application in floral art.

The Avellano has also been found to be an excellent honey plant in the Central Range. It is one of the few Chilean native plants to produce an edible nut.

In another direction, the Avellano has

aroused considerable scientific interest in its possession of special types of root, called proteoid roots, which form the basis of a number of investigations.

The presence of these roots gives the plant an advantage in competing for water and nutrients. This is because these roots have greatly-augmented absorption surfaces, which permit the plant to act as a typical semi-xerophyte (suited to dry conditions), with the roots able to efficiently capture whatever water is available. This suggests the possibility of using Avellano for reclaiming difficult biological areas and improving degraded soils.

Results of experiments indicate that the formation of proteoid roots is associated with soil organic matter, and it is the microorganisms in this organic material which induce their formation. The present study investigates the influence of organic matter on the formation of proteoid roots in Avellano.

[The thesis is: "Influencia de la materia organica del suelo en la formación de raíces proteiformes de *Gevuina avellana* Mol." by Francisco Manuel Pozo Alavarado].

Another Clue

Pozo Alavarado's thesis quoted extensively from the work of local expert on the Proteaceae, Dr Byron Lamont of Curtin University (Dr Lamont was the author of an article 'Australian proteaceae as food plants' in the 1985 WANATCA Yearbook).

I contacted Dr Lamont and asked him if he had any comments on the Chilean thesis results. He had not heard of any sensitivity to organic matter in the family. However, he confirmed that the proteoid roots developed in the family are extremely efficient at extracting nutrients from the soil because they have a very large surface area for their mass compared to other plants.

I also asked Dr Lamont whether either of these species might benefit from inoculation with soil matter from other Proteaceous plants to induce proteoid root formation. He thought that it didn't matter, as these roots seem to form readily even in the absence of any obvious plant or soil source.

Meanwhile, Back Home

Last year, Hans Muller of Sydney, a noted expert in rare tree crops, was kind enough to supply me with some seeds of Red Nut, the Australian relative of Avellano mentioned before. Hans also gave detailed instructions on raising them, as follows:

Growing Hicksbeachia (Red) Nuts

Here are the instructions as to how to grow the Red Nuts to 1 metre in height. In my experience red nut trees, until they reach 1 m in height, require special treatment or they will surely die, when about 8-12 cm high.

This is why it is a rare tree, not available from any of the nurseries, and is mainly only found in rare fruit collections. For the average person, it is too much of a hassle to get them growing.

1. The most important thing is the container they grow in and the tray where they sit in must be boiled in water, and the soil should be mixed with coarse river sand and baked in the oven at a temperature of 110°C, or better even hotter, for up to two hours. Unless you do this particular thing not one plant will make it.

2. Other things should be followed up too. Do not use any organic matter, manures or compost etc. If there is any need for fertilizer use a chemical or liquid one.

3. Keep plants on sterile surface.

4. Always wash your hands or use sterile gloves when touching plants.

5. Regularly use an anti-fungal spray to spray the plants and water the root system.

6. Use only clean or boiled water.

The better you do it the more successful

you will be.

Once the plants are about 1 metre in height they can be planted safely out in the garden. The most critical time is when they are still very small and they are very sensitive to fungal attack, to the root system mainly.

Wishing you good luck and success with these plants.

— **Hans Müller**, 68 Frances St, Lidcombe NSW 2141

An Explanation

Here then is a starting-point to suggesting what is actually going in in this interesting pair of organic-matter sensitive plants. The inference is, that the high surface area of their proteoid roots makes them very efficient in taking up scarce nutrients and water. But, and this is the crux, it also makes them liable to overkill when the nutrient source is richer, and perhaps also leaves them more open to invasion by pathogenic fungi, as they have left "all doors open", so to speak.

This suggestion is in accord with the fact that WA banksias, in the same family, are notably liable to die from *Phytophthora*, the fungal Dieback disease.

What I Did Next

At this time, I had some of the Red Nuts germinated in an ordinary potting mix, and at the crucial 8-12 cm height noted by Hans Muller! I quickly obtained some red loam from a sub-soil horizon at Dwellingup, which appeared to be low in organic matter, and washed some of the Red Nut roots off, re-potting in pure red loam.

Now I wait with bated breath to see if they do any good compared to those left in ordinary mix. What was interesting, was that at this 8-12 cm stage, the proteoid roots were just beginning to form!

— **David Noël**

[The Tree Cropper (NZTCA) / 1996 March]

The ASIMOYA, *Asimina triloba*

Asimina triloba, often called the American pawpaw, was a favourite food of the native Indians and an essential part of the diet of the early European settlers. It was harvested from wild patches and little cultivation of this fruit has occurred since then.

A few commercial endeavours and some variety selection have taken place, but this work has generally been forgotten or lost as the enthusiasts have died and their properties have been sold. Several enthusiasts championed them at the beginning of the century, learning how to grow them and selecting superior types. I know that at least 21 cultivars were named. However, most of these, as far as I know, have been either lost or exist only in private gardens.

Even in the natural state many selections were good enough for commercial production. But the fact that they were originally so easy to obtain from the bush, meant few people bothered to grow them themselves. Nevertheless, it is a crop we in New Zealand should not discard without testing its worth.

CONFUSED NAMING

A browse through American magazines is most frustrating. Their references to pawpaws turn out to be not the pawpaw that we know, that tropical melon-shaped fruit, *Carica papaya*, belonging to the plant family Caricaceae. Instead, they mean a completely different fruit, the *Asimina triloba*. This fruit was known to the Indians as 'Arsimin', and has also been variously referred to as the Hardy Custard Apple and the Kentucky Banana, which are equally confusing as names. The *Asimina triloba* actually belongs to the family Annonaceae, the same plant family which contains our cherimoya (*Annona cherimolia*) and atemoya (*Annona cherimolia* x *squamosa*).

Because of its close relationship with these



other fruits, we are recommending the name **Asimoya** as our new name for the *Asimina triloba*. It is a pleasant-sounding, marketable name, with the advantage that it avoids all confusion with the pawpaw, *Carica papaya*.

SOME FACTS

Asimina triloba is basically a diploid, $2n = 18$, but some stands contain triploids. Seedlings of these stands can be in the ratio of

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40:1. Triploids would probably be seedless. If the crop developed there would also be a place for someone to produce tetraploids from the better types.

As far as I know there are none of the superior selections in New Zealand. I don't even know that they still exist in the USA, but hopefully some still do. Seed was introduced 10 or so years ago into New Zealand and although only a few of the seedlings survived, some are now beginning to fruit. Like the ones I visited recently in Hamilton. Many, however, have grown slowly and haven't set fruit yet. I have heard of none that have fruit worth writing home about.

SOME GENERAL INFORMATION

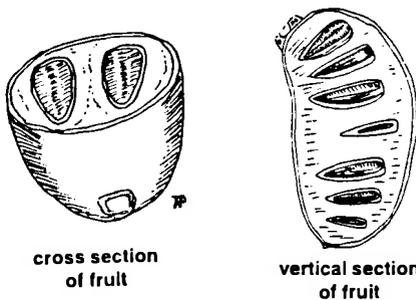
The tree, as seen in New Zealand, is very similar to a small cherimoya but is reported to be much hardier in cold winter conditions. They often sucker in the wild, so that a single plant may cover a large area called a "patch" (as in the children's song "Way down yonder in the Pawpaw Patch"). However, there were large specimen trees, with one champion having a girth of 65 cm, a height of 16 m and a spread of 18 m.

Growth, from most reports, seems very slow for the first two seasons, unless ideal conditions prevail. But there are two diverse schools of thought about ideal conditions for young trees. One is that they need about 50-85% shade and the other is that they need really good sunlight. I tend toward the idea that they need shade for at least two years.

SELECTED SUPERIOR VARIETIES IN THE USA

Little Rosie (a pollinator), Davis, Kurle, Glaser, Sweet Alice, Vena, Rees, Over Eese, Uncle Tom.

Late varieties: Gable, Tiedke, Jumbo, Shannondale, Osborne, Buckman, Martin, Taylor No. 1 and No. 2.



cross section
of fruit

vertical section
of fruit

Early varieties: Fairchild (considered the best), Ketter(er) (2nd best), Hopes August.

Many of these are the names of early enthusiasts. If you discover any of these make sure they are preserved, and I would love to hear about them.

FRUIT

There are two basic types of fruit white-fleshed and yellow-fleshed. The white-fleshed type is generally considered late maturing, with a mild to flat (even insipid) flavour.

The yellow-fleshed type generally ripens earlier and has a rich flavour, some being too rich but some delicious. These are the ones we want. The white one is also a longer banana shape and the yellow a fatter oval.

PECAN NUTS WANTED

**Good quality Pecan
Nuts required for
shelling**

Larger Quantities preferred
Contact BJ & CF Rochester
Mumballup Pecan Shelling
Phone 097-341309, 322051
Fax 097-343343
90 Bucktin St, Collie 6225

Large fruit will weigh 250-340 grams, and are 8-13 cm long and 2-4 cm wide. Smaller fruit will weigh 86-200 grams.

Skin colour is green, turning brown to black when ripe. The flesh is green, turning white or yellow (even pinkish) as they ripen. When the fruit is ripe the flesh goes buttery and the odour sweetens. They have a high sugar content, 16% sucrose (similar to a banana) and 17% carbohydrate. The flavour varies according to soil type and fertility.

The approximate fruit composition is: Flesh 50-80%, Seeds 14-17%, Skin 6-10%.

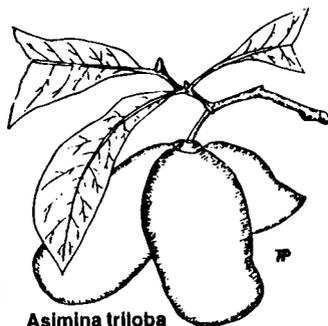
CLIMATE AND SOIL TYPES

In the U.S.A. the asimoya (see how easily we slip into using the new name) grow from Northern Florida to Ontario, and from Nebraska to Texas. However, the main areas are Pennsylvania, Ohio and Indiana. It is evident, therefore, that there is a lot of plasticity in the asimoya germplasm for adaptation to various climates. The best types so far, however, have come from Susquehanna, Potomac and Ohio.

The general climate requirement is considered to be for winter chilling to break bud dormancy, followed by a hot summer, with between 150-260 growing days. A rainfall of 75 cm in the growing season, or supplementary irrigation, is needed. Soil can be from clay to a sandy loam but soils rich in humus are needed for regular good fruit production - lots of mulch, decayed vegetable matter, along with plentiful lime and potash.

CROPPING

Good cropping will initially need hand-pollination. This seems evident from the number of trees in New Zealand that are flowering but not fruiting. Current information is unclear whether all varieties are self-fertile, or whether they need crossing. A little trial



Asimina triloba
fruit

and error should sort that out. Given the variability in other characteristics, there are probably both types.

Hand-pollination is very easy. Petals can be removed to make it easier. The main difficulty is getting fresh pollen when the female stigmas are receptive. Also, a gentle touch is needed as the style breaks easily. So use a light touch with a soft camelhair brush. Well-grown trees should begin cropping after five years. Yields of 50-100 fruit per tree are possible. As local trees so far are setting 10 or less fruit per tree, we have a long way to go.

HARVESTING

The harvesting season in New Zealand will probably be between February and May. This will depend on whether we have early or late types. Pick fruit as they start to soften. The colour may also change. Store in a cool place. The old method was to store them wrapped in oat straw. Most fruit kept in a fridge should be ready to eat in two weeks. Longer-storing types may take longer.

PROPAGATION

Ideally seed should be kept damp in sphagnum or something similar. Cold treatment in a fridge for 8 weeks and then soaking in water for 24 hours before sowing works well. Cover seed with at least 2 cm of soil. Sowing can be direct into the field with 5 to 6 seeds per hill.

Cuttings take relatively easily from softwood to semi-softwood. The size of the cutting can vary considerably from 1 cm to 30 cm long. Where possible, use bottom heat and mist. Less sophisticated methods will also work reasonably well.

Grafting is best done from October to early November.

TRANSPLANTING INTO THE FIELD

Asimoyas are tricky things to transplant. Many are lost at this stage. The best time to do this is probably between August and September. Shading and irrigation will be worth trying, to minimise losses at this stage.

CONCLUSION

In New Zealand attempts to grow asimoya have so far been slow and not very productive. This may be, to a large extent, due to our lack of knowledge of what we are doing, plus the fact we are growing seedlings rather than superior selections. I feel sure we haven't seen the true potential of this crop yet.

What we need to do is locate and import varieties such as Fairchild and Ketter(er). Then learn how and where to grow them best. With our wonderful climate we tend to expect everything to be easy. With a little more effort we may see the asimoya's full potential.

This article has been based on my own observations, plus reference material from USA, especially the Californian Rare Fruit Growers Handbook: Pawpaw Tree—Asimina triloba, Volume 6 (1974)*.

— *Roy Hart*, 87 Trewavas St, Motueka (NZTCA Research Co-ordinator.)

[*Q Ed: A Mr Zaknich called in at the Tree Crops Centre in February, he passed on a good tip on Asimoya (I like the name!). He has had excellent results with a plant surrounded by a 1.5 m high cylinder of 50% shadecloth, with a towel draped over the top!*]

*Photocopy version available from Granny Smith's Bookshop, \$23.60 (Ref. R01A).

Three New Life Members for WANATCA

Long-time WANATCA Executive member **Alex Hart** has been elevated to the status of Honorary Life Member.

I first met Alex back in the 1970s, when I asked the then Forests Department who they could recommend to talk about non-timber products of trees at a Summer School course on tree crops. They sent along this tall, good-looking (this was some years ago!) fellow in a green forester's uniform, who gave an excellent contribution.

One of Alex's topics then was pecan trees, an area where he has retained a considerable interest. In recent years, since he has retired, he has also devoted a lot of time to fig varieties, and to the WANATCA Hamel project, plus it is rumoured he still hits a golf ball around!

Two overseas WANATCA members have recently paid the fee to become Life Members. **Glen Jacobsen** of Lae, Papua New Guinea, continues the work started by her husband Jim, whose death was reported in the Second Quarter 1995 *Quandong*. Welcome Glen.

Last but not least, one of our US members, **Joe Traynor** of Bakersfield, California, has also taken up Life Membership. Joe has been a great help to the Association in supplying information on tree crops in his area, the leading production area of the USA, and runs a bee-supply and pollination service with sense and insight. One of his contributions appears on page 12.

Each such Life Membership application is a vote of confidence in WANATCA's future. Thank you all.

— *David Noel*

[Pacific Nut Producer / 1996 January]

Increasing Almond Set: Several Factors Up the Odds

With the disappointing 1995 US almond crop now history, pollination, or lack thereof, is receiving the brunt of the blame. It is easy to see why, as most growers remember the 1995 blooming season as a rainy one.

There were, however, a number of excellent crops in 1995 — 1 ton of meats or better per acre. How does one explain these excellent crops? A close look at individual orchards that had good crops in 1995 shows three constant recurring factors that all had in common: 1) Strong bee hives; 2) Young trees (or trees that had not totally filled in between rows, i.e. open orchards) and 3) Retention of leaves during September and October, 1994.

These 3 factors are discussed separately below:

STRONG HIVES

In spite of the marginal conditions during the 1995 bloom, there were enough good days, or enough good hours on some days, to get the pollination job done — but only if strong hives were present.

During the recent drought years, hive strength was not as important as it was in 1995 since there was ample time for all hives, weak

and strong, to cover the bloom. Weather conditions in 1995 gave strong hives the opportunity to shine.

It takes far less time for bees to pollinate an almond than might be imagined. With a compressed bloom, a good crop can be set in a few hours of reasonably good weather during one day. Ample bee populations, however, are necessary to do the pollination job in such a short period of time. Growers that didn't have strong hives in 1995 simply didn't have the bee numbers necessary to get the job done.

YOUNG TREES

We've heard it in the past years, and we heard it again in 1995: "The young trees (4-8 years old) had a good crop, but the older trees just don't have the set."

There are several explanations for this phenomenon: Young trees have a high leaf:nut ratio, and bigger leaves (important in providing food for developing nuts). Young trees intercept more sunlight; each leaf on a young tree is more efficient as a food producing entity because it is less likely to be shaded by adjacent trees. And in young orchards there is better air circulation; blossoms on young trees dry faster, providing two benefits: more effective bee time and less chance for disease to take hold (fast-drying blossoms can be worth a fungicide spray).

With the entire focus on bloomtime weather, growers often overlook a crop input that can be equally important: post-bloom sunlight. Not only was bloom weather



marginal last spring, but post-bloom storm systems and lower temperatures were not conducive to the retention of pollinated nutlets. This led to many orchards having excessive nutlet drop during March and April. This was a drop of pollinated nutlets that did not receive sufficient nourishments from light-intercepting leaves to be retained.

A well pollinated orchard sets a large number of nuts and these rapidly growing nutlets put a tremendous demand on the trees for food reserves. If this demand can't be met, then nutlets drop. Young trees are better equipped to meet this demand.

Although no post-bloom sunlight studies have been conducted on almonds, an Oregon study on hazelnuts provides some interesting insights: trees were artificially shaded during the immediate post-bloom period and the effect on both nut set and nut size was dramatic. The researchers concluded that "shading during this period clearly reduces yield" and has an "astronomical" effect on the size of nuts. They explained that "the kernel is going through rapid cell division, and we think that shade during this period of development somehow impacts cell division within the kernel." (1)

A 1989 study on apples showed a similar effect: the crop on (postbloom) shaded trees was half that of control trees.(2)

The Fritz variety had the best crop of any variety in 1995, partly because most Fritz trees are relatively young, but also because the post-bloom nut development of Fritz is the slowest of any variety, thus putting less demand on a tree's food reserves and less demand for post-bloom sunlight.

In years of below normal postbloom sunlight, such as 1995, young trees and older orchards that have been opened up, are better

equipped to take advantage of available sunlight.

RETENTION OF LEAVES

Recent UC studies have shown that the post-harvest irrigation is one of the most important inputs to attaining maximum almond yields. Postharvest water allows trees to retain leaves during September and October, two normally sunny months. A study on pecans adds credence to the UC studies: "Removal of leaves prior to Oct 1 resulted in no nuts set and no yield the next year." (3)

Leaves can manufacture a lot of food during September and October and this food is stored in the tree to be parcelled out to the developing nutlets in the spring. Without sufficient food, nutlet drop will be excessive. It's either bank some sunlight in the fall, or pray for sunlight in the spring. Growers with good crops in 1995 stored much sunlight in the fall of 1994.

A number of lessons can be learned from 1995:

1. *It's worth taking measures to ensure getting the strongest hives possible.*

2. *That post-harvest irrigation is important — believe it!*

3. *When planning an orchard, the diamond pattern — each tree equidistant from the other — is the best (note: a knock on the diamond pattern is that there is a dead space at the end of every other row; many growers compensate for this by crowding another tree into this dead space). Hedge-row plantings will give great yields during the first years of production, but will cause shading headaches when the trees reach full size. For crops such as apples, hedge-row shading provides a natural thinning mechanism that reduces thinning costs.*

4. *Open up older trees to provide more*

post-bloom sunlight; shaded limbs on older plantings in 1995 were often devoid of nuts.

5. Consider planting the Fritz variety. Fritz blooms with Nonpareil but harvests after Mission, so give careful thought to whether you can live with such a late harvest.

As with any ag commodity, there's much more opportunity to make money in a short-crop year than in a year when everyone has a good crop. Some almond growers will make twice as much money from the 1995 crop than from the 1994 crop. It pays to be prepared for

a poor spring every year.

— **Joe Traynor**

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1. Made in the Shade, Sun-Diamond Grower, Fall 1995 pp 12-13.

2. Seasonal Light Requirements in a Fruit Orchard, U. of Mass. Fruit Notes, Summer 1991, pp 20-21.

3. Keep those Leaves on the Trees Until Frost, Pecan South, July 1995 p. 4.

Joe Traynor is owner of Scientific Ag Co., Bakersfield, California

News from Dennis Ting in Melbourne

Mymacadamia nut 'Nutty Glen' continues to grow well. It only has one growth flush of leaves in December each year so has slowed (matured) in terms of growth. However it appears to have several flowerings a year now in April, July, and October (the main flowering). Only the October flowering sets nuts. I am getting useful crops of nuts especially when the bees are active in October. Perhaps cross pollination may increase the size of the crop but I don't know.

The loquat 'Bessell Brown' is an excellent variety setting good crops of large fruit 4 cm x 6 cm with only 2-3 pips per fruit; it has a nice flavour and solid flesh. I don't know if you have heard of this variety but it might be worth a try as it sets only 3-6 fruit per cluster so does not require thinning for good fruit size. I have grown some seedlings and have just tried to T-bud in summer.

I see some WANATCA members are growing hazelnuts in WA. I have had a 'Wanliss Pride' in a large tub for several years. Last winter I obtained two catkins of 'Cosford' and hand pollinated all the flowers. The result was 50 nuts which are ripening now. I have a theory which I am trying out. Rather than growing pollinator trees I am T-

budding some 'Cosford' into my 'Wanliss Pride' and also some 'Wanliss Pride' into the 'Cosford' pollinators.

The idea is that the 'Wanliss Pride' have such a poor rootstock (almost no fibrous roots) that I am hoping the 'Wanliss Pride' will grow better on a stronger 'Cosford' rootstock. I can't see why it is necessary to plant pollinator trees when several branches on the variety tree (if kept pruned) would supply ample pollen to the crop variety. Also perhaps several different pollinators could be grafted to a single crop tree to get early / mid / late pollination. I don't know if anyone else is trying this idea or not.

While 'Wanliss Pride' may not grow into a large tree I consider that in terms of crop / tree size rates it is more productive than other larger growing varieties.

— **Dennis Ting**, Unit 8/14 Jubilee St, Nunawading Vic 3131

Tip on Direct Seeding of Nuts

US researchers involved in a trial of direct-seeding acorns to establish oaks have found that a squirt of 'Surf' laundry detergent discourages stealing of the nuts by mice and other small rodents.

[AQIA News / 1996 Summer; from SGAP Journal / 1995 August]

Propagating quandongs (*Santalum acuminatum*)

Below is the simple, quick and efficient method that I often use to grow my quandongs. It can be applied by most home gardeners.

SEED SELECTION

Use only clean, fresh seed collected from a situation where cross-pollination is likely to have occurred. Seed of unknown age may not be viable and seed collected off the ground is usually badly contaminated with fungal spores. Seed derived from self-pollination (i.e. isolated trees) usually produces plants of inferior quality.

PREPARATION OF GERMINATION MEDIUM

I often had problems obtaining vermiculite of the right consistency to promote quandong germination. Either it was too dry or was contaminated with fungal spores, which was often associated with dry sterilisation of the vermiculite. Wet sterilisation and hot handling of the vermiculite alleviates these problems.

Soak the vermiculite in rain water, then drain it on a sieve until there is no free-draining liquid. Then place it on an oven tray, cover with aluminium foil and cook at 150°C for 1 hour. While still hot (caution, steam!) transfer it to Zip-lock sandwich bags, seal and allow to cool overnight. The bags may be stored until required.

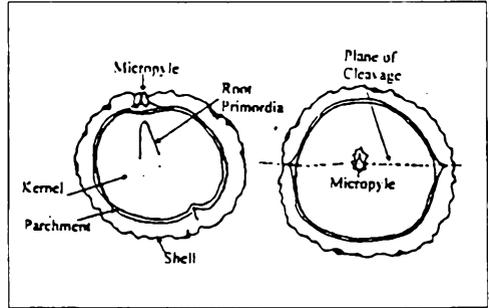
SEED PREPARATION

Either whole seed or kernels may be used. Germination of kernels is usually complete after two months but that of whole seed may take a year or more.

KERNEL EXTRACTION

Some knowledge of the anatomy of the quandong seed (diagram) is needed for successful extraction of the kernel.

Most of the diagram is self evident, but one important feature does require some explanation. The micropyle is a very fine tube



Anatomy of a Quandong seed

connecting the inside of shell to the outside. It is the usual means by which the seed absorbs moisture. The micropyle is usually evident on the outside of the seed by a flat area with or without a symmetrical bump. It is obvious on examining a cross section of the remnant shell after whole seed germination. The micropyle is the weakest point of the shell and is the first point of the shell to break during germination.

The micropyle also intersects a depression in the shell which bisects the entire seed. This natural weak point in the shell, which usually breaks during the germination process, can be utilised to efficiently extract whole kernels from whole seeds. Once you have identified the micropyle, place the seed in a vice with micropyle directly against the vice jaws and very carefully place pressure on the seed. The seed should, more often than not, crack cleanly and the kernel can be removed. It is usually covered with a parchment layer that can be picked off with a thumb nail.

SEED STERILISATION, GERMINATION AND GROWTH

Place the seeds or kernels in a pot with holes in the bottom for drainage. Fill a larger

container with 10 % bleach (1 part White King: 9 parts water). Place the pot in and agitate until the contents are completely wet. Soak for 30 to 45 minutes. Remove the pot and rinse the seeds or kernels thoroughly with cool, boiled rainwater. Place the seed directly in the vermiculite (about 10 per Zip-lock bag) and incubate in the dark at 15 to 23°C (18 to 20 is optimal). A dark cupboard indoors is suitable. Addition of some fungicide to the whole seed preparation is suggested.

Examine the bags after one week and remove any contaminated seed. Continue to examine twice weekly and remove germinated seed when the root radical is one cm long (approx 3 weeks for kernels, 2 months for seed). Either plant the germinated seed directly into the ground or pot on into as large a pot as practicable.

Pot depth and size are important as the tap root of the quandong is very vigorous. In unrestricted growth situations over Winter the shoot may only be a few centimetres long but the tap root can exceed 30 cm long. It is important to try to maintain the root system as close to natural as possible. The smaller the pot, the more care and attention will be required to prevent loss of the plant while trying to establish it in the field.

POTTING MIX

Choose any low-phosphate free-draining potting mix. A potting mix made of peat moss

and alkaline sand (1:4) supplemented with a low-phosphate slow-release fertiliser is suitable.

HOST PLANTS

Quandongs are semi-parasitic plants. This means that a host plant will be beneficial, but not essential. Any plant, even an already established one, will do. It best to choose a plant that is not too vigorous as competition for water and/or nutrients can be a problem. It is important to get a good balance. I suggest a native perennial grass, legume, herb, shrub or prostrate species as suitable. It is perhaps advantageous to add the host to the pot before planting out as this may not only improve the parasitism but may also hold the root mass intact so that the quandong can be transplanted without root disturbance.

ESTABLISHMENT

People often describe quandongs as being adapted to growth and survival in arid to semi arid conditions. Direct-seeded quandongs are not adapted to pot culture. When they are grown in pots, their root structure is drastically modified.

These plants must be carefully nurtured after transplanting if they are to survive and thrive. The young quandong is quite succulent and preventing desiccation is important. Partial shade, supplementary watering, mulching and protection from strong hot and cold winds should be maintained until the plant has developed an adequate root system.

It is suggested that quandongs be planted as early as possible into their permanent site. The best period is April to September. The soil should be well drained. Its pH is of lesser importance. I have found mulching and tree guards prepared from shade cloth to be beneficial to the establishment of pot-grown quandongs.

— Ben Lethbridge

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Tree crops in Carnarvon

In the last issue of Quandong, we reported on Marcus Vigilante's award of a scholarship to work in Carnarvon, on the WA coast just south of the Tropic of Capricorn. Here is Marcus' report of his jaunt.

Every year in Western Australia, one student of horticulture is selected to spend the summer at the Gascoyne Research Station near Carnarvon for the Dennis Marr Horticultural Scholarship.

The scholarship is named in honour of a man who contributed greatly to the development of the horticultural industry in Carnarvon and is jointly funded by the Departments of Primary Industry and Education. I was the only applicant last year so I got to spend December, January and February in this subtropical paradise.

Gascoyne Research Station is one of several research stations operated by Agriculture Western Australia throughout the state. It is the administrative centre for the Southern Pastoral Region and has over 30 staff, many of whom are lucky enough to live

permanently on the property. The research station covers an area of 66 ha, 25 of which are fully developed for irrigated cropping.

The climate is described as semi-arid subtropical with hot summers and mild winters (see table 1). The average annual rainfall is only 225 mm and the evaporation is extremely high necessitating year round irrigation. The land used for horticulture in this region is found mainly along the Gascoyne River and would be the envy of anyone living on Perth's sandy Swan Coastal Plain. The soils are described as alluvial fine sandy clay loams. They are slightly alkaline (pH7.2-8.0) and have high fertility, good drainage, low salt levels and are generally over 10m in depth.

Research on the station is carried out for the benefit of the Carnarvon Horticultural District. This region produces a wide range of fruit and vegetables mainly for the Perth market. Current research is in progress for these crops: mangoes, pink-fleshed grapefruit, grapes, bananas and low-chill stone fruit.

A mango hedgerow trial has been undertaken to assess how mango trees perform when planted at high density, in rows, with regular pruning to keep them to a manageable size. The benefits of this type of planting over traditional spacing are expected to be: higher yields per hectare in the first years after fruiting; less wind damage to fruit; and harvesting without the need for ladders and cherry pickers.

Many growers are now using tissue cultured seedlings for their banana plantings because of their uniformity. The research station is carrying out a trial to determine at what time of the year tissue cultured bananas



should be planted, in order to produce a crop at a specific time in the future. This information will let growers target times of the year when the supply of bananas is traditionally light.

The GRS has a wonderful mango arboretum where one can find specimens of many mango varieties that are in cultivation. I was fortunate enough to be around to sample every one of them. What follows is my assessment of some of the mango varieties I tried. Please remember these are my personal opinions and that you would do well to consult other sources of information before making decisions on what trees to plant in your area.

The earliest variety was Earlygold, which matured during the second week of December. Taste was very bland and the trees were badly affected by mealy bugs.

Haden and Carabao matured between Earlygold and Kensington Pride. Haden is a small fruit of good flavour and has an attractive colour. Carabao had superb flavour, yellow skin and was somewhat tear-drop shaped. The fruit was almost too small to send to market but Carabao would be worth growing in the backyard for its flavour alone.

Kensington Pride (KP) began maturing just before New Year. This variety was bred in Australia and comprises the bulk of Carnarvon's mango exports. The fruit is large, very shapely, has good colour and yields heavily. KP is very hard to beat.

Delta, or better known by its trial name R2E2, matures shortly after KP. This fruit is huge (sometimes weighing up to 1kg) and is becoming more and more popular on export markets for this reason. Its flavour is mild and to my taste, unappealing.

Of the late varieties, Ono, Fascell and Allen were of poor flavour although Fascell did have a beautiful pinkish blush. Nam Dok Mai and Bangalora were two long, slender

varieties, somewhat dagger shaped. Nam Dok Mai was the better of the two, having excellent flavour and a very thin seed but it does not yield nearly as well as KP.

Kent and Brooks have good flavour with Brooks being the latest variety grown on the station. Brooks is normally ready from late February to early March.

Aside from the mango arboretum, the RS has a miscellaneous block where new fruit are assessed for suitability. There are several jakfruit trees; the varieties Galaxy and Cheena were not performing very well compared to seedling trees from Bali.

Three varieties of Casimiroa were growing. Pike had large, good tasting fruit that are green when ripe. Ortago yielded very poorly while in contrast Goldenglobe was loaded with medium sized yellow fruit.



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Of the four Lychee varieties grown, Haak Yip was very spindly and had no fruit, Tai So (known as Kwai Mi in Queensland) was low yielding but its fruit were very tasty; Wai Chi yielded well; but Brewster was the best in terms of yield, growth and taste.

The following varieties of Carambola were growing: B2, B10, B16, Arkin and Fuang Tung. With the exception of Fuang Tung, all were disappointing in terms of taste, although they all seemed to yield well.

Other trees in the miscellaneous block included: custard apple (African Pride), low

chill apples and stone fruit, jojoba, sapodilla (Manila), black sapote, longans, pommelo and other citrus fruit.

The Gascoyne Research Station is a tremendous information resource for the growers in the area. I certainly learnt a lot during my stay there and I envy those people who live and work on the station all year round. I must thank Mr David Parr, the Gascoyne Research Station Manager, for allowing me to share this information.

— *evigilante@ALPHA2.CURTIN.EDU.AU (Marcus Vigilante)*

Table 1. Camarvon Climatic Averages

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max Temp	31.3	32.5	31.3	28.9	25.9	23.2	22.1	22.8	24.3	25.8	27.3	29.1 27.0
Min Temp	22.4	23.3	22.0	19.1	14.9	12.5	11.1	11.6	13.9	16.3	18.5	20.5 17.2
Rainfall	12.8	21.1	13.4	12.1	36.7	48.8	42.4	18.3	5.9	5.6	4.6	2.2 224.8
Daily Evap	10.0	9.7	8.6	6.5	5.0	3.7	3.7	4.8	6.6	8.1	9.1	9.8 7.1

Swedish researchers develop 'square' trees

A recent breakthrough has been reported by Swedish scientists working on an arboricultural research project to develop trees with a square cross-section at maturity.

A Forest Research Unit spokesman claimed that the square trunks will revolutionize the forest products industry, with greatly reduced waste material and substantial cost reductions in transport and handling.

In addition, industrial accidents involving rolling logs (a frequent occurrence) would be eliminated during loading, processing, and handling.

The breakthrough was reported in local newspaper The West Australian on April 1. Yes, that's right.....



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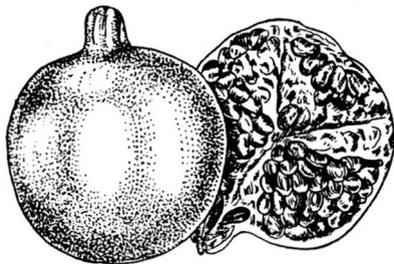
Bill Napier: 399 6683

Pomegranate variety research results

Cuttings of the leading pomegranate varieties were obtained from Dr F R Hobman, Loxton Research Centre, South Australia and planted at Medina Research Centre [on the coastal plain just south of Perth] from 1991 to 1994.

These have grown well and have required minimal management and pruning. The trees have shown slight twisting of new shoots which is believed to be due to aphid feeding. The earliest plantings have fruited well for the past three years.

Quality was poorer in 1996, possibly due to high temperatures in February and rotting due to fruit fly stings, although there was minimal development of fruit fly larvae.



Fruit quality was as follows:

Variety	External appearance	Internal appearance/ juiciness, acidity	Comments
Gulosha Rosavaya	Large, good external appearance (light pink skin).	Large, deep red grains Juicy	Best variety for combination of sweetness and acidity and external appearance.
Wonderful	Medium size. Claret red skin	More acidic than Golosha rosavaya Deep red grains.	Next best variety to Golosha rosavaya but is smaller and more acidic
Victorian Giant	Large, not very attractive skin	Grain is not highly coloured, not juicy, mild flavour	Poor variety
Berri	Skin is not attractive	Not juicy, too sweet, bland flavour	Poor variety
Veles	Squarish shape, pink red skin	Juicy, rich flavour but too acidic	May be suitable for processing
Griffith	Claret red skin	Deep red grains, rich flavour, but slightly too acidic	Fairly good variety

A number of varieties have not yet commenced harvesting and these include Elche, Golosha Azerbaijani, Wright, Waikerie, Indian and Seedless.

Cuttings of these varieties may be collected in July by people interested in these crops, especially for commercial production.

Results with these varieties at Loxton Research Centre from 1990 to 1993 were as follows:

Cultivar	Saleable yield, kg/tree				Juice colour	Skin colour
	1993	1992	1991	1990		
Guloshia Azerbaijani	11.2	66.5	31	57	Bright red	Creamy red
Guloshia Rosavaya	20.2	52.4	31	36	Light red	Creamy red
Veles	27.1	27.2	18	22	Bright red	Creamy red
Griffith	7.5	31.6	37	50	Crimson	Crimson to red
Wonderful*	32.6	31.5	10	3	Crimson	Creamy pink
Berri	53.3	38.3	42	59	Red	Green, Light
Waikerie	18.4	42.8	10	53	Light pink	Creamy with pink streaks
Wright	3.7	8.6	1	25	Pink to colourless	Brownish cream
Victorian Giant	33.5	23.6	22	60	Pink	Creamy with pink blushes
Indian	0.1	1.9	4	8	Dark pink to red	Streaky red

*Young trees. Note: Brix° and pH, 16.0 and 3.0 to 4.0 respectively, varied little between cultivars. Acid varied widely.

— **J R Burt**, Horticulture Development Officer, Agriculture WA, South Perth

[John Burt also grows exotic fruits in his Perth backyard. He reports: "Had a few tropical fruits this year, including a banana with 150 fruits, mangos, papaws for 11 months of the year, sapodillas, and one pineapple. My carambola 'F. Tung' is starting to flower and my 'Arkin' is well grown now, so I am hoping it will flower and give me some pollinaton. Monsteras are also growing well"].

Julie Firth takes over as Pomegranate Action Group Leader

After many years as Pomegranate Action Group Leader, Dr Marius Loeffler of Yarloop has had to give up the position. Marius lost many of his unusual fruit varieties after a fire swept though his property some years ago.

We have been fortunate in getting Julie Firth of Geraldton to agree to take over the position. Julie is a specialist in arid-country tree crops and their growth under permaculture regimes, and already has a range of pomegranate varieties, many available through her nursery operation, Yilgarn Traders. Julie's contact details are on the back of this issue of Quandong.

Our grateful thanks for his help in the past to Marius Loeffler, who remains ready to help members in his area where he can.

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New apple directory from Agroforestry Research Trust

BOOK REVIEW

Directory of Apple Cultivars. Martin Crawford. Published 1996 by Cornucopia Press, WA. 234 pages. Paperback. *\$89.95.

This unique new work originates from the UK's Agroforestry Research Trust, and is one of the monumental information sources assembled by its Director, Martin Crawford.

The Directory includes detailed information on over 2,650 apple varieties, among which are all varieties commercially available in Britain and North America.

Australian varieties are also included, although these are of course fewer in number than those from traditional apple-growing countries. Of interest is the fact that two quite distinct varieties called 'Pink Lady' are listed, both the one bred in WA and another originating in Canada. This name duplication could have implications in the current arguments over the use of the name in overseas markets.

The directory is set out in double,

landscape-orientation pages, some 60 cm wide, and for each variety includes details such as picking date, ripening dates, flower date, flowering group, diseases/pests (all in bar-charts or columns), plus a description of the fruit skin colour, type, tree habit, and country of origin and parentage if known. For example, the Canadian 'Pink Lady' is described as having a small-medium round-conical fruit with yellow skin, flushed carmine; flesh is pink, quite sweet, juicy, aromatic, flavour very good; the tree is of low vigour, spreading, a heavy cropper; its parentage is a cross between 'Pink Pearl' and 'King of the Pippins', and it originated in Ontario.

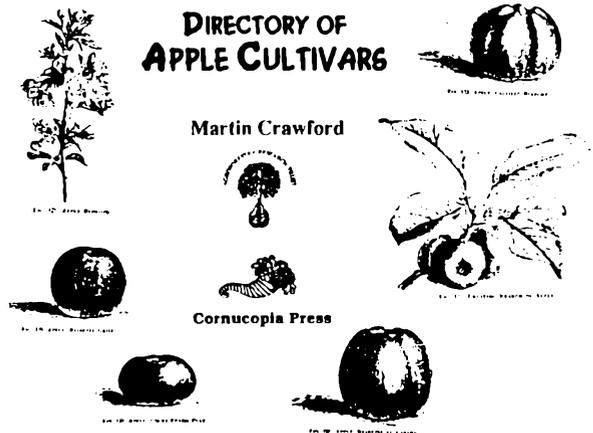
The main directory is divided into four parts, covering dessert/dual purpose apples, cooking apples, cider apples, and crab apples.

There are in addition some 20 'Descriptor Lists', giving keys to varieties with specific characteristics and properties. These include self-fertile cultivars, tip bearers, spur bearers, varieties for areas with late frosts, for chalk/alkaline soils, organic cultivation, high and

low-rainfall areas, for drying, juice production, and for no-prune culture.

Further tables or descriptions cover apple shapes (with drawings), rootstocks, sports, triploids, and vitamin-C content.

Everything is cross-referenced and there is a good index.



This is a densely-printed work which is crammed with information never available in this comprehensive form before.

Because of its format, this book required special care in manufacturing so that it could open out to show the wide tables, and has been produced with a glueing method which is durable and not supposed to crack. A very limited edition of less than 100 copies of this book has been produced by Cornucopia Press, the publishing division of the Tree Crops Centre.

The Agroforestry Research Trust

This organization is a charity registered in England with the object to research into temperate tree, shrub, and agroforestry systems, and to disseminate the results. In practice it closely parallels the work of the Tree Crops Centre in Perth,

The ART magazine, *Agroforestry News*, is in my view the most valuable magazine coming out of Europe. Almost everything in it is painstakingly and exhaustively researched and written by ART Director Martin Crawford. In spite of its title, it really covers tree crops rather than what most people in Australia think of as agroforestry.

ART have allowed WANATCA to use some valuable articles from the magazine, such as that on Nut Pines in the 1995 WANATCA Yearbook.

Recently some lengthy series on particular nuts and fruits have been re-issued as booklets—see, for example the Granny Smith ad on page 31.

Subscriptions to *Agroforestry News* (4 issues/year) cost £22 per year (46 Hunters Moon, Dartington, Totnes, Devon TQ9 6JT).

— David Noël

*Price from Granny Smith (see ad p. 31)

Acacia seed for human food

The Spring 1995 issue of the CSIRO magazine Ecos contained an excellent 10-page description of the work CSIRO scientists have done on the development of wattle species seeds as human food, especially in drier areas.

Around 30 species have been investigated, and the best ones selected as a food source, usually for flour production. The work is well beyond the trial stage. Dr Chris Harwood of the Australian Tree Seed Centre says our acacias "are poised to become a significant component of diets in the Sahel of Africa".

We have managed to get a few all-colour reprints of this article, available as leaflet L68S, 'Seed Saviours', at \$5.00 from Granny Smith.

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Growing Bunyas from cuttings

In a recent experiment, I was able to root cuttings of Bunya Pine (*Araucaria bidwillii*) without any special difficulty, using the plastic Cola-bottle technique described in the 4th Quarter 1994 issue of *Quandong*.

There are some special requirements. It is essential to use material from the stem or an upright shoot of the parent plant, as ('plagiotropic') buds from branch material lead only to a long, ground-hugging branch (maybe this could lead to field crops of bunya nuts!).

Obviously the stem ('orthotropic') buds, which differ in nature from the branch buds, are normally taken from the top of the tree, although upright shoots may sometimes be found on bunyas quite low down, coming from an old undeveloped bark bud — they are quite distinctive. I took the top off a plant about 1.5 metres high, and cut it into four pieces for the experiment.

The Bunya shows very strong apical dominance, and the stock plant soon shoots from the point of cutting, with one bud soon taking over. To propagate from a tall 'Plus' tree in the wild, some people have used a crack rifle shot to shoot out the tip of the tree.

The base of each cutting was dipped in 'Clonex' cutting gel, the four pieces put in a 5-inch pot filled with wetted compost off my compost stack, and the top of the plastic bottle placed over the cuttings with the screw top in place but not tightly sealed (if sealed, contraction of the air inside at night can distort the bottle). That was it — no special watering thereafter, the cuttings were only watered from below by the rain or irrigation water running down the sides of the bottle.

After about 4 months, 3 of the cuttings appeared to have taken and were growing new shoots. The one which failed appeared to be the tip cutting, the best results were from cutting wood which had already turned brown. After another two months or so, the screw top was removed to let the plants harden up a little, after which the rooted cuttings could be potted up in larger containers.

The same precautions about using stem buds also apply with grafting Bunyas, either on bunya rootstock or using buds of the South American nut species, *Araucaria araucana* (Chile Pine) or *A. brasiliensis* (Parana Pine). However, the above technique could be a useful method of bulking up rootstock for these nut and top-quality timber trees. No doubt some individual bunyas will strike more readily from cuttings than others.



Bunya pine nut cuttings grown with the cola-bottle technique

— David Noël

[West Australian / 1996 February 7]

New line in fruit fly battle

Primary Industries South Australia began the release of 20 million sterile fruit flies yesterday in its latest bid to control fruit fly outbreaks in the State.

PISA said a million flies were released at suburban Glenside following a two-week baiting program after a fruit fly outbreak was declared in the area last month.

Another million flies would be released next week at the site of another outbreak at Moana, south of Adelaide, with a further release of a million flies planned for each area each week for the next 10 weeks. PISA recently began using sterile fruit flies as a way of controlling fruit fly outbreaks after the successful completion of a three-year trial. A rearing facility that can produce more than five million flies a week was established in Adelaide.

WA Government lags in fruitfly elimination

It is galling to read about other States' work on fruitfly eradication while we still have the Mediterranean Fruitfly widespread over WA.

There is no more important project in horticulture which needs to be faced up to by the WA Government — this is not something which can be tackled by growers. Fruitfly in our fruit cuts WA out from many export markets and means continual use of chemical sprays is unavoidable for commercial growers.

Only the will to invest the time and money required is needed now. WA eliminated Q-fly, why stop now? Why is WA not a participant in the National Fruitfly Scheme?

— David Noël

[Australian Neem Newsletter / 1996 March]

Neem combats grasshoppers in WA

Through December grasshopper plagues appeared in the Perth southwest region, and a trial was conducted with 'Green Gold' extract to effect clearance, at dilution rate 1:60. This proved efficacious in just one spraying, corroborating what Wilps (1990 - 1995) showed ever so clearly at the Fifth World Neem Conference, based on his extensive work in the Sahara Desert with the world's worst locust, *Schistocera sp.*

Swarms are sprayed ideally on and under grass tufts etc, in the evenings as swarms settle. Repellence and antifeedancy occurs within 48 hours, and breeding is fully interrupted.

Interestingly, it is said the WA Department of Agriculture stopped all research on this WA grasshopper species after nothing was found available to combat the pest!

Correspondant: I. Smith, Mt Lawley, WA.

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Banning the Jujube — Revisited

The article *Banning the Jujube - & shooting yourself in the foot?*, which appeared in the 4th Quarter 1995 *Quandong*, attracted quite a lot of comment. Some favoured the suggestion that tough, drought-hardy, salt-tolerant, productive trees such as *Prosopis* should be developed in WA even though they were thorny, while others were less convinced. Here are some of the responses.

The first is from John Stretch of the Agriculture WA Carnarvon office. There is a strictly-controlled occurrence of *Prosopis pallida* on Mardi Station in the north-west, which appears to be a good source of stock feed and timber, and has been the basis of a commercial honey source. What follows is the Editor's understanding of John's comments, and is not John's own words.

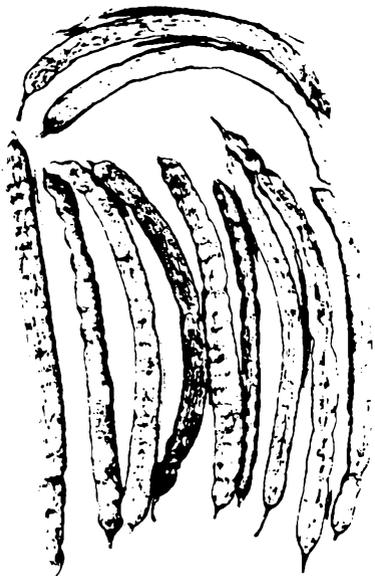
PROSOPIS ON MARDI

Pods of Mesquite [*Prosopis pallida*] were collected from the APB [Agriculture Protection Board] Control Area on Mardie by Mick Minchin of the Karratha APB. I am interested in the potential this genus has (especially salt-tolerant species such as *P. pallida*) for rehabilitation of degraded river frontage soils in the Northwest.

This genus is coming into prominence overseas, particularly for its value as a firewood/ woodlot plant. It does however also have significant potential as a food source for sheep and/or goats, although the high sugar levels of the straight pods can cause stock losses with cattle.

Some pods from a heavy-yielding tree on Mardie were tested in 1989 by the Agriculture WA Feed Evaluation Unit. They showed almost 68% Digestible Dry Matter, a metabolizable energy of 9.7 Mj per kg DM, and a crude protein level of 10.7%. These are better than typical results for oats as feed.

These plants could be a useful source of stock feed for river country with a high water table (less than 10 m down, optimum 6 m). It would be worth looking at techniques to



Prosopis pods from one tree at Mardie

manage them for pod production, such as budding selected trees on *P. juliflora*. Cross-pollination is essential with these trees, perhaps 5-6 high pod-yield lines could be developed.

FROM WAYNE O'SULLIVAN ...

[The following two contributions have been shortened because of space limitations]

Your article *Banning the Jujube-& shooting yourself in the foot?* (Quandong Fourth Quarter 1995) raises several issues that I feel compelled to comment on.

In the initial remarks, the "us and them" scenario between those working to improve sustainability and those that have a "phobia about weeds" raises two issues.

Firstly, there are many ways to increase

sustainability and plant introductions are a very small component of this work. Developing alternatives to the existing management systems would probably have greatest effect of all. Working to develop the potential of the plant resources that are already here could keep us all busy for quite some time.

Secondly, those who deal with weeds are perhaps justified in their caution of haphazard introductions. Our ecological history is peppered with examples, to give a couple:

Between 1947 and 1985, 463 exotic grasses and legumes in at least 2033 accessions were intentionally introduced into northern Australia. Of these, 21 (5%) came to be recommended as useful plants, while 60 (13%) became weeds. Of the useful plants, 17 also became weeds, which left 4, or less than one percent as useful and non weedy!!

Your article refers to the *Prosopis* genus and this serves well as a second example, as *Prosopis* now cover around 120 000 ha in Western Australia. The explosive distribution after a long period of quiescence displayed by these trees is a dangerous characteristic.

Fear of their weediness is far from placated here or elsewhere in the world. Of the 44 species, at least three are aggressive weeds causing great devastation to tropical grasslands. They are; *P. glandulosa* from N. Mexico and South W. USA; *P. ruscifolia* (Gran chaco region of East Bolivia and Paraguay to N. central Argentina) and *P. juliflora* (Central America and the West Indies). *P. ruscifolia* is an aggressive weed of the Argentinian Pampa. *P. glandulosa*, *P. velutina* and *P. juliflora* and now occupy 38 million hectares in the United States. *P. juliflora* is a despised weed in the Caribbean.

While we often recognise the factors contributing to the spread of these plants,

such things as overgrazing, cultivation, earthworks, erosion, silt deposition, running water and herbivorous animals, they are unlikely to be addressed *en masse* by the current land managers. Sadly, experience shows that weed species tend take over the valuable areas as well as the denuded and abandoned farmland.

My next concern is the promotion of The Environmental Superplant. I am disappointed that people still follow this grail, instead of exploiting a range of species to suit the multitude of environmental niches we have.

I find the ongoing calls for greening the deserts, green belts across the Nullarbor and stepping up productivity of these regions quite distressing. Our desert and semi arid areas do not need salvation in the form of introduced plant and animal species. Our desert regions are among the most unique, beautiful and fragile ecosystems in the world. I don't want them to look like the Gran Chaco region of South America and be able to carry more sheep. In fact, the single biggest landcare move we could make is to campaign for removal of stock and control of feral animals in these areas.

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Good species-intrinsic homework should be a prerequisite of any introduction of new plant material into Australia. *Prosopis* may have a role to play, but there is an enormous amount of study to be done *before* we bring more of these type of plants into the country. Work needs to be done within Argentina, Uruguay and Paraguay, where several useful species exist, selecting and collecting germ plasm to breed trees that are fast growing, high yielding, spineless, and having large seeds with little pulp to balance the proportion of protein to sugars. Work also needs to be done on harvesting methods for pods, spacing for best production and on ways of minimising insect damage. Vegetative means of propagation should receive more attention to increase strike and survival rates

The big question for Australia, given the amount of selection work required is, can the work be justified in this country, given the scant resources channelled into similar programs with our endemic legumes and the potential of those species? The Australian *Acacias* may be able to provide all of the benefits we seek from the *Prosopis* without the spectre of serious weed problems, if only we would take their development seriously.

As for *Jujube*, *Ziziphus mauritiana* is a weed which has spread to become an annoyance in some areas, rather than a serious pest. Nearly a century after its introduction it has failed to become an accepted part of the Australian culinary tradition or to play an important role in animal nutrition. *Ziziphus* fruit is marketed in Australia at rock bottom prices. It is hard to imagine this spiny shrub with a fairly ordinary fruit and mediocre market acceptance being the saviour of the semi arid zones and when I do reread the APB article, I conclude that the annoyance value of this plant does outweigh its advantages as a crop.

The current restrictions on the importation of some plant material may have the effect of causing us to do a little more homework on these plants before presenting a case for introducing them. Historically the lack of research into the ecology of plants prior to their introduction into new areas has proven to be a recipe for disaster around the world.

— *Wayne O'Sullivan*

FROM DAVID BROWN...

Some support must be voiced for the Agriculture Protection Board (APB), following your article in the previous *Quandong* (Vol 21, No 4, pp 4-5).

I shuddered at your idea of an "Environmental Superplant" for WA. Even if such a thing existed, it would be contrary to WANATCA ideals to use it as suggested. Our aim is to support a wide diversity of perennial plants (each with its disadvantages as well as advantages) but always planted in the appropriate place.

There is no such thing as a "problem-free" plant or organism, especially when it is dislocated from its region of evolution. The Australian *Acacia*, *Casuarina* and *Eucalyptus* species are as undesirable in parts of America, as are our possums in New Zealand.

The problem with the APB and our quarantine rules, is quite different from what you suggest because the biggest threat to nut and tree cropping, past, present and future, comes from the deliberate or accidental introduction of inappropriate, exotic species.

The APB suspicion of new species is well grounded in history, in ecology, in economics and in the common sense of the Precautionary principle. We need a new direction, the primary focus of protection must be the land itself, with its watercourses and natural biodiversity. We should aim to protect the prospects for a sustainable agriculture, from

the land-degrading, inappropriate form of agriculture brought here from Europe and America.

Unfortunately, the APB is not concerned with these things. It will ban any vigorous, prickly plant that might prevent access to watercourses and fertile lands. Access to these areas must be guaranteed for all the hard hoofed, introduced animals to trample the native plants, compact the soil, erode the banks and slopes, cause salinity, and place excess nutrient loads in the water bodies. APB protection is not for the land as such, but for unquestioned land uses and entrenched economic interests.

The far-sighted protection of land in production, requires that its use is based on sustainable systems which have as their central component, very long living, productive plants (mainly trees). This is where the work of WANATCA is important, but only if it is in tandem with effective, rational quarantine. Australia's existing quarantine is neither very rational nor very effective.

— **David Brown**

DAVID NOEL RESPONDS ...

Wayne O'Sullivan and David Brown bring out many points on this issue which are worth examining.

The figures which Wayne quotes on the tendency of imported grasses to become weeds really have no relevance to import of tree species as potential crops. I cannot think of even a single tree species imported into Australia for production of food, fibre, or even timber, which has become a weed in a real sense. The whole point is that crop tree species, unlike grasses, are raised and planted individually and monitored for their yields. This is totally different from introduction of grasses and clovers, which must, in a sense, go wild if they are to establish successfully.

Obviously the more we know about a plant, including its ecology, before introducing it, the better we can use it. But a suggestion such as Wayne's that introductions without such work is "a recipe for disaster around the world" just does not hold water. The history of civilization is a history of introducing and developing crop plants — in Australia, all but a tiny fraction of 1% of our crop plants are introduced, virtually everything was brought in without any special thought, or dire consequences.

While few would disagree with Wayne's desire to retain our unique and beautiful desert areas, this does not then run on automatically to suggest doing nothing about

(continued on next page)

New Olive Growers group formed in WA

The Quairading Olive Growers Co-operative, based in a Wheatbelt town east of Perth, was formed last year to promote olive growing in this lower-rainfall area.

The group believes that their activity is a growing, and much undervalued, industry in Australia. It presents opportunities to diversify and reduce salinity problems in the wheatbelt, where climatic and soil conditions are conducive to growing olives. Olive imports into Australia are expected to amount to \$200 million per year by the year 2000.

A recent Field Day looked at an innovative small olive processing built by Fred Starcken, who has been involved with olives for over 25 years.

QOGC Secretary Sharon Richards can be contacted at PO Box 5, Quairading, WA 6383 (phone 096-466249).

[Thanks to Dick Taylor of the Rural Innovation Centre for alerting us to this].

our vast areas degraded through overstocking, as brought out by David Brown. These are the areas appropriate for rehabilitation through hardy tree crops.

In fact, it appears our whole Australian climate and vegetation has been fundamentally changed by man, and not just by European migration. According to Tim Flannery, in his book *'The Future Eaters'*, Aboriginals converted much of early Australia from forest to open savannah through regular burning. By all means restore the environment, but do this by building up diverse ecologies based on perennial plant genetic material taken from

anywhere and everywhere, rather than using the rather parochial view that 'Australian' must be best.

THE CATTLE-STRAYING ANALOGY

Finally, a practical proposal for those who want to be careful. It would be quite feasible to allow people to plant species which were a cause for weed concern under a 'cattle-straying' provision, that is, the planters would have to acknowledge that if the species escaped from their property, they would be liable for damage caused to others. In this case, only those who were serious would go ahead.

— David Noël

Macadamia experts join WANATCA

WANATCA is delighted to welcome Henry and David Bell of Hidden Valley Plantations, Queensland, to WANATCA membership.

The Bells are Australia's foremost macadamia breeders, and originated the varieties A4, A16, and A38, two of which were the earliest Australian native plants registered under the Plant Variety laws. They are also innovative macadamia nut producers, and featured in the article on 'High-density planting of macadamia nuts' in the 1995 WANATCA Yearbook.

Henry was asked to comment on the new Agriculture WA bulletin 'Growing Macadamia Nuts', and he replied with a lot of useful information on varieties and other matters. Some of this is reproduced here.

VARIETIES

Hinde or H2 is not *M. integrifolia* but a hybrid and so is Renown or D4. Some of the progeny from H2 when used as an F parent tree can have pink flowers. It is possible that pink flowers may be a recessive gene which would upset the taxonomists no end, but I can't prove that - yet!

ROOTSTOCK

I would be very careful about accepting the hypothesis that tetraphyllas used as a rootstock have superior growth, better anchorage and are less susceptible to *Phytophthora cinnamomi*. It has also been said that *M. tetraphylla* used as a rootstock

for integrifolia varieties produce crop quicker. This is correct initially, however yields of cultivars grafted on to integrifolia rootstock perform better on a long term basis.

It was believed in the seventies that tetraphylla rootstock was more disease resistant to *Phytophthora cinnamomi*, however this is not normally a problem in well drained soil and the most usual form of the disease is trunk canker above ground level, usually due to bark damage. In Californian avocado orchards where trees had died out from *Phytophthora*, they were replaced with Macadamias which are resistant.

Nearly all the early plantings in Hawaii were on tetraphylla rootstock and they are the ones that are now seriously affected with 'dieback'. At MacFarms plantation on the island of Hawaii, which is about 1200 ha, from the air it is clearly visible which trees were planted on tetraphylla rootstock. They are just starting a major replanting program to replace these trees, using integrifolia rootstock. I think one of the problems long term may be incompatibility between rootstock and scion which can take a long time to show up, also although tetraphyllas grow faster initially, they finish up as smaller trees and used as a rootstock may not be able to support the large canopy on top. Macadamia doesn't have a single deep tap root as a mature tree, but like many rainforest trees, they put down a series of tap roots as they tend to feed more on the litter from the forest floor. I have never observed any difference between the root systems

of the two species. In California the industry is based on tetraphylla varieties on tetraphylla rootstock. South Africa uses largely Beaumont (hybrid) clonal rootstock which is very vigorous and produces even cuttings with a good root system.

The early NSW plantings were largely Renown rootstock. It is a hybrid and heterozygous in respect to the degree of diversity in the genotypes. Hinde or H2 on the other hand is homozygous and most of the progeny are vigorous and fairly true to type, which is what nurserymen like. Most of the later plantings in Eastern Australia have been on H2 rootstock.

GRAFTING

Few people use a cleft graft, although I know of one propagator that uses a modified cleft or wedge graft. Whip and tongue are seldom used, most nurseries use a straight whip grafts although I prefer a modified side graft because you don't have to match the scion with the root stock. Chip budding is not practical, the main criterion in punch budding is that it needs to be done outside over the summer months when there is good sap flow in both scion and rootstock, the bark must lift cleanly. Just how you would strap a growing shoot to the stub of a trunk I have yet to find out, I have never seen it done and it certainly wouldn't be successful for any large nursery operation. You can nip the tip off the growing shoot to make it branch and thicken up when it is about 10 cm long, where wind is a problem.

FERTILIZERS

We use only a couple of teaspoons of slow release Osmocote in the bottom of the hole when the trees are planted and nothing further for the first six months, after that they get a mix with high N and K and low P, with trace elements. You have to be careful with P with Macadamias, if you put on high quantities of fowl manure or artificial forms of P, you can finish up with phosphorus toxicity which stays in the soil for a very long time. The only area where our soils and leaf analysis differ very much from Hawaii is in Boron levels, it is important to give extra Boron either as foliar sprays or as side dressings in a balanced mix — add too much and you will kill the tree.

— *Henry F D Bell*, PO Box 6, Beerwah Qld 4519

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CALENDAR OF FORTHCOMING EVENTS

1996

Deadline for next issue: Jul 20

- May 15 Wed General Meeting (Harrie Hofstede - *Worms, Compost, Trees*)
Jul 2 Tue Executive Committee Meeting
Jul 8-11 §First Australian New Crops Conference, Gatton, Queensland
Aug 17-22 §First Australian Macadamia Research Conference, Gold Coast, Queensland
Aug 21 Wed General Meeting (?Sujit Dey - *All about Mangos in Perth*)
Aug 28-29 *Dowerin Field Days
Sep 28-Oct 5 *Perth Royal Show, Claremont
Sep 28-Oct 7 §Sixth International Permaculture Conference, Perth
Oct 15 Tue Executive Committee Meeting
Nov 20 Wed Annual General Meeting (?Roger Meyer - *Rainbow Kiwis & Jujubes?*)

*General Meetings are held starting at 7.30pm. Venue: Theatre Room, Kings Park HQ, West Perth. These meetings usually include a current magazine display.

• Event with WANATCA participation; § For contact details refer to the Tree Crops Centre.

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**Current Subscription Rate: \$40.00 per year
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Quandong is produced by the Tree Crops Centre, PO Box 27, Subiaco, WA 6008.

Phone: 09-385 3400. Fax: 09-385 1612. E-mail: davidn@interworld.com.au

Advertising Rates: Whole page. \$80; Half page, \$45; Quarter page, \$25;

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