



POPULAR ARTICLE

Red sandalwood: A profitable tree for sustainable agroforestry

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Introduction

Agroforestry is gaining increasing importance as a sustainable land-use system that integrates trees with agricultural crops to improve farm productivity, environmental quality, and farmers' income. In recent years, the cultivation of high-value timber species under agroforestry has become an attractive option for farmers seeking long-term financial security. Among these tree species, Red Sandalwood (*Pterocarpus santalinus*), popularly known as Red Sanders or Erra Chandan, occupies a unique position because of its exceptional commercial value and ecological significance. Red sandalwood is indigenous to the southern parts of India, particularly the dry deciduous forests of Andhra Pradesh. It is famous worldwide for its dark red heartwood, which is highly prized for manufacturing luxury furniture, handicrafts, musical instruments, sculptures, decorative articles, and medicinal products. Owing to its premium market value, Red Sandalwood is often referred to as the "Red Gold" of Indian forests. With increasing emphasis on sustainable agriculture, climate resilience, and diversification of farm income, Red Sandalwood cultivation under agroforestry systems offers an excellent opportunity for farmers, especially in rainfed and dryland regions. Proper planning and scientific

management can convert small and marginal farms into long-term income-generating assets while simultaneously improving the environment.

Botanical features

Red Sandalwood belongs to the family Fabaceae. It is a medium-sized deciduous tree that generally grows up to 8–15 metres in height under favourable conditions. The tree develops a straight bole with rough grey bark and a broad crown. The heartwood develops gradually and acquires a deep reddish colour as the tree matures. The species is naturally slow-growing but possesses excellent wood density and durability. Its deep root system enables it to survive prolonged dry spells, making it highly suitable for semi-arid and drought-prone regions.

Climatic and soil requirements

Red Sandalwood performs best under tropical and subtropical climatic conditions. It thrives in areas receiving annual rainfall between 600 and 1000 mm and temperatures ranging from 15°C to 40°C. The tree prefers dry climates with a distinct summer season and moderate winter temperatures. Well-drained red loamy soils, gravelly soils, and lateritic soils are ideal for cultivation. Slightly acidic to



neutral soils (pH 6.0–7.5) support optimum growth. Waterlogging should be avoided because excess moisture adversely affects root development and may increase susceptibility to diseases. One of the greatest advantages of Red Sandalwood is its adaptability to marginal lands where many commercial crops fail to perform satisfactorily. Red Sandalwood is primarily propagated through seeds collected from healthy, mature, and superior-quality trees. The seeds are usually treated before sowing to improve germination and are raised in nursery polybags under suitable conditions. Healthy seedlings generally become ready for field planting within six to eight months. Planting is best carried out at the onset of the monsoon season to ensure better establishment and higher survival rates under natural rainfall conditions. Before planting, pits measuring approximately $45 \times 45 \times 45$ cm are dug and filled with topsoil mixed with well-decomposed farmyard manure to provide favourable conditions for root growth. Under agroforestry systems, Red Sandalwood is commonly planted at spacings of 5×5 m, 6×6 m, or 8×4 m, depending on the cropping pattern, soil fertility, and management objectives. Wider spacing facilitates the cultivation of intercrops and allows adequate sunlight penetration during the initial years, while closer spacing may be adopted where timber production is the primary objective. Selecting an appropriate spacing helps optimize tree growth, intercrop performance, and overall farm productivity.

Red sandalwood in agroforestry systems

Agroforestry is a sustainable land-use system that integrates trees with agricultural crops, enabling farmers to obtain multiple products and income sources from the same piece of land. Red Sandalwood is highly suitable for agroforestry because of its slow initial growth and relatively small canopy during the early years. During the first five to seven years after

planting, the trees occupy only a limited portion of the field, allowing sufficient space and sunlight for the cultivation of seasonal agricultural crops between the tree rows. Farmers can successfully grow a wide range of intercrops such as finger millet, groundnut, greengram, blackgram, cowpea, horsegram, pigeonpea, sesame, and castor under rainfed conditions. In irrigated areas, vegetables, medicinal plants, and other short-duration crops may also be cultivated during the initial years. This system provides farmers with regular annual income from the intercrops while the Red Sandalwood trees continue to grow and mature, thereby reducing financial risk and ensuring better utilization of land, labour, water, and other farm resources. In addition to enhancing farm profitability, the integration of trees with crops improves soil fertility, conserves moisture, increases biodiversity, and contributes to the long-term sustainability of the farming system.

Nutrient, water, disease management

Although Red Sandalwood is well adapted to dry and semi-arid conditions and exhibits good drought tolerance after establishment, young plantations require proper care and management during the initial growth phase to ensure healthy development and better survival. Adequate nutrient supply through the annual application of 10–15 kg of well-decomposed farmyard manure per plant helps improve soil fertility and promotes vigorous growth. Regular weeding during the first three to four years is essential to minimize competition for moisture and nutrients. Light irrigation should be provided during prolonged dry spells, particularly in the first two to three years after planting, to prevent moisture stress. Mulching around the base of the plants with crop residues or organic materials helps conserve soil moisture, suppress weed growth, and regulate soil temperature. Young plants should also be protected from grazing animals



by providing suitable fencing or tree guards. Once the trees are well established, Red Sandalwood requires comparatively little maintenance, making it a low-input and economically viable tree species for agroforestry systems. Its deep root system and natural adaptability enable it to withstand drought conditions and continue growing with minimal management compared to many horticultural and plantation crops. Red Sandalwood is generally resistant to many pests and diseases, making it a relatively hardy tree species for agroforestry systems. However, young plantations may occasionally be affected by stem borers, leaf-eating caterpillars, root rot in poorly drained soils, and termite infestation in dry regions. These problems can be effectively managed through the adoption of Integrated Pest Management (IPM) practices, regular field monitoring, maintenance of proper field sanitation, and ensuring adequate drainage to prevent waterlogging. Balanced nutrient management and timely cultural operations promote healthy plant growth, thereby enhancing the natural resistance of trees against pests and diseases. Regular inspection of plantations enables early detection and control of infestations, minimizing economic losses and ensuring healthy tree development.

The greatest attraction of Red Sandalwood lies in its exceptionally high commercial value, making it one of the most valuable timber species in the world. Its richly coloured heartwood is in great demand in both domestic and international markets for the manufacture of luxury furniture, decorative wood carvings, musical instruments, premium handicrafts, religious artefacts, natural dyes, Ayurvedic medicines, and traditional Chinese medicinal products. Because of its superior quality, durability, and unique colour, Red Sandalwood commands premium prices in the timber market. Although the crop requires a long rotation period of about 15 to 25 years before harvesting, the financial returns are

considerably higher than those obtained from many conventional timber species. During this period, farmers can continue cultivating intercrops between the tree rows, thereby generating regular annual income while waiting for the trees to mature. Consequently, Red Sandalwood serves as an excellent long-term investment that has the potential to appreciate significantly in value over time, providing substantial economic security to farming families.

Environmental benefits

Apart from its remarkable economic value, Red Sandalwood plays an important role in environmental conservation and sustainable agriculture. The integration of Red Sandalwood into farming systems improves soil fertility through the addition of organic matter from fallen leaves and plant residues. Its extensive root system helps reduce soil erosion, enhances soil structure, and improves water infiltration, thereby conserving soil moisture. The tree also contributes significantly to carbon sequestration, helping mitigate the adverse effects of climate change by absorbing atmospheric carbon dioxide. Furthermore, Red Sandalwood plantations create a favourable microclimate within agricultural fields by moderating temperature and reducing wind velocity. They also provide habitat and shelter for birds, beneficial insects, and other wildlife, thereby enhancing biodiversity. These ecological services improve the resilience of farming systems against climatic uncertainties while promoting sustainable use of natural resources.

Challenges in cultivation

Despite its enormous economic potential, Red Sandalwood cultivation is associated with certain challenges that require careful planning and management. The tree exhibits relatively slow initial growth and has a long



gestation period before harvest, requiring farmers to adopt a long-term investment perspective. The availability of quality planting material from reliable sources is essential for establishing productive plantations. Owing to the high market value of its timber, plantations may also face the risk of illegal harvesting and theft, necessitating adequate security measures. Successful cultivation further depends on scientific plantation management, including proper spacing, nutrient management, weed control, and protection from pests and diseases. In addition, farmers must comply with the government regulations governing the cultivation, harvesting, transportation, and marketing of Red Sandalwood. Procuring seedlings from authorized nurseries and remaining updated with the prevailing legal guidelines are essential for ensuring profitable and lawful cultivation.

Government support and future scope

The Government of India has been actively promoting agroforestry through the National Agroforestry Policy and various state-level programmes to encourage tree cultivation on agricultural lands. Several agricultural universities, forestry departments, research institutions, and extension agencies provide farmers with technical guidance, quality planting material, improved production technologies, and advisory services for the cultivation of high-value tree species such as Red Sandalwood. With the increasing global demand for premium timber, rising awareness about climate-smart agriculture, and the need to diversify farm income, the future prospects of Red Sandalwood-based agroforestry are highly promising. Continuous advancements in nursery technology, scientific plantation management, improved market linkages, and supportive government initiatives are expected to enhance farmer confidence in adopting this valuable tree species. As awareness and technical knowledge continue to expand, Red

Sandalwood is likely to become an increasingly important component of sustainable agroforestry systems, contributing to enhanced farm profitability, environmental conservation, and long-term livelihood security.

Hence in conclusion red Sandalwood is one of India's most precious timber resources and represents an excellent choice for sustainable agroforestry. Its ability to thrive under dryland conditions, coupled with its exceptionally high economic value, makes it an attractive long-term investment for farmers. When integrated with agricultural crops, Red Sandalwood provides diversified income, enhances environmental sustainability, conserves natural resources, and contributes to climate resilience. Although the tree requires patience due to its slow growth and long rotation period, the returns are substantial when managed scientifically. With increasing government support and growing awareness of agroforestry, it has immense potential to transform the livelihoods of farmers while promoting ecological conservation. Adoption of this valuable tree species can play a significant role in building resilient, profitable, and environmentally sustainable.

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