4

Sandalwood Research Newsletter

February 1995 Issue 4 ISSN 1321-022X

Sandalwood - Scope for commercial propagation on community lands in India

by Dr UV Singh IFS

Dr UV Singh IFS is a silviculturalist with the North Zone of the Karnataka State Forest Service, India.

Sandalwood *(Santalum album L.)* is economically and culturally important to many parts of India and Indonesia. *S. album* is mainly distributed throughout India, Nepal, Sri Lanka, the Indonesian islands of Timor, Sumba, Flores, Java, Bali, and along the extreme northern Australian coastline.

S. album site specifity is highly variable. It is found in a rainfall range from 300 to 3000 millimetres, an altitude range of 0 to 2000 metres and it is capable of growing in different soils, such as, laterite, loam, sand, clay and black cotton soils. *S. album's* distribution is restrained by water logged areas, but the species is able to tolerate a pH range from 6.0 to 8.0. Sandalwood also has extreme temperature tolerance where temperatures can range from 4°C to 46°C throughout its distribution.

Due to this high range of tolerances of environmental factors, it is easily thought that *S. album* could grow in a range of locations through most tropical and sub-tropical regions, but this is not so. One factor limiting the distribution of *S. album* is the vegetation type and the nature of its hosts. Even though it is reported that for adequate *S. album* survival and growth any green tree can be a parasitised and act as a host. Rai (1990), reported a series of host plants used for *S. album* in India. Sandalwood is mainly dependent on the host plants for the absorption of nutrients which it is unable to absorb through its own the root system. Particularly phosphorous, magnesium potassium and nitrogen. Hence, a good host plant for *S. album* is a tree which efficiently absorbs these nutrients and translocates them to *S. album*. According to Rai (1990) for *S. album* growth *Casuarina equisitifolia* is the best host plant.

A recent inventory of *S. album* in the southern States of India, including Karnataka, Maharastra and Andhra Pradesh was undertaken. The purpose of this inventory was to understand the association and distribution of *S. album* in relation to *Prosopis juliflora* (Bellary jali). The survey concentrated on the Bellary, Chitradurga, Bangalore, Kolar, Dharwad, Belgaum, Biljapur, Gulbarga, Bidar and Raichur districts of the Karnataka State; and the Pune, Ahmed Nagar, Satara, Kolhapur districts of Maharastra State; and the Anantpur, Mahboob Nagar, Kurnool districts of Andhra Pradesh State.

P. juliflora is a native legume of Central America and the West Indies. This species can spread rapidly due to their easy propagation and remarkable ability to withstand both adverse conditions that reduce competition of other plant associations and heavy grazing. The *Prosopis* genus is well adapted to the heat and poor soils of dry regions (BOSTID 1981).

Listed below are the climatic conditions of these three states:

1. Annual rainfall ranges from 500 to 1200 millimetres, mainly caused by the south west monsoon, but occasionally the north east monsoon causes significant rainfall.
2. Soil types range from sand, loam, red soil, black cotton, alluvial and rocky, skeletal soil types.
3. Temperature ranges from 8°C to 46°C.
4. Forest types are classified as dry scrub forests.

A major species of the predominant vegetation type in the states is *P. juliflora*. *P. juliflora's* distribution is wide spread, occurring across the entire landscape of the three States, except on land utilised for agriculture. Fallow or vacant

land is covered by *P. juliflora*, in particular road sides, canal sides, community land, field boundaries in and around the villages and other fallow lands.

The three States comprising the survey are the main sandalwood producing states of India. *P.juliflora* is a new introduction to the Indian landscape, perhaps in the last 30-40 years. However, the occurrence of sandalwood with the association of *P. juliflora* has gone relatively unnoticed. From this survey study it is reported that *P. juliflora* is one of the best 'natural' host plants for *S. album*.

Listed below are the advantages of host-parasite relationship between *P. juliflora* and *S. album*:

1. *P. juliflora* is an evergreen plant and never sheds leaves. At all times it provides good shade to *S. album.*
2. It coppices after grazing very vigorously. Continued pruning does not reduce the vigour of its coppice.
3. It generally has a bushy habit and thorns which protects the *S. album* seedling.
4. It grows in all types of soil and remains green even in drought conditions which in turn provides a continuous nutrient and water supply to *S. album* for growth throughout the year.

An interesting observation in the study is that no spike disease was recorded from sandalwood trees found in association of *P. juliflora.* This indicates tremendous potential for sandalwood growing on lands which are not used for agriculture and are highly colonised by *Prosopis* spp.

P. juliflora offers wide scope for the planting of *S. album* in areas of low *S. album* occurrence, due to its relationship with the non-occurrence of spike disease. *P. juliflora* is found in every State of India. It may aid the establishment and spread of *S. album* from the traditional production areas of Karnataka and Tamil Nadu.

Table 1: State-wide distribution of sandalwood in India

Karnataka	5245 km^2
Tamil Nadu	3040 km^2
Andrapradesh	175 km^2
Madyapradesh	35 km^2
Orissa	25 km^2
Maharastra	8 km^2
Kerala	7 km^2
U.P. less than	1 km^2
Other private holdings	500 km^2

The relationship between the (*S. album*) spike disease and nutrient deficiencies have been studied in detail. It apepars that micronutrients do not influence the control of the disease.

Spike disease is present in the areas of high density growing sandalwood like Chickmangalore, Mysore, Hassan, Hunsur, Shimoga, Tumkur, Bangalore and Kolar districts of Karnataka and Salem, Coimbatoor and other adjoining districts of Tamil Nadu. But spike disease is either absent or negligible in the northern district of Karnataka and southern parts of Maharastra and in *S. album* associated with the *P. juliflora*. Is this caused by increased nitrogen supply to *S. album* by *P. juliflora*? This remains an unsolved problem and requires further study.

Since the *P. juliflora* is extremely thorny *S. album* establishment is difficult. How to plant *S. album* over such a vast area in such difficult spiny bushes? Dibbling seed underneath the canopy of *P. juliflora* appears the logical method. Seeds should be well treated and cool stored in advance for dibbling. The *S. album* seeds take 30 to 45 days to germinate, constant moisture is required for that period. Hence, seeds should be dibbled just before the onset of monsoon. Seeds should be treated with an insect and rodent repellent. Germination percentage by this method is likely to be low, hence profuse dibbling is required. It is advisable to dibble 4 to 6 kilograms seeds per hectare. Seeds should be dibbled about 0.5 to 1 metre away from the origin of roots of *P. juliflora.*

References

Rai, S.N. (1990). Status and cultivation of sandalwood in India. *In:* Proceedings of the Symposium on Sandalwood in the Pacific. 9-11 April 1990, Honolulu, Hawaii. USDA For. Serv. Gen. Tech. Rep. PSW-122. pp66-71.

Board on Science and Technology for International Development (BOSTID) (1981). Tropical Legumes: Resources of the Future. National Academy of Sciences. Washington.

The Sandalwood Research Newsletter invites readers to write to the article authors to acquire aditional information concerning issues disseminated in these articles. Increased internaitonal cooperation and liaison between sandalwood researchers and managers is encouraged.

Dr U V Singh, IFS
Silviculturist
North Zone
Dharwad - 580 008
INDIA

Andrew Radomiljac
Department of Consevation and Land Management
PO Box 942
Kununurra
WESTERN AUSTRALIA 6743

Sandalwood Workshop, 1-11 August 1994, Noumea, New Caledonia.

Andrew Radomiljac

Andrew Radomiljac is a research officer with the Department of Conservation and Land Management, Western Australia.

A sandalwood workshop, 1-11 August 1994, hosted by CIRAD-Foret, was held in Noumea, New Caledonia. The workshop was an outstanding success in achieving its main objectives of promoting the awareness of Pacific Island sandalwood.

The existing global upsurge in sandalwood demand and the limited recovery of sandalwood reserves has re-created considerable interest in Pacific Island sandalwood management, such as in Vanuatu where sandalwood is a highly prized forest product by local landowners (Tacconi 1994). Increased sandalwood awareness has lead to a greater focus on sandalwood silvicultural research, natural resource assessment, gene pool conservation and utilisation, on some of the previously little known *Santalum* species. This has prompted the need to disseminate acquired *Santalum* species information to developing Pacific nations to ensure the rejuvenation of sandalwood interests is sustainable. The sandalwood workshop was a timely event in promoting the social, commercial and ecological importance of sandalwood.

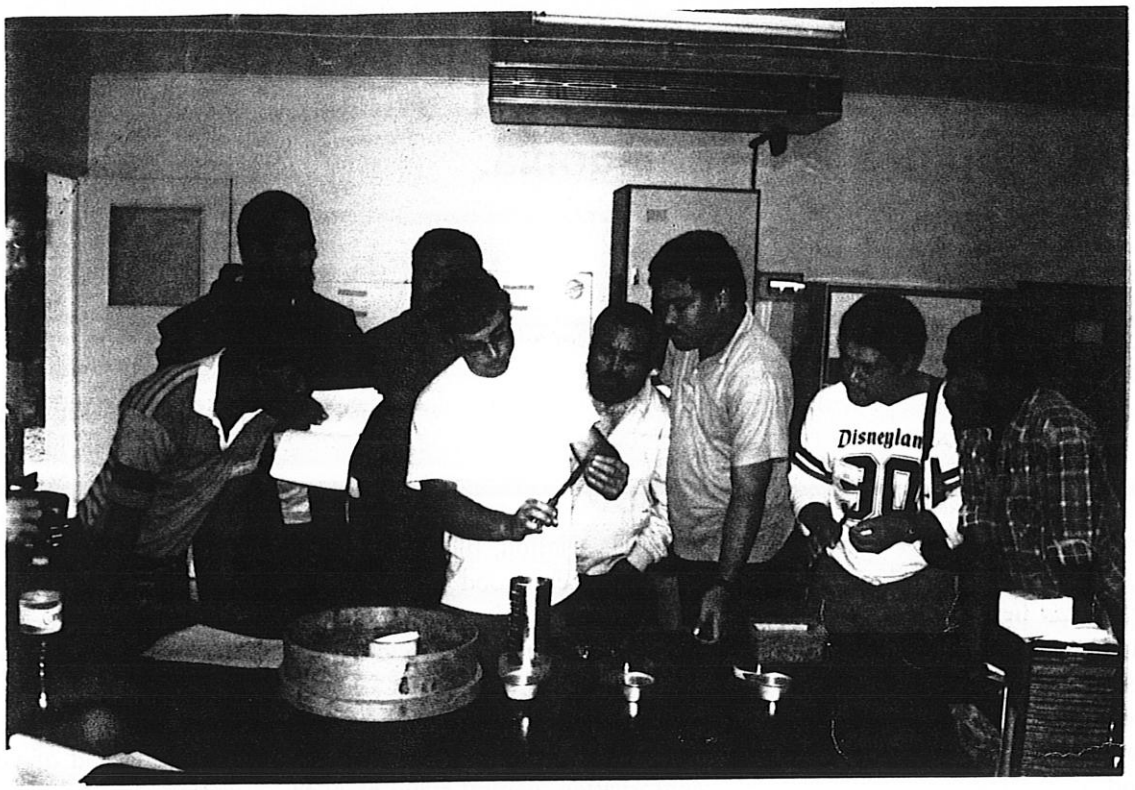
The sandalwood workshop consisted of paper presentations on a range of sandalwood issues including species distribution and ecology, seed and germination, pot host selection, nursery propagation, genetic variation, plantation establishment, heartwood formation and economic analysis. This was complemented by relevant field trips to research plots, nurseries, natural stands, plantations and value adding processing plants. Sandalwood conservation, natural stand management, plantation silviculture research and value adding processes are well abreast in New Caledonia. Papers encompassed most species comprising the *Santalum* genus. Participating country representatives presented country reports on recent sandalwood developments including research, management and utilisation. Participating countries included Vanuatu, Fiji, Western Samoa, Tonga, Cook Islands, Indonesia, Federated States of Micronesia, Solomon Islands and several representatives from New Caledonia. Main resource speakers attended from New Caledonia, Vanuatu and Western Australia.

As an outcome of the workshop considerable benefit should be gained from countries where sandalwood exploitation has increased and natural resources are substantial enough to encourage plantation establishment of either native or exotic *Santalum* species, such as in Vanuatu and Fiji. In Pacific countries where sandalwood resources are unsubstantial or where sandalwood management is limited the workshop should give a thorough insight into the value of sandalwood and the initial requirements of plantation research. However, seed acquisition will remain a large obstruction to many sandalwood research programs. This should be overcome with international cooperation and localised persistence.

Participating country paper presentations highlighted the severe plight of several Pacific *Santalum* species. The Cook Islands' *S. insulare* has only a small remaining population on the island of Mitiaro which has not seed viable seed for several seasons (Koroa 1994) . In Fiji severe cyclones have caused the failure of recent *S. yasi* seed crops and a method of vegetative propagation via shoot cuttings has been developed to increase the nursery growing stock for the development of seed orchards (Bulai 1994) .

The workshop detailed the substantial progress international aid research programs have achieved in relatively small time frames. The CIRAD-Foret attempts to introduce the exotic *S. austrocaledonicum* to Rarotonga of the Cook Islands have proved very fruitful where trial plots have demonstrated good growth on very exposed raised coral terraces. Additionally, the ACIAR *S. album* research program in Indonesia has assisted with the rapid progress achieved in the selection of *S. album* candidate plus trees, nursery propagation and field establishment research. It is perceived that continued international aid programs are of high importance to ensure that other threatened *Santalum* species can be conserved and infant sandalwood export industries developed for the benefit of small Pacific island rural economies.

A 'state of knowledge' from the workshop has been compiled formulating concepts on sandalwood conservation, propagation and planta-



Several workshop participants observe Jean-Paul Chauvin demonstrate techniques for nicking the seed coat of sandalwood seed at the Technique du Centre de Semences Forestieres, New Caledonia.

tion establishment. This will form a component of the workshop proceedings currently being compiled and published by CIRAD-Foret and the South Pacific Forestry Development Programme (SPFDP).

The workshop emphasised several universal similarities between the silvicultural regimes of different *Santalum* species. These included the use of *Alternanthera* spp as a pot host, immediate seed defleshing and cold storage, leguminous field hosts (*Acacia* and *Sesbania* spp) and the high conservation importance of remaining populations and the inherent high value of sandalwood.

The importance of information dissemination, the exchange of germ plasm (seed) and continued international cooperation were reiterated at the workshop. The workshop was well conceived as all country participants were medium level forestry professionals. Hence, technical details acquired during the workshop should be implemented in field situations with comparative ease. Proposals on research collaboration were raised focusing on an international *Santalum* species/provenance trial. A proposal will be developed by CIRAD-Foret for distribution to relevant forest organisations for endorsement.

Even though the sandalwood workshop's 'terms of reference' was to concentrate on Pacific Island sandalwood notable non-attendants of the workshop were Hawaii, PNG and India where significant sandalwood resources exist. Future workshops of a similar nature (at another venue) with a 'terms of reference' to include global sandalwood interests may be beneficial, including representatives from sandalwood utilisation industries to ensure future plantation sandalwood is encouraged.

Once again I reiterate the value of the sandalwood workshop in the dissemination of sandalwood research information. I commend the considerable effort that CIRAD-Foret placed into the organisation and smooth running of the sandalwood workshop.

References

Bulai, P.B. (1994) Sandalwood in Fiji. Presented at the Sandalwood Workshop, 1-11 August 1994. Noumea, New Caledonia.

Koroa, N. (1994) Cook Island country report. Presented at the Sandalwood Workshop, 1-11 August 1994. Noumea, New Caledonia.

Tacconi, L. (1994) An Economic analysis of sandalwood cultivation and trade in Vanuatu. Presented at the Sandalwood Workshop, 1-11 August 1994. Noumea, New Caledonia.

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.

Andrew Radomiljac
Departrment of Conservation & Land Management
PO Box 942
Kununurra 6743
WESTERN AUSTRALIA