

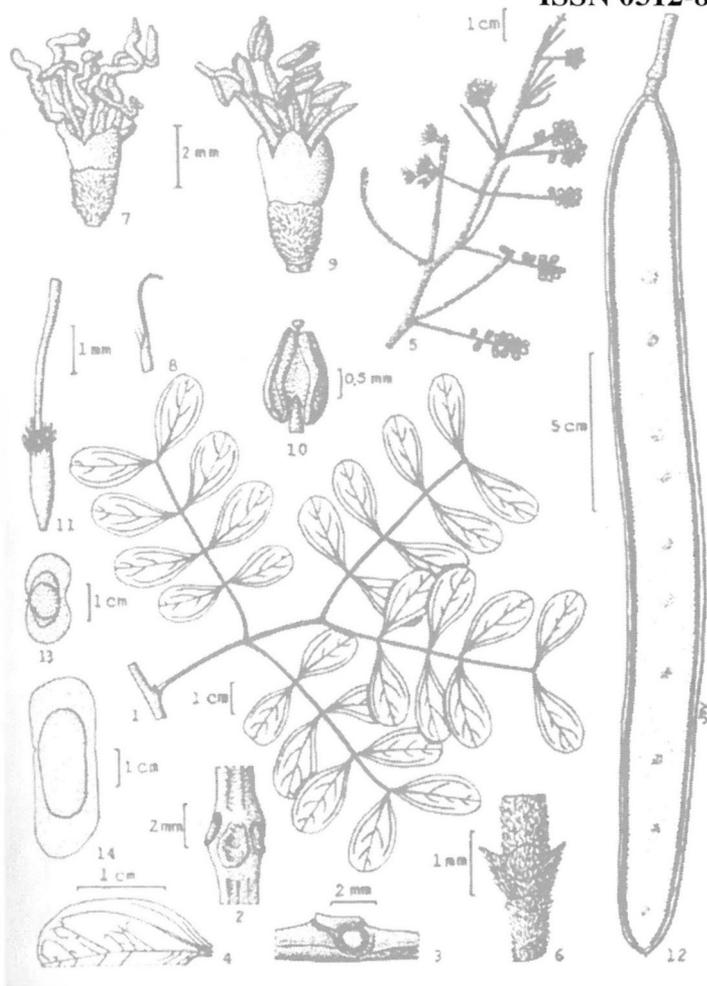


Quandong

magazine of the
West Australian Nut & Tree Crop Association (Inc)
www.AOI.com.au/wanatca

First Quarter 2004 • Vol 30 No 1

ISSN 0312-8989 • \$5.00



Quandong • First Quarter 2004 • Vol 30 No 1

***DON'T MISS THE NEXT WANATCA GENERAL MEETING:
7.30 pm, THURSDAY February 19, 2004.***

At our next meeting, George Ainsley & Charles Peaty will give us a presentation on:

Propagating & Planting Useful Exotic Trees

This meeting is at Kings Park and is on a THURSDAY instead of our usual Tuesday.

Both speakers are WANATCA Exec members and will be well known to local WANATCA members. Charles Peaty has been working in large-scale reforestation over vast areas of the State for many years. George Ainsley is more concerned with newer tree crops with valuable products.

The pair are involved in a nursery operation at Greenough, south of Geraldton, where neem trees and many other interesting crop plants are being raised.

Full details on accompanying leaflet. Enquiries to 9250 1888 please.

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About the Cover

The cover drawing of the Tara Nut tree is from George E Schatz's book *Generic Tree Flora of Madagascar*. See the story on page 7 about this scarcely-known and under-exploited plant.

Material appearing in Quandong is the views of the authors. It is offered in good faith, but neither WANATCA nor Quandong take any responsibility for any use of this material

[Countryman Horticulture / 2003 Dec 4]

Manjimup ginkgo plantation steaming ahead

The dream of Perth company Natural Medicines Australia (NMA) to gain a big slice of the natural medicine industry is fast becoming a reality in Manjimup.

NMA resource manager Mark Tonkin said 40 hectares of company-owned land outside Manjimup was being prepared for ginkgo biloba trees which have been used medicinally in the Orient for hundreds of years.

"We are in the process of cleaning up and we'll be deep ripping and mounding the soil for the trees very soon," he said.

The crop will be planted as a hedge with 25,000 trees planted per hectare, and the trees will be pruned to a manageable height of 1.5 m.

As well as the land being planted at NMA's property, 15 farmers from Waroona, Yarloop, Cowaramup, Margaret River, Balingup, Nannup, Pemberton, Manjimup and Narakup have pledged land to the contract growing of the crop for NMA.

The ginkgo biloba tree leaf has three separate compounds with the potential for use in 140 different medicinal applications, from memory loss to cosmetic cream.

Mr Tonkin said a state-of-the-art super-critical extraction plant would soon be built on the property which will eventually sport tourist attractions and retail outlets on the same site.

The plant will be used to process the leaves of the tree which are ready to harvest



Graham Bell, of Natural Medicines Australia, with a tray of ginkgo biloba seedlings destined to become alternative medical products

Quandong Links to **ATCROS**

Many of the articles, advertisements, and news items in Quandong refer to organizations and people who are listed in the Directory section of the ATCROS Web Site, which is at:

<http://www.AOI.com.au/atcros>

In this issue, items underlined in the text have Atcros reference numbers listed at the end of an article or elsewhere close by. This is so that readers can get more contact details.

ATCROS usually lists name, address, and phone numbers, also fax, e-mail, and web page details where available.

Quandong: Atcros ref. <A1466>.

when the trees are three years old.

He said NMA would also be contracting growers to supply fresh, organic vegetables to be sold as gourmet foods to niche organic markets.

NMA managing director and founder Graham Bell said the alternative medicine industry in Australia was big and growing.

He has forecast that the ginkgo industry in WA would be bigger than the wine industry in the South-West within 10 years.

[West Australian / 2003 Dec 10]

Manjimup moves into tree crops

There is a lot more to Manjimup these days than spuds, cauliflowers and loggers.

Since green policies saw the timber industry nosedive in 1999 and traditional agriculture began battling global markets, innovative projects have started springing up.

Manjimup is already the site of a "black gold" crop—the European truffle fungus—and will soon host a green tea plantation.

There is also a project under way that will purportedly become the world's biggest commercial organic plantation of ginkgo biloba.

Ginkgo is a herbal stimulant gaining popularity in natural medicine and used in pharmaceutical supplements.

Perth company Natural Medicines Australia has propagated 600,000 ginkgo seedlings at the Forest Products Commission nursery 8 km from town and 15 farmers are organically certifying 150 ha of combined land to grow the trees.

The harvested ginkgo will be processed at a plant in the town that will be ready for production next year.

Natural Medicines Australia managing director Graham Bell said another three million seeds would be germinated in January and February to service the massive growing global market.

"Demand for organic natural medicines around the world has got to a point where it is outstripping production," he said. "The future market is expanding at such a rate that companies like Sainsbury's and Marks & Spencers in the UK are travelling the world looking for new sources of quality products, especially from places that can produce them cleanly and ethically.

"In the South-West, we are ideally positioned because we have one of the cleanest environments in the world—this is one of only five or six countries



Stimulating venture: Mark Tonkin holds aloft a ginkgo biloba seedling ready for planting in the back blocks of Manjimup

in the world that can truly be certified as organic — and we can show that we produce products without resorting to child labour or exploitation."

Mr Bell said natural medicine was only a few years away from becoming a giant industry and would provide great job opportunities for Manjimup.

"These 15 farmers we have involved in the ginkgo project will act as examples of how foods and crops can be processed organically and others will look to them and join in the movement towards natural farming," he said.

"In 10 years, this industry will be bigger

than the wine industry."

Mr Bell said 18-month trials were under way for another 40 plants that could be used in natural medicines, essential oils and organic foods.

The foods would be sold in Australia through the recently acquired food subsidiary company Globalin, and vacuum-packed for export.

Natural Medicines Australia also has secured a location in the Manjimup shire for a health and relaxation clinic using the Indian herbal and lifestyle principles of ayurveda, India's ancient system of medicine.

Do you have trees to sell?

The St Barbe Grove Nursery of Men of The Trees have indicated that they are willing to set aside part of their sales area to display useful trees produced by WANATCA members.

This is a real opportunity to improve the availability of crop trees to the general public, particularly rarer fruit or nut trees, sometimes available only in very small numbers — items which commercial nurseries can't be bothered to stock.

Details of the projected service are still to be finalized, but MOTT would receive a commission on sales, and the agreement would envisage each WANATCA member offering trees undertaking to label their own trees and set their own prices.

Contact David Noel on 9381 7341 if you have stock you would like to enter in this scheme. MOTT's Nursery Manager, Ross Burnett, can be contacted on 9250 1888 with any queries as to how the trees would be housed.

World walnut conference this November in Italy

The Institute for Agro-environmental and Forestry Biology, belonging to the Governmental National Research Council of Italy, in collaboration with other Italian important structures and Institutions, is arranging a World Walnut Congress in Sorrento (Italy) to be held from 7 to 14 November 2004.

A brochure illustrating the event can be obtained from from me as below, or emailed to you as an attachment by contacting me at my e-mail: <l.cherubini@ibimet.cnr.it>.

For further details, please feel free to contact us at this e-mail address or by phone at the following numbers:

(office in Rome) Tel. ++39 (0) 6 49932710 fax ++39 (0) 6 49932730

(office in Porano) Tel. ++39 (0) 763 374903 fax: ++39 (0) 763 374980.

—LuciaCherubini for Dr.FrancescoCannata

[Countryman / 2004 Jan 15]

Vetiver as a farming cure-all

Vetiver grass is being investigated as a cure-all for farmers and water users throughout the country and its merits are being pushed by WA landcare specialist Fred Armstrong, of Katanning.

The grass has been used for centuries in Asia may be able to save river systems, act in contour banks and erosion control on farms and orchards and feed stock on salt affected land

Mr Armstrong said Monto, a sterile cultivar of vetiver, had a deep, dense root system and thick growth and had been used effectively to stabilise gully heads and rehabilitate gully floors in cropping and grazing land in Queensland.

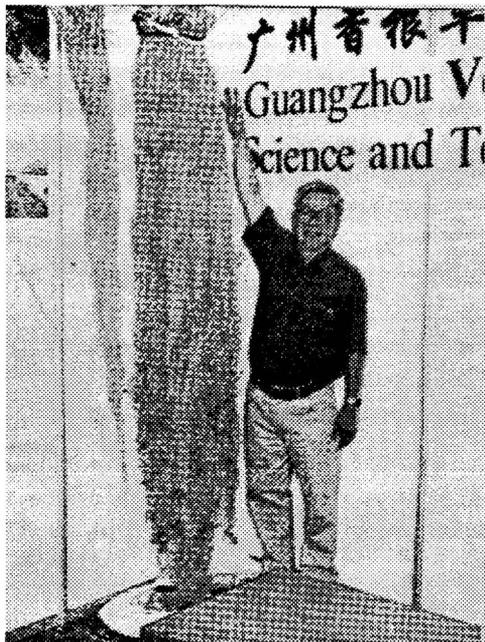
"This plant is drought, salt and fire tolerant, it can take-up heavy metals, can be used as a fodder plant, thrives after slashing, mowing or grazing and will not spread like a weed," he said.

"We are crying out for a means of preventing nutrients getting into water courses downstream and this plant has demonstrated it can take up large volumes of nitrogen and phosphorus and chemicals from farm runoff."

Trials of Monto in Queensland have shown more than 90 per cent of phosphate, pesticides and herbicides were trapped in sugar cane and cotton farms and similar results were reported for pineapple lands in south-east Queensland.

Primary consultant for Veticon Consulting at Darwin, Dr Paul Truong, said extensive trials on the fodder properties of vetiver grass had been conducted in China, Queensland and Katanning.

"The grass has been used to feed buffalo, pigs and goats in trials in Thailand and China



Dr Paul Truong, of Veticon Consulting, displays a vetiver grass root system at the third International Vetiver Conference at Guangzhou, China, in October

and the results have been promising but most work done on the plant in Australia has been on erosion control and phytoremediation," he said.

The plant has been found to thrive in effluent waste from piggeries and has the potential to clean up water courses and partially treat sewerage water.

The roots of vetiver have also been used for centuries to extract an oil that is highly prized for perfume production.

The Tara Nut— a little-known species from Madagascar, with a WA connection

In 1985 and 1988, Tim Willing of Broome, at that time on the staff of CALM, got financial help to travel to the island of Madagascar and report on interesting plants there.

In fact, Madagascar is an amazing treasure-chest of plant species, a high proportion of which are endemic (found only there), though many have relatives in Africa, southeast Asia, northern Australia, and far into the Pacific. This endemism reflects the historical fact that Madagascar split off from the Gondwana supercontinent some tens of millions of years ago, carrying with it all the ancestors of its current flora. This was long enough ago for many of its species to have evolved and split into numerous new species, most of which are therefore confined to the Island itself.

The species which, perhaps more than any other, attracted Tim's attention was *Lemuropisum edule*, the Tara Nut. On return to WA, Tim carried out trials on growing this plant. A mimeographed report was produced, and a copy of this found its way to Britain's Kew Gardens.

This report was picked by FAO workers in Rome (the Food and Agriculture Organization of the United Nations), who were preparing a book, 'Edible Nuts', which they later converted and placed on the World Wide Web. An extract from this website, relating to Tara Nut, is reproduced below.

Tim's work appears to have been the only attempt to bring this interesting species into

commercial cultivation. A Web search with Metacrawler gave only 7 leads to *Lemuropisum*, one of which was the FAO reference. The other 6 were botanical notes.

In spite of, perhaps because of, its enormous plant riches, Madagascar has never had a complete survey of its plants, although some sections of a national flora have been tackled in earlier years. So I was most interested to get a copy of *Generic Tree Flora of Madagascar*, by George E Schatz, published by the Kew and Missouri Botanic Gardens in 2001.

Running to 500 pages, this book gives descriptions of every known plant genus in Madagascar which has at least one species in the genus reaching the status of a tree. For someone like myself who is interested in plant distributions and relationships around the world, the book provided a fascinating background and confirmation of the ideas put forward in my book *Nuteeriat*.

Schatz's book includes a good line drawing for each of the 490 Madagascan tree genera, and is the source of the cover illustration in this issue of *Quandong* for *Lemuropisum* (the only species in this genus). Some idea of the richness and special place of plant life in Madagascar can be grasped from the statistic that the island contains some 4220 plant species, of which 4051 (96%) are endemic.

By comparison, Australia's Northern Territory has only about 520 distinct plant species, of which less than 40 are endemic. So Tim Willing's work on Tara has hardly scratched the surface of the potential for greater use of the plant resources of this unique flora.

— David Noel



[<http://www.fao.org/docrep/V8929e/v8929e06.htm>]

**Tara: *Lemuropisum edule*,
Leguminosae, subfamily
Caesalpinioideae**

Distribution and ecology

Native to south west Madagascar; the precise distribution is not known due to difficulty of access but apparently confined to two disjunct populations some 60 km apart, from near Itampolo and around Lake Tsimanampetsotsa. It appears to be confined to the exposed seaward facing rocky limestone escarpment and the sandy soils immediately below, growing at altitudes between 15-100 m.

The local rainfall is bimodal, very erratic, with an annual average less than 400 mm; the average temperatures of 27.4° C in summer

and 19.9° C in winter. The species is currently under investigation as a potential nut crop in Western Australia (Willing, 1989).

Description

Unarmed, multistemmed, much branched, spreading shrub up to 4-6 m tall, crown dense, branchlets sometimes spine-like. Leaves sparse, semi-persistent, paripinnate, with 1-4 pairs of oval to suborbicular leaflets, 3.5-6 mm wide. Inflorescence a raceme; flowers bisexual, with 4 white petals and 1 tinged yellow. Fruit pendent, subcylindric, depressed between the seeds, 20-30 cm long, 2 cm wide, 2-valved, valves membranous, dehiscent; seeds 6-12, ovoid-reniform, 2.5 cm long, 1.6 cm across, testa thin and brittle (Willing, 1989).

Cultivation

Not cultivated in Madagascar. Seeds require storage under conditions of low temperature and low relative humidity. In Australia seed sown in 20 cm long tubes; germination rapid after soaking for 10 hours. Aerial growth characteristically zigzag with rapid development of side branches requiring plants to be well spaced in nursery to prevent entanglement; root growth rapid. Plant at 4 m x 4 m spacing after 3 months. Alkaline soils preferred.

After 1 year, two growth forms are noted, a spreading open bush or the less common compact, somewhat fastigiate bush (Willing, 1989).

Harvesting

Nuts (seeds) are harvested from the ground following dehiscence (Willing, 1989).

Post-harvest treatments

None required (Willing, 1989).

Production and consumption/utilization

Nuts (seeds) eaten raw, discarding the brittle testa, the cotyledons agreeably sweet with a cashew-like flavour, smooth

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consistency and a flexible, rather plastic texture. Apparently not used in cooking; when eaten green the flavour reminiscent of fresh garden peas (Willing, 1989).

Nutritional value

The nuts contain 38-43% available carbohydrates, 26-32% unavailable carbohydrates, 14-16% protein and 6-9% fat, comparing favourably with those of *Cordeauxia edulis*. However, the ingestion of 100 g kernels, ca. 84 raw seeds, may inhibit human production of chymotrypsin and cause digestive upsets, although this could possibly be reduced by cooking or roasting the seeds (Willing, 1989).

By-products and other uses

Browsed by goats when little else to eat, they also eat the seeds. Possible potential for windbreaks and hedges (Willing, 1989).

Marketing

Apparently not sold in the local markets (Willing, 1989).

Discussion

Survey of extent of natural populations and genetic variability, and applying measures for its in situ and ex situ conservation is required as well as investigation of its autecology. Establish provenance trials; select high-yielding, toxin-free trees and evaluate the two life forms; investigate potential for micropropagation and agronomic requirements; investigate possible potential for Mediterranean regions in addition to the arid tropics (Willing, 1989).

Reference

Willing, T. (1987) Tara nut (*Lemuropisum edule*, Caesalpinioideae) from south west Madagascar. Royal Botanic Gardens, Kew (mimeo).

[The following technical description is from the Schatz book note above]

Lemuropisum H. Perrier, Bull. Soc. Bot. France 85: 494. 1939.

Endemic monotypic genus

Lemuropisum edule is distributed in subarid thicket along the coastal sands and limestones escarpment S. of Toliara from Itampolo to Tsimanampetsotsa RNI. It can be recognized by its thick twigs with lateral shoots terminating in rigid spines, large flowers with free, spreading, clawed, white petals, and thin, spirally dehiscent fruit, the seeds not partitioned in separate chambers. The seeds are edible when immature.

Hermaphrodite shrubs to 4 m tall, much-branched, the bark pale grey-brown, smooth, the thick twigs with lateral shoots terminating in rigid spines, and short shoots bearing the leaves and inflorescences. Leaves alternate but in tight clusters, paripinnately compound, with 2-3 pairs of small, opposite, entire, penninerved leaflets, stipules small, caducous. Inflorescences axillary, solitary racemes produced near the tips of short shoots, flowers large, slightly irregular; fused calyx with 5 unequal, valvate, leathery lobes enclosing the flower in bud; petals 5, white fading to yellow, free, clawed, spreading, the upper petals slightly larger, lemon-yellow with a white margin, the margins of the claw inrolled and forming a narrow tube: stamens 10, filaments free, spreading, anthers dorsifixed, longitudinally dehiscent; ovary sessile, style long slender, maroon-pink, stigma punctate: ovules 6-10.

Fruit a large, thin compressed, leathery, spirally dehiscent, bivalved pod, the seeds not partitioned in separate chambers, densely pale grey pubescent mottled with darker grey and red-brown resin droplets; seeds oblong, truncate, i.e., barrel-shaped, with a cream-white leathery seed coat.

Vernacular name: Tara

[West Australian / 2003 Nov 14]

York's good oil makes its mark

A switch from cropping and sheep to growing olives has flowered like the 6000 trees the von Altenstadt family have on their York property, Talbot Grove.

The grove, started seven years ago, burst into flower this week at the same time as the news arrived that one of Britain's most exclusive department stores, Harvey Nichols, wanted all three of the family's oils.

A buying group from Harvey Nichols tasted the oils along with several other WA oils in Perth last month.

John von Altenstadt, who as a German defence force officer sold Leopard tanks to Australia more than 20 years ago, knew nothing about olive oil when he migrated to Australia and bought a farm south-west of York.

But when his son Frederik went to the Philippines as an Australian volunteer he

realised that agriforestry would be a more sustainable use of the Talbot Brook farm than cropping.

His parents agreed and after some research they decided that the most suitable crop would be olives.

The first planting was nearly wiped out by sap-sucking Rutherglen bugs. Following a steep learning curve, the von Altenstadts extended the planting to more than 6000 trees by 1998.

The third commercial crop is expected to yield between 4000 and 5000 litres of oil including peppery Frantoio, fruity Manzanillo and subtle and complex Nevadillo.

Mr von Altenstadt said the Nevadillo from



*Premium product: Frederik von Altenstadt says production is doubling every year at Talbot Grove as the trees mature and he expects a peak output of 20,000 to 50,000 litres.
Picture: Ian Ferguson*

trees planted in WA. They are expected to produce an estimated 8,000 tonnes of olive oil when they come into full production in six to seven years. This is calculated to have a value of \$30 -40 million a year.

Most of this development is taking place within some picturesque countryside, in the Moore River region, just one hour away from Perth. The region also hosts tourist attractions along with other primary industries such as wine, citrus, beef, and fishing.

Moore history

Today's olive industry in the Moore River region has its roots in the Benedictine Monastery town of New Norcia, where the first commercial olive grove was established. New Norcia, 132 km north of Perth, was established in 1846 and the olive grove was planted in the 1860s. In 1908, New Norcia won a silver medal for its olive oil at the Franco-British Exhibition.

Olive Grower & Processor: A3140.

News on the WANATCA Yearbook Online site — do we have your e-mail?

Work is continuing on converting the WANATCA Yearbook printed editions into versions which can be downloaded from the Web.

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Moore facts

- *The Moore River Olive Region is developing as the biggest olivegrowing area in Western Australia.*
- *700,000 olive trees planted in the last 7 years and will likely exceed 1,000,000 trees by 2005.*
- *More than 70% of all recent plantings in WA have been in the Moore River Region.*
- *Investment in the industry in the region since 1996 is more than \$40 million.*
- *In excess of 25 new groves have been established, varying in size from 215,000 trees down to less than 500 trees.*
- *Oil production is forecast to be 2.5 million litres in 2005 and 6,000,000 litres by 2010.*
- *Value of the production is conservatively estimated to be \$18 million in 2005 and double that by 2010.*

The newer issues will be converted first. Parts of the website such as listings and indexes will be available to the public, but the full texts of papers will be restricted to current members, who will need a password to be able to download one or more papers.

It is expected some full texts will be available at the time of the next *Quandong*, and that passwords will be sent to current members by email at that time. Do we have your current email address recorded? This is normally shown on the mail slip sent out with the current issue.

If you do not have an e-mail address but want to access the Yearbook Online, say through a library terminal, you can ask for the password by phone or mail. More later

[Sunday Times / 2004 Jan 18]

Nature's own lozenge

The jujube or Chinese date (*Ziziphus jujuba*), also known as the red date and in China as zao, is a most unusual fruit.

It's thought to have originated in Syria, others say China, but it has spread throughout the hot, dry climates of the world.

It is known to have been cultivated in China in the third century BC and was introduced into England in 1640 where it grows only in mild areas.

This is an important fruit in traditional Chinese medicine and is used mainly as a tonic to overcome anemia, irritability, diarrhoea and insomnia.

It's fairly well known as a soothing fruit particularly for throat and chest problems and the juice is often used to alleviate cold symptoms and sore throats.

This is how the word jube, the lozenge one chews to treat throat problems, originates.

While they are difficult to obtain, jujube trees are available in limited quantities.

The fruit of the jujube is shaped like a plump olive and is about 3 cm to 5 cm in length. When ripe, it is a reddish mahogany-brown and has a flavour remarkably similar to a granny smith apple.

The fruits are harvested in autumn. When fully ripe the flesh is spongy and very sweet.

When eaten fresh, the fruits of jujube are quite delicious but they can be readily dried also. This dried fruit is what is known as traditional Chinese dates.

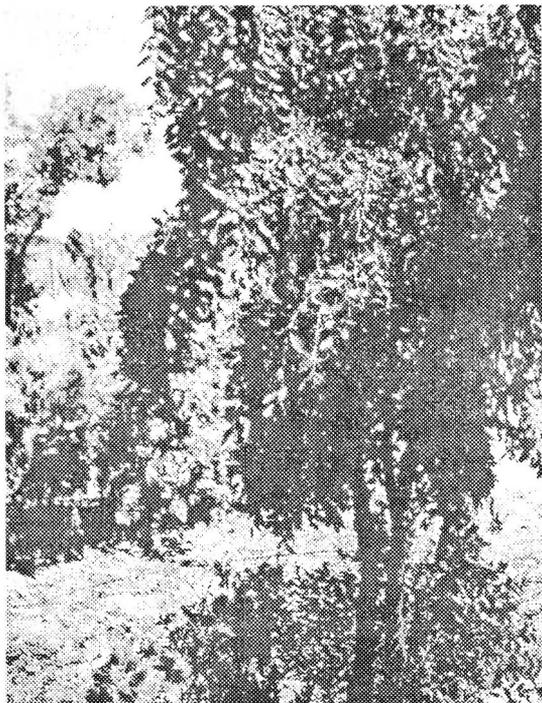
In this form they can be used in

savoury dishes, for example with fish casseroles and soups.

They are also tasty additives to puddings, cakes and breads. Jujubes can be candied and this is another famous Chinese dessert.

To candy your own fruit, puncture the fruit all over with a pin and then boil in syrup. The juice of the jujube makes an excellent jelly. Fruits can be frozen for six weeks in an open container.

The tree is a small, very handsome deciduous specimen growing somewhere



The jujube tree produces a fruit vital to traditional Chinese medicine in curing everything from sore throats to insomnia

between 3 m to 5 m high in most locations.

Jujube is an incredibly tough tree that is drought-tolerant, able to withstand sub-freezing temperatures in winter and extreme heat during summer.

Many varieties have a weeping habit and the unusual way the shoots grow in a zigzag style makes even the bare branches unusual and attractive in winter. In summer the foliage is a shining deep green. In autumn, before it drops, leaves turn a rich golden yellow.

Jujube needs a long, dry, hot, summer for best fruit development and dislikes humidity. This means that most of the metropolitan area should be ideal.

It's tolerant of heavy clay soils, even alkaline and poor-draining soils and is not demanding when it comes to feeding.

Pruning isn't essential for fruit development and isn't usually necessary even for shaping as the tree tends to be fairly well formed.

The jujube tree does have a few problems. It has spiny branches that have to be manoeuvred around carefully when picking the crop. It does have a tendency to sucker, which takes some years to overcome.

The best preventative treatment to sucker formation is to water only occasionally through summer. When you do water, leave the sprinkler on for a long time to drive the moisture down deep.

The roots will follow the moisture to greater depths and this discourages sucker forming surface rooting.

Fruit fly can affect the crop so some spraying is necessary to keep the fruits clean.

Overall the jujube is a very attractive, exceedingly tough tree that is a proven winner in the Perth metropolitan area. The fruits are useful and the tree has many enjoyable ornamental qualities.

— *Neville Passmore*

Vision 2013 — towards a commercial nut industry group for WA

Plans to advance commercial nut industries in WA took a step forward last October with a meeting of leading figures in various WA nut industries.

The stated purpose was to explore organising commercial nut industries in WA through formation of an efficient and viable body to assist this process in the future.

The areas where such a body could act were:

- **Growing:** *achieving the best yield and most cost effective production by sharing and distributing information amongst all commercial nut crop growers.*

- **Harvesting and processing:** *examine efficiencies which may come from adaptation of equipment and systems which may be*

relevant to more than one nut crop.

- **Research:** *improve ability to attract research funding for worthwhile projects.*

- **Marketing:** *develop an effective marketing strategy to sell produce domestically and internationally.*

The participants were Bernie & Sheryl Rochester, Tony & Shirley Fontanini, Bert Hayes, Graham Fellows, John Cory, and Tony Riggall.

The meeting led to a general agreement on the need to pursue the concept of cooperation to effect economies of scale with regard to the

items listed above. One example was cooperative marketing of WA Nuts as a brand encompassing all nuts.

One possibility was making nut products available from one central location, for ease of purchase and distribution for trade buyers, and possibly incorporating a retail/tourist

section to help the promotion of WA nuts.

A conference might not be useful at present but should certainly be considered in the future.

For further information, contact John Cory on 9574 6163.

[Countryman Horticulture / 2003 Dec 4]

New air nut sorter saves time, money

Macadamia growers now have access to an affordable tool that promises to save them time and money at harvest.

The Nut Air Sorter, available from Shelterbelter Macadamias at Gidgegannup, is a simple yet effective machine that sorts commercially grown nuts by using a specifically shaped air curtain.

Shelterbelter owner John Cory said most on-farm nut sorting was done with a water sorter which presented problems to the grower.

"A water sorter relies on viable nuts to sink and non-viable nuts to be floated off," Mr Cory said.

"The major problem is that the oil and moisture content of the viable nut must be in the correct ratio for it to sink. "It has been found that about 40 per cent of floating nuts are viable and are thrown out needlessly."

He said water sorters also added to the drying time and expense.

"Nuts that have been submerged cannot be used in the second sort and the oil and protein levels in the nut can make the water become a health issue," Mr Cory said.

He said some large commercial growers used a vacuum air system to sort their produce, but these systems were expensive and uneconomical for most growers.

For more details phone John Cory at Shelterbelter on 9574 6163.



Shelterbelter owner John Cory with the macadamia air sorter

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[*Fruit Gardener (California Rare Fruit Growers) / 2004 Jan-Feb*]

Lesser-known fruiting cacti

Recently the *Fruit Gardener* has featured articles on dragonfruit and Peruvian apple cactus. While these and the Indian fig cactus are certainly the most well-known and most-utilized fruiting cacti, the cactus family includes many more examples that bear edible fruits of local and regional significance.

Arizona and much of California are similarly arid regions, unsuitable for many commonly grown temperate and subtropical fruits. Population growth has strained water resources, raising the spectre of future restrictions on water use. Future fruit gardeners in the Southwest may want to learn more about growing cactus as a way to adapt to these changing conditions. Gardeners in less arid regions may find cactus virtually maintenance free, productive and even good to eat!

Because past articles have focused on the triad of fruiting cactus mentioned above, this article will cover only other species of cactus whose fruit is utilized on a regular basis. The table titled "Cacti as Food" lists them, along with information on hardiness. For reasons of limited frost tolerance, time to maturity and fruit production, and even eventual size, not all of these plants are suitable for cultivation in our area. However, the essence of a rare fruit gardener is to push the limits and to try what pundits would call the impossible.

Cactus Fruit Types

Cactus fruit at maturity can be generally divided into two types: dry and moist. In the latter group, all cactus fruit are technically edible — nontoxic, but not necessarily palatable. Further complicating the consumption of these are the numerous seeds embedded in the pulp, which makes many of them unsuitable for out-of-hand eating.

Those seeds, however, are a food resource themselves because they are high in protein.

Many traditional users separate and process the seeds by roasting or grinding, then use them in the forms of paste or flour as an additional food item. This is possible even for cactus whose pulp is unpalatable otherwise.

The term pitaya or pitahaya is a Spanish term that is generically applied to all cacti with edible fruit and to some without. The ubiquity of common name use underlines the importance of knowing the botanical names of these plants as well.

As the accompanying table illustrates, there are too many varieties of cactus to present a detailed discussion of all of them; so expansive a topic would be more suited to a book than an article. I would like to discuss primarily some of the more important groups, skipping those that have already received attention as well as those that would be impractical to grow because of size or time to



*Garambullo cactus,
Myrtillocactus
geometrizans*

maturity, or both. These are mostly slow-growing columnar cacti from consistently warm regions and which must attain considerable age and size before

Cacti as Food

Scientific Name	Common Name	Hardiness	Comments on Food Use
<i>Acanthocereus tetragonus</i>	Barbed-wire cactus, Chaco, Organo	Probably hardy to upper 20s. Plants from Florida or Texas more reliably hardy	No information beyond the fact that it is edible
<i>Browningia candelaris</i>		Frost sensitive	Locally important fruit source. Very slow-growing columnar cactus
<i>Carnegiea gigantea</i>	Saguaro	Low 20s	Trademark cactus of Arizona. Fruit traditionally harvested by natives
<i>Cereus hildmannianus, repandus</i>	Peruvian apple cactus	Low to mid 20s	Easy, fast, productive and good taste
<i>Coryocactus pulquinensis</i>		Frost sensitive	Locally important fruit source
<i>Echinocereus engelmannii, enneacanthus, fendleri and stramineus</i>	Strawberry pitaya or Hedgehog	Upper teens to low 20s	Beautiful flowers but fruit not particularly tasty
<i>Echinopsis atacamensis</i>	Cardón	May tolerate brief light frosts	Columnar cactus from Chile, Bolivia and Argentina
<i>Echinopsis coquimbana</i>	Quisco coquimbano	May tolerate brief light frosts	
<i>Echinopsis schickendantzii</i>		May tolerate brief frost	Locally important fruit source
<i>Epiphyllum anguliger</i>	Moon cactus	Not frost hardy. Needs shade	Epiphytic cactus, beautiful white flowers
<i>Escontria chiotilla</i>	Chiotilla, Jiotilla	Not frost hardy	Important fruit in Mexico, sold in markets
<i>Ferocactus pottsii</i>	Visnaga	Probably hardy low to mid 20s	Fruit made into cactus candy
<i>Hamisia eriophora</i>		Not frost hardy	Vining cactus from the Caribbean
<i>Hylocereus costaricensis, guatemalensis, ocamponis, polyrhizus, triangularis and undatus</i>	Dragonfruit	Not frost hardy	Vary in fruit and pulp color as well as quality between species. Hybrids also exist
<i>Mammillaria species</i>	Pincushions, Chilitos	Varies by species. Many are hardy	Fruit resemble small peppers. Too small for major use but tastes good
<i>Myrtillocactus cochal, eichlamii and geometrizans</i>	Garambullo	<i>M. geometrizans</i> hardy to mid 20s. <i>M. cochal</i> and <i>M. eichlamii</i> upper 20s	Small brown fruit look and taste like raisins. Very good. Market fruit in Mexico
<i>Neoraimondia herzogiana</i>	Canpari	Not frost hardy	Columnar from Peru. Important fruit locally
<i>Opuntia ficus-indica</i>	Indian fig, Tuna	Low to mid 20s	Most important fruiting cactus. Grown in warm regions worldwide
Other <i>Opuntia</i> species— <i>amyclaea, azurea, bensonii, dillemii, engelmannii, hyptiacantha, joconostle, lasiacantha, pilifera</i> and <i>streptacantha</i>	Tuna, Xoconostle	Varies by species but many are at least somewhat hardy	Locally and regionally important fruits. Some grown commercially in Mexico, such as <i>O. amyclaea</i> and <i>O. joconostle</i>
<i>Pachycereus grandis</i>		Not hardy	Mexican columnar cactus
<i>Pachycereus pecten-aboriginum</i>	Hecho	Not hardy	Red pulp, important local food
<i>Pachycereus pringlei</i>	Cardon	Not hardy	Seed utilized, rather than fruit
<i>Pachycereus schottii</i>	Senita	Upper 20s	
<i>Peniocereus johnstonii and serpentinus</i>	Queen of the night	Upper 20s	Fragrant night-blooming flowers
<i>Pereskia aculeata</i>	Barbados gooseberry	Upper 20s	Flowers like single pink roses, fruit very acid
<i>Pereskia guamacho</i>		Not hardy	Similar to above
<i>Pereskopsis aquosa</i>		Not hardy	
<i>Pilosocereus alensis</i>	Pitahaya barbona	Not hardy	Local use northwest Mexico
<i>Selenicereus megalanthus and setaceus</i>	Yellow pitaya	Not reliably hardy	<i>S. megalanthus</i> already being grown for fruit
<i>Stenocereus alamosensis</i>	Sina	Hardy to mid 20s	Northwest Mexico, bonus red tubular flowers
<i>Stenocereus fricii</i>	Pitayo de Aguas	Not hardy	Market fruit in Mexico, commercial potential
<i>Stenocereus griseus</i>	Pitayo de Mayo	Not hardy	As above
<i>Stenocereus gummosus</i>	Pitaya agria	Upper 20s	"Agria" means bitter, but fruit is simply less sweet than others
<i>Stenocereus montanus</i>	Pitahaya colorado, Sahuira	Not hardy	Local use in Sonora, Mexico
<i>Stenocereus pruinosus</i>	Pitayo de Octubre	Not hardy	Local use
<i>Stenocereus queretaroensis</i>	Pitayo de querétaro	Not hardy	Cultivated for its fruits
<i>Stenocereus stellatus</i>	Pitayo, Xoconostle	Not hardy	As above
<i>Stenocereus thurberi</i>	Pitahaya, Organ pipe	Upper 20s	Harvested by locals
<i>Stetsonia coryne</i>	Toothpick cactus	Low 20s	Locally harvested and eaten

NOTE: The terms local, locals and locally denote that a given fruit is important where it naturally occurs.

producing fruit. A classic example of such a cactus is the saguaro of the American Southwest, which must be about 75 years old before it begins to branch and bloom.

Columnar cacti

Surprisingly, not all columnar cacti are ruled by age or size. Quite a few are rapid growers and will begin blooming at a moderate level of development. Good examples of this are the *Stenocereus* species of Mexico — *S. alamosensis*, *S. fricii*, *S. griseus*, *S. gunmosus*, *S. montanus*, *S. pruinosus*, *S. queretaroensis*, *S. stellatus* and *S. thurberi*. An unrelated columnar cactus, *Escontria chiotilla*, could also be included in this fast-growing group. These plants have for many years been grown in rural Mexico on a small scale for fruit that is sold in local markets. They are now under cultivation on a larger scale for commercial fruit production.

One of the aspects of the *Stenocereus* species, or "Pitayos," is that they naturally succeed one another in the times at which their respective fruits reach maturity. This succession is reflected in their common names. Thus, *S. griseus* is Pitayo de Mayo (May), *S. fricii* is Pitayo de Aguas (season of rains,

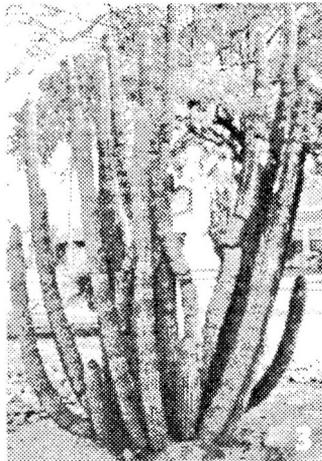
probably late summer) and *S. pruinosus* is Pitayo de Octubre (October). Other varieties fill in the gaps, providing a near-continuous supply of fruit.

Stenocereus species can be propagated readily from stem cuttings approximately 50 cm in length, with the apical portion removed. This encourages early branching close to ground level. Most *Stenocerei* are not frost-hardy but may be able to grow in areas like Southern California or Phoenix with occasional frost protection. With supplemental water and fertilizer, they grow quite rapidly and may reach blooming size from cuttings in five to seven years.

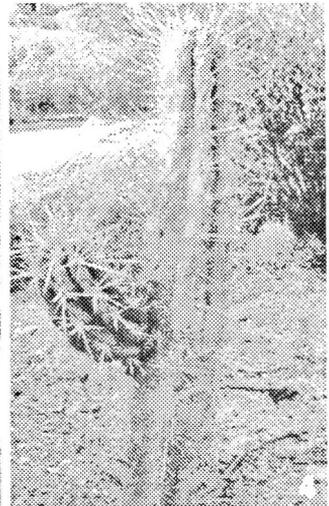
I once purchased an 8 cm *Stenocereus griseus* seedling in an El Paso, Texas, supermarket. I planted it in the ground inside my greenhouse here in Tucson, and it grew to a branched plant 2.4 m tall in about five years with no special attention. It has been moved twice since then and has not yet bloomed, but similar plants in Phoenix apparently bloom regularly.



Pitayo de Mayo,
Stenocereus griseus



Organ pipe cactus,
Stenocereus thurberi



Toothpick cactus-note the
spines! *Stetsonia coryne*.
This species is Argentinian

Another Mexican cactus significantly utilized for its fruit is *Myrtillocactus geometrizans*, known as "Garambullo," which can be best described as a candelabra cactus that branches early and often until it attains the form of a candelabrum. Garambullo is cold-hardy down to around -4°C , very ornamental with its powdery blue stems, and begins flowering and fruiting at an early stage. The fruit are small, juicy and brown, and are quite comparable to raisins. The flavor is pleasant and the seeds are so small as to be unobjectionable. Most large nurseries with a cactus section will carry *M. geometrizans* for sale. The related species *M. cochal* and *M. eichlamii* are similar in flower and fruit to *M. geometrizans*, but less hardy.

Prickly Pear Cacti

The final group of cacti I would like to touch upon are the *Opuntias*, or the prickly pears — with the exception of *O. ficus-indica*, the Indian fig. The genus *Opuntia* is the most widespread and common in the cactus family, extending from Canada to Tierra del Fuego.

The list of fruiting species shown in the table is only partial; a complete listing would probably include many more species. Very little information is available, for example, on fruit use among the South American *Opuntia* species. In Mexico, one can find the fruits of many more species than *O. Ficus-indica* in the markets. Mexican grocery stores often carry them as well. Some of these varieties have already undergone significant selection for superior fruit production and are cultivated on a major scale. *O. amyclaea*, *O. hyptiacantha*, *O. joconostle* and *O. streptacantha* are all significant regional crops.

The fruit of various *Opuntia* species in Mexico are known generically as "tunas." Tunas vary considerably in size, color and flavor. Their use, however, tends to be similar.

Because of their large, hard seeds most tunas are processed to pulp or juice for use as syrups, candies or food additives. Mexican consumers reportedly prefer white-fleshed varieties whereas Americans prefer red fruit with red flesh. Current breeding efforts are directed at encouraging parthenocarpy, the production of infertile soft seeds which would be less of an impediment to consumption of fresh fruit.

Many *Opuntias* are frost-hardy, and do especially well in the mild winters of the Southwest. They are virtually self-replicating, as anyone who has tried to exterminate a patch will attest. All you need is a pad (a callused-over slice of the desired cactus, dirt and water (optional) and stand back. Some *Opuntia* varieties are susceptible to cochineal insects, which are similar to mealybugs and are best managed by early removal and disposal of infected pads.

This has been a brief introduction to cacti as fruiting plants. Cacti offer a lot of advantages as fruit-bearing plants, in particular their minimal water needs. Additionally, most cacti are not subject to pests and diseases in the Desert Southwest. They can be ornamental as well as useful; their blossoms are among the most beautiful nature has to offer. It is my hope that this article will inspire more fruit gardeners to devote some of their precious garden space to growing cactus for fruit.

— Chris Marshall

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Dr. Chris Marshall, M.D., lives in Tucson, Ariz., and grows arid-zone plants, including cacti and succulents, subtropical ornamentals and exotic fruit. View his collection online at http://home.att.net/~christopher.marshall/AcaciaEtc_plantlist2.htm.

Fruit Gardener: A2886.

California Rare Fruit Growers: A1115.

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Pitayas in northern NSW

I am in the process of establishing a commercial planting of pitaya on the Far North Coast of NSW. Starting back in March this year, I have some 1250 plants in with a further 1250 to come.

Rather than put all my eggs in the one basket, and hopefully to extend the harvest season, I went with two species - *Hylocereus undatus* and *Selenicereus megalanthus*.

The original *S. megalanthus* flowered just prior to winter, holding the fruit until harvest in September/October, and are budding again now. I expect the *H. undatus* to flower around Christmas and periodically continue for around 4 months.

I know in the Northern Territory they flower well ahead of us down here. Any ideas on an easy way to remove the spikes from the *S. megalanthus* fruit? As this fruit is relatively unknown it has been a bit of a battle getting useful information.

— *Michael Youman.* E-mail:
<michael.youman@agric.nsw.gov.au>.

¥

Acotanc-2004 Website now open

The website for the next Australasian Conference on Tree and Nut Crops, to be held at Gatton, Queensland, on September 20-24, 2004 can be accessed at:

www.newcrops.uq.edu.au/nc2004

The conference is to be a joint event with the Second Australian Conference on New Crops

[*Chronica Horticulturae* / 2003 No. 4]

Pineapple Wars

The world fresh fruit market for pineapple has been reinvigorated and is growing about 10% per year, an expansion exceeded only by the mango industry.

The recent explosion of the pineapple market since the mid 1990s has been associated with the introduction of a sensational cultivar, 'MD-2', sold under the name Del Monte Gold Extra Sweet Pineapple, which is extensively grown in Costa Rica, and marketed through Del Monte Fresh Produce.

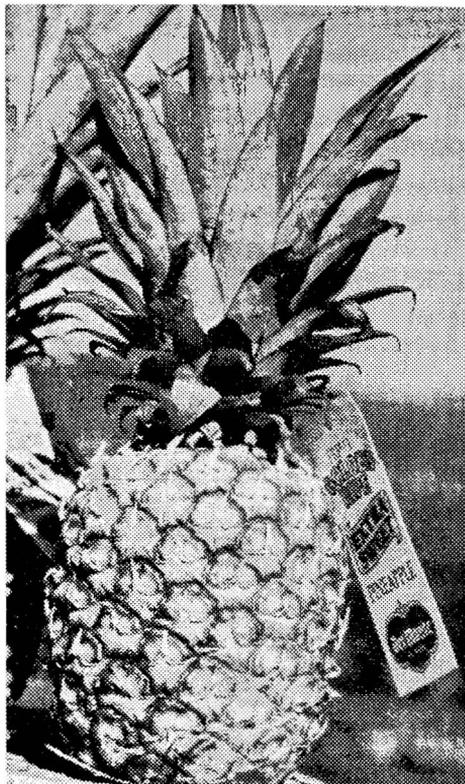
Fresh pineapple sales in the US have more than tripled, earning hundreds of millions of dollars in profit for Del Monte Fresh in a world-wide market valued at more than \$1 billion. Costa Rica has increased its grip on the world market, with Ecuador a distant second

At the present time a number of similar types of pineapple are being marketed and a legal imbroglio has developed over the ownership, identity, and trademarks of these new types.

The origin of the new gold-fleshed pineapples on the market is confused. These types originated in the 1970s in the breeding program carried out by scientists at the Pineapple Research Institute (PRI) in Hawaii, a trade group of growers that conducted joint research, including Del Monte, Maui Land & Pineapple, and Dole.

Two seedlings, perhaps similar sister seedlings of a complex cross, appear to be involved in the story: 73-50 (marketed at one time as 'Hawaii Gold') and 73-114 (marketed at one time as 'Royal Coast').

The selection 73-114 had bright gold, very sweet, low acidity flesh and was highly resistant to parasites and internal rot; its skin turned amber when ripe and most importantly could survive cold storage for up to two weeks. However, at that time the Hawaiian industry was dominated by 'Smooth Cayenne',



'Golden Ripe' pineapple

the premier cultivar for processing that was also used for the fresh sales, and the new gold-fleshed types did not become well established.

Hawaii's processing industry moved to Asia due to high labour costs in Hawaii. As a result PRI dissolved in 1987 and its assets, including germplasm, was divided up among Del Monte and Maui Land. Del Monte claimed ownership of 73-114 which became known as MD-2.

Del Monte rolled out production in 1996

in Costa Rica, and acceptance was immediate even at very high prices. Patent protection had been applied for in 1992 but the patent was denied because the pineapple had been previously marketed and ownership was in dispute with Maui Land.

Subsequently Del Monte Fresh patented another yellow-fleshed cultivar, CO-2, selling it as Del Monte Gold. Under dispute was 'Hawaiian Gold' marketed by Maui Land, which they claimed was 73-50 (co-owned by Maui Land and Del Monte), and identical to CO-2!

Until recently there were legal disputes between Del Monte and Dole, who market their gold-fleshed selection as 'Premium Select', that Del Monte claimed was really MD-2, in which the propagules were obtained illegally. These litigations seem to have been resolved and it is clear that the new yellow-fleshed types will soon dominate the entire world fresh fruit industry. The pineapple wars indicate the key role of improved cultivars to horticulture.

— Jules Janick

[*Rare Fruit News Online / 2003 Dec 1*]

Forcing pineapples

For several years I have had good luck with forcing pineapples by just dropping a single pellet of calcium carbide (smaller than a pea) in the centre of the plant. This generates ethylene gas (miners used this for their lamps many years ago).

Sporting goods stores carry calcium carbide. I have also had good results by dropping a piece of banana peel or piece of apple into the bud, and have recently had pineapples the size of those bought in supermarkets.

— C. L. Mings, Sarasota, Florida
<CLMings@aol.com>.

Rare Fruit News Online: A3510.

[*David Noel comments: actually calcium carbide reacts with moisture to form acetylene, C₂H₂, but this easily picks up extra hydrogen to form ethylene, C₂H₄, which is given off naturally by ripening fruits, and also used commercially to force fruit (particularly bananas) to ripen. I have tried calcium carbide*

successfully to ripen fruit (just drop a little into a plastic bag with the fruit, moisture in the air will usually be enough to form the gas), and also to help germinate fruit and nut seeds (ethylene has been recommended to germinate marula nuts), but without notable success. Calcium carbide is available in Australia from Sigma Chemicals and other suppliers. Be cautious with its use, acetylene is highly inflammable, only expose a little at a time to moisture!].

Dowerin Field Days very successful

WANATCA's participation in the Earth Village stand at the Dowerin Field Days on August 26-28, 2003, was judged as 'our most successful yet'.

Congratulations to Barrie Oldfield of Men of The Trees for initiating the Earth Village concept and organizing the stand and its six cooperating groups, and grateful thanks to the Eastern Metropolitan Regional Council, one of the groups involved, for their generous sponsorship of much of the costs.

Lots more ACOTANC-2001 papers released

Following the highly successful Acotanc-2001 conference staged by WANATCA in Perth, some of the contributions available in accessible form were put up on the Web, at www.aoi.com.au/acotanc/Papers.

After the Conference, Pat Scott put a massive effort into recovering more of the papers, from audio and video recordings made at the time, and converting the files for the above website. This more than doubled the original number of papers up.

Most of the authors of these talks and papers have now been contacted and given the opportunity to verify the Web versions of their contributions, and most have now been made available for use, although a few authors have asked for their contributions not to be released, due to changes in circumstances, or to be released after modification.

The following is the full list of papers involved. Most will already be available from the website, others will follow as final changes are made.

Profound thanks to Pat Scott for the Trojan efforts put into this project.

Harold Adem: The Tatura Hedgerow System for Walnut Trees.

Harold Adem: Water Use Efficiency & Partial Rootzone Drying in Fruit and Nut Trees.

Liz Barbour: Specialist Pollination of Blue Gums for Seed Production.

Dave Bauer: Dryland Rehabilitation.

Kylie Bauer: Propagating Useful Australian Plants for Dry Climates.

Phil Bellamy: Tree Niche Crops as the Saviour of Country Towns.

Phil Bellamy: Slide Show on Tree Niche Crops as the Saviour of Country Towns.

Philip Bodeker: Chestnuts at Dwellingup--Tree Crops Versus Forest.

Alan Bodger: Are Carbon Credits Going to Work?.

Kim Chance: Official Opening.

Andrew Cohen: Experiences in Establishing a Pomegranate Orchard in WA.

Roberto Coronel: The Economic Fruits and Nuts in Southeast Asia.

Roberto Coronel: Underexploited Nuts and Fruits of the Philippines.

Phil Coutts: The International Nut Trade.

Bob Cowan: Energy Generation and Oil Extraction from Mallee Eucalypts.

Bill Davey: Making Landcare Profitable.

Bernie Dell: Mycorrhiza and Tree Nutrition.

Rosemary Du Preez: Investigation into Commercial Potential of Indigenous South African Fruits.

Rosemary Du Preez: Annonas and Carambolas.

Rosemary Du Preez: Subtropical Fruits and Nuts in South Africa.

Rosemary Du Preez: Guava Wilt Disease.

John Duff: About Pistachios in WA.

Aaron Edmonds: Growing Australian Bush Foods in WA.

Tim Emmott: Greening Australia's Involvement in Low Rainfall Farm Forestry.

Steve Errington: Medicines and Chemicals in WA Plants - Historical Overview.

John Evans: Problems of Setting up a Chestnut Orchard.

Cos Faiello: Olive Propagation.

Cos Faiello: Olive Oil -- The Global Marketing Industry.

Graham Fellows: Manjimup--the Heart of the Walnut Industry in WA.

Chris Ferreira: All About Site Planning .

Chris Ferreira: Management for Tree Crops.

Dr Rob Fletcher: New Crops. How to get them Working.

Joshua Forner: The Didjeridu Industry in Northern Australia : Is It Sustainable?.

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Julian Gorman: Sustainable Use of Cycads in Central and Eastern Arnhem Land, Northern Territory, Australia.

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Bert Hayes: About Pistachios in WA.

Stephen Hill: Revegetating Western Australia: Research to Reality.

Richard Hordacre: Coping with Mass Demand for Tree Seedlings.

Dr Pat Howden: Living for Free, Sustainably.

Caroline Hughes: The World of Sandalwood Products and Uses.

David Kennett: Water Dowsing to Assist Performance of Trees.

R.R.B. Leakey: Sustainable Agroforestry: Some Insights on Practices by Rural Communities in Indonesia and Their Wider Potential.

R.R.B. Leakey: Diversification of Tree Crops: Domestication of Companion Crops For Poverty Reduction And Environmental Services.

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Rob Manning: Bee Tubes in Fruit Pollination.

Ross Mars: Permaculture: Setting the Scene.

Honorlea Massarella: Northern Australian Plant Species with Cultivation Potential for Food or Useful Extracts.

Honorlea Massarella: Harvesting Plants for Commerce on Aboriginal Lands.

Honorlea Massarella: Processing Brazil Nuts.

James Maxwell: How Earth Expansion Gave Us Our Tree Resources.

Alex McCalla: Population and Agriculture.

Roger Meyer: Fruits Called Sapotes.

Roger Meyer: New Species of Kiwifruit for Commerce.

Roger Meyer: Jujube Orchards.I.

Tony Murphy: General Overview of Carobs in Australia.

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Jeff Nugent: Integrating Approaches to Tree Cropping.

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Maxine Thompson: Exploration for Fruit and Nut Genetic Resources in Central Asia.

Bruce Toohill: Mango Prospects in Australia.

Bruce Toohill: Ora Blanca and Other Citrus in the Tropics.

Bruce Toohill: Fruits and Nuts in the Tropics of Australia.

Dr Joan Tous Marti: World Hazelnut Production.

Dr Joan Tous Marti: Hazelnut technology for warmer climates.

Joan Tous Marti: Olive Cultivars .

Joe Traynor: Tree Crop Pollination in California.

Paul Vantomme: Gum Arabic--A Tree Crop for Arid Lands.

Peter Whitehead: Sustainable Use of Cycads in

Central and Eastern Arnhem Land, Northern Territory, Australia.

Dan **Wildy**: Alley-Farming Tree Crops in Semi-Arid Environments.

David **Williamson**: Engineering Solutions to Salinity.

Kim **Wilson**: The Role of the Australian Macadamia Society.

Kim **Wilson**: The Past, Present and Future of the Australian Macadamia Industry.

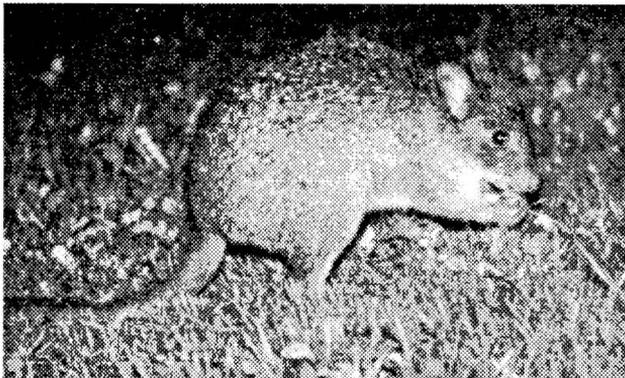
Andy **Wright**: Sandalwood as a Plantation Crop.

[Sandalwood Research Newsletter / 2003 Dec]

Woylies the key to sandalwood, quandong regeneration

At the time of European settlement the woylie (*Bettongia penicillata*) or brush-tailed bettong, a small marsupial, was extremely common and occurred in large numbers across the southern third of the continent.

Tragically, in just 100 years the woylie had declined to the point that it existed in only three small remnant patches of woodland in the south-west of Western Australia and was on the brink of extinction. The good news is that recent conservation efforts by the Department of Conservation and Land Management has seen a remarkable come back of the woylie, so much so that in 1996 the woylie was reclassified to non-threatened.



A woylie (Bettongia penicillata) carrying a sandalwood (Santalum spicatum) seed in its fore paws, at Karakamia sanctuary, Western Australia (Photo: R. Armistead)

Since the recovery of the woylie, it has become possible to study their ecology in some detail and it has been shown that woylies are important ecosystem 'engineers'. For example, the woylie can create in excess of 100 small diggings per night as they forage for underground fungi, or truffles, and a variety of bulbs. These diggings have a positive impact on the soil by allowing rainwater to infiltrate the normally water repellent soil. Woylie diggings also affect soil properties such as bulk density and the behaviour of soil nutrients

Woylies have another very important role in the ecosystem, which has been largely overlooked until recently. They are very efficient seed dispersers. For the past 30 years, anecdotal evidence suggested that woylies disperse and cache seeds from a variety of plants including *Gastrolobium* species, quandong (*Santalum acuminata*) and Western Australian sandalwood (*S. spicatum*); however, this behaviour was not examined in any detail until recently.

In a study carried out in Dryandra

Woodland it was shown for the first time how important woylies are to the ecology of sandalwood regeneration through dispersing and caching their seeds.

Sandalwood has been harvested for many years in both Western Australia and South Australia and is a profitable industry yielding export earnings of approximately 11 million dollars annually. The heartwood and roots contain the valuable, strongly aromatic oil containing santalols, which is used in the manufacture of sandalwood scented products. Sandalwood is a root hemiparasite and commonly grows with nitrogen fixing plants such as *Acacia* or *Allocauarina*.

The tree has pendulous fruit, with red-brown leathery exocarp encasing a large seed; it is the nature of this seed that hints at the intriguing relationship that has evolved between sandalwood and the woylie.

In recent years, natural regeneration of sandalwood has been poor. Habitat fragmentation, its parasitic nature, grazing, and poor seed dispersal have all been implicated in these poor rates of recruitment; however, this is not the case in habitats in which woylies are still present.

The woylie sandalwood story began in a sandalwood stand just outside the main block of Dryandra Woodland where it was noted that many new sandalwood recruits were springing up across the road from the main plantation. This fascinating development sparked the interest of sandalwood managers and so, in collaboration with scientists from the Forest Products Commission of Western Australia, the investigation into how the recruits got there began.

Throughout this sandalwood site there was extensive regeneration of all age classes of sandalwood, and the young plants are

spreading up hill away from the parent trees. Clearly some animal was removing the seeds from where they fell under the adult trees and dispersing them in all directions.

In striking contrast, sandalwood stands in Wickepin, 54 km east of Dryandra, showed no regeneration at all and there were literally hundreds of seeds lying beneath the parent, the vast majority of which will perish. Trapping sessions were conducted at the Wickepin site to determine if there were any woylies, but it was completely devoid of native mammals. These findings pretty much confirmed the theory that woylies were a significant dispersal agent for sandalwood. The question was... how do we prove it?

We decided to set up bait stations at the Dryandra village where woylie numbers were relatively high. To enable us to determine the fate of the sandalwood seed once it was removed by the woylie, cotton bobbins were used; the end of the thread was glued to the seed and the bobbin was staked into the ground. This allowed the thread to unwind freely if the seed was removed. We then sat and waited.

Sure enough, after a short while a woylie appeared at our bait station to investigate the seeds. After a few moments the woylie picked up the seed in its fore paws, put the seed in its mouth and left the area at some speed. The cotton thread unwound rapidly as the woylie hopped away with its prize. A few moments later the cotton stopped unwinding and the woylie returned to the bait station and repeated the procedure.

The trail left by the cotton was clearly visible and was easy to follow around, under and through vegetation. Finally, the trail stopped and disappeared into a small hole in the ground. There at the bottom was the sandalwood seed, pressed hard into the soil.

Surprisingly, the cache was not covered by soil in the majority of cases, but after a couple of days the caches were almost completely covered with leaf litter that had fallen into the cache. The distance of the caches from the bait station ranged from 8 m to 81 m and occurred in a scatter hoarded pattern (one seed per cache).

So for the first time ever it was shown that woylies do disperse and cache sandalwood seeds, and as a result, woylies have an important role to play in the regeneration of at least one woodland plant species. The study was also the first of its kind to link directly the conservation of a mammal to the regeneration and management of an important plant species.

The implications of these findings for conservation of biodiversity are clear. The discovery of the link between the woylie and sandalwood provides an "icon" for the many functional relationships that exist in our

landscapes.

Over the millennia, many plants and animals have co-evolved, forming close and intimate relationships. The woylie sandalwood story is one example of such a relationship and is a prime example of how biodiverse ecosystems can function; indeed, the woylie sandalwood story can give us a "functional icon" to drive the conservation of plant and animal biodiversity as a whole.

For the first time we have the opportunity to demonstrate to all Australians the relationships, complexity and beauty of the ecology of Australia and, hopefully, we can change our current view of degraded systems to one of high functional biodiversity.

—Marie Murphy and Mark Garkaklis, School of Biological Sciences, Murdoch University Murdoch, Western Australia.

Sandalwood Research Newsletter: A3144

[Sandalwood Research Newsletter / 2003 Dec]

Genetic study for *Santalum*

The Forest Products Commission of Western Australia is supporting a Doctorate grant application to the Australian Research Council to investigate "Indian Sandalwood: genetic and oil diversity, and biochemistry of the Australian germplasm collection".

This is a request for partners who can provide material from their local populations, whether they are *Santalum album* or one of the other 15 *Santalum* species. In return, a phylogenetic analysis of the *Santalum* species will be distributed to all partners, which will provide information on the relationships between species and resolution of the taxa

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within the genus. This information is of vital importance to the world-wide genetic conservation of the genus and *S. album* species. It also will place the Australian germplasm collection in context.

The project is supported by the expertise of Assoc. Prof. Julie Plummer (Plant Biology, University of Western Australia) who is a plant physiologist with expertise in breeding and selection, including plants for essential oil production; Prof. Emilio Ghisalberti (Chemistry, UWA) who has an international reputation as a chemist of secondary products in Australian plants; Dr. Margaret Byrne

(Department of Conservation and Land Management) is a molecular geneticist with considerable expertise in the application of genetic markers to tree breeding and Dr Liz Barbour (FPC) who is the scientist responsible for developing elite sandalwood germplasm for the Forest Products Commission.

If you can supply the material or would like further information, please contact: Dr. Liz Barbour, Forest Products Commission, 5 Dundee Road, Wanneroo 6065, Western Australia, Email: lizbfc.wa.gov.au, Phone: +61-8-9404 5491, Fax: +61-8-9404 5492

Sandalwood Research Newsletter; A3144.

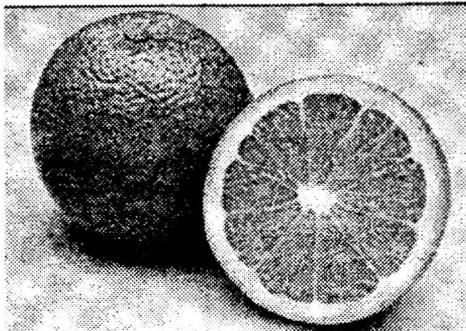
[Western Suburbs Weekly / 2003 Dec 16]

Report reveals citrus benefits

A diet high in citrus fruits can reduce the risk of some cancers by up to 50 per cent, a report released by the CSIRO has revealed.

The report, *The Health Benefits of Citrus Fruits*, examines the relationship between citrus fruit consumption and the prevention of chronic diseases.

As well as the reduced risk of some cancers, it also claims that a diet high in citrus fruits can reduce the risk of stroke by 19 per cent.



Citrus fruit has healthy effects

CSIRO Health Sciences and Nutrition Consumer Science Program head Dr Katrine Baghurst said the report was the most extensive review ever conducted on international research into the health benefits of citrus fruit.

"Citrus fruits contain a powerful combination of nutrients and bioactive phytochemicals which protect the body through their anti-oxidant properties and strengthen the immune system, inhibiting tumour growth and normalising tumour cells," Dr Baghurst said.

"There is strong scientific evidence to show these protective attributes can reduce the risk of cancer of the mouth, larynx, pharynx and stomach by 40 to 50 per cent.

"A major US study has shown that one extra serve of citrus a day reduces the risk of a stroke by 19 per cent due to the variety of phyto-nutrients, potassium, fibre and folate in citrus fruits.

"Unfortunately, Australians are missing out on these health benefits because many do not eat citrus regularly. The average fruit and vegetable intake is well below the five daily serves recommended in dietary guidelines.

The report claimed citrus fruits had the highest level of anti-oxidants of all fruit classes and were rich in phyto-chemicals, folate, fibre, vitamin C and vitamin A.

"One orange has more than 170 different

phytochemicals, including more than 60 flavonoids, which have been shown to have anti-inflammatory, antitumour and blood clot inhibiting properties, as well as strong anti-oxidant activity," Dr Baghurst said.

Like to help with the WANATCA Exec?

If you would like to see the Association's efforts to promote tree crops and rational land use prosper, consider nominating for a position on the Executive Committee.

The Exec meets in Perth, normally only four times per year, so the meetings are not a big call on members' time. Expertise in tree crops is not necessary, but some Exec members

have experience in other areas of society which the Committee finds very useful in planning our future activities.

There are currently vacancies to be filled, and our February meeting is designated as its Annual General Meeting, at which offers to serve can be formally ratified by the membership.

Contact Stanley Parkinson on 9386 2518 or David Noel on 9381 7341 if you are interested.

Combatting fruit fly

WA continues to suffer from fruit fly. Two quite different articles here look at large-scale government efforts, ironically applied by WA to keep South Australia clear while we are unable to afford a general clearance like those maintained by New Zealand and California ourselves, and a new suggestion of a small-scale biological control method which merits much more investigation.

[Countryman Horticulture / 2003 Dec 1]

Sterile WA fruitfly in cross-border offensive

The Medfly Sterile Insect Technique program is in full swing with the WA Department of Agriculture sending millions of sterile flies a week to combat South Australian infestations.

Five million sterile fruitfly pupae are sent to South Australia every week from South Perth in an effort to stem recent incursions of

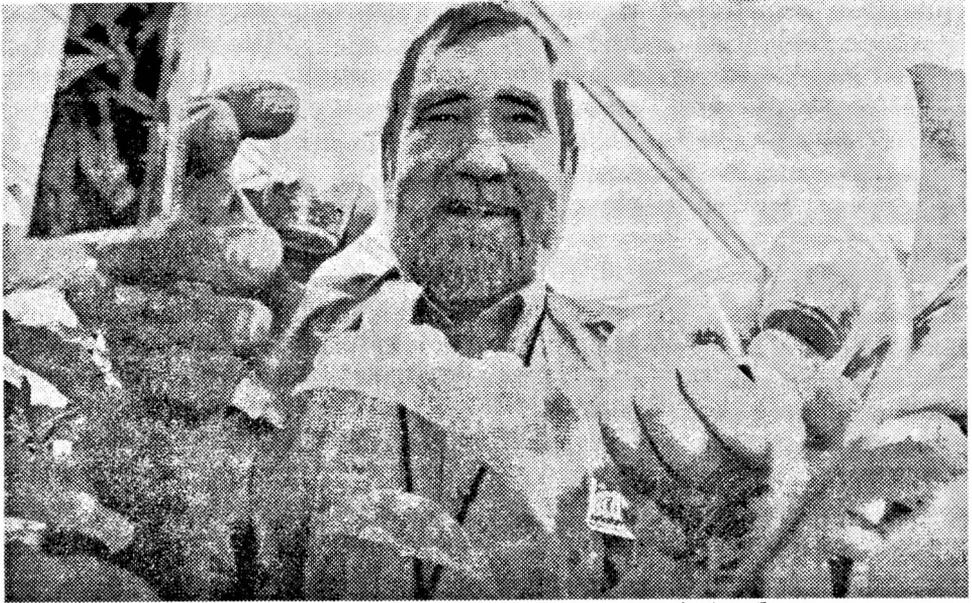
the WA pest into SA's fruit crops.

The medfly, a serious pest in WA, is capable of devastating fruit crops in large numbers and substantially reducing yields.

Worldwide trials had earlier established that adequate control of medfly populations was not possible using parasites and predators of the pest. It was shown the female medfly had a lifecycle that spanned one month in summer and six months in winter, explaining the ability of the pest to withstand the cool winter period.

It was concluded that citrus fruit was the main fare for the over-wintering fruit fly, both in its larval stage and for adult females which could survive on honeydew produced by scale insects and aphids on the foliage.

Using the nutrition gained from the honeydew, it was found the female fly could develop eggs and continue to mate to fertilise them. The female then released the fertilised eggs about 10 days after emerging from her pupa. Only the female medfly damages fruit by laying eggs inside it and each female is



Flying to the rescue: Terry Mack, administrator of the sterile fruitfly program, was at the South West Horticulture and Forestry Expo at Manjimup recently handing out tubs of medfly pupae to the general public

capable of laying 300 eggs in her lifetime. In response to the trials, the department has successfully managed to treat eggs so they only hatch as sterile males.

The sterile flies are then released in large numbers wherever there are fruit trees. The sterile male will compete with healthy males

to mate with a limited number of females, eventually resulting in the reduction of the females that have fertilised eggs.

Medfly sterile insect technique administrator Terry Black said the program was working well in SA. "The flies have been successfully used to eradicate three recent infestations in Adelaide in combination with a preparatory baiting strategy," he said.

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[Grass Roots / 2003-4 Dec-Jan]

Natural Fruit Fly Predator

Think before you spray. The answer to the problem could be right there in front of your nose. Leave the poison in the store and experiment organically and you'll be glad you did. I am.

For example, for the second year in a row this year, I found absolutely zero fruit fly grubs in my peaches, thanks to some predatory

visitors that have decided to stay. The peaches are covered in webs spun by beautiful, small green spiders. The spiders are in plague proportions and I think they must also eat mosquitoes because their webs are thick in the rafters of the wigwam under which I build my prototype canoes and catamarans. They seem to follow my local harvest trail. I have also noticed them standing guard on my mangos, lilly-pillies and ice cream beans.

I gave the local Department of Primary Industries office some spider photos and they identified them as a type of lynx spider, *Oxyopes macilentus*, a hunter that jumps on its prey.

Everyone else I know has the dreaded fruit fly. If you have ever lived in Queensland, you will know just how unbelievably fantastic it is that these peerless pests are at last leaving me alone. The Queensland fruit fly is the ultimate sneaking spoiler costing hardworking farmers millions each year.

Normally, growers must either spray or have no peaches. To spray or not to spray? For years I have opted for the second option and sadly watched my peaches rot on the trees, riddled with fruit fly maggots. The trouble with spraying is that I would have killed all the resident spiders and only half of the visiting fruit flies. Predator populations need time to multiply.

Also, don't forget spraying is a waste of time in rainy weather, and each year you'll need a stronger dose as your target insect develops natural immunity.

I am now collecting my eight-legged spider friends to give to my two-legged organic gardening friends to put in their stone fruit trees. Let's hope the spiders multiply and gobble up their fruit flies too.

— *Trever Wilkins*, Russell Island, Queensland.

A great website on propagation

If you have access to the Web, and are interested in grafting, budding, and other methods of clonally propagating fruit and nut trees, check the excellent website on this put up by Texas A & M University. It is at:

<http://aggie-horticulture.tamu.edu/propagation/propagation.html>.

The Plant Propagation site includes:

An Overview of Asexual Reproduction; Grafting and Budding; T or Shield Budding; T-Budding Citrus; Approach Grafting ; The Four-Flap Graft ; Texas Inlay Bark Graft; Greenwood Grafting; Whip Grafting; Collecting and Storing Graftwood; Grafting Texas Pecans (QuickTime videos); Layering; Air Layering for Difficult to Root Plants; Plant Tissue and Organ Culture (in vitro culture); and Micropropagation.

A nice feature of some of the budding demonstrations is that they are 'animated gifs' — clicking on a diagram sets it alive, so the transfer of budwood to scion is shown in action. If you want to have all this available at any time, you can save the main file and all the illustrations in a folder on your hard drive, and view it at any time by opening the main file with your web browser. ¥

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CALENDAR OF FORTHCOMING EVENTS

(See also www.AOI.com.au/wanatca/Events)

Deadline for next issue: Apr 20, 2004

2004		
Feb 19	Thu	* <u>Wanatca General Meeting: George Ainsley & Charles Peaty - "Propagating & Planting Useful Exotic Trees".</u> (Kings Park)
Apr 6	Tue	Wanatca Executive Committee Meeting
May 18	Tue	* <u>Wanatca General Meeting</u>
May 23	Sun	* <u>Wanatca Field Day, York -York Olive Co</u>
Jun 14-18		§ 6th International Congress on Hazelnut, Tarragona, Spain.
Aug 17	Tue	* <u>Wanatca General Meeting</u>
Sep 20-24		§ <u>Acotanc-2004, Gatton, Queensland</u> (www.newcrops.uq.edu.au/nc2004)
Nov 16	Tue	* <u>Wanatca General Meeting</u>

*General Meetings are held starting at 7.30pm. *Venue: As noted in each case.*

These meetings usually include a display of current world tree-crop magazines for sale.

• Event with WANATCA participation; § Refer to news item in this issue of *Quandong*.

Material originating in Quandong may be reprinted; acknowledgement of author and source requested.

Current Subscription Rate: \$60.00 per year

(includes all publications for four consecutive quarters). Student Rate: \$30.00

Quandong is produced by the Tree Crops Centre, PO Box 27, Subiaco, WA 6008. Phone: 08-9381 7341. This issue edited by David Noel. WANATCA contacts: Phone 08-9250 1888. Fax: 08-9250 2735. E-mail: <wanatca@AOI.com.au>. Websites: <www.AOI.com.au>.

Quandong Advertising Rates: Whole page, \$100; Half page, \$60; Quarter page, \$35; Eighth page, \$20. 20% discount for 4 insertions.