



CULTIVATION METHODS FOR RED SANDERS TO ENHANCE PRODUCTIVITY

INTRODUCTION

Red sanders (*Pterocarpus santalinus*) is an economically important tree species, highly valued for its heartwood and medicinal properties. It is endemic to India and naturally distributed in the southern parts of Eastern Ghats (Fig. 1 and 1a). Till date, the demand for Red sanders wood is met from natural forests, with very few plantations under private



Fig 1. A natural population of Red Sanders

ownership (Fig. 2). Long gestation period and the unfavorable policies governing Red sanders cultivation and trade were the main reasons for its unpopularity among tree farmers. However, the continued international demand, high wood price and the gap in demand and supply, have spurred interest among tree farmers. With an imminent change in policy scenario governing all aspects of Red sanders cultivation and trade, Red sanders cultivation is going to be a profitable venture, especially for large holding farmers, who are willing to invest and wait long term. This guide is prepared based on research carried out at various institutes under Indian Council of Forestry Research and Education (ICFRE) and the pool of knowledge that is available in the public domain. The guidelines provided here will help the prospective farmers in choosing the right area and right cultivation practices for maximizing yield from Red sanders plantations.

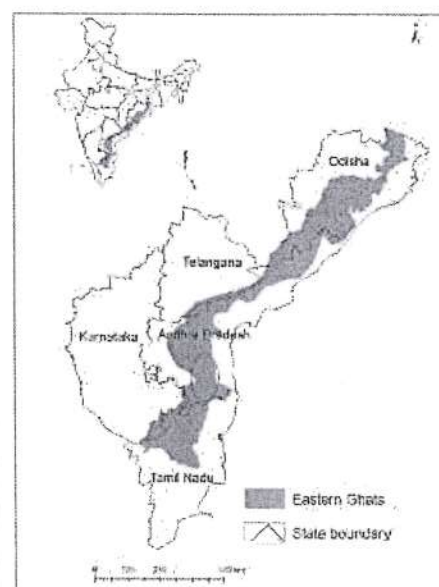


Fig 1a. Map showing natural range of Red sanders (○) in the Eastern Ghats



Fig 2. A plantation of Red Sanders

MAJOR USES

Santalins extracted from wood is used as an organic dye in textile, food and pharmaceutical industry. The wood is put to numerous other uses starting from high value furniture, toy making to musical instruments. Wood extracts are used in Ayurvedic preparations to treat ailments like diabetes and skin diseases. The wood has high demand in international markets, with wavy grained wood (WG) having more value than straight grained (SG) wood type due to its superior acoustic qualities.

CULTIVATION PRACTICES

Soil: Red sanders grows well on soils that have their origin from gneiss, quartzite, shale and lateritic rocks. Lateritic loam is considered best for its growth and development. In nature, the species is found growing on dry, hilly and often rocky grounds. Highly fertile agriculture lands must be avoided. On fertile lands Red sanders put on good diameter and height growth, however, the heartwood formation gets delayed (Fig. 3 & 4).

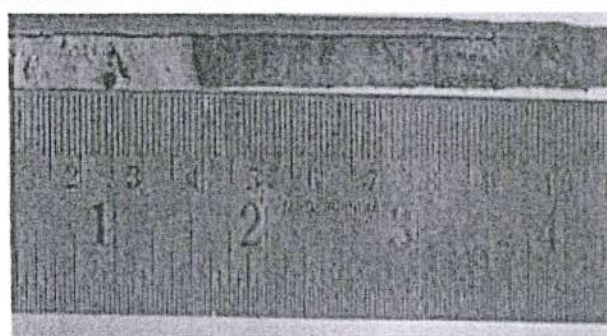


Fig 3. Increment core showing heartwood formation (18 year old tree growing on lateritic soils)

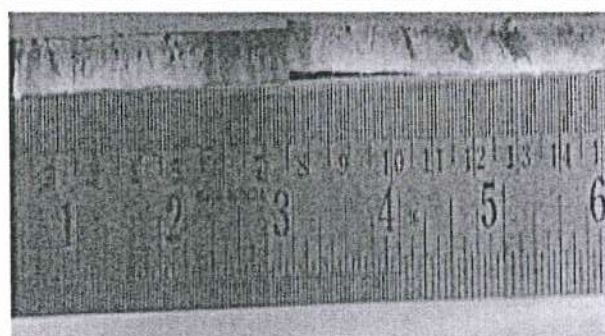


Fig 4. Increment core showing poor heartwood formation (18 year old tree growing on fertile agriculture soils)

Rainfall

Red sanders, basically, is a species of dry deciduous forests and suited to semi-arid tropical climate. Natural ranges of this species receive about 700 mm to 1200 mm per annum in a bimodal pattern. A minimum of 700 mm rainfall is needed for Red sanders, preferably distributed throughout the year. It should not be cultivated in areas receiving high amount of rainfall.

Temperature

The natural ranges of Red sanders experience a dry hot climate with mean annual temperature ranging from 26-28°C and maximum temperature reaching as high as 48°C.

Nursery Development

Red sanders pod (fruit), containing one or two seeds, is hard and bony. The pods contain a large amount of phenolic compounds that inhibit germination. Pretreatment with water flushes away phenolic compounds and softens the pods. Soaking in tap water for six days with daily change of water has been found to be the optimum pretreatment for Red sanders.

Pods are sown vertically with stalk side up, in primary beds containing river sand (Fig.5). Daily watering and overhead shade is provisioned for the primary beds. Germination is epigeous and starts within 8 to 10 days of sowing. Seedlings develop a long and tapering primary root with few fibrous lateral roots. Seedlings are pricked out when the primary roots attain a length of about 12 - 15 cm (5-6 inches) and planted in long polybags (Fig.6). In nursery, shoot



Fig 5. Primary bed with vertically sown pods; Radicle and cotyledons emerging out of pod (inset)

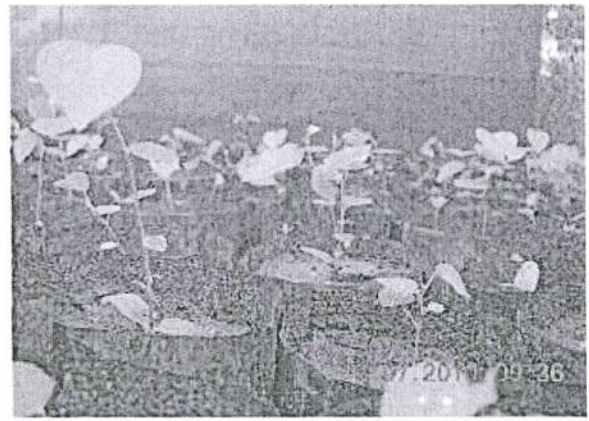


Fig 6. Transplanting of seedlings to polybags

growth is poor compared to root system. Seedlings have to be tended for a period of 1 to 2 years in nursery for making them field worthy.

CURRENT PRODUCTIVITY

Recent studies have shown that the growth and predicted yield of Red sanders timber from plantations are much higher compared to the natural forests. However, there is wide (within plantation i.e. plant to plant and between plantations) variation in heart wood content, wood density, colour of heart wood and heart wood extractives. The wood quality parameters (wood density, colour of heart wood and heart wood extractives) of plantation-grown wood are slightly on the lower side compared to wood from natural forests. Wood from plantations growing on dry and degraded lands, have shown better quality parameters compared to wood from plantations growing on rich soils with high amount of rainfall.

Red sanders, basically, is a long rotation (gestation) species and is not suitable for small holding farmers looking for quick returns. The initiation of heart wood formation, which is the main economic product of Red sanders, starts at the age of around 20 years. At 30 years age, the tree puts up an average diameter at breast height (dbh) of 20 cm. Considering an average heart wood content of 30% and an average wood density of 0.865, a single tree is expected to yield an average of 59 kg heart wood. The expected yield per hectare will be around 16.2 metric tonnes (considering 275 stems at 30 years age).

At 40 years age, the tree puts up an average dbh of 35 cm. Considering an average heart wood content of 35% and an average wood density of 0.865, a single tree is expected to yield an average of 190 kg heart wood. The expected yield per hectare will be around 38.0 metric tonnes (considering 200 stems at 40 years age).

The domestic consumption of Red sanders wood by the local Ayurvedic industry and toy making handicraft industry is very less compared to the international demand, mostly from China and to a certain extent from Japan. As a result, the pricing of Red sanders wood is mostly dependent on international demand as well as the quality of wood. The heart wood is usually converted into logs of 75 cm in length and graded into three grades as A, B and C with criteria like presence or absence of wavy grain, soundness, presence or absence of any defects etc. The average sale price, during 2017, was Rs. 27.8 lakhs per metric tonne. As Red sanders is a highly restricted tree species, there are several state, national and international legislations governing its felling (cutting of trees), transport, domestic trade and exports. Forest department is the only marketing agency in the country at present. All activities starting from felling to sale of wood is done through permits from the respective state forest departments.

SOURCING QUALITY PLANTING MATERIAL (QPM)

Since tree improvement work has just been initiated for Red Sanders, there are no specific varieties / clones available for a given planting site. High quality planting material is still raised with seeds collected from natural forests and a few plantations available under private ownership (Fig. 7). It is recommended to procure seeds and seedlings from authentic sources like State Forest Departments and Forest Research Institutions. The Andhra Pradesh Forest Department is the only authentic source of Red sanders seeds. Seeds may be procured by contacting State Silviculturist whose address is provided at the end of this chapter.

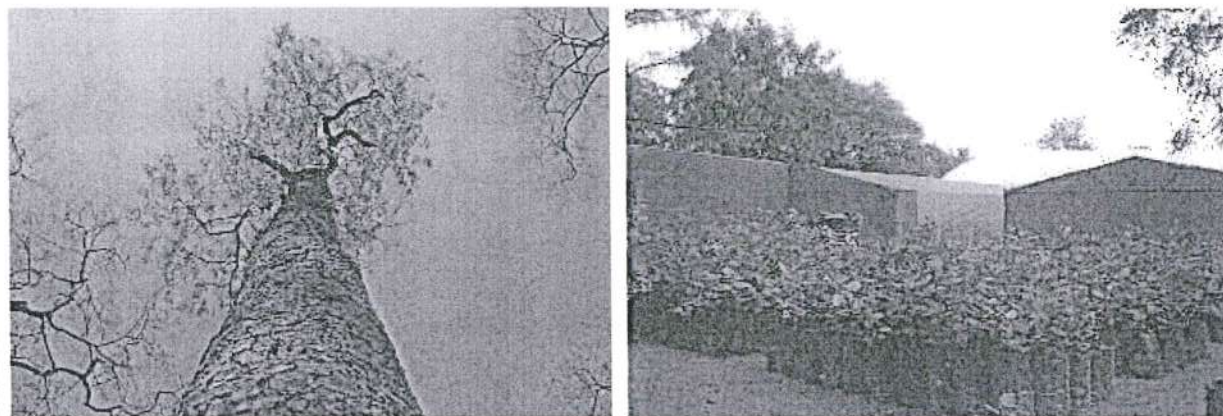


Fig 7. Seed collection from phenotypically superior plus tree (left); Quality planting stock (right)

IMPROVED CULTIVATION PRACTICES

Red sanders is a strong light demander and requires adequate spacing for its optimum growth. However, large spacing at the time of planting leads to stem forking and multiple branching from a very low level. An initial spacing of 3x3m (1111 plants/ha) is recommended for clean bole formation and which is, also, amenable to mechanized weeding. A close spacing of 3m between plants is recommended for row plantings along boundary. Red sanders is an excellent tree species for Silvi-pastoral systems owing to its deep root system, small crown, palatable leaves, nitrogen fixing and deciduous nature.

The planting area is prepared with a tractor to remove any previous growths including rootstocks. Large sized pits (45x45x45 cm) are dug up at the aforesaid spacing to accommodate tall seedlings (Fig. 8). Depending on the nutrient

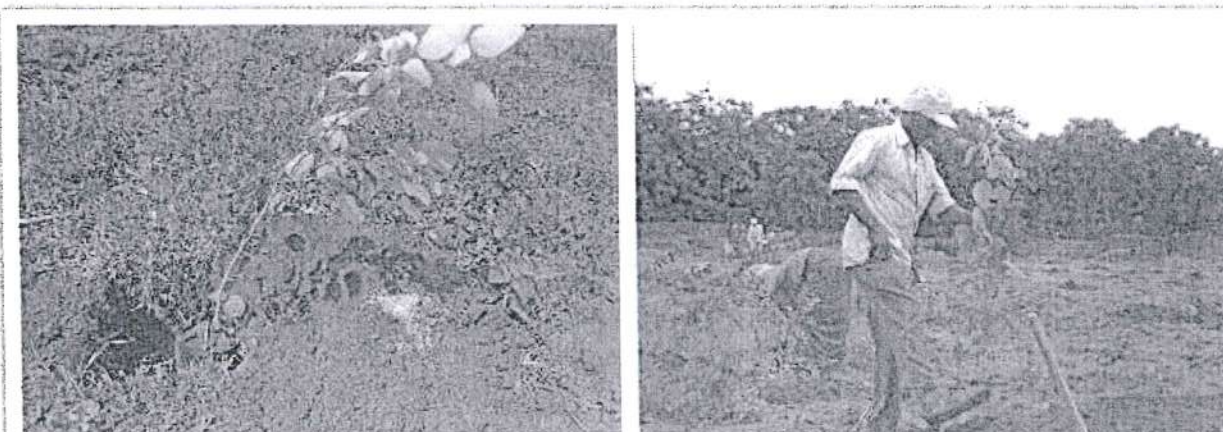


Fig 8. Field planting of Red Sanders; tall sized seedling and soil fertilized with chemical fertilizers (left) and Planting of tall seedling after removing the polybag (right)



status of the plantation area, the dug up soil is fortified with chemical fertilizers and organic manures containing macronutrients (Nitrogen, Phosphorous and Potassium). Red sanders is also amenable for stump planting in crowbar holes. Seedlings are prepared for field planting by de-topping the main stem, about 2.5 cm above the collar region, two months before the planting schedule. This is done to promote coppicing. A single coppice shoot is retained and allowed to take the place of main stem. Seedlings prepared like this establish in field very quickly and show good shoot growth. Planting is normally done at the beginning of rainy season.

Weeding

Weeding of plantation, at least once a year, during the initial three years helps the plants establish quickly free of any competition. The recommended spacing of 3x3 m is amenable to mechanized weeding with a tractor.

Pruning

Red sanders saplings develop forking and multiple branching from low height unless side branches are pruned annually. Pruning of side branches up to one-third height of saplings is recommended during initial years of establishment (Fig. 9). Pruning operations are taken up during lean period (December-January) when plant growth and development is least affected.

Thinning

The initial close spacing at the time of planting and subsequent annual prunings help in clear bole (stem) formation. However, horizontal growth (increase in diameter) requires more photosynthetic activity, as well as more space. Thinning creates the much needed space for crown development and increase in photosynthetic area. Owing to the wide plant to plant growth variation in seed originated plantations, selective thinning is recommended. Poor performers, diseased/moribund trees are thinned first, subsequently other trees are removed as per requirement of the good performers. First thinning should be carried out around the age of 10 years. The number of plants retained should be around 275 at 30 years age.

INSECT AND DISEASE PROBLEMS AND CONTROL MEASURES:

Two diseases viz., (i) leaf spot disease caused by *Cylindrocladium scoparium*, (ii) leaf blight disease caused by *Sclerotium rolfsii* (Fig. 10), have been reported from Red sanders nurseries. These diseases reduce photosynthetic area and severely affect the growth of seedlings in nursery. Control measures for these diseases include viz., (a) Incorporation of *Trichoderma viride* into the potting mixture (One part *Trichoderma* added to 10 parts soil); (b) Foliar spray of Carbendazim (Trade name - Bavistin) or any other sulphur based pesticides (@ 0.2% i.e. 2gm in 1 litre water) at 15 days interval.

Mechanical damage to tree stem during ploughing or due to any other cause leads to fungal attack and, degeneration of



Fig 9. Pruning in Red sanders plantations



Fig 10. Leaf blight disease in Red sanders nursery.



Fig 11. Fungal attack leading to degeneration of bark and conducting tissues



Fig 13. Dieback in Red sanders

bark and conducting tissues (Fig. 11). Wood decaying fungus *Ganoderma lucidum* (Fig.12) have been found to infect adult trees in plantations. Cultural measures like pruning the affected branches and sealing the cut ends with Neem oil or Bordeaux paste or with any water repellent paint controls further spread of this disease in plantations. Dieback (tree dries up/dies top downwards) of Red sanders trees have been observed both in natural forests and plantations, the exact cause of which is not known (Fig. 13).

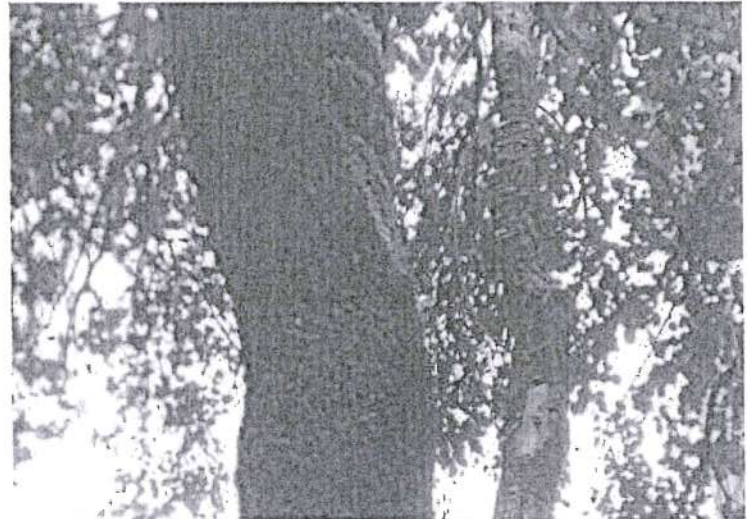


Fig 12. A Red sanders tree infected with wood decaying fungus *Ganoderma lucidum*

CURRENT RESEARCH FOCUS

Looking at the economic importance and conservation significance of Red sanders, Indian Council of Forestry Research and Education is about to launch an All India Coordinated Research Project on 'Conservation and productivity improvement of Red sanders'. This coordinated initiative involving seven national research institutions will take up nine research components starting from plus tree selections, development of techniques/molecular resources to improved products. The project is expected to create improved resource base (seed orchards, germplasm banks, molecular resources), improved techniques (clonal propagation, heart wood evaluation, genetic diversity & structure evaluation, wood forensics) and improved products (quality planting material, biofertilizers) for increasing area under Red sanders cultivation.

CONSERVATION STATUS AND FUTURE CULTIVATION PROSPECTS

International Union for Conservation of Nature (IUCN) specifies criteria, assesses, declares and updates threatened species across the world. It has a five main measurable set of criteria for classification of threatened species. Red sanders was added to its list during 1998 as EN B1+2de (Ver. 2.3 1998), based on recommendations of CAMP workshop on medicinal plants, held during January 1997. Recently, during February 2018 it has been down listed as 'Near Threatened' (Ver. 3.1 2018).



Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) restricts international trade in threatened species and their products by listing them in Appendix I, II or III. Red sanders is added to Appendix II, which puts restrictions on international trade of its wood and wood products from natural forests. CITES restrictions are not applicable to trade of Red sanders wood sourced from plantations. However, Directorate General of Foreign Trade (DGFT) Ministry of Commerce & Industry, Government of India (GOI), had imposed a blanket ban, till recently, on export of Red sanders from India in any form and from any source.

Recently, during February 2019, DGFT has revised the earlier prohibited policy for 'Red sanders wood in log form and roots, exclusively of cultivation origin obtained from private land (including Pattaland)' to 'restricted' category, which permits exports under license subject to conditions/ documentations like (i) Application of export license to be submitted along with certificate of origin from PCCF of concerned state, (ii) Certificate of current position from a verification authority nominated by PCCF of concerned state, (iii) Issue of export license subject to conditions such as MEP, quantity ceiling requirements under CITES, etc., (iv) Issue of export license subject to an yearly quota fixed by MoEF&CC upon recommendations from CITES Management Authority.

The present day policy governing cultivation of Red sanders, its felling, transport, possession, trade, conversion of wood to various end products and its sale, are yet to be farmer and industry friendly. The farmers have to go through complex procedures for obtaining permissions for felling, transit and trade of Red sanders wood. Recognizing the importance of trees outside forest (TOF) in conserving Red sanders as well as meeting market demands partially by farm grown wood, National Biodiversity Authority (NBA) undertook a comprehensive study recently on various issues pertaining to conservation and sustainable utilization of Red sanders. Following the study, NBA has recommended for liberalization of domestic trade in plantation grown Red sanders timber and exemption of plantation sourced timber for export under foreign trade policy (FTP). Also, it has recommended for simplifying and decentralizing procedures for various permissions pertaining to Red sanders cultivation, felling, transit and its trade. The future prospects are looking a lot better for farmers and industries who are keen in cultivating Red sanders.

CONTACT DETAILS

Technical Advice

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- Dr. Maheshwar T. Hegde, Scientist F, Arid Forest Research Institute, New Pali Road, Jodhpur-342 005, Rajasthan; Phone: +91-291- 2729162; Email: hegdem@icfre.org
- Sri M. Maria Dominic Savio, Scientist E, Institute of Forest Genetics and Tree Breeding, P.B. No. 1061, P.O. R.S. Puram, Coimbatore-641002, Tamilnadu; Phone: +91-422-2484143; Email: dominic@icfre.org

Supply of Seedlings

- State Silviculturist, Biotechnology Research Centre (BIOTRIM), Akkramalli Post, Tirupati-517 507, Andhra Pradesh

