



The Avon Sandalwooder

Autumn 2006

Welcome to the 5th issue of the Avon Sandalwooder, a newsletter produced by the Avon Sandalwood Network Inc

From the Chair

Bruce Storer, Chairman, ASN Inc

Welcome to the 5th edition of the Avon Sandalwooder. The ASN continues to grow with support from our members, executive committee and contributors to our newsletter and workshops. We acknowledge funding support provided through the Avon Catchment Council's Native Plant Industries program, and the generous sharing of information from our members.

The ASN executive committee is focusing on further developing the sandalwood industry in the Avon region, focusing on sandalwoods role in achieving sustainable agriculture and economic returns. We are compiling an ASN business plan, to determine our future direction, and to assist with securing funding and partnerships with government and industry.

It is apparent that governments are investing in industries that promote sustainable agriculture. This ranges from environmental credits, salinity and water quality issues, renewable energy, fertilisers and fossil fuels, biodiversity issues and the general welfare of our environment and regional communities.

To secure funding, investment and partnerships, projects need to be well research and planned. The ASN committee is working with Lisa Grosskopf of the Avon Catchment Council, to progress our business plan. We can then pursue opportunities to develop the sandalwood industry further. The ASN committee views this as our primary role. We are developing a vision for the ASN, determining where we want to go and what we want to achieve.

We are mindful of clearly identifying our goals and developing an economically viable industry. Many alternative agricultural industries have come and gone. We believe the sandalwood industry has great potential if structured properly.

The ASN executive has pledged \$2,000 to assist Dr. Geoff Woodall from the Centre of Excellence in NRM, should he succeed in obtaining additional funds to continue research on developing products and markets for sandalwood nuts. This is the first of what we hope will be many research programs and partnerships, aimed at taking the industry forward. We plan to provide sandalwood seed to Dr. Woodall from the ASN, and we will advise members how you can contribute seed for this research project, should you feel inclined.

The recent workshop held in Beverley was well attended and we continue to gain new members. The ASN committee is aware of our diverse membership base, with some members well advanced with large areas established, and others starting out, seeking information on establishment and management. Future workshops will aim to cater for all levels within our membership base. If you require specific information, or would like to speak to other members from your area, contact the ASN secretary. I wish you all a good season and happy planting.

Membership & ASN Update

Tim Emmott, ASN Secretary & Newsletter Editor.

In this issue you will notice several articles focusing on Indian sandalwood (*Santalum album*) being cultivated in northern areas of the state. The ASN is not advocating the cultivation of Indian sandalwood in the colder southern areas of WA; however it is interesting to keep abreast of general sandalwood plantation industry developments.

Membership

Welcome to all new members that joined at the March workshop in Beverley. The ASN now has over 100 members, most of whom are current sandalwood growers.

Autumn Field Day

The Autumn ASN workshop and field day was held in Beverley on the 30th of March 2006. Attended by 82 people, the day was our best turnout yet. All members should have received a summary of the day's events, including copies of speaker's presentations, notes and site visit summaries.

Next Workshop

The ASN will be holding their AGM and spring workshop in August / September 2006 (date and location TBA). If you have a specific topic you would like covered, please contact the secretary.

Advertising

You will notice that we are now accepting advertising in the newsletter, as a means of funding future newsletters. A quarter page advertisement is \$100 for members and \$200 for non-members. For more information contact the secretary.



ASN Chairman Bruce Storer inspecting young sandalwood while in-filling sandalwood nuts in his Gabbin plantation (320 mm annual rainfall), April 2006

Disclaimer: This information may be of assistance to you, but the Avon Sandalwood Network executive committee and newsletter editor do not guarantee that the publication is without flaw of any kind, or is wholly appropriate for your particular purposes, and therefore disclaims all liability from any error, loss or other consequence which may arise from you relying on any information in this publication

An update on 2005 Indian Sandalwood Establishment

Andy Wright, Forest Services Manager, Integrated Tree Cropping, Albany WA, Tel (08) 9892 0907

*In June 2005, ITC established 195 ha of Indian sandalwood (*Santalum album*) in Kununurra. The company plans to establish a further 250 ha during the dry season this year.*

Weed control on these plantings is ongoing, with a combination of manual (chipping) and mechanical (cultivating) methods. Alternanthera (a ground creeper and the primary seedling host) is colonising the mounds very successfully. Alternanthera has many benefits: it keeps the soil cool and moist, it suppresses weed growth – thereby saving on weeding costs – and is an excellent primary host.

Sandalwood survival is excellent bar a small area of trees that suffered extensive damage from brolgas (large native wading birds) immediately post establishment. This area was in-filled when the adjacent chickpea crop was harvested and the brolgas flew off.

The intermediate and long-term host trees were either direct seeded or planted at the same time as the sandalwood. All host trees are legumes. Seedlings are irrigated using the standard flood irrigation technique as required.

For those considering that they might grow Indian sandalwood in the Avon region, ITC attempted to grow Indian sandalwood in Albany nurseries many years ago with no success. The seedlings grew well initially but complete mortality resulted on the first cold day – and I'm only talking 10 degrees, not frost.

But don't let that deter people from trying. Based on glasshouse trials in Perth, the trees appear to grow very well in hot houses and you would only require a handful to make a viable parcel of wood. Try them next to your tomatoes.



"Kneebone Treefarm, aged 6 months"

ASN Committee Update; the way forward for 2006

Tim Emmott, ASN Secretary
Tel (08) 9621 2400, email temmott@gawa.org.au

The direction and operations of the Avon Sandalwood Network Inc (ASN) are guided by an elected executive committee, consisting of our Chairman, Vice Chair, Treasurer, Secretary and 4 committee members.

The executive committee has met twice in 2006, on the 2nd of February and the 9th of May. At the most recent meeting a main focus for the committee was on initiating the development of a business plan for the ASN. As a relatively new group, with a great deal of momentum, developing a business plan is an important step for the ASN to now take, and is the main task being addressed by the ASN executive committee.

The business planning process will aid in defining the objectives of the ASN, highlight our future direction and role in this industry and determine the actions required to meet these aspirations.

Guidance and input on the role and future direction of the ASN is always open and encouraged from members. If you would like to provide input during our business planning phase, please contact the secretary on the numbers above.

ASN Member record keeping

The ASN encourages members to keep records of your plantation establishment. This may involve keeping a diary or file that documents the methods, and timing of operations regarding your plantation establishment and management.

For example, basic information worth recording is the year of establishment of hosts and sandalwood, host species, provenance of hosts (your nursery can supply this information), source of sandalwood seed, area (ha) established, site preparation techniques and herbicides used. This information is useful to assist your future plantation development.

For members starting to collect seed from plantations, documenting the nut yield per tree or per hectare will be of great value, both to you and the network. The ASN will be updating our member plantation inventory later this year, and members will be advised on how they can contribute.



ASN executive committee and guests hard at work at a recent meeting in Northam

Growers Update & Views

Les McTaggart, Farmer, Sandalwood Grower and ASN Treasurer, Koorda WA

My first attempts at sandalwood cultivation on our west Koorda property was in 1996, when I began hand planting sandalwood nuts amongst remnant stands of Jam (*Acacia acuminata*). My first attempts were unsuccessful; however I kept at it for several years, and have managed to get some sandalwood up and going in my remnant Jam bushland.

I began my first sandalwood plantation in 2001, establishing 6,000 *Acacia acuminata* host seedlings. I used a mixture of typical variant and narrow phyllode variant Jams. Seedlings were established with a Chatfield tree planter in a one pass operation. Row spacing varied, between 2.5 and 4 metres between rows.

I have continued to establish approx 6,000 host seedlings per year, to now have 18 hectares established with hosts and sandalwood. Survival of the host seedlings over the years has been excellent, considering 2001 and 2002 were very dry years for our part of the world. Some host infilling has been required.

In 2002 I began seeding sandalwood nuts, and have continued this every year since. I plant one nut on the north side of every host during autumn, using un-cracked nuts. It has been reassuring to see the number of sandalwoods starting to develop in the plantation.

Being a 330 mm annual rainfall area, growth rates for the hosts are a lot slower than I've seen on ASN field trips in the more western areas; however I am happy with how my plantation is developing.

I have used a range of host species over the years including various forms of *Acacia acuminata* as well as, *Acacia microbotrya*, *Acacia saligna*, *Acacia aneura*, *Acacia iteaphylla*, *Casuarina obesa* and some *Hakea*'s

I am finding very good sandalwood growth adjacent to *Acacia saligna* and *Acacia microbotrya*, however in some areas these hosts are smothering the sandalwood seedlings where I have planted too close to these aggressive hosts. I find that sandalwood established very close to aggressive hosts do not perform well, due to smothering and competition, however when they can get going in the gap between these hosts (e.g. approx 2 metres away), with plenty of access to sunlight, they do very well.

With my nut planting in March 2003 I found I seeded too deep at 75mm. In August 2003 I dug up nuts to see what was happening. Most of the reserves in the nut were used just to get to the surface. In the softer ground the nuts went in even deeper, and did not make it to the surface. The harder ground was more successful due to the shallower planting. Now I do not seed nuts deeper than 50mm.

I find that sandalwood nuts planted in autumn generally do not emerge above the surface until late August (depending on the year). I think it is important that these newly emerging sandalwoods are not emerging into a high weed burden or their survival will be much lower.

I have been conducting weed control operations within the plantation to control winter weeds. Unfortunately in June 2004 I killed, or affected, many sandalwood and young hosts when I over-sprayed with 1litre per hectare of Roundup. I lost approx. 20% of hosts and sandalwood in 2004 from this spraying operation.

I have not yet collected any sandalwood seed from my plantation, however many trees are flowering strongly for the first time this year.

An interesting observation is that old remnant sandalwood trees on my property are being defoliated each summer by Cockchafer beetles. They are destroying all the flowers so that they do not fruit. Borers (cossid moth larvae) are also affecting the older remnant jam trees, as do gall rust fungus. So far these issues have not affected my plantation.

This year I am continuing with host establishment in a new area with mixed species hosts. See you all at the next meeting in spring. Regards Les McTaggart



Les McTaggart inspecting sandalwood within his plantation, autumn 2006

Market Update by Wescorp International

Tim Coakley, Executive Chairman

It has been a very interesting last 12 months with sandalwood prices peaking around December/ January 2006. Since then there has been a back away by buyers at the top end, particularly in India and the Middle East.

At the January auction in India where 200 tonne of *S. album* was offered, it was all passed in and nothing was sold. This was mainly due to the fact that the system in India governs that the reserve price must increase by 10% on the previous sale price. The buyers have had enough and kept their hands in their pockets. This put a shot through the industry and we saw the *S. album* oil price come off from over US\$1600/kg in December down to US\$1450/ kg.

There was an auction in April of 60 tonne of illegally seized *S. album* and this all sold for an average of US\$73/kg.

Pacific Sandalwood sold well this last season with prices up to 20% higher than previous years. Island governments are now getting better control on the harvesting and there is increasingly less illegal sandalwood coming into the market, giving the buyers more confidence. Many of the islands are planting more sandalwood each year in the village gardens, but there has been strong interest for plantations on commercial scales in some areas. We know of one plantation last summer of 80 hectares of *S austrocaledonicum*.

Queensland supply of *S. lanceolatum* has been very limited due to the heavy rains in the harvesting regions and only 120 of the 400 tonne quota reached the market in the last 8 months. This has put enormous demand on other aromatic timbers in Australia and other parts of the world. It has been another demonstration that supply and prices can always be quickly corrected by substitute woods in this agarbatti industry. (Agarbatti refers to the fragrance burning industry where products are joss sticks, incense sticks, coils, and cones).

When the *Santalum* species only make up 5% to 10% of the total wood used in the agarbatti industry, substitution is always going to be a threat whilst there are;

1. high prices
2. inconsistent supply
3. poor quality
4. market discounting

The Western Australian sandalwood is going well even though we did have some delivery problems during the summer due to rainfall. The prices were increased on the 1st of February and there has been some of the usual resistance initially but the market has since settled down.

Due to decreasing supply in other regions, we believe *S. spicatum* now makes up over 50% of the traded *Santalum* species in the world, and slowly the centre of sandalwood for the world is moving from Mysore to Western Australia.

All buyers are now well aware of the sandalwood plantations in Western Australia and are very keen to know when the harvesting will start of both *S. album* and *S. spicatum*.

Wescorp would like to work with all plantation owners and put together an inventory of areas and dates planted so when the harvest starts, marketing can be done in an orderly fashion.

Prices will always be determined by;

1. oil content yields
2. santalol content within the oil
3. colour of the heartwood
4. percentage of heartwood
5. which part of the tree it is from
6. consistency of supply

In closing, the demand is excellent for all sandalwoods at the moment and provided the prices are not pushed too high to allow substitution, and supply is sustained until the plantations come to harvesting, the future looks very good for all stakeholders in the industry.



***Santalum austrocaledonicum* butt (endemic to the archipelago of New Caledonia) sold for US\$2,765 FOB (Weight 79kg, US \$35 per kg)**

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ASN Member Photos

A selection of photos of ASN members, autumn 2006



Tony Ednie-Brown, Beverley, inspecting sandalwood seeded in April 2003 and Jams planted in winter 2001



Pat Butterworth, east Beverley, direct seeding sandalwood nuts in 2 year-old Jam hosts, April 06



Nathan Davey, Konnongorring, inspecting sandalwood seeded in April 2003 on *A. acuminata* (left) and *A. saligna* (right) established in 2002



Bob Huxley, Gabbin, inspecting prolific flowering and seed development in his older plantation trees following extensive summer rains, May 2006



Dustin McCreery, Tammin, inspecting impressive sandalwood growth on *Acacia stenophylla* March 2006.



Hand grading 15 tonnes of sandalwood nuts collected from a large plantation, for use in new plantation establishment, Landcare Services, Midvale.

The sandalwood nut industry: Lessons from Queensland's macadamia industry

Aaron Edmonds, Sandalwood Grower and ASN Executive Committee Member, Calingiri WA

Phone: (08) 9628 7019, Email:

The future of the budding Sandalwood nut industry looks certain to provide rural Australia with an unparalleled success story in profitable, sustainable and energy efficient land management.

The framework forward for profitable production and marketing does not need to be re-invented thanks to the pioneering work of the Australian macadamia nut industry. This paves the way for large scale broadacre adoption of what is essentially a dryland horticultural proposition for Australia's southern grain growing and indeed irrigated arid production zones.

What the sandalwood tree possesses that no other crop in the world does, is the ability to greatly reduce the need for fossil fuel inputs to a fraction of that of other agricultural systems, whilst still producing both food/fuel and a highly valuable resource in the aromatic heartwood. That also gives Australia an amazing opportunity to utilize a crop that no other global competitors have access to because it is our unique native tree. It also insulates Australian agriculture's exposure to negative developments in global energy markets.

The sandalwood tree sets oil rich nuts in much of a similar manner as the macadamia tree where ripe nuts fall to the ground. The size and shape of the two respective nuts are almost identical as well. Further investigation into the harvesting machinery used by macadamia producers has shown the suitability for adoption of the same technology by sandalwood nut producers. A significant finding as it confirms mechanization is possible and will greatly reduce the costs associated with harvesting.



Sandalwood nuts (top) are very similar in size to macadamia nuts (above).

In fact the level of investment required to purchase harvesting machinery as well as post harvest handling infrastructure is extremely low when compared to other broadacre, dryland farming systems. This is important as it greatly reduces the risk of production and this may reverse corporate Australia's general disinterest in investing in these agricultural zones. Sandalwood provides a low cost, low risk crop to access the productive capacity of these regions.

It is clear to see that given a low risk, highly profitable option in sandalwood for nut production, we can value add the productive capacity of dryland regions and in the process reinvigorate socially and economically disintegrating communities in rural Australia. Not to mention the immeasurable benefit of having the means to be energy self sufficient in producing what is not only a food commodity but also fuel commodity.

Orchard Design

Orchard design is critical to the efficiency in managing a tree nut crop. Row spacings in particular must consider the following areas:

1. Machinery trafficability – the most common row spacing observed in the Bundaberg area was at 8 metres. This allowed for the trafficability of large nut harvesters, mechanical hedge pruners and also pesticide application.
2. Canopy management – Sunlight must be allowed to infiltrate the orchard to increase canopy surface area for flowering and hence potential nut set.



The standard row spacing is 8 metres between rows for irrigated macadamias.

Given the extreme and variable rainfall events experienced in Bundaberg and other high rainfall, sub tropical regions, orchard design must consider the risk for soil erosion to occur. All macadamia orchards control weeds chemically in strips up the tree lines. Weeds in the inter row spacings are allowed to grow to stop water run off and bind soils. These inter rows are sometimes mown just prior to the beginning of the harvesting season in March depending on weed growth.

The sandalwood nut industry: Lessons from Queensland's macadamia industry

Nut Harvesters

A large range of nut harvesters exist with varying designs and sizes. The flexibility and manufacturing capacity of nut harvester makers allows basically for the tailoring of harvester design to suit orchard design. A large number of engineering firms are producing machinery for the macadamia industry on the East Coast.

The larger nut harvesters which have large diameter nut combing wheels require for tree skirts to be pruned essentially from ground level to wheel height. Therefore the smaller the diameter of the combing wheels the less amount of pruning that is needed and this represents an opportunity to significantly reduce costs by removing the need to prune. Trees that also have lower canopy skirts also have fewer weeds and lower levers of evaporation particularly if irrigation is employed as is the case for the Bundaberg area. A great many of the northern NSW plantations are unirrigated.



Harvester with front mounted dual combing wheels.

Because macadamia nuts ripen over a long period of months, typically February up until August, the number of times an orchard is harvested could number as many as 10 to 12 times. Nuts are generally harvested as such to reduce water and rat damage to dropped nuts and also to generate cash flow as soon as is possible in the season. Sandalwood trees are different in that they will drop their nuts over a far shorter time period from late October through until December. Given the much lower chance of rainfall during these months, the number of harvest operations for sandalwood nuts may be as low as one and as high as a few times. For this reason it may be more desirable to have dual harvesting wheel combs to allow for picking a higher density of nuts likely to be lying on the ground. A number of macadamia harvesters do have these dual wheel combs in order to allow for the harvester to be driven at faster speeds.

Most nut harvesters also dehusk as the macadamias are harvested. Sandalwood nuts would benefit from this as well since they are housed inside a similar sized husk. The dehusking simply occurs as nuts are augered up from the harvesting wheels and into the collecting hopper bins.



Auger housing is slotted to enable husks and other foreign debris to fall onto the orchard floor. The auger itself has a rubber insert which muscles the nuts away from their husks.

For front mounted harvesting booms small cameras are mounted at ground level so the driver can see how close he/she is getting to the tree trunks via a small television screen in the tractor cab. Front mounted booms are preferred to back mounted as no nuts can be squashed by the propelling machinery. Back mounted booms do have the advantage of clear vision of the boom end if the skirt canopy is not too thick.

Most harvesting booms are equipped with blowers on the outside end. This allows for nuts in the zone up the tree lines that cannot be reached by the boom to be blown out into the next row to be harvested. This also does remove soil from this zone and may be problematic on coarser textured west Australian soils if blower power is too high.



Blowers mounted on the harvesting boom ends force any nuts between trees out into the inter-row area so they can then be picked up as the next row is done.

Nutrient Management

As with all commercially important horticultural tree crops, nutritional status in macadamia trees is monitored primarily through leaf analysis. Given the slightly more complicated system in sandalwood where it hosts upon another species in the planting mix, plant health will need to be monitored both in the sandalwood and also in the host species.

Whilst it could be assumed that nitrogen would almost certainly not be a nutrient required as an input, other fertilizers may serve to increase the productive capacity of the trees such as phosphorus and potassium. This would almost certainly be the case where sandalwood plantings occur on marginal soil types. Leaf analyses could well become a vital management tool in sandalwood nut production.

The sandalwood nut industry: Lessons from Queensland's macadamia industry

Pests

Rats are a pest of the macadamia nut. They are able to chew through the tough shell in order to extract the nutritious kernel. Given the physical likeness between sandalwood and macadamia nuts, rats could well become a pest in sandalwood orchards. Baiting stations are strategically placed throughout macadamia orchards in order to minimize damage to the crop. Racumin® (coumatetralyl) has been the industry standard but with a bounty of delicious nuts about, it is not a completely effective control strategy. This means that a concerted baiting effort should be engaged in before nuts ripen.



Rat damaged macadamia nuts

Post harvest handling

Nuts are collected from harvesters and then need to be hand sorted to remove immature and damaged seconds. This equipment is relatively simple and cheap once again highlighting the low capital costs that will be associated with sandalwood nut ventures. Once nuts are sorted they then need to be stored in a drying silo that allows moisture levels to come down. This would be less of an issue for sandalwood since the hot dry environment that persists around the months of harvest may already be low enough for bulk storage.



Hand sorting to remove second's nuts is an essential post harvest operation when servicing high value food markets.

Energy production options

Electricity cogeneration / cellulosic ethanol

One macadamia processing company, Suncoast Gold Macadamias at Gympie, north of Brisbane, has been converting 5000 tonnes of waste macadamia nut shells each year into electricity. A \$3 million capital investment was undertaken with energy partners Ergon and uses only 20% of the power generated on-site, exporting the rest into the electricity grid. One example of how a waste stream can be turned into value.

Another exciting energy sector that appears to be showing promise for the future is cellulosic ethanol. This is where wood, crop wastes like stubble and in fact almost any organic carbon source can be utilized to produce ethanol, the only realistic future liquid fuel source as oil prices increase. One tonne of wood has the potential to yield around 250 litres of ethanol. Any organic waste coming out of sandalwood orchards namely the nut shell or host trees at the end of a rotation could be turned into ethanol.

The ASN would like to acknowledge Aaron's commitment and contribution to the developing nut industry. Aaron used his annual holiday to travel to QLD to investigate the Macadamia industry and provide the ASN with this comprehensive report. We also acknowledge the funding support provided to Aaron through the Australian Government Department of Agriculture, Fisheries and Forestry Young People's Development Awards

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**For further information contact Ron
Tel: 0417 910 207**

ASN Member Photos

A selection of photos of ASN members, autumn 2006



Over 2 million Jam (*A. acuminata*) seedlings are being grown by Wheatbelt nurseries in 2006



Early stages of sandalwood nut germination



Remnant WA sandalwood, Bruce Rock area



Ben Boxshall, researcher from Albany, with WA sandalwood growing on *A. stenophylla* on alluvial clay loams in north central Victoria



Don Moir in his plantation at Narrogin, hosts direct seeded in 1999, sandalwood nuts sown in 2000



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matt.field@landcareservices.com.au

bernard.mclean@landcareservices.com.au

Bits & Pieces

Tim Emmott, ASN Secretary and Avon Native Plant Industries Officer

Phone: (08) 9621 2400, Fax (08) 9621 2580, Email: temmott@gawa.org.au

Australian Plague Locust and Pest info

There is some concern within the Agricultural community regarding high numbers of Australian plague locusts covering many of the shires in the Wheatbelt in 2006. Eggs laid in autumn this year are expected to hatch some time during spring. In the past, when numbers have been high, there has been evidence of Australian plague locusts and wingless grasshoppers damaging commercial tree crops in the Wheatbelt, such as maritime pine.

The main issue for tree growers is where large numbers of locusts are present in late spring when agricultural crops are drying off. The ASN will aim to keep members updated as to developments of Australia Plague Locusts, however for specific locust and general agricultural pest information, you can subscribe to PestFax free of charge

PestFax is a reporting service on diseases and pests threatening agricultural crops and pastures throughout the grain belt of WA. Weekly news updates throughout the growing season provide readers with risk alerts, current information and advice. PestFax is sent direct to readers via e-mail, by requesting free subscription from PestFax@agric.wa.gov.au or current and back issues can be found at: www.agric.wa.gov.au and search on the word PestFax. Insect samples can be sent to Peter Mangano, Entomology Section, Department of Agriculture and Food, 3 Baron-Hay Crt. South Perth, 6151 for free identification and control advice.

Early ordering avoids disappointment

2006 has seen strong demand for sandalwood host seedlings from farm tree nurseries in the Avon – wheatbelt region. Many regional nurseries are full to capacity this year. There does not seem to be any spare *Acacia acuminata* seedlings available from regional nurseries when this newsletter went to print.

If you are considering establishing host seedlings in 2007, plan now and place your order with your preferred nursery as early as possible. Nurseries in the Wheatbelt generally begin to sow species such as *A. acuminata* in December for seedling dispatch the following winter. Nurseries also need to source appropriate host seed, so plan now and get your order to the nursery by November at the latest.

Some nurseries may also offer discounts for large orders, early orders or if a deposit is paid up front. The ASN advocates members support nurseries that are members of the network. For a list of nurseries that are members of the ASN, contact the secretary.



Australian Plague Locust (APL). The picture below shows the identification characteristics for APL i.e. dark blotch on the tip of the hind wing and red colouration on the inside of the hind leg. (Courtesy of the Department of Agriculture and Food)



Sandalwood Plantation Training Course


Due to increasing numbers of people entering the sandalwood plantation industry, the Avon Catchment Council's native plant industry program in partnership with South Coast Regional Investment Planning Team's commercialising native plants program will be holding a 2 to 3 day 'introduction to sandalwood cultivation' course in Spring 2006.

The aim of the course will be to extend to new growers information covered at previous ASN workshops, and equip people with the basic skills required in sandalwood plantation establishment and management. To gauge the level of interest in the course, please register your interest with the Avon Native Plant Industries Development Officer Tim Emmott on the numbers above. There will be minimal costs to attend the course due to funding support from the Avon Catchment Council. Participant numbers will be limited. Registers of Interest to be received by the 8th of July 2006.

Acacia species information

For growers seeking further information on various *Acacia* species, such as distribution, soil type, landscape position, images etc, have a look at www.worldwidewattle.com.


Address <http://www.worldwidewattle.com/>



World Wide Wattle

To inform, educate and promote the conservation, utilisation and enjoyment of Australian *Acacia* species ('Wattles'), many of which are grown worldwide.

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ASN Member Photos

A selection of photos of ASN members, autumn 2006



Left and below: 'Cracking' sandalwood nuts in Albany using a simple wetting and rapid drying technique to crack sandalwood nuts prior to sowing in the field, to improve germination. In this method, sandalwood nuts are laid out on shade cloth on a bench in a hot house. Sprinklers are set to come on over night for 30 minutes at a time at 2 hour intervals to wet up the nuts. The nuts are then left in the hot house to dry rapidly the following day, causing the nuts to crack. This method is conducted in the hot summer months of January and February. The hot house is not required for those wishing to use this method in the warmer wheatbelt environment of WA. For more information refer to 'Cracking the woody endocarp of *Santalum spicatum* nuts by wetting and rapid drying improves germination' G.S. Woodall 2004.



Sandalwood



Sandalwood

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Establishing and managing a sandalwood plantation requires the investment of considerable resources in terms of both time and money. As with any pursuit that is subject to the vagaries of the natural environment the potential risk of loss is always present.

Taking out an insurance policy on your sandalwood plantation is one way of managing this risk. It is important to remember that plantation insurance is only one strategy to manage risk. Other strategies include, avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk.

In relation to sandalwood plantations the main risks could be considered, fire, drought, insect or vermin damage and storm damage. Other risks can stem from poor management i.e. accidentally spraying herbicide on trees or allowing sheep to graze young trees.

The strategy you choose to adopt for each of the risks will determine the type of insurance you need and can afford.

Essentially an insurance policy is a form of risk management that transfers the risk of a potential loss from one entity to another in exchange for a premium and duty of care. This last point is important as most insurers will insist that you provide a duty of care for the plantation. This may require the development of a management plan or the provision of evidence that you have considered risks, such as fire, and have in place the necessary systems and equipment to deal with a fire or other risks should they occur.

There are a number of starting points when seeking an insurer. The Australian Forest Growers www.afg.asn.au has an insurance scheme that would suit most sandalwood plantations. Details are available on their website.

Alternatively a number of insurance companies that deal with agricultural pursuits are able to arrange insurance. If you already have policies with one of these companies they are often worth talking to as they may be able to package your needs into existing policies. General insurance companies tend to have less experience in this area and from my experience are difficult to deal with.

An example of a typical plantation insurance policy can be downloaded at www.agricola.com.au.

Premiums will obviously vary according to the level of risk you are insuring against and how the insurer views your competence as a manager. It is important to remember that insurance is only one strategy for risk management and being able to demonstrate to insurers that you have a range of strategies in place and a management plan may help reduce insurance costs.

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ASN Member Photos

A selection of photos of ASN members, autumn 2006



Prolific flowering of plantation sandalwood in Autumn, following summer rains



ASN members at the ASN autumn 2006 field day, Beverley



Bob Huxley, Gabbin amongst one of his earlier irrigated plantations



Bert Wansbrough, Beverley, demonstrating his prototype nut harvesting system, ASN autumn field day

(Right) Allan Briggs, National Trust of Australia (WA) inspecting sandalwood direct seeded in April 2005 on Acacia acuminata. The National Trust, through BushBank, has commenced rehabilitation of 200 hectares at Yarraweyah Falls Farm of poorly productive land that was tending to erode. The Trust entered into a partnership with FPC, to improve the natural environment at Yarraweyah by extending the vegetation around breakaways and existing remnant vegetation. The native sandalwood and biodiverse host species system has been used. Consideration is being given to incorporating "Wild Harvest" species endemic to the region as part of the rehabilitation process and FPC has enabled harvest of these species under its Profit a Prendre at the request of the Trust.



Preliminary oil results from a 14-year-old Indian Sandalwood (*Santalum album*) plantation at Kununurra, WA

Jon Brand, Senior Forester, Forest Products Commission

Preliminary oil analysis from 20 young Indian sandalwood trees growing in FPC plantations indicate that the trees are producing good quality oil, but the volumes of heartwood are low. These results are encouraging, because the trees were only 14 years old, and were one of the first Indian sandalwood plantations on the Ord River Irrigation Area (ORIA) Kununurra, Western Australia.

Today, over 1,000 ha of land has been planted into sandalwood on the ORIA by private companies, farmers and the FPC. Indian sandalwood is typically established on mounded lines, together with a pot-host, intermediate host and a long-term host (Figure 1). Flood irrigation is commonly used to water the trees

Sandalwood establishment and growth have been good at Kununurra, but more information is required on oil production within these young trees. In December 2004, twenty Indian sandalwood trees (age 14 years) within an FPC plantation were sampled for total oil yield and santalol content (Figure 2). Core samples were taken from each sandalwood stem at 30 cm and 100 cm from the base, and were analysed using solvent extraction.

The heartwood volumes were relatively low, with only 34 % at 30 cm, and 29 % at 100 cm. At this stage, the trees are still mainly sapwood, representing 66-71 % of the timber. The mean total extractable oil yields from the heartwood were reasonable, with 2.9-3.4 % oil. These oil readings are approximately half that obtained from mature trees aged over 50 years growing in India, which have an average oil yield of 5-7 %.

The heartwood oil contained 45-47 % α -santalol and 21-22 % β -santalol. These santalol levels meet the current ISO standards for *S. album* oil, which are 41-55 % α -santalol and 16-24 % β -santalol (ISO 3518: 2002E). This implies that although the oil yield was low, the quality of the oil would meet sandalwood oil requirements.

Oil yields were highly variable between trees, with some as high as 7.1 %, while three trees had less than 0.3 %. These trees were all growing under the same conditions, which indicates that there is huge variation and there could be some genetic control that could be exploited. Until this is better understood, future plantings at Kununurra should aim to use seeds or progeny from known superior oil producing parent trees.

These results provide evidence that the young Indian sandalwood plantations at Kununurra are producing oil, but the volume of heartwood at this age is relatively low. However, it is expected that both heartwood volume and percentage oil will increase with age. This article is from a paper that will be published in the SRN:

Brand, J., Kimber, P. and Streatfield, J. (2006). Preliminary analysis of Indian sandalwood (*Santalum album* L.) oil from a 14-year-old plantation at Kununurra, Western Australia. Sandalwood Research Newsletter 21.



Figure 1. One-year-old Indian sandalwood seedlings beneath host plants, within an FPC plantation (Photo: G. Pronk).



Figure 2. 14-year-old FPC Indian sandalwood plantation (Photo: L. Barbour).

Sandalwood Research Newsletter

Sandalwood Research Newsletter (SRN) is a web-published periodical for the communication of research related to the genus *Santalum*. The newsletter provides information about current research, development and extension activities within industry organizations, government departments and research institutions. The aim of the publication is to increase public awareness of the natural source of sandalwood products and the need for genus conservation and plantation establishment. Back issues and further information is available at; www.jcu.edu.au/tropbiol/srn

ASN Member Photos

A selection of photos of ASN members, autumn 2006



Sandalwood growers may have experienced the above – sandalwood direct seeded in autumn has germinated and emerged in spring, grown for several months, and then died over summer. Possible causes include;

- **Sap sucking insects (e.g. Rutherglen bugs) feeding on the young sandalwoods are a common cause of mortality in the first summer.**
- **Sandalwood has not formed a functional connection to the host plant. This can be influenced by the season e.g. a late start to the season with an early finish can result in sandalwood seedlings not having sufficient time (in moist soil) to form functional host connections. Other factors that can effect early sandalwood survival include**
- **Heavy weed burden, sandalwood emerging into a thick mass of winter weeds can smother and shade the emerging sandalwood, however a small weed burden may not be a problem**
- **Aphids (another sap sucker); in a plantation at Bolgart (hosts planted winter 2004, sandalwood sown April 2005) an excellent germination of sandalwood was achieved, however 70% of the seedlings died during December 2005. High densities of aphids were noted on the young sandalwoods, and it is perceived they were primarily responsible for sandalwood seedling mortality. The plantation was adjacent to a canola crop, and there was a high density of broadleaf weeds in the 'inter-rows' of the plantation, that may have contributed to high aphid numbers within the young plantation.**
- **Soil types – host species established on their non-preferred soil type may result in hosts being under stress and not providing sufficient resources to young sandalwood**

Right: Adult Rutherglen Bug, a sap sucking insect. In spring and early summer, large numbers often move on to remaining green plants such as tree seedlings.



Sandalwood Plantation and Revegetation Services

The Environmental Services Unit of Greening Australia WA maintains a large collection of locally collected Sandalwood seed and host species seed.

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Sandalwood Plantation Design – Focus on Row Spacing

Tim Emmott, ASN Secretary and Avon Native Plant Industries Officer

Tel (08) 9621 2400, email temmott@gawa.org.au

Giving some thought to plantation design is a valuable exercise, to ensure the design and layout you choose will meet your long term objectives.

WA sandalwood (*Santalum spicatum*) is predominantly being cultivated in the wheatbelt to produce oil bearing wood, with the aim of profiting from the sale of this wood when the plantation is harvested some time in the future.

Interest in products from sandalwood nuts continues to increase and several growers are establishing plantations with the sole focus on harvesting nuts. We recommend that growers design plantations with both products in mind; harvesting nuts in the short to medium term, and oil-bearing wood in the longer term.

Although the sandalwood plantation industry is still young, there are a number of best-bet design guidelines to work with for both nut and wood production.

Luckily, members of the Avon Sandalwood Network have been establishing sandalwood for many years, with both wood and nut production in mind, and we can learn from their experiences. Calingiri sandalwood grower Aaron Edmonds, who recently completed a Queensland study tour investigating macadamia harvesting systems and orchard design, has developed some thoughts on plantation design where nut production is the foremost priority.

Overall Design

Block and wide-belt plantations are the preferred configurations. Alley-farming systems integrated with pastures and livestock are not usually suitable, because grazing before about year 5 to 7 is likely to cause too much damage to the hosts and sandalwood.

Block plantings can be targeted to specific areas to gain other benefits: reducing recharge to water tables; drying seepage areas and reducing waterlogging; providing windbreaks and shelter; and increasing property aesthetics."

Wide-belt plantations (e.g. 10 - 20 rows in a long belt) can also be targeted to specific areas to gain extra benefits: along creek lines and other drainage lines for habitat, erosion and siltation control, and improved water quality; and as corridors between patches of bush. Belts can provide a significant visual effect.

Establishing narrow belts in conjunction with surface water management structures has merit. This may involve establishing 4 - 6 rows below a contour or interceptor bank. In this system sandalwood and hosts planted in thin belts have improved access to resources (eg soil moisture and nutrients). However, if the paddock is to be grazed the belts require fencing to exclude stock until the sandalwood is well above grazing height, which can be in 5 to 7 years.

Machinery access

A main issue that existing sandalwood growers are finding within their established plantations is machinery access. Designs should allow for machinery access for the range of operations needed on the site. Plantations generally need weed control for the first few years.

Mechanical nut harvesting needs access between rows. And there should be adequate firebreaks and access paths for fire control.

The most common form of machinery used for weed control within sandalwood plantations is a 4WD ute with a spray unit, however 4 wheel motorbikes and small tractors are utilized. One design criteria for a sandalwood plantation may be to ensure that a ute or small tractor can be driven up each row, or every second row, for the duration of the rotation.



Top:

Steve Gray in 4 year old plantation with 'narrow phyllode' *Acacia acuminata*, rows at 3 metres

Middle:

4 year old plantation, rows at 5 metres (R. Mulder)

Bottom:

Graeme King in 5 yo plantation, rows at 6 metres

Sandalwood Plantation Design – Focus on Row Spacing

Tim Emmott, ASN Secretary and Avon Native Plant Industries Officer

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Hosts and their impact on plantation design

Your choice of host will influence row spacing. Hosts with spreading, bushy forms (eg *Acacia acuminata* narrow phyllode variant or *Acacia saligna*) will need wider inter-row spaces than the narrow upright forms of hosts (eg *Acacia acuminata* typical variant or *Allocasuarina hugeliana*).

Fencing Plantations

If fencing your plantation, allow plenty of space between the trees and the fence. This is important if a fire break is to be constructed around the perimeter of the plantation, and to reduce future pressure on the fence from external grazing, or trees / branches smothering the fence. Ensure enough room is left between the end of the rows and the fence to enable the turning of machinery for future management or harvesting.

Reducing risk of erosion

Establishing rows on or very near to the contour can minimise erosion risk. Ripping along the contour also contributes to establishing nutrient cycling processes through increasing water infiltration and retention of leaf litter. These factors can reduce the loss of natural resources from the site, improving foundations for ecological functioning. (Mullen & White)

Growers Perspective – comments from ASN members;

Aaron Edmonds, Calingiri

All of our plantations are established in block or wide belt plantings that target a specific soil type. Where possible, rows are established in strait lines for ease of management. Initially our plantations were established with rows at 4metres apart, and hosts 3metres apart along rows (833 hosts per hectare). With this system I established approx 500 sandalwood per hectare. Current plantations are now designed with rows at 5 meters apart, with hosts established 3meters apart along the rows (667 hosts per hectare). This system has 1 sandalwood for every 2 hosts, (300 sandalwood per hectare). If a plantation is being established higher in the landscape with less moisture availability, I increase the row spacing to 6 metres.

My plantation design is based solely on nut harvesting, with the aim of ensuring healthy sandalwood trees producing as many nuts as possible. With hosts, I purposely target species with an upright 'tree' form, and avoid hosts with a 'bushy' form, to keep the understorey clear in the plantation for ease of nut harvesting. My main reason for moving out to 5 metre row spacings is for more plantation access, and to increase moisture availability for trees in the plantation. I have generally established hosts by ripping, spraying and hand planting, however this year I may use a mechanical tree planter due to the number of hosts I have to establish.

Bert and Norma Wansbrough, Beverley

All of our plantations are established in 'block' type plantings. Originally, we established hosts at 4 metres between rows, as per the recommendations at the time. Our host species have included mixtures of typical and narrow phyllode variant *Acacia acuminata*. We now find that at 4 years of age we have difficulty gaining access down the rows for weed control operations. Now we are using a minimum row spacing of 5 metres to ensure we have plenty of access between the rows for herbicide application and nut harvesting.

Ron Mulder, WA Sandalwood Plantations, Beverley

All of our plantations are established in large block type plantings. We started out with our initial row spacing being 3 metres between rows, and found this to be far to close. We then moved out to 4 meters between rows, however we were finding that by age 4 years, we were unable to gain access between the rows with a ute for weed control and other management actions, being limited to using a 4 wheel motorbike. All of our current plantations are established with rip lines at 5 metre intervals. The main reason being we are using a larger percentage of 'narrow pyhllode' variant *Acacia acuminata*, and we want to ensure vehicle access into the future. We are maintaining a high initial host stocking density, and are planting host seedlings closer together along the rows. We always try to leave a 10 to 15 metre fire break around the perimeter of our plantations.

Paired row designs

Geoff Woodall, a researcher who has worked for many years establishing sandalwood plantations with mixed native host species, prefers to use a 'paired row' plantation design to ensure future plantation access and moisture availability from the wider row. This involves establishing a pair of rows 2 or 3 metres apart, then leaving a 6 or 7 metre gap, before establishing another pair of rows 2 or 3 metres apart. The paired row system allows sandalwood to access hosts in both rows early in the plantation life.



Above: Establishing a paired row sandalwood system

Stocking density table for various row spacings (guide only)

	Row Spacing Design Options	Distance of ripline (metres) per 1 Hectare	Target host seedling density / ha							
			800	900	1,000	1,100	1200	1300	1400	1500
			Distance between seedlings required to achieve target density							
Even Spaced Rows	Rip lines 4 metres apart	2500	3.1	2.8	2.5	2.3	2.1	1.9	1.8	1.7
	Rip lines 4.5 metres apart	2222	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5
	Rip lines 5 metres apart	2000	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3
	Rip lines 5.5 metres apart	1818	2.3	2.0	1.8	1.7	1.5	1.4	1.3	1.2
	Rip lines 6 metres apart	1667	2.1	1.9	1.7	1.5	1.4	1.3	1.2	1.1
Paired Rows	Twin rows, 2 meters apart, then 6 metre gap	2500	3.1	2.8	2.5	2.3	2.1	1.9	1.8	1.7
	Twin rows, 2 meters apart, then 7 metre gap	2222	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5
	Twin rows, 2.5 metres apart, then 6 metre gap	2353	2.9	2.6	2.4	2.1	2.0	1.8	1.7	1.6
	Twin rows, 2.5 metres apart, then 7 metre gap	2105	2.6	2.3	2.1	1.9	1.8	1.6	1.5	1.4
	Twin rows, 3 metres apart, then 6 metre gap	2222	2.8	2.5	2.2	2.0	1.9	1.7	1.6	1.5
	Twin rows, 3 metres apart, then 7 metre gap	2000	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3

Strengthening the developing sandalwood industry

Tim Emmott, Avon Native Plant Industries Officer & Geoff Woodall, Centre of Excellence in Natural Resource Management
Email: temmott@gawa.org.au or gwoodall@agric.wa.gov.au

In 2005, Greening Australia, in partnership with Geoff Woodall, SCRIPT and various ASN members, commenced a National Landcare Program funded project that involved the establishment of over 100 hectares of 'biodiverse' sandalwood systems in the Avon and Blackwood catchments, with a focus on direct seeding of hosts.

The background and development of this project has been summarised in previous editions of this newsletter, and presentations delivered at ASN workshops. This article aims to provide a update on the progress of the projects established in 2005, and planned projects for 2006.

An excellent to satisfactory host density has been achieved over 75 ha of the 100 ha established in 2005. Of 15 sites established, 4 sites require 'in-filling' of hosts this winter, to build up the number of hosts within the plantations. This mainly involves hand planting mixed *acacia* seedlings.

Sandalwood nuts, at a rate of between 2.5 and 3 kg per hectare, have been established across 12 of the 15 sites during March and April this year.

In the Avon and Blackwood catchments a further 100 hectares of mixed species sandalwood hosts will be established this winter (2006). In the Avon, locations include Aldersyde, Bolgart, Bruce Rock, Cunderdin, Dowerin, Gidgegannup, Meckering and Trayning.

In the Blackwood, the 2006 sites will be located at Duranillin, Gnowangerup, Kojonup, Narrogin, Wagin and Woodanilling.

The focus of these sites is to demonstrate and develop direct seeding as a means of reducing plantation establishment costs, and establish plantations that comprise a high density and diverse mixture of native host plants.

Several modifications have been made to the direct seeding equipment to be used in the 2006 projects, with an emphasis on precision seed placement. We are ensuring thorough pre treatment of the host seed, as there were some issues with our seed treatment in the 2005 projects.

If you require further information on this project, please contact Tim Emmott or Geoff Woodall on (08) 9892 8427.



Planting sandalwood nuts, March 2006, Ross Blagrove's Cuballing property, hosts direct seeded June 2005



Bethan Lloyds east Toodyay property, May 2006, hosts direct seeded in August 2005



A poor result experienced at this west Beverley site, direct seeded in 2005. This will be replanted in winter 2006



Planting sandalwood nuts, April 2006 at Bob Huxley's Gabbin property, hosts direct seeded in June 2005



Direct seeding hosts at Ray Allen's 15 ha site, Aldersyde, May 2006. Site pre-scaled with a Chatfield planter

ASN Member Photos

A selection of photos of ASN members, autumn 2006



Bob Harrington, Oakford inspecting one of his original plantation sandalwood trees, growing on Bassendean sands with some early irrigation.



Bob and Roger Harrington, Oakford, inspecting 6 year old sandalwood on Bassendean sands. Hosts trialled have included *A. iteaphylla*, *A. mearnsii*, *A. baileyana* and tagasaste



Steve Gray, Wundowie, inspecting sandalwood seeded in autumn 2004 on *Acacia acuminata* (narrow variant) established in 2002



Bethan Lloyd, Toodyay, inspecting sandalwood seeded in autumn 2005 on *A. pulchella* and *A. acuminata* established in 2004



Les McTaggart, Koorda, with sandalwood growing on *Casuarina obesa* (Swamp sheoak)



Bruce Storer, ASN Chairman, contemplating the role of direct seeding hosts, Bob Huxley's property, Gabbin

South Australian Interest Grows

During April 2006 Geoff Woodall (Centre of Excellence in Natural Resource Management, University of Western Australia) travelled to the Eyre peninsula, in western South Australia to present at a Farm Forestry Workshop at Wudinna.

During the trip Geoff met with various enthusiastic sandalwood growers and potential growers. A few sandalwood plantations were visited as were some spectacular remnant sandalwood populations.

In this region of South Australia sandalwood grows naturally with various species including a range of *Acacia*, *Senna* and *Dodonaea* species. During the trip, the merits of using local host species were apparent.



Above: South Australian sandalwood grower John Grund, inspects his 7 year old sandalwood growing on Old Man Saltbush near Wudinna, SA (350 mm rainfall) The Saltbush in this system is now starting to die out.

Below: South Australian sandalwood growers John and Sue Grund, inspecting a more recent plantation, with a mix of hosts including local *Acacia*'s



Remnant stand of *Santalum spicatum*, on the Eyre peninsula, western South Australia



Not a member of the ASN? For more information, contact the ASN secretary on the numbers below;
Address: PO Box 184, Northam WA 6401, Phone: (08) 9621 2400, Email: temmott@gawa.org.au

The Avon Sandalwood Network is supported by the Avon Catchment Council's 'Native Plant Industries' project, coordinated by Greening Australia (WA,) with funding from the State and Australian Governments through the National Action Plan for Salinity and Water Quality"

