

Sandalwood Research Newsletter

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Santalum lanceolatum in Queensland

by Dr Rod Keenan

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Santalum lanceolatum R. Br. is the most widespread of Australian *Santalum* species, with a range extending from Cape York Peninsula, through Queensland to New South Wales and parts of Victoria, South Australia and Western Australia, and can be found in a diverse range of climates and habitats. It grows as a tall shrub up to 7-8 m tall, with a deep and usually drooping crown. It has a wide but variable pale yellow sapwood band, and a brown heartwood. The timber has an air dry density of 930-950 kg/m³.

In Queensland *S. lanceolatum*, particularly trees of merchantable size (>12 cm diameter at 30 cm height), can be found more commonly in the north, above about 25° latitude. Like other sandalwood species it is parasitic. It generally grows within clumps of other species or adjacent to other sandalwood saplings. In the Mitchell Plains and delta country at the southern end of the Gulf of Carpentaria (rainfall 870 - 1250 mm) it tends to occur on the outer edge of *Melaleuca acacioides* or gutta percha

(*Excoecaria parvifolia*) scrubs adjacent to gilgai areas and around drainage lines. It is rarely found in open woodlands. The Hughenden area further south of the Gulf has lower rainfall and sandalwood is found on the 'basalt wall' country composed of boulder fields derived from old tertiary lava flows rising up to 60 m above the surrounding plains. *S. lanceolatum* grows in amongst the boulders in association with gidgee (*Acacia cambadgei*) and other dryland species. Other merchantable individuals can occur down to and south of Longreach, along drainage lines and on scrub edges usually in association with acacias. Factors determining the distribution of the species are still undetermined but there is considerable evidence to indicate that it does not withstand annual burning, and as the foliage is palatable to stock it is also likely to have been affected by the widespread sheep and cattle grazing that has occurred in

northern and western Queensland since last century. Land tenure where sandalwood occurs is largely Crown land occupied by graziers under pastoral leases of varying status.

The use of *S. lanceolatum* commenced in Queensland with exports from the Cape York Peninsula region in about 1865. Cutters and export facilities were concentrated around Cooktown, Coen, Weipa, and Somerset, and later around Normanton. The industry developed in western Queensland and on the basalt wall country in the 1920's and 30's. Marketing of wood from both Crown and freehold land during this period was controlled by the government under the Sandalwood Act and wood was sold through an agreement with the Australian Sandalwood Company of Western Australia. The Act was disincentive to contractors and the industry petered out during WWII. This act was revoked in 1982 and since 1987 wood from crown tenures has been sold through a tendering process under varying terms and conditions. In recent years a number of independent contractors have also been cutting and exporting wood from freehold land. Sandalwood on Crown land is managed and marketed by QDPI-Forestry. Cutting areas are assessed before harvesting and a cutting limit (trees must be greater than 12 cm diameter at 30 cm height) ensures retention of sufficient residual

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growing stock to allow for future harvests. 500 - 700 tonne is sold annually from Crown land.

Most of the sandalwood sold from Crown land is exported to Taiwan. Larger pieces are sometimes used for carving and small furniture pieces, smaller pieces are powdered and mixed with various resins and other fragrances and used for incense sticks. Heartwood oil content of *S. lanceolatum* has not been extensively assessed, but it is generally considered to be around one per cent. In comparison, *S. spicatum*, the mainstay of the WA industry, has an oil content of two per cent and Indian sandalwood (*S. album*) is 6-7 per cent. The optical properties of the species also vary. These differences result in a considerably lower royalty being obtained for *S. lanceolatum* timber compared with other species, with current returns to the Crown of about A\$2000 per tonne of desapped wood.

Further research is being undertaken into the distribution, growth, ecology, and effects of harvesting on the species, and this will be reported in due course.

(This article draws heavily from Applegate, G. B., Davis A.W. and Annable, P. 1990. *Managing sandalwood for conservation in North Queensland, Australia. In Proceedings of the Symposium on Sandalwood in the Pacific*, Edited by L. Hamilton and C.E. Conrad; April 9-11 1990; Honolulu, Hawaii. USDA-Forest Service, GTR PSW-122, pp. 12-18.)

***Santalum austrocaledonicum* Seed Germination Study**

by Rexon Vira and Atchinson Smith

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The exploitation of *Santalum austrocaledonicum* is becoming an increasingly important revenue source for local landowners on the islands of Vanuatu. Presently, the small sandalwood export industry in Vanuatu is exclusively supplied from natural forests. A small research program has recently been established concentrating on refining the nursery propagation requirements of *S. austrocaledonicum*.

Adequate seed collection, cleaning, storage and germination pre-treatments are important to ensure sandalwood seed lots remain viable and germinate uniformly. A germination study conducted on *S. austrocaledonicum* seed was performed to determine if the rate and uniformity of seed germination could be increased. Four treatments were applied to sandalwood seed lots (listed below):

1. Soaking in gibberellic acid
2. Soaking in water over night

3. Soaking in 60°C water
4. Control

The rate and uniformity of sandalwood germination was increased by the gibberellic acid treatment. Seed treated with gibberellic acid commenced germination only 14 days after sowing and the peak of sandalwood germination occurred around 18 days after sowing. Sandalwood seed soaked overnight in water commenced germination 19 days after sowing and the peak of germination occurred 50 days after sowing. Germination under this treatment was non-uniform and seeds continued to germinate 70 days after sowing. The control treatment commenced germination 22 days after sowing and germination peaked at 36 days after sowing. The hot water treatment seed lot failed to germinate. The gibberellic acid treatment gave the highest percentage of seed germinants (see Table 1).

Table 1: *Santalum austrocaledonicum* seed germination rates

Treatment	Germination (%)
Gibberellic acid	22.0
Control	15.9
Overnight water soaking (24 hours)	10.3
60°C water	0.0

Forthcoming Roving Sandalwood Workshop

by TANG Hon Tat.

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Following the very successful regional training workshop on sandalwood technology in Noumea, New Caledonia (1-12 August 1994) and the subsequent publication of the workshop's proceedings there have been requests for follow-up training in sandalwood technology from South Pacific countries.

The South Pacific Forestry Development Programme responding to four requests is organising a 'roving' sandalwood training course to visit interested South Pacific countries. The French government will sponsor one resource person (Mr Yves Ehrhart, CIRAD-Foret) to visit Tonga, Fiji and Vanuatu. The Australian government (ACIAR) has been approached to sponsor another resource person to visit PNG. PNG did not attend the original Sandalwood workshop due to internal miscommunications. PNG's native species, *Santalum macgregorii*, is one of the lesser known species within the genus.

Mr Ehrhart will spend one week in each of the three countries and the Australian resource person will spend about two weeks in PNG during October/November.

The Noumea workshop indicated that there is a strong interest in *Santalum* species conservation, nursery propagation and regeneration. This has been re-confirmed by countries requesting follow-up training workshops. Due

to genera's silvicultural complexities and overall poor status a coordinated approach is required to ensure there are successful outcomes from *Santalum* species research and regeneration.

The training workshop will focus on most aspects of nursery propagation and plantation silviculture. Including:

- identification of seed production areas;
- seed collection, cleaning, storage and pre-treatment;
- nursery propagation regimes;
- suitable nursery host species identification;
- initial field silviculture and plantation maintenance;
- suitable field host species identification.

The cultural, ecological and economic importance of sandalwood underlies the need to coordinate training in areas like seed collection, provenance identification, silvicultural research and regeneration. The roving workshops also aim to foster further international cooperation in sandalwood research.

Host countries will need to cover local travel and support costs and organise local logistics to run the training workshops. Sponsor organisations will supply the resource persons external travel costs and per diems.

An outcome of the New Caledonian workshop was to put in place mechanisms for an international *Santalum* species/provenance experiment. Seed collection and provenance identification during the roving workshops will assist in developing this concept. It is perceived that the workshop will also involve the collection of botanical, seed and heartwood samples from each host country for further research.

Interested persons within PNG, Tonga, Fiji and Vanuatu should contact their respective forest departments or the South Pacific Forestry Development Programme in Fiji to gain additional information on the forthcoming training workshop.

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DIRECT SOMATIC EMBRYOGENESIS FROM MATURE EMBRYOS OF SANDALWOOD

Described below is an abstract on sandalwood somatic embryogenesis research conducted by Dr Ravishankar Rai. V. whilst on a UNESCO Short-term Fellowship in biotechnology at Murdoch University, Perth, Western Australia.

Indian sandalwood (*Santalum album* L.) is closely tied to the culture and economies of many Asian countries. It has been valued for its perfumed wood and oils for thousands of years.

Somatic embryogenesis has many potential advantages for mass propagation and genetic improvement of hardwood forest trees. There has been no report of direct somatic embryo formation in sandalwood. Somatic embryogenesis has been achieved in a number of angiosperms but success has been limited with woody plants. This report describes the induction of somatic embryos from directly on the mature zygotic embryo and their regeneration potential.

Dr Ravishankar Rai, V., Department of Botany, University of Mysore, Manasagangotri, Mysore, India, 570 006

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Articles on a range of *Santalum* species research and management issues are welcomed by the Sandalwood Research Newsletter. If you wish to contribute an article to the SRN or wish to be included on the SRN mailing list please write to the Editor stating your name, organisation and postal address.

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Three new sandalwood books available:

R. A. Srimathi, H. D. Kulkarni and K. R. Venkatesan (Editors). **Recent Advances in Research and Management of Sandal (*Santalum album* L.) in India.** Associated Publishing Company, New Delhi, India, 1995. 416pp. Price: Rs. 600 within India and \$US55.00 other countries. ISBN 81 85211 40X.

Purchasing contact: S. K. Dutta, Associated Publishing Company, 8798/7 Rani Jhansi Road, Karol Bagh, New Delhi 110 005, India.

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L. Gjerum, J. E. D. Fox and Y. Ehrhart (Editors). **Sandalwood Seed, Nursery and Plantation Technology. Proceedings of a regional workshop for Pacific Island Countries, 1-11 August 1994, Noumea, New Caledonia.** UNDP/FAO South Pacific Forestry Development Programme, Suva, Fiji,

(RAS/92/361), field document No. 8, 1995. 303pp.

Purchasing contact: TANG Hon Tat, UNDP, South Pacific Forestry Development Programme, Private Mail Bag, Suva, Fiji.

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V. V. Srinivasan, V. R. Sivaramakrishnan, C. R. Rangaswamy, H. S. Ananthapadmanabha and K. H. Shankaranarayana. **Sandal (*Santalum album* Linn.).** Institute of Wood Science and Technology. Indian Council of Forestry Research and Education. Malleswaram, Bangalore, India. 1992. 233pp. Price Rs. 350.00, £15.00, US\$25.00. ISBN 81 900284 05.

Purchasing contact: Director, Indian Council of Forestry Research and Education, P.O. New Forest, Dehra Dun 248 006, India.

Book reviews will be presented in future issues of this newsletter.