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The Avon Sandalwooder

Welcome to the second issue of the Avon Sandalwooder, a newsletter produced by the Avon Sandalwood Network

Sandalwood Network gains momentum

Tim Emmott, Greening Australia (WA), Avon Sandalwooder Editor

2nd Workshop Overview

The recently formed Avon Sandalwood Network (ASN) held its second workshop and field trip on the 8th of April in Calingiri, attended by 39 enthusiastic people. Participants included current and prospective sandalwood growers, researchers, nursery managers and natural resource management professionals.

Presentations were delivered by Jon Brand of the Forest Products Commission, discussing the predicted timber and oil yields in sandalwood plantations, followed by Geoff Woodall from the CENRM who expanded on sandalwood seed and germination issues, and then Peter Jones of Renew Environmental Services, who presented on future trends in the Sandalwood Market, touching on plantation design and management issues.

The afternoon session involved a field trip to several plantations, where issues such as weed control, host species, plantation design and establishment techniques provided plenty of discussion.

ASN members discussing silvicultural issues at the Calingiri workshop; Geoff Woodall demonstrating host root development at the Calingiri workshop

Where to now with the ASN

The ASN steering committee met on Monday the 17th of May in Northam to advance the process of becoming an incorporated association, discuss membership fees, and develop the next workshop. The ASN initially received $5,000 funding, which has been used to deliver two successful workshops, produce two newsletters and initiate the processes for the ASN to become incorporated. As at the 30th of June 2004, the ASN has $1,400 remaining from the initial funding.

Incorporation should be completed for the third ASN workshop planned for September 2004 in Beverley, and the workshop will hopefully include the first AGM of the ASN. This will include the formal calling for nominations for the executive committee, and members are encouraged to nominate on the day.

For more information on the Avon Sandalwood Network, contact Tim Emmott from Greening Australia (WA) on (08) 9621 2400 or temmott@gawa.org.au.

Growers Update & Views

Bert and Norma Wansbrough, Sandalwood growers and ASN members, Berverley WA

Greetings sandalwood growers! We are semi-retired from general farming, having disposed of part of our property in the Bally Bally district east of Beverley, and are leasing out the remainder.

Our initial tree planting projects began many years ago, mainly for salt reclamation, and has been quite successful. Recently we have moved into sandalwood production, with a total of 8 hectares currently under cultivation. Our first sandalwood was sown in 1995, when CALM researcher Wally Edgcombe established sandalwood seed on some Jam (*Acacia acuminata*) host trees planted in 1993. 30 of these 9-year old semi mature trees are growing well.

In 1999, with great excitement, we collected seed from these trees, totalling 2100 seeds. In 2000 we harvested 11,500 seeds from the same trees. In 2001 we harvested 9,450 seeds, however then came the dry years, and in 2002 we managed only 233 seeds and in 2003, these 30 trees supplied us with the grand total of 30 seeds! On a brighter note, the 30 sandalwood trees look to have prolific seed growth this year.

The seed collected from these trees has been used in our sandalwood plantations, which we started seriously in 2001, when we established sandalwood seed to 6,200 2-year-old Jam trees. Over the years we have experienced very high sandalwood germination rates, in the order of 80–90%, without any preliminary preparation of the seed such as cracking etc. However in the 2003/04 season we experienced a high mortality rate of the young sandalwood seedlings. We attribute this to several factors:

1. Hot dry conditions experienced in November 2003 stressed the young seedlings

2. We planted the seed half way between the host trees, which were spaced at 3 meters, and perhaps the small host roots were not able to support the young sandalwood seedlings.

This has prompted us to re-plant the failed areas this year, moving closer to the host tree, at around half a meter on the south side of the host.

Our biggest headache comes from parrot damage to our young sandalwood and host trees. The parrots have been walking around the young trees, chewing the bark, effectively ring barking the trees just above ground level. We have placed small protective guards made from recycled rabbit netting around the young sandalwood trees, and this seems to have been successful in protecting the main stem.

The question of which type of jam host works best in our situation remains open. We feel that the busy habit of some Jams provides some deterrent to parrots; however we have not noticed any difference in parrot damage to sandalwood seedlings beneath bushy or upright forms of Jam. We wish all growers good luck for the 2004 season, and trust you have the enjoyment we experience in the growing of sandalwood. Bert and Norma Wansbrough.

Pruning Sandalwood

Peter Jones
Renew Environmental Services Pty Ltd

The practice of pruning sandalwood in a plantation setting is one that is often adopted with very little questioning of the reasons why.

Growth Habits

West Australian sandalwood (*Santalum spicatum*) does not "self prune" in its natural setting. Most Australians that are fortunate enough to have regular contact with our magnificent Eucalypts are aware of the ability of most Eucalypts to develop a bole or trunk that is free of branches.

However West Australian sandalwood generally produces branches at a much lower level from the ground and in many instances may only produce a trunk of less than a meter. (I can already hear the many "Yeah but I saw this one tree….")

If we consider the type of forest or woodland that West Australian sandalwood has evolved in it becomes apparent that the forest structure is more open and allows light to penetrate more easily.

One of the purposes of a trees' trunk is to elevate its branches and subsequently its leaves above other trees that are competing for the available light. In contrast a tree growing in open woodland will tend to produce more branches and grow "out" rather than "up".

The structure created in your plantation through the spacing of trees and the species chosen will affect the growth habit of your sandalwood.

Clear Wood

One of reasons pruning is carried out in timber plantations is to prevent the occurrence of large knots in the timber produced from the trunk. As the trunk grows branch wood remains in the trunk and becomes evident when the tree is felled and sawn timber produced.

In the case of West Australian sandalwood, almost all timber produced will end up as powder or small chips. The structural integrity of the timber is not relevant to buyers of sandalwood.

Reasons for Pruning

There are a number of valid reasons for pruning within a sandalwood plantation. These include providing access. With branches removed access between rows is obviously easier and this may be desirable particularly if access is required for collection of seed. (Provided there are commercial quantities of seed remaining on fewer branches!)

Access also becomes critical in cases where fire suppression is required. In larger plantations consideration should be given to providing access suitable for a 4WD with a light tank and pump at regular intervals.

A second reason for pruning may be to improve the form of the sandalwood present. A tree that has a forked trunk that is detected early may be able to have one of the branches removed to create a single stem. Parrot damage that occurs in the early years of a plantation may also be able to be remedied to an extent by careful use of the secatuers.

The form of the sandalwoods in your plantation can be directly influenced by the source of your sandalwood seed. Seed from sandalwood that has good form is more likely (but not guaranteed) to produce sandalwoods with corresponding good form. So go back to the "One tree that you saw" and grab the seed. (Legally and with the owners consent of course.)

Cost

To date there is no conclusive evidence that pruning within a Western Australian sandalwood plantation provides increased returns that compensate for the cost of pruning.

There is always a cost associated with any activity you carry out in the plantation and pruning is no exception. For small scale plots and trials this cost can easily be absorbed, but on a larger scale the cost of pruning can significantly affect the end returns.

The exception to activities that cost is the activity of simply being in your plantation and enjoying your accomplishments and I recommend that this be done on a far more regular basis than pruning.

Growers Update & Views

Felicity and Tony Ednie-Brown
Sandalwood growers and ASN members, Beverley WA

We are newcomers to this industry and thank all those members of the Network who have shared their knowledge and assisted us with such good humour!

When we first decided to establish sandalwood, in 2000, the selected land was under wheat and sheep production. We embarked on a staged plantation model that we plan to develop over a six year planting programme. As this has progressed, the wheat and sheep uses are contracting and, incrementally, being replaced by contoured planting of various eucalypts for erosion repair, habitat, wind breaks and plantations of acacia acuminata as a prospective host for the sandalwood.

The land is characterized, predominantly, by well-drained sandy loam over granite. However, in our second jam planting (winter 2002), we encountered quite heavy clay soil in one of the paddocks which is accompanied by an invasive strong growth of wild oats. The jams have not taken in this country and we lost over 50% of the seedlings over the summer of 2002/03 – very heartbreaking.

In the winter of 2003, we experimented with limited back planting of alternative species – Acacia microbotria, Acacia hemiteles, Acacia merrallii, and Casuarina campestris.

As of April 2004, the manna wattle has generally survived with some examples now bushy and up to half a metre in height. (We have subsequently been informed that the land before clearing was characterised by this species). The other species have not faired so well but there are an encouraging number battling on, even though they are less than 200 mm in height and, with a favourable winter this year, we may see them pull through. We may then adopt the philosophy to back plant a variety of hosts gradually as the microclimate extends – although we suspect that the sandalwood may also not be too amenable to the heavier country.

In April 2003, seeding of our first sandalwood was undertaken, resulting in a reasonable germination but survival now has fallen back to a disappointing level and we put this down to the drought.

Staging our plantation has proved to be fortuitous since plantation management and planting techniques are evolving and we have learned much from experience since we planted our first jams in 2001. In addition, the Network has been established and this has contributed to a collegiate approach to problems.

In retrospect, our biggest challenge has been weed control. Herbicides which we currently use (e.g. Roundup, Simazine) have a fairly narrow spectrum of effect and it would be most helpful if research could identify a wider range of chemicals that could be sprayed safely over tree-hosts and sandalwood seedlings without damage or impairment, particularly in the early years of establishment.

Felicity and Tony Ednie-Brown.

Parrots and Traps

Terry Mondy
Farmer, Tree grower and parrot trap supplier
Boyup Brook WA
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Damage to tree crops by parrots and galahs causes huge economic losses as well frustration when non commercial areas are planted. Reducing bird numbers is obviously the first step in any control program.

The feeding habits of parrots and the fact they learn from one another means that they can be successfully trapped. When natural food sources are low during autumn and winter parrots will be attracted to sites where grain is available. Feeding sites can be created by free feeding with grain or using existing sites such as silos, grain bunkers etc.

Time is the biggest cost in controlling parrots and traps are a time efficient way of reducing numbers. Traps have to be monitored daily when in use and some time is required to establish feeding sites. Only approved traps are permitted to be used and the criteria for the humane disposal of the parrots, and release of non- targeted species, needs to be met. A license to trap parrots is required from the Department of Conservation and Land Management. For further information contact Terry Mondy on the number above.

Predicted long-term growth rates of sandalwood grown in plantations

In the 400-600mmm annual rainfall zones.

Jon Brand
Senior Forester
Forest Products Commission

Over the past 5-10 years, the Forest Products Commission (FPC) have successfully established sandalwood (Santalum spicatum) in a number of trial plantings in the 400 600 mm annual rainfall zone of the wheatbelt.

Trial plantings of sandalwood near one of the preferred host species, jam (Acacia acuminata), have shown excellent growth rates at three separate sites: Kwobrup, Narrogin and Dandaragan (Figure 1). At each of these sites, 4-6 S. spicatum seeds were direct seeded near 52-320 A. acuminata, aged 1-5 years. At S. spicatum age 3-6 years, survival (over 80 % per spot) was relatively high and mean stem diameters (at 150 mm above the ground) were growing at 9.7-12.3 mm year-1 (Figure 2). This is a relatively fast growth rate for a tree that requires a minimum stem diameter of only 127 m (at 150 mm) to be of commercial value from natural stands.

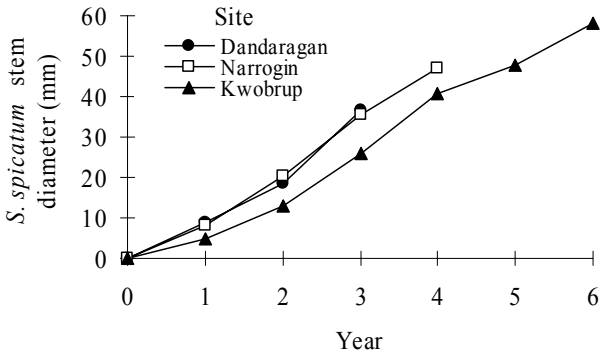

Figure 1. Mean annual stem diameter (at 150 mm) growth of S. spicatum direct seeded near A. acuminata (age 1-5 years) at Kwobrup, Narrogin and Dandaragan.

Although the sandalwood are currently growing at up to 10-12 mm yr-1 (at 150 mm) near A. acuminata in plantations, it is unlikely the trees will maintain this growth rate over 20 years. A separate trial at Northampton showed that mean annual stem diameter growth dropped 2 mm yr-1 after age six years. The Northampton trees were under stress, due to a high host mortality, but it does indicate that mean S. spicatum stem diameter growth may not be linear over 20 years. It is more likely that the mean stem diameter growth will be approximately 7 mm yr-1 over 18 years in the 400-600 mm annual rainfall zone.

Therefore, allowing two years to establish both host trees and S. spicatum and then a mean annual stem diameter growth of only 7 mm year 1 for 18 years, the S. spicatum are expected to reach commercial size (127 mm at 150 mm above the ground) in 20 years. This mean stem diameter (127 mm) equates to a commercial weight of 14.7 kg per tree, using the equation developed by Ben Sawyer and Peter Jones:

Log y = 2.8045 log x – 4.7331

Where:

y = weight of the S. spicatum product

x = stem diameter of S. spicatum over the bark at 150 mm.

If the plantation contained 300 S. spicatum ha 1, and 1000-1200 A. acuminata ha-1, the predicted sandalwood yield would be 4.4 tonnes ha 1, at plantation age 20 years. The wood may be classed as “small green logs”, which are pieces 0.3-1.2 m in length, with 25-50 mm heartwood. Small green logs are currently worth approximately AUD $4,500 a tonne 1, but net returns would need to factor in establishment, maintenance and harvesting costs, which may be approximately AUD $3,500 ha-1. Based on these predictions, the net return may be approximately AUD $14,000 ha-1, in the 400-600 mm annual rainfall zone.

It is important to note that the prime value of S. spicatum is the volume of heartwood produced. At present, S. spicatum stems harvested from plantation trials appear to have a lower volume of heartwood than those harvested from natural stands, with an equal stem diameter. When estimating returns from plantations, the quality of the timber (i.e. the amount of heartwood and oil) must be considered in order to estimate an accurate price per tonne. Unfortunately, this will not be known until S. spicatum plantations trials that are currently age 4-12 years, reach age 18 years.

Picture: Four-year-old sandalwood (S. spicatum) growing near a five-year-old jam (A. acuminata), near Narrogin, Western Australia (Photo: J. Brand).

This article is from a paper that will be published in the Sandalwood Research Newsletter 19.

Summaries of Recent Research

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Greetings sandalwood growers! In this article I have included summaries from two recent scientific papers. If you're interested in them and require further information you can contact me or download the full papers from the Australian Journal of Botany web page <www.publish.csiro.au/journals/ajb>.

1: The natural diversity of sandalwood host species in south coast river systems and their incorporation into profitable and biodiverse revegetation (by Woodall and Robinson, 2003)

This study investigated the distribution of remnant *S. spicatum* within the Pallinup River catchment and assessed the risk of *S. spicatum* population decline due to salinity. The natural range of host species at different sites (seven river catchments) across the south coast was also investigated. Remnant populations of S*. spicatum* within and adjacent to the Pallinup River catchment were small (1-70 trees) and highly fragmented. The risk of further population decline due to salinity was concluded to be small because remnant trees were generally growing in well drained, sandy soils that were elevated above (median 9 m) their immediate drainage line.

Across the seven river catchments surveyed, *S. spicatum* occurred in a range of vegetation associations and parasitised numerous species (68) from a wide range of genera and families. The suite of species exploited varied within and between catchments. Thirty species, including most monocots and *Myrtaceae*, were not successfully parasitised. Remnant *S. spicatum* always occurred on well-drained soil types that supported open woodland or mallee heath communities. Sandalwood plantations, supported by numerous individuals of a range of host species (10-40 species) were shown to be productive in terms of sandalwood growth.

The scale of the developing sandalwood plantation industry is likely to be small and unlikely to cover large areas of catchments, thus this industry alone is unlikely to address the salinity crisis through broadscale recharge management. However, additional to on-site recharge reduction, biodiverse host plantations may improve the prospects for biodiversity and rivers in salinising landscapes through the protection and enhancement of natural biodiversity, creation of new habitat, conservation of plant species and by providing a commercial incentive to protect biodiversity.

Conclusion
This study has shown that sandalwood naturally parasitises a diverse suite of host species, which varied across the seven river catchments surveyed. It has also shown that sandalwood will grow well in plantations on host species not encountered as natural hosts. This extends the range of potential hosts for inclusion into productive plantations, so that plantations can be established in any area with species which bolster and reflect local plant diversity.

2. Cracking the woody endocarp of Santalum spicatum nuts by wetting and rapid drying improves germination (by Woodall, 2004)

Seeds of many plant species including those of sandalwood (*Santalum spicatum (R. Br.) A. DC. Santalaceae*) are surrounded by a fruit endocarp that is hard and woody (this structure hereafter referred to as a "nut"). The woody endocarp of *S. spicatum* provides a physical barrier to germination.

This study investigated how this barrier is removed and the mechanism(s) controlling it. Field trials demonstrated that the endocarp cracked naturally and that the time of harvest and the presence of the epicarp affected the percentage of endocarps that were cracked. An investigation into the influence of wetting period and rate of drying on endocarp cracking showed that the rate of drying was most critical in inducing cracking and that the process was not heat dependent. Field and pot studies showed that germination of sown nuts was improved when the woody endocarp was fractured.

Results suggest that a simple wetting and rapid drying procedure can be used to crack large amounts of sandalwood nuts prior to sowing in the field. Results are discussed in relation to *S. spicatum* seed ecology. Many species from a range of plant families have seeds that are physically restrained from germinating because of the presence of a woody endocarp and the significance of endocarp weakening through wetting and rapid drying is discussed.

Nut cracking and germination sequence of sandalwood

Become an ASN member!

We welcome your feedback on this edition of the Avon Sandalwooder, and if you have a suggestion for topics for the next ASN workshop or newsletter, we would love to here them. Members are encouraged to submit articles relating to their experiences with sandalwood.

To become a member of the Avon Sandalwood Network or for more information, contact (08) 9621 2400.

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