Van Sangyan

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Note to Authors:
We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org
or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
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The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number. TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert’s reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve
Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)
From the Editor’s desk

Nurseries that work to strengthen and expand the presence of tropical native species are concerned about fostering diverse, strong, and well-adapted populations. For many tropical plants, however, the natural diversity of wild populations has been depleted. Habitat loss has reduced the range and sheer numbers of plants. For plants with commercial value, unsustainable harvesting practices may have reduced the numbers of plants with desirable characteristics while leaving behind inferior plants. The process of depleting a population of the best genetic properties so that future populations are weaker than the original populations is called genetic degradation.

Seed collection for plant propagation is an opportunity to reverse trends of genetic degradation and species loss. Nurseries have a key role in conserving the gene pool of native plants. Seed collection began as an art during the stone age. Later, it became a science when the need for improved seeds arose. The aim of seed collection is to obtain large quantities of seed of the best genetic quality. To minimize seedling variation, seeds should be collected from suitable sources.

Before creating a strategy for collecting native plant seeds, it is important to understand some key points regarding genetics and collection ethics. Seed collection strategies must protect genetic diversity for the future both at the collection sites and in the places where the offspring will be planted. On the outplanting sites, good seed collection practices ensure that inbreeding will not become a problem and that plant populations will be genetically viable to survive and adapt to new stresses. For restoration and conservation projects, maintaining genetic diversity is a key part of project objectives and of the target plant requirements.

In line with the above, this issue of Van Sangyan contains an article on Seed collection, processing and nursery techniques for Anogeissus latifolia – an important multipurpose tree species. There also useful articles viz., Hort-pastoral system: An alternative to fodder security in arid and semi-arid regions, Sandalwood: A Promising Economical Tree of India, Pongamia pinnata (karanja) tree and वेद एवं वृक्ष (in Hindi).

I hope that readers would find maximum information in this issue relevant and valuable to the sustainable management of forests. Van Sangyan welcomes articles, views and queries on various such issues in the field of forest science.

Looking forward to meet you all through forthcoming issues

Dr. Pawan Rana
Scientist ‘E’ & Chief Editor
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Seed collection, processing and nursery techniques for *Anogeissus latifolia* – an important multipurpose tree species

S. Saravanan, M. Kundu and N. Berry

Silviculture, Forest Management and Agroforestry division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
RFRC (PO), Mandla Road
Jabalpur – 482021. Madhya Pradesh, India

About the species

*Anogeissus latifolia* (Roxb. ex DC.) Wall ex Guill and Perr commonly known as Axle wood is a small to medium-sized tree up to 20-36 m tall, with a straight and cylindrical bole up to 80-100 cm in diameter. Its wide leaves (that give it the name *latifolia*) are opposite or sub-opposite, simple with grayish-yellow or whitish hairs below. The fruit is a 2-winged pseudo-achene, packed into a dense head with a single seed. *A. latifolia* timber gives a heavy hardwood, good charcoal and firewood. It provides a gum that is a good substitute for gum arabic.

Its leaves give tannins used for tanning and dyeing. *A. latifolia* is used as fodder for cattle, buffaloes and other ruminants. In certain areas of the subtropical forest of the Himalayan foothills of India, *A. latifolia* is the most important fodder, fuel and timber tree, and excessive lopping of leaves and cutting of saplings and branches for firewood may cause poor regeneration. In these regions, *A. latifolia* may be a major fodder tree for buffaloes in pastoralist communities.

*A. latifolia* is native to India, Myanmar, Nepal and Sri Lanka, and found throughout tropical Asia. A tree of tropical and subtropical climates, it is found in deciduous or semi-evergreen forests. It is a common element in teak forests but also occurs in the under storey of dipterocarp forests, in bamboo forests. It is also present in vegetation under semi-arid conditions such as savanna woodland and dry rocky hills.

It is usually associated with *Albizia lebbeck, Dalbergia* spp., *Grewia tiliaefolia, Albizia amara, Gyrocarpus jacquini* and *Mesua ferrea*. In India, it grows in most parts of the country except in arid areas and moist areas of North-West India. *A. latifolia* grows up to an altitude of 1200 m, with an average annual temperature of 38-45°C and an average rainfall of 625-2250 mm. It is found on a variety of soil types but prefers deep alluvial soils. It does not tolerate water logging.

In India, *A. latifolia* is leafless in February-May, flowers in June-September depending on locality, and mature fruits are present in December-March. Leaf flushing begins in the dry season, reaching a peak time before the onset of rains (Edgaonkar, 1995).

Natural regeneration

Natural regeneration of this species is very good, though young trees are very intolerant of weed competition. The tree produces root suckers, coppices and pollards well, but this exhibit great seasonal variability. Coppicing and pollarding should not be done during the rainy season. Thinning of coppice is necessary. Coppicing is relied upon to regenerate natural stands, coppice shoots
grow fairly quickly. Trees are easily damaged by fire. Requirements for the establishment of natural regeneration are sufficient light, moisture, good drainage and the lack of thick weeds or in growth. Coppicing is invoked to regenerate the natural stands of coppice shoots grow quickly. Dilution of coppice shoots is necessary, as the number of coppice growth is usually produced by more than two.

**Seed collection and storage**

Generally, seed viability is low but increases after very dry seasons. Germination rates can be increased by pre-soaking the seeds for 3 minutes in hot water. Fruits should be collected only when they are fully ripe as immature seeds fail to germinate. The ripe fruits are collected from the trees, dried in the sun and then stored. Seed storage in metal tins or polythene containers is the best.

The fruits should be collected when the heads start to break up and not earlier. The seeds of *A. latifolia* mature in second fortnight of March each year when the seed moisture content is around 12 per cent and colour of fruits turns to blackish green. Seeds are about 95% empty when collected from the trees.

The germination percentage of seeds is only 1-2 per cent; however 50% seeds are sound and viable. Seeds can easily be stored at 15°C in refrigerator in polythene bags at a moisture content of 9% with slight decrease in viability up to two years. Then the seeds are dried and stored in gunny bags. The seeds should be sown immediately as it loose its viability very soon. Approximately one kilogram seed contains 1,08,000 to 1,35,000 seeds (Aswathanarayana, 1997).

**Nursery Technique**

The seeds are sown densely on raised beds, the soil being mixed with large quantity of coarse sand. The bed is well-shaded and 45 cm above the ground. Germination is fairly quick. The seedlings are extremely liable to insect damage. The development of the seedlings is very slow.

**Planting techniques and maintenance**

Planting and maintenance techniques: Planting is done in July and August after the onset of monsoon rains. Planting seedlings or stem is in pits of size 30 cm³ pits dug in advance at a spacing of 3 x 3 m. Although the use of bare seed for planting, the seedlings must be torn from the nursery beds with balls of earth, carefully wrapped and transported and planted.

Good rainfall after planting ensures good survival rate. Planting operations should be suspended if no rain is expected for a few days of planting. Bush cutting and weeding are necessary to prevent the removal of seedlings. The planting areas are in need of protection against pests and fire.

**Uses**

It is one of the most useful trees in India. Its leaves contain large amounts of tannins, and are used in India for tanning. The tree is the source of Indian gum, also known as ‘gum ghatti’, which is used for the printing of banners and other uses.

*A. latifolia* yields good charcoal and firewood with an energy value of 17 600-20 500 kJ kg⁻¹.

It produces a heavy hardwood with a density of 760-940 kg/cu m. Heartwood absent or small; texture fine to medium and even. Shrinkage upon seasoning is moderate to high, and the wood is difficult to season as it is liable to warping, splitting and surface checking. It is possible to
modify surface checking completely by soaking in solutions of 50% polyethylene glycol-600 for 1 day. The wood is hard, strong, and can be difficult to saw. When mixed with other woods can make good packing and writing paper.

References
Anogeissus latifolia

A. latifolia tree

A. latifolia flower

A. latifolia bark

A. latifolia seeds

A. latifolia trunk
Horti-pastoral system: An alternative to fodder security in arid and semi-arid regions

Brajkishor Prajapati¹ and Jaya Prajapati²

¹Department of Agronomy
KrishiVigyan Kendra, Balaghat, M.P., India
²Department of Agriculture Chemistry and Soil Science,
BHU, Varanasi, India
E-mail: brajkishorprajapati1@gmail.com

The farming systems in rainfed areas are quite diverse with a variety of crops, cropping systems, agroforestry, horticulture and livestock production. Among the livestock, small ruminants are very important resources and contribute meat, milk, fiber and other functions that are significant to the productivity, stability and sustenance of many farming systems more so on dry lands. Livestock often constitute the main capital reserve of farming households, serving as a strategic reserve that reduces risk and adds stability to the overall farming system. For these reasons, livestock remain an integral part of most rural agricultural systems. The human population in India is expected to reach around 1.48 billion by 2025 with the shift in lifestyle and feeding habits towards milk products, meat products, and eggs leading to an increase in demand for livestock. India supports about 20 per cent of the world’s livestock population and 16.8 per cent human population on a land area of only 2.3 per cent. India is leader in cattle (16%) and buffalo (55%) population Kumars et al. (2012) and having world’s second largest goat (20%) and fourth largest sheep (5%) population (Prajapatiet al., 2016). According to IGRFI Vision 2050, there is a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% feeds (Kumar et al., 2018). India has recently emerged as the largest producer of milk (187.7 million tonnes) in the world but livestock productivity is very low as compared to the developed countries. Malnutrition or under nutrition due to a large gap in demand and supply of feed and fodder in the country is the main reason for the low productivity of our livestock. But the critical challenge with us is to improve the livestock productivity with the existing fodder resources and feeding strategy by technological intervention includereorient agroforestry potential by inducing the fruit trees based horti-pastoral systems. Hence, it is suggested to develop horti-pastoral systems/model by introducing pasture and foliage component under trees so as to provide nutritious green forage and foliage to livestock and small ruminants for getting higher production from unit of land in rainfed areas.

Horti-pastoral system
Horti-pastoral system, where in the inter spaces between fruit trees species are utilized for cultivation of grasses, legumes and grass legume mixtures. Only during dormant season of the fruit tree, the livestock are allowed to graze on the available pasture for a period of 3-4 months in a year. Fruit trees are suitable for arid and semi-arid region given below with nutritive value(El-Siddig et al., 2006;
Mulberry (Morus alba) is reported to be a good quality leaf fodder and can be profitably utilized as a supplement to poor quality roughages. It coppices and pollards very well. It can withstand light frost. It is susceptible to browsing damage. Leaf yield varies with fertility of the soil, irrigation and frequency of plucking of the leaves. The leaves contain crude protein, crude fiber, N-free extract, ether extract, total carbohydrates, total ash, calcium and phosphorus. The tannin accounts for 0.80 per cent.

Lasoda (Cordia dichotoma) is another fruit tree of which leaves yield good fodder and are lopped for this purpose. It coppices and pollards well. Young plants are susceptible to browsing damage and fire, but they exhibit good power of recovery from such injuries. The leaves contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus. The tannin is about 0.84% in the leaves.

Bael (Aegle marmelos) is a good fodder tree. It has shallow root system, coppices well and produces root suckers in abundance. It is resistant to drought and can grow in dry localities. The leaves contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus. Tannin content of leaves is 1.21 percent.

Jackfruit (Artocarpus heterophyllus) seedlings and saplings are readily browsed by cattle and tree coppices well. Leaves are lopped for fodder in Kerala, Maharashtra, Odisha and West Bengal. Ripe fruits can also be fed to cattle. Elephants also eat the bark besides leaves and fruits. Young plants are very badly browsed by deer and domestic cattle. The chemical composition of leaves varies with the locality and the season of lopping. They contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus. Crude protein content decreases as the leaves mature. October lopped leaves have higher crude protein than November lopped ones.

Gular (Ficus glomerata Roxb./ F. recimo Linn.) coppices well with slow growth rate and its leaf is generally rated as good fodder. The seedlings and saplings are easily browsed by cattle. It is extensively lopped for fodder in Assam, West Bengal, Madhya Pradesh, Maharashtra, Odisha, Punjab and Uttar Pradesh. The leaves contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus. The tannin accounts for 0.76% in dry leaves.

Mahua (Madhuca longifolia) seedlings and saplings are readily browsed by cattle and wild animals. The tree coppices well if felled in the hot season. The tree is lopped for lead fodder in Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh. In Maharashtra, it is lopped only in times of scarcity. Its flower and fruits can also be fed to cattle. The leaves contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus on dry matter basis.

Mango (Mangifera indica) is shade bearer and unable to withstand severe frost or drought. It grows well in moist warm climate. The mango tree is lopped for fodder during fodder scarcity. The chemical analysis of leaves resulted that it has crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus.

Khirni (Manilkara hexandra) is a light demander and seedlings and saplings suppressed under heavy shade. The
seedlings and saplings are susceptible to browsing. It pollards but shows poor coppicing power. It is reported to be lopped to feed buffaloes in Maharashtra. The leaves contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus.

**Jamun (Syzygium cumini)** has good coppicing power and a large numbers of shoots arise along the cut stump. Even large stumps produce coppice shoots. The leaves are lopped for fodder and the nutritive value of the leaves differ according to the locality. The leaves contain crude protein, crude fiber, total ash, calcium, phosphorus, total minerals (5.31%), reducing sugar (2.40%), total sugar (6.89%) and starch (15.90%). The tannin in the leaves constitute about 7.57 percent.

**Ber (Zizyphus spp.)** leaves are considered to be a good fodder for cattle and goats and in some part of Rajasthan it forms almost the sole green fodder available to the animals. The tree has remarkable power of recovery from injury by frost, fire or grazing. The tree coppices and suckers well. The leaves of *Zizyphus nummularia* contain crude protein, crude fiber, N-free extract, ether extract, total ash, calcium and phosphorus whereas analysis of *Zizyphus mauritianiana* leaves resulted crude protein 15.37%, crude fiber 15.76%, total minerals 6.66%, reducing sugar 1.87%, total sugars 7.57%, starch 16.84% and tannin 1.79% in dry matter of leaves.

**Imli (Tamarindus indica)** leaves are regarded as good fodder and the chemical composition of leaves varies with the locality and season of lopping. The tender leaves of imli contains moisture 70.50% and crude protein 13.14%, fat 2.10%, crude fiber 17.70%, N-free extract 52.40%, ether extract 7.00%, total ash 9.50%, other carbohydrates 18.20% and minerals 1.50%. The other constituents are calcium 101, magnesium 71, phosphorus 140, iron 5.2, copper 2.09, chlorine 94, sulphur 63, thiamine 0.24, riboflavin 0.17, niacin 4.1, and vitamin C 3.0 mg/100gm.

### Grasses and Shrubs

**Suitable species**

**Grasses:** *Lasiurus sindicus*, *Cenchrus ciliaris*, *Cenchrus setigerus*.

**Legumes:** *Alylosia scarabaeoides*, *Clitoria ternatia*, *Lablab purpureus*.

**Ravine lands**

In India, there are about 4.0 million ha area of ravine lands, a major of which is confined to Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat. These lands are below their economic utilization.

**Suitable species**

**Grasses:** *Cenchrus ciliaris*, *C. setigerus*, *Pennisetum pedicelatum*, *Chrysopogon fulvus*.

**Legumes:** *Stylosanthes humilis*, *S. graminis*, *Atylosia scarabaeoides*, *Macroptilium atropurpureum*, *Alysicarpus monilifer*, *Stizolobium deeringeanum*.

### Semi-arid, rocky and gravelly areas

A vast area of the country comes under semi-arid zones, where lot of area is rocky and gravelly.
Suitable species
Grasses: *Lasiurusindicus, cenchrcuscilioris, cenchrussetigerus.*
Legumes: *Atylosiascarabaeoides, Stylosantheshamata, Stylosantheshumilis, Macroptilium atropurpureum, Macroptiliumlathyroides, Lablab purpureus*

Salt affected lands
These are about 8.0 million ha of area affected by saline and alkali soils in the country.

Suitable species
Grasses: *Cynodendactylon, C. plectostachyon, Paspalumnotatum, P. dilatum, Chloris gayana, Brachariamutica, Sporobolusmarginatus, Urochloamossiambicensis.*
Legumes: *Glycine javanica, Macroptilium spp., Stylosantheshumilis, Phaleoluslunateus, Lotononisbainesii*

Conclusion
Importance of forage production in maintaining food security as well as nutritional security has been felt since long. The overall scene of forage production is very alarming and corrective measures have to be taken to improve this problem. Suitable and appropriate site specific Agroforestry system (Horti-pastoral) is to be developed. Farmers are to motivated in bringing more area wasteland under horti-pastoral system. Research organization and fruits based industries are to be directly linked with the farmers. Fruit trees are generally considered to be nutrition garden for human but timely view on its potentiality as a fodder resource obviously will be treated as an intelligent choice and judicious agro-managerial option for the future.

References
Sandalwood: A Promising Economical Tree of India

Irshad Alam, Manoj Kumar Jharia* and Dhiraj Kumar Yadav

Department of Farm Forestry,
Sant Gahira Guru Vishwavidyalaya, Sarguja,
Ambikapur-497001 (Chhattisgarh), INDIA
Email: manu9589@gmail.com

Abstract
Sandalwood tree (Santalum album) and its wood is a part of Indian tradition and known to have medicinal as well as cosmetic usage besides there environmental and ecological benefits. This tree is great important due to its economic, social and cultural values towardshuman welfare. The present article describes the economical as well as various ecological aspects of sandalwood. Sandalwood when cultivated promisingly it may good fortune to cultivator as it has wide scope and market globally. Sandal tree also look attentively at sacred. Sandalwood already used in different occasion that include birth and even cremation ceremonies. The best quality of sandalwood is attaining from an Indian variety (Santalum album). Sandalwood is top rated species among the fragrant woods. Its timber is heavy, creamy yellowish and small particles, but different from a large number of another fragrant tree, it retains its aroma to prolonged time that may last more than decades. Oil of sandalwood is much valuable and can obtain by steam distillation of heartwood. Essential oil of sandal is used in various industries (perfume, herbal medicine, cosmetic, etc.). It has wide economic value and the grower can increase his economic gain when proper scientific management implication and farming practices are applied.

Keywords: Essential oil, Sandalwood, Livelihood

Introduction
“Sandal” is derived from Sanskrit word “Chandana”. Its wood and oil a used as medicines in India from ancient times. It has been said that the wood of sandal tree is fully utilize throughout the life of a person, in tradition of our country it is used throughout the life of a person i.e., from “Cradle to Cremation”. Sandalwood is a profit-oriented (economically) and ethnic vital tree species. Sandalwood plant semi parasitic tree is a member of Santalaceae family and its genus is Santalum (Bisht et al., 2019).

Oil of sandalwood is obtained from heartwood. Heartwood powder is also fetches good economic gain. Colour of essential oil is (pale yellow-yellow gelatinous liquid) having likeable, scent, pungent, lukewarm, arboraceous, animalise, lacteous, and eccentric note. Sandalwood oil is used in various industries like medicine, scent and perfumery, spiritual rituals, and oil is also used in cultural goal over various time frames in India (KC, 2019).

Sandalwood oil in India is widely utilized in the maquillage manufacturing industry. Mainly Arab and Asian regions, sandalwood powder and its wood is used for, spirituals, cultural and medicinal goals (KC, 2019). The reason behind economical and beneficial assessment of essential oil holds by the
timber of sandalwood, for the most part in the heartwood. Oil content in heartwood varies as per species, growing habitat, age, climatic scenario, and growing environment, etc. Indian sandalwood is eminent for its oil, having various properties (sweetness, scent, likeable, fixative property, etc.) which is in the great demand and makes it valuable as well as high economic and promising species. Sandal oil reported to have nearly 90% of santalol and alpha (α) santalol (Lefort et al., 2017). Overall oil content in heartwood in all the girth classes ranged between 1.0 to 4.0% (Mishra et al., 2018). Sandal tree and its wood is a part of Indian tradition and is known to have medicinal as well as cosmetic usage, which can be used economically for welfare of human being.

**Sandalwood worldwide distribution**

There are around 18 sandalwood species belonging to the genus *Santalum* which are presented in the Table 1 (Vieillard, 1861; Little and Skolmen, 1989; Lani, 1990; Cheng et al., 2017; Ken, 2020).

### Table 1: Sandalwood distribution across the globe

<table>
<thead>
<tr>
<th>Species</th>
<th>Location/Region</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>S. freycinetianum</em></td>
<td>Hawaiian</td>
<td>Hard, yellowish-brown wood Included as endangered spp (red list of IUCN)</td>
</tr>
<tr>
<td><em>S. haleakalae</em></td>
<td>Islands of Hawaii</td>
<td>Included as “Vulnerable” (red list of IUCN). A shampoo made from a leaf infusion. Edible seed.</td>
</tr>
<tr>
<td><em>S. ellipticum</em></td>
<td>Hawaiian</td>
<td>Listed as endemic spp in Hawaiian (coastal sandalwood)</td>
</tr>
<tr>
<td><em>S. peniculatum</em></td>
<td>Hawaiian Islands, Pacific</td>
<td>Contain top quality essential oil gained from the heartwood.</td>
</tr>
<tr>
<td><em>S. pyrularium</em></td>
<td>Hawaii</td>
<td>In wet forest island of Kauai listed as endemic spp.</td>
</tr>
<tr>
<td><em>S. involutum</em></td>
<td>U.S. States and Canadian Provinces</td>
<td>Extremely rare and has variable floral variation</td>
</tr>
<tr>
<td><em>S. boninese</em></td>
<td>Ogasawara–shoto</td>
<td>Listed as both endangered and endemic.</td>
</tr>
<tr>
<td><em>S. insulare</em></td>
<td>Cook island, Pitcairn island</td>
<td>Low quality and economic value of its oil. Species possess short leave.</td>
</tr>
<tr>
<td><em>S. austrocaledonicum</em></td>
<td>Islands of new Caledonia</td>
<td>Gray bark and green leaves. Average height about 5-12m flowering occurs after 6-7 years.</td>
</tr>
<tr>
<td><em>S. yasi</em></td>
<td>Pacific – Niue, Tonga and Fiji</td>
<td>This is fast growing tree. Growing slightly warm to hot lowland region.</td>
</tr>
<tr>
<td><em>S. macgregorii</em></td>
<td>Indonesia and Papua new guinea</td>
<td>This species is threatened by its habitat losses.</td>
</tr>
<tr>
<td><em>S. accuminatum</em></td>
<td>Central desert and southern areas of Australia</td>
<td>The species, especially its edible fruit</td>
</tr>
<tr>
<td><em>S. murrayanum</em></td>
<td>Australia</td>
<td>Plant known as Ming and</td>
</tr>
</tbody>
</table>
Botanical description

The generic name is derived from the Greek ‘santalon’ meaning ‘sandalwood’, and the species name from the Latin ‘albus’ meaning ‘white’, in allusion to the bark (George and Hewson, 1984). Sandalwood is a small evergreen tree and starts flowering generally at an early age of 2-3 years. Trees flower twice in a year from March-May, and September-December. Sometimes the two flushes of flower production may overlap each other so knowing the species distribution and natural habitat morphology and phenology that the same tree may show all stages of development of flower initiation to mature fruits at one time (Teixeira et al., 2016). The attributes of Indian sandalwood is given in Table 2.

Table 2: Indian sandalwood tree attributes (Source: Warrier et al., 1996)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Up to 18-20 meter</td>
</tr>
<tr>
<td>Girth (meter)</td>
<td>Up to 2.0-2.4 m</td>
</tr>
<tr>
<td>Leaves</td>
<td>elliptical, 3-8 x 3-5 cm</td>
</tr>
<tr>
<td>Flowers</td>
<td>purplish-brown, about 4-6 mm long</td>
</tr>
<tr>
<td>Flowering</td>
<td>March to April in India</td>
</tr>
<tr>
<td>Fruit</td>
<td>Fleshy drupe; red, about 1-5 cm in diameter</td>
</tr>
<tr>
<td>Desirable/Quality seed production</td>
<td>After five years</td>
</tr>
<tr>
<td>Fruiting time / Fruit maturity</td>
<td>March to April And June to September.</td>
</tr>
<tr>
<td>Seed dispersal</td>
<td>By birds (Frugivory)</td>
</tr>
</tbody>
</table>
Ecological description
Sandalwood is indigenous to the tropical belt of the Indian peninsula, eastern Indonesia and northern Australia. There is still debate as to whether Sandalwood is endemic to Australia or was introduced by fishermen or birds from eastern Indonesia centuries ago. The main distribution is in the drier tropical regions of India and the Indonesian islands of Timor and Sumba. The principal sandal tracts are most parts of Karnataka and adjoining districts of Maharashtra, Tamil Nadu and Andhra Pradesh in India. S. album is found in dry deciduous and scrub forests in the above mentioned region. Sandalwood is also reported to grow on coastal sand dunes immediately above the normal high water mark and close to the mangroves. It also grows on low lateritic cliffs above the beach. The sandalwood shows diverse eco-environmental requirements for its growth, development, distribution and adaptation in varying eco-habitat (Table 3).

Some of the sandalwood ecology and population studies were conducted on regional and broader sense or basis. The study of Sinha (1991) on sandalwood in Bundelkhand Forest Division, Uttar Pradesh of India, S. album profile study conducted in Pondicherry region of India. Balachandran and Kichenamourthy (2007) worked the dendrological research on S. paniculatum in the dry Montane forests of Mauna Loa of Hawaii Island conducted by Senock (2012), and sandalwood resources and its management in East Nusa Tenggara, Timor Province of Indonesia by Septiani (2012). A large extent of ecological research of sandalwood species have been conducted in more broader manner, e.g., distribution and ecology of S. insulare by Butaud (2004); distribution and status of sandalwood in Hawaii by Stemmermann (1990).

It is a partial parasite that attaches to the roots of other trees; it needs ‘nurse’ species in the area of planting out. Host plants that fix nitrogen and provide light shade are preferred. Senna siamea is good for this, and a most probable natural host is Drypetes lasiogyna, observed to be the most prolific species in the vicinity of Sandalwood. It does not tolerate frost or water logging, but is drought-hardy and is a light demander in sapling and later stages. Prolonged drought and fire kill trees (Balachandran and Kichenamourthy, 2007).

Table 3: Eco-environmental requirement or description of Indian sandalwood (Source: Balachandran and Kichenamourthy, 2007)

<table>
<thead>
<tr>
<th>Description</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of altitude</td>
<td>600 - 1200 mean</td>
</tr>
<tr>
<td>Temperature (annually)</td>
<td>2-38°C</td>
</tr>
<tr>
<td>Rainfall (annually)</td>
<td>400-3000 millimetre</td>
</tr>
<tr>
<td>Types of soil</td>
<td>Sandy or Rocky Red Soil Zones</td>
</tr>
<tr>
<td>pH value</td>
<td>6-6.5</td>
</tr>
<tr>
<td>Sandalwood not found in</td>
<td>Black soil</td>
</tr>
</tbody>
</table>

Production of sandalwood      Global production of sandalwood is about 4,000 tonnes. Officially, India produces
about 400 tonnes (2000-2007). Australia produces about 1,800 tonnes of the Australian variety; about 350 tonnes comes from Timor, Malaysia, Cambodia, Vietnam, Thailand and Myanmar India, Indonesia major exporters; China and Taiwan are the largest consumers of sandalwood (Figure 1). USA and France are the largest importers of sandalwood oil. The first commercial harvest of *S. album* from Australian plantations in 2014 was estimated about 400 tonnes. Countries like Australia are encouraging companies who enters into the plantation crops by extending huge rebates from income tax in the context of investment made towards the maintenance of eco-balance. Such kind of rebates should be given by Indian government also to encourage the sandalwood plantations in India. However, our government encourages the farmers for cultivation of the *S. album*. Department of AYUSH has announced subsidy up to 75% to the growers of *S. album* plantations in states like Maharashtra and Gujarat. Many farmers have taken up the plantations of sandalwood tree in states like Gujarat, Maharashtra, Karnataka and Kerala. In 2010, cricketer Adam Craig Gilchrist owned the TSF Company of Australia. The TSF Company grows Indian sandalwood in 10,500 hectare land which is world’s largest Indian sandalwood plantation. He is now Brand ambassador of that company. He earned moreover 17 crores of rupees in 6 months (DivyaBhaskar-Gujaratinewspaper)dtd.19.09.2016) several countries such as China, Australia, Thailand, Costarica, Cambodia, and Srilanka are also venturing into *S. album* plantation because of its fragrance characteristics and high demand for natural products. Jain *et al.* (2003) reported that heartwood of *S. album* was priced ₹12 lakhs per tonne and oil was priced at ₹ 22,000 per kg. However, the prices are highly depended on the quality and its marketing.

According to Ananthapathmanabha (2012), *S. album x S. yasi* hybrid called F1 shows a more vigour and an average of 7% oil which is not able to occur obtain from the parent trees. McComb and Jones (1998) attempted to form a hybrid using *S. album* and *S. spicatum* using in vitro culture method (Zhang *et al.*, 2016). A trial established in Hawaiian ethno botanical garden of Honolulu in 1959 in hybridisation of *S. frecinetianum* and *S. album* is still present. However, there is a debate on the quality of the oil produced by those hybrids and further; there is a fear among the top level sandalwood merchants in entering low quality sandalwood oils by the hybrid species to the market.

Biotechnological approaches were also attempted to propagate *S. album* in mass scale by many scientists. Subbaet *et al.* (2018) conducted detailed studies on that aspect in India. Sandalwood trees are considered to be growing very slowly; it takes 8 to 10 years for Heartwood formation. The growth rate of sandalwood tree will be 1cm girth per year in forest conditions while the growth rate is 4cm to 5cm girth per year under favourable moisture and soil conditions along with good farming practices. Table 4 revealed sandal tree age, girth and yield at different growth phase.
Figure 1: Global scenario of sandalwood production (tonne/year) (Source: Wiersema and Leon, 2013)

Table 4: Sandalwood growth attributes in different age-series with associated economics (Source: Reddy, 2018)

<table>
<thead>
<tr>
<th>Tree Age (in years)</th>
<th>Girth (at breast height in cm)</th>
<th>Heartwood Yield (in kg)</th>
<th>Income-Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10 – 12</td>
<td>1</td>
<td>Particulars Cost (₹/Acre)</td>
</tr>
<tr>
<td>20</td>
<td>20 – 22</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30 – 33</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>40 – 44</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>50 – 55</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

| Total income        | 3,44,40,000/-                 |
| Total cost          | 7,60,000/-                    |
| Total Profit        | 3,36,80,000/-                 |

Major sandalwood oil market distributor and manufacturer
The major sandalwood oil market distributor and manufacturer are Quintis (TFS Corporation)(Australia), Santanol Group (Australia), RK-Essential Oils Company (India), Meena Perfumery (India), Naresh International (India), Essentially Australia (Australia), Katyani Exports (India), KS&DL (Karnataka Soaps & Detergents Limited)(India), Sandalwood Forest (Qingyuan) (China), Jiangxi Jishui Natural Essential oil Factory (China), JinagxiXuesong (China).

Sandalwood: A promising economical tree in India for human welfare
Sandal tree and its wood is a part of Indian tradition and are known to have medicinal as well as cosmetic usage that can be used economically for welfare of human being. Sandalwood tree when cultivated promises a very good fortune to the cultivator as it has wide scope and market in India and Abroad. Jain et al. (2003)
noted that the market price of one tonne heartwood is ₹12.00 lacks in Indian market, its one kg of essential oil market price at twenty two thousand. Sandalwood timber and its essential oil market price are extremely determined by the quality. These studies pay particular attention to production of sandalwood essential oil with its good life span.

**Sandalwood oil extraction methods**

Oil extraction of sandalwood is done by the process of distillation. Various processes by which oil can be extracted are presented in Figure 2. Steam Distillation is a most widely adopted method. Extraction of sandalwood oil takes place in four steps boiling, steaming, condensation and separation. Boiling water at (140-212°F) is passed through the wood. The oil which is tightly bound to the cellular structure of the wood then comes in contact with the high temperature steam. The oil gets volatile and then is condensed and collected. The process takes about 14 to 36 hours to complete, and produces high quality oil. In older days traditional method of sandalwood oil extraction where used called hydro distillation in which the wood was soaked in water and boil till the oil got released. This method is not used now a day due to its high amount of fuel and long duration.

**Figure 2: Schematic diagram of sandalwood oil extraction process**

**Utility of sandalwood oil for human health**

Sandalwood oil is very beneficial for the health of human besides providing economic benefits to the growers, because it has medicinal properties. Sandalwood oil is helpful in relieving symptoms of various diseases as described below in Figure 3.
Figure 3: Sandalwood oil utilization in human health

**Uses of sandalwood essential oil in various industries**

Sandalwood oil along with different flower extract like rose oil, jasmine, kewda, lavender, etc, creates attar. Attar is been used and manufactured in India for centuries, the quality of attar depends upon the concentration and volume of sandalwood oil and the effervescence that flower essence creates with sandalwood oil. Sandalwood oil having a strong aroma is used in various mouth fresheners and Pan Masala to add a distinct flavour to a chewable product commonly known as Gutka. It is also used in preparation of incense sticks.

Sandalwood oil is natural top class fixative that knows good perfume can lack in its composition. The East Indian sandalwood is claimed to be one of the best sandalwood oil and is demand at highly by perfumery industry. It gets easily blend into all composition and thus used widely in soap industry.

Now a day’s Indian sandalwood oil uses has declined due to the subsidence
faced by Eruption perfumery houses as the availability of Indian sandalwood oil is quite low and limiting, this shows the high demand of sandalwood oil in perfumery industry in and abroad, thus the commercial cultivation of sandalwood will not only be a great economic deal but will also help to conserve various species of sandalwood as it is at the verge of extinction and is notified in the green book. Due to aroma and medicinal properties of sandalwood oil is used in many industries (Figure 4).

Figure 4: Utilization of essential oil in different industries

Scope and opportunity for cultivation of sandalwood
- The scope of sandalwood cultivation is a promising fortune.
- High demand and low supply creates sandalwood cultivation a good business.
- Govt. of India encourages sandalwood cultivation by extending the subsidy through National Medicinal Plant Board and National Horticultural Mission for the growers along with other houstarial plants.
Generates green cover, reduces eco impact, conserves, *S. album* species from the verge of extinction.

This would also facilitate the poverty alleviation, rural employment and economic empowerment of the growers.

**Conclusion**

The cultivation of sandal tree has wide scope from social, economical and eco-environmental point of view. The benefits to cost ratio is quite high that indicates market feasibility and promises good fortune for the cultivators. With proper knowledge and correct marketing sandalwood cultivation can serve as a prominent source of income. The supply of sandalwood and it’s by product is very low with respect to the demand of the same. Looking at the current scenario any one can clearly observe the opportunities in sandalwood cultivation.

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**Pongamia pinnata** (Karanja) tree

Shephali Sachan

Forest Ecology and Climate Change Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Jabalpur, 482021 (M.P.)
Email: shefalisach@gmail.com

The nature has bestowed our country India with the wealth of flora. Although, there exist so much diversity, from north to south and even from east to west but each and every species infolds the huge and greatest importance for livelihood and natural ecosystem management. The present study describes about one of such species *Pongamia pinnata* (Karanja) which is not only the source of valuable medicine, various carpentry items and wood furnitures, tannin but also a popular source of biodiesel after *Jatropha curcas*. Also, well known species for areas affected by changing climatic conditions like drought, waterlogging and slight saline affected areas.

**Introduction**

The Karanja tree species belongs to the very famous Pea family (Fabaceae) is one of the richest and brightest tree of India. It is a fast-growing, medium-sized, evergreen or briefly deciduous and glabrous tree species, widely distributed in the Indian subcontinent, south-east Asia, Fiji, Myanmar, northern Australia, the East-African coast, southern China and the Seychelles Islands. In India, this tree is distributed throughout the country except for temperate regions and is considered to be native to Western Ghats. Karanja is famous for infolding multipurpose qualities. The species is valued for oil, dyestuff, wood, fuel, insect repellent, medicines and various other commodities. It is a good nitrogen-fixing tree species with a dense network of lateral roots which helps in controlling soil erosion and binding sand dunes. The tree is often planted in the homes as an ornamental tree, roadsides, along the stream and canal banks and in the areas suffering from problems like salinity, waterlogged, cold, drought, frost, heat, limestone, sand and shade.

**Products**

All parts of *Pongamia pinnata* are used to produce the variety of products.

**Medicine**

Different parts of the plant have been used as a medicine against various diseases and disorders. The leaves are used to cure cold, cough, diarrhoea, dyspepsia, gonorrhoea, piles, wounds and other inflammations. Flowers are prescribed for glycosuria and a remedy for diabetes. The bark is used internally for bleeding piles, beriberi and diabetes and as an antimicrobial medicine. Flowers are prescribed for glycosuria and a remedy for diabetes. The bark is used internally for bleeding piles, beriberi and diabetes and as an antimicrobial medicine. The seeds are used as a tonic and in bronchitis, whooping cough, itches and other skin diseases. Roots are utilized for cleaning gums, teeth and ulcers.

**Timber**

The wood is used for cabinet making, cartwheels, posts, agricultural implements, tool handles and combs. The ash generated from burning wood is used for dyeing.

**Fodder**

The leaves are used as fodder for cattle especially readily consumed by goats.
whereas de-oiled cakes are used as poultry and also as cattle feed.

**Fuel**
Karanja is commonly used as a fuel-wood. The seed oil is used as fuel for cooking and seed cake used for biogas production.

**Fibre**
The bark fibre is used for making string, twine or rope, and the wood provides paper pulp.

**Tannin or dyestuff**
Roots yield a natural pigment, pinnatin which is used as tannin. The wood ash is also employed in dying. The seed oils often utilized for leather dressing in tanning industries.

**Apiculture**
Flowers are considered a good source of pollen for honeybees in India and they yield adequate nectar.

**Oil**
The nonedible, bitter in taste and offensive in smell seed oil is used for lamp fuel and production of biodiesel. Furthermore, it is also used as a lubricant, water-paint binder, in leather dressing, soap-making, candles, and tanning industries. Crude Karanja oil (CKO) is used in making body oils, salves, lotions, hair tonics, shampoos, and pesticides.

**Poison**
The press-cake is used as a pesticide, especially against nematodes while dried leaves are stored with grain to repel insects. The pounded and roasted seeds are utilized as fish poison.

**Services**
This species provide variety of services which contributes in the management of natural environment, have been discussed below-

**Nitrogen fixing**
The atmospheric nitrogen is naturally fixed in the roots of Karanja like Pea species which helps in maintaining the growth and development of species and also the soil fertility.

**Soil improver**
Incorporation of leaves, flowers and the press-cake into soils improves fertility and also used by villagers on slopy uplands to bind the soil.

**Erosion control**
Karanja is a preferred species for controlled soil erosion and binding sand dunes because of its extensive network of lateral roots.

**Reclamation**
Karanja trees have been used for soil reclamation in the degraded or moderate salinity soil areas, around coal mines and reforestation of marginal land.

**Biodiesel**
The seeds of *Pongamia pinnata* is a source of nonedible vegetable oil and used as an alternative liquid fuel against diesel and kerosene.

**Shade or shelter**
The tree is commonly planted for shade in pastures.

**Ornamental**
Karanja is often planted in homes as an ornamental tree and along roadsides, stream and canal banks.
Figure 1: *Pongamia pinnata* (a) Tree (b) Leaves (c) Flowers (d) Seeds with cover (e) Mature seeds after removal of cover

References


बेद एवं वृक्ष
राजेश कुमार मिश्रा
उपपतितवर्धिय वन अनुसंधान संस्थान
(भारतीय वाणिज्य अनुसंधान एवं विज्ञान परिषद, भरतपुर, जल्लावा मण्डल, भारत सरकार)
जबलपुर

भारतीय संस्कृति वृक्ष-पूजक संस्कृति है। वृक्षों में देवता की अवधारणा और उसकी पूजा की परम्परा हमारे देश में प्राचीन काल से रही है। भारतीय संस्कृति वृक्ष-पूजक संस्कृति है। वृक्षों में देवता की अवधारणा और उसकी पूजा की परम्परा हमारे देश में प्राचीन काल से रही है। वृक्षों की पूजा प्रकृति के प्रति आदर प्रकट करने का सरल माध्यम है, वृक्षों के प्रति केसा प्रेम शायद ही किसी देव की संस्कृति में हो जहां वृक्ष को मनुष्य से भी ऊंचा स्थान दिया गया है।

बैदिक काल में प्रकृति के आराधक भारतीय ऋषि भी अपने अनुष्ठानों में वनस्पति पूजा को विशेष महत्व देते थे। बैदिक काल में आराधक ग्रंथों में प्रकृति की महत्मा का सर्वाधिक उल्लेख देखा जा सकता है। इस काल में बृक्षों को लोक देवता की मान्यता दी गयी थी।

वृक्षों में देवता की अवधारणा का उल्लेख बैदिक के अन्तिरिक्त प्रमुख रूप से मवत्पुराण, अग्रिपुराण, भविष्यपुराण, नारदपुराण, रामायण, भगवदगीता और शास्त्र ब्राह्मण आदि ग्रंथों में मिलता है। मोटे रूप में देखे तो बेद, पुराण, संस्कृत और वृक्ष प्राकृतिक साहित्य, आगम, ब्रह्मचर्य, जातक कथायें, कुरान, ब्राह्मण साहित्य हो या अन्य कोई धार्मिक ग्रंथ हो भी रूप में बृक्षों में लोक मंगलकारी स्वरूप का परिचय मिलता है।

दुनिया में सभी प्राचीन सभ्यताओं का आधार मनुष्य के प्रकृति के प्रति प्रेम और आदर का रिश्ता है। इसी कारण गौड़, गहड़, नदी और मनुष्कार प्राणियों की पूजा की परम्परा का प्रचलन हुआ। मोहनजोदरों और हुड्डा की खुदाई से मिले अवशेषों से पता चलता है कि उस समय समाज में पूजन पूजा के साथ ही पेड़-पौधों और जीव जनताओं की पूजा की परम्परा भी थी।

भारतीय प्राचीन साहित्यिक ग्रंथों में ब्राह्मण, ग्रामवास्तुकला और वृक्ष पूजा के अनेक प्रसंग मिलते है। अंजता के गुफाओं, निर्माण और संतों के तीरां स्तंभों की विभिन्न आकृतियों में पृथिवी-पूजा के वृक्ष है। जैन और बौद्ध साहित्य में पृथिवी-पूजा का विशेष स्थान रहा है।

हमारे सबसे प्राचीन गंधर्व शब्द में प्रकृतिकी परमात्मा स्वरूप में स्तुति है। इसके बाद वास्तिकी रामायण, महाभारत, मनुस्मृति और नारद संहिता में पृथिवी-पूजा की विभिन्न विधियों का विस्तार से वर्णन है। सभी धार्मिक आयोजनों एवं पूजा पाठ में पंच पलब (पीपल, गुड़, पलाश, आम और वट वृक्ष के पतंग) की उपस्थिति अविवाह होती है। हमारे प्राचीन साहित्य में
जिन पत्रिका और अन्तर्जाति पत्रिकाओं का उल्लेख है उनमें कल्पवृक्ष प्रमुख है। कल्पवृक्ष को देवताओं
का वृक्ष कहा जाता है। पौराणिक प्रथा स्तंभपुराण में
पांच पत्रिका ज्यादादर बुध (पीपल, वेंक, वराद, आवला व अशोक) के समुह की पंचचरी
कहा गया है। हमारे सभी धर्मग्रंथ पौधे पौधों के
प्रति प्रेम और आदर का पाठ पढ़ाते हैं। भगवान
बुध के जीवन की सभी घटनाओं बुध की ज्यादा
में घटी थी। आपका वचन साधन में बीता,
इसके बाद प्रथम समाधि गामन बुध की ज्यादामें,
बोधि प्राप्त पीपल की ज्यादा में और निर्वाण
साधन बुध की ज्यादामें हुआ। भगवान बुध ने
भ्रमणकाल में अनेकों वनों में प्रवास किया था
इसमें बैशाखी की आगमाली का प्रारम्भ,
पिपला का सहारदेव आगमन और नालार में
पुखरीने आगमन के नाम उल्लेखनीय है। जैन
धर्म में जैन वाद्य जिने से बना है, इसका अर्थ है
समस्त मानवीय वस्तुओं पर विजय प्राप्त करने
वाला। नीरक का शाब्दिक अर्थ है नीर का पानी करने
का स्थान अर्थात् चांद। धर्म स्टील नीरक का जो
प्रवर्तन करते हैं वे नीरकर कहलाते हैं। तपस्या के
प्रारंभ सभी नीरकरों को कैरल ताना (विशुद्ध
ताना) की प्राविशुद्ध किसी न किसी वृक्ष की ज्यादा में
हुई थी, इन वृक्षों को कैरलबुध कहा जाता है।
सिख धर्म में वृक्षों का अयांगकीण महत्व है,
देशभर में 48 गुरुद्वारों का नाम वृक्ष पर है। वृक्ष
को देवता और धर्मस्थल के पास स्थित वृक्ष समुह
को गुरु के बाग कहा जाता है। इसमें गुरु से जुड़े
कुछ प्रमुख वृक्ष हैं - नांकनमरता का पीपल वृक्ष,
रीढ़ा साहब का रीढ़ा वृक्ष, टाली साहब का शीथम,
और बेर साहब का बेर का वृक्ष प्रमुख है। इसके
साथ ही कुछ अन्य पूजनीय वृक्षों में दुध भंजनी
बेरी, बाबा के बेरी और मेहताब सिह के बेरी
प्रमुख है। पृथ्वी पर पाने जाने वाले जिन पौधे पौधों
का नाम कुरान-मजीद में आया है, उन पौधों
को मुस्लिम धर्मस्वत्त्वी पूजनीय मानते हैं। इन
पत्रिकाओं में खजूर, बेरी, पीपल, मेहंदी, जैतून,
अनार, अंजीर, बुखार, अंगूर और तुलसी प्रमुख है
इलेस के सुध पौधों के बारे में मोहम्मद साहब
(रहमतुल्लाह अल्लाह) ने वर्णित किया है, इस कारण
इन पौधों का महत्व और भी बढ़ जाता है।
भारतीय संस्कृति की परम्परा वृक्षों के साथ सह-
जीवन की रही है। पौधे संस्कृति के बाहर है।
प्रभुत्व और संस्कृति के साहचर्य से ही सम्बन्ध
त्रिनिताभोली होती है। इसलिए जंगली महाराज
की सैंस्कृतिक का स्थान कह गया है, सिर सारे रब रहे तो
सत्संग, इसी में धरारी और आराधना जैसी
स्थाई चेतना का प्रकृति चेतना से
सत्संग कर बुध पुजा और बुधा रथा से जीवन
में सुख-मुस्तिस्थि और आनंद की कामना की है।
आज इसी भावना को विस्तारित कर हम
मानवता के भविष्य की सुरक्षा कर सकते हैं।
भारतीय संस्कृति एवं परम्पराओं में पौधे को
विशिष्ट महत्ता प्रदान की गई है। पौधे हमारी
संस्कृति के संरक्षण भी माने जाते हैं। हमारे साथ
साथों और महत्व के नाम पौधों की छत्रहारा में ही
साधना करते हैं। जल नाम प्राप्त किया था। भारत
भूमि पर वृक्षों, वनों, पौधों और पत्तों को देवतय
मानकर पूजा जाता रहा है। प्रयोक मौलिक अवसरों पर वर्षों के दर्शावां पर कोई आदि ना ऊंचे और केले के पत्तों से सजावट होती है। विशेष पहर और उत्सवों पर पूजा की पूजा अर्चना की जाती है। " परम्परा से आधार उस परिपाटी से है जो निधित्र सांस्कृतिक मूल्यों के निर्माण कथा उन्हें पीढ़ी दर पीढ़ी आगे से आगे हस्तांतरित करने के उद्देश्य से समाज में निधित्र अवसर पर निधित्र विधि से अपनाई जाती है।" हमारे प्राचीन धर्मिक प्रथाओं और वेदों में भी उल्लेख है कि मानव शुद्ध वायु में खाना लेने, शुद्ध जलपान करने, शुद्ध अत्र फल, भोजन करने, शुद्ध मिट्टी में खेले नृत्य व कृषि करने तब ही वेद प्रतिपादित है। उसकी आयु " शतमुं ह्योम शरदः शतम्" हो सकती है। हिन्दु धर्म में तो कई देव मन्त्रों में पेड़ को पूजा देवता का प्रतीक माना जाता है। पीपल, तुलसी, वट और वृक्षों की पूजा अर्चना पयारवर शुरू कर दिये जाते हैं। हमारे धर्मशास्त्रों में महामन्नीयों ने वापस, पारी और जलाशय बनाकर वहीं वृक्षरोपण करना किया जा रहा है। बचपन में यह हिन्दू आदि दिनी निम्न का धर्म होता है जब भी वृक्षों के पौधे को यह अवसर से कम नहीं माना जाता है। इसी आदिमों में यह हिन्दू आदि दिनी निम्न का प्रयोग होता है जब भी वृक्षों की पौधे को यह अवसर से कम नहीं माना जाता है। वृक्ष एक और जहाँ हमारे प्रीतिकोंपार्जन के साधन हैं वहीं दूसरी और हमारे जीवन के आधार है। वृक्षरोपण और जलाशय की पुनरीत कार्य माना जाता है। हमारे राजा-महाराजाओं ने प्रजा की सुख सुविधा के लिए न केवल सड़कों का ही निम्न कराया बल्कि इनके किनारे छायादार वृक्ष और जलाशयों की व्यवस्था भी की थी। समार अशोक ने समूचे राज्य में पयारवर शुरू किया जा रहा फलदार व छायादार वृक्ष लगाकर बना से ही जीवन और जीव जन्तुओं को आधार प्रदान किया। “ वृक्ष हमारे जीवन के सहार हैं हमारा जीवन वृक्षों के अतिल पर निर्भर है। वृक्षों की देवी गई प्राणांस हमारी श्रद्धा है। वृक्षों के मूल, तना, पत्ता, पूणा फल हमारे जीवन की अंद्र आश्वान्त को पूर्ति करते हैं। वृक्षों का देवी हमें श्रद्धालु श्रद्धालु प्रदान करती है। वृक्ष में अनिवार्य कर हमारे लिए प्राकृतिज जल की व्यवस्था करते हैं।" - वृक्ष पुराण भारतीय समाज में पेड़ों की पूजा और बनाने के माष का दर्जा देना प्रकृति संरक्षण ही का परिचय है। गंगा , यमुना, सरस्वती आदि पवित्र नदियों का उल्लेख शाखाओं में पूज्य भाव से हैं। रामायण में काण्ड, महाभारत में पर्व और श्रीमद भागवत में स्त्राम शब्दों का प्रयोग हुआ है जिसका कारण क्रमशः तना, पोर और प्राणांस संरक्षण से हैं। कथा की पूर्ण शकुनीता का पूरा वचन वृक्षों की देवी तथा जीवी हुआ। उसकी विदवाई के समय वृक्षों की विवि से आय्या टपक रहे थे। उसने वृक्षों से गले मिलकर बिंदा ली। रामायण काण्ड में राम का वाणों में निबास करना और वृक्षे को अपना आधार बनाना उनके प्रकृति प्रेम का ही युक्त रहा है। लंका में अशोक बाटिका में सीता का दर्शन वृक्षों की महता प्रतिपादित करता है। वृक्ष और वस्तुर्य रूढ़ के रूप में मानी गई है क्योंकि वे विवृत गैस पीकर
जल बढ़कर एक और चरक वन, दस बढ़कर एक वन और सफल वन कर घर उस घर कथन पथ पर फल फल वह पर आक आक, और तुलसी को पौधा सबक है। हाथियों के पुष्कर सबक है जिस घर में तुलसी की पौधा होती है उस घर में यमराज प्रवेश नहीं करता है। प्राचीन काल में प्रथम थिवालय के पास विभल पन्ना का वृक्ष लगाया जाता था जिसकी पत्तियों थिवजी को अर्पित होती है। तुलसी एकादशी के दिन तुलसी के पौधों की अपराम पृथ्वी के समान विवाह की रस्म सम्पन्न की जाती है।

शाक्षेत्रों का कथन है कि यह पर वृक्षारोपण करने से दुर्गम फल की प्राप्ति होती है जो फल अप्रिय होकर करने से भी उपलब्ध नहीं होता वह माना पर पेड़ लगाने पर मिल जाता है। पृथ्वी पुराण में लक्ष्मी को कदम्ब बनावटिकर कहा गया है। कदम्ब के पृष्ठों से भगवान विषु की पौधा की जाती है। वृक्षारोपण के उपाय में पुरुष को वृक्ष का स्वरूप माना गया है। पद्म पुराण में भगवान विषु को पीपल वृक्ष, भगवान शंकर को बदूर्धक और ब्रह्मा जी को पलाश वृक्ष के रूप में प्रतिपादित किया गया है। घर में वास्तु दोषों को नष्ट करने के लिए तुलसी का पौधा सबक है। माता लक्ष्मी की प्रसन्न करने के लिए घर में भेद आक, केला, अंबल, हरसिंघर, अशोक, कमल आदि का रोपण शुभ मुहृद्व में करने का विधान है।

आद्य देश में तो नीम के पेड़ को राज्य वृक्ष माना गया है। शाक्तिसागर ईश्वर को बना अंबला नर्तक में इम्में, आँग्रेज़ में अनार, वायु में वेल, उत्तर में इंद्र व पाकर, पूर्व में वरगद, दक्षिण में पुंगल और पुंजाब तथा पश्चिम में पीपल का वृक्ष लगाना शुभ माना गया है। तुलसी की विषु प्रिया, केला को बुधसत्ता और सन्तान
वात तथा पीपल को भ्रष्टा, बिषू, महेश के
निवास के रूप में पूजा जाता है। चन्दन भक्त और
भगवान के माये की शोभा है। कार्तिक मास की
शुक्ल पक्ष की नवमी को उंवला नवमी कहते हैं।
कहते हैं कि पीपल के पेड़ को नियम पूर्वक जल
चढ़ाया जाए तो शति का दुर्भाव समाप्त हो
जाता है। चैत्र मास की कृष्ण पक्ष की दशमी की
"दशामाता" कहा जाता है। खियाँ इस रोज
पीपल पूजा करती है। व्येष भास की पूर्णिमा को
खियाँ देवसिनिया का ब्रत रखती हैं। अब बृहस्पति को
जन सींचती हैं। छत्रियंत्री आभास और बसंत
पंचमी आदि पहुँच पर नव उपवास के साथ
वनस्पति पूजा होती है। छत्रियंत्र के रतनपुर
क्षेत्र के ग्रामीण इलाकों में आम के पेड़ से आम
tोड़ने से पहले उसको विभाग की विधि समाप्त की
जाती है। बसंती जनसंध्या और भीष्मक वादी
व्यस्थाओं के फलखस्ते बृहस्पति की अन्धाधुंध
कटाई हो रही है। प्रकृति से निर्देशवाले पूर्वक
छड़छाड़ की जा रही है अतः जान धर्मस्तु की
भयानक समस्याओं का सामना करना पड़ रहा
है। गाँवी में कहा था “प्रकृति सभी जीवों का
भरण पीपल तो करती हैं किंतु एक भी लालची
की तुषार शांत करने में अभाव है। पीपल वर्ग
को अभारण माना जाता था उन्हें काटना ब्रह्म
हथा के समान माना जाता है। जिन पेड़ों पर
पक्षियों के घोंसले हो तथा देवलय और श्रेष्ठान
भूमि पर लगे पेड़ों की काटना शाखावतुकुल नहीं है
साथ ही बृहस्पति के बढ़े पृथ्वी नेम, पीपल, बहेड़ा,
आरड़, नीम आदि को काटने पर पाप का
भागीदार होता है किसी कारण से बृहस्पति काटना ही
हो तो बृहस्पति के बालों जलन जश्न करने में
सहभागिता करते हुए अन्यन्त कृष्णा व्यस्था की
व्यस्था का जाना चाहिए। जोधपुर जिले की
खेजरी हाम्मार में वंशज 1780 में 363 बीर-
बीराणशिलाओं ने अपने शिर कटवाकर महर्षियों
खेजरी के बृहस्पति की स्था की थी। आज भी विशेष
सम्बंधाय के लोग खेजरी के पेड़ की तुलना हेतु
समर्पित है। पेड़ों को नहीं होने से बचाने के लिए
ही लोग खेजरी तथा सोवर खेजरी की
परम्परा का विचार हुआ था। भाराण एक संरक्षण
वन है जो किसी देव स्थान से जुड़ा होता है।
खेजरी किसी मठ या मन्दिर के पुजारी का
व्यस्थान सम्बन्ध है तथा एक भी जानती है तकि वन
संरक्षण होता रहे। बसंती जनसंध्या और
भीष्मक वादी व्यस्थाओं के लघुवार्षिक वृक्षों की
अन्धाधुंध कटाई हो रही है। बसंती जनसंध्या के
जल, उद्योगों का स्थान, बूंदों के निर्माण तथा
रेतदेव की बात का कारण बृहस्पति की अपार
कटाई हो रही है अतः नहीं रहे वृक्षों के स्थान
पर नये धारणारोपण पर ध्यान दिया जाए तथा
कारूँ तो कठोरता से पालन किया जाना
आवश्यक है अन्यथा वह वह दूर नहीं हैं जब
प्रकृति प्रकृति से पूरा पृथ्वी नाम भारतीय हो
जाएगा और हमारे असत्त्व को खतरा उत्पन्न
होगा अत: वृक्षों के चक्र में हेतु सभी को कृष्ण
संस्कार होता है। हमारे जीवन का पालन-पोषण करने के लिए
हमारे धर्मत्व मात्र की तरफ से वास्तव में हमें बहुत
एक और पर और तरह वजह पर “हरा सोना” कहा जाता है। संपत्ति के साथ ही हमारी सेहत का बी वातावरण से अधिक हैं। क्योंकि ये और वजह पर घर और रहने के स्थान के बाद देख उपयोगी होता है। पेड तक सभी CO2 उपयोग कर्ता है, जहाँ उसके से हवा को ताजा करता है और हमें बायु प्रदूषण से बचाता है। पेड वेद धरती पर अपना प्रयोग और अपना जीवन प्रदान करता है। क्योंकि ये और वजह पर घर और बारिश का सील है। धरती पर देख सबके बुखार और प्राण के रूप में जाना जाता है।

पेड व्रुत्ति का आधार है। पेडों के बिना प्रकृति के संरक्षण एवं संरक्षण की कल्पना भी नहीं की जा सकती है। इसीलिए हमारे पृथ्वीवर्ती ने पेडों को पृथ्वी महत्व दिया। पृथ्वीवर्ती में वृक्ष तौर पर लिखा है कि पेड वेद देखने से उतना ही पुष्प मिलता है, जितना कि दस गुणवत्ता पुष्पों से यथा की प्राण होती है। इससे जिस प्रकार हम अपने बृहों को पेड करने के बाद उनकी परवरिश बढ़ी तत्त्वता से करते हैं, उसी तत्त्वता से हमें जीवन में एक पेड तो जरूर लगाना चाहिए और पेड लगाने के बाद उसकी सेवा व सुरक्षा करनी चाहिए। तभी हमें पेड लगाने का परम पुष्प हासिल होता है।

प्रवृत्ति पूर्वाधिकार में वर्णन मिलता है कि जिसकी संतान नहीं है, उसके लिए वृक्ष ही संतान है। बृक्ष एक तथा संतान की तरह ही मानव की उपवास सेवा करते हैं। इसलिए, वर्तमान व्रुत्ति को एक पेड अवश्य लगाना चाहिए। पूर्व पुराण में तो यहां तक लिखा है कि जलाशय (तालाब/बावड़ी) के निकट पीपल का पेड लगाने से व्रत्ति को संरक्षण यहां के बारवर पुष्प की प्राण होती है। केवल इस दी नहीं भारतीय संस्कृति में एक पेड लगाना, सो गाथाओं का दान देने के समान माना गया है।

धरती पर सब कुछ एक-दूसरे से जुड़ी हुई हैं और प्रकृति के संरक्षण से चलता है, अगर इसके साथ कोई गड़बड़ी होती है, पूरा परवरिश बाधित हो सकता है और धरती पर जीवन को उत्साह पहुंचा सकता है। पेड हमें बहुत सारी प्रकृतिक आपदाओं से सुरक्षित रहता है और बहुत निकटताओं से हमारे जीवन का पालन-पोषण करता है। यदि मुड़ा अपरदन होने से भी बचते हैं और प्रसूतून से बचाने के द्वारा परवरिश को ताजा रखते हैं। पेड बहुत मददगार होते हैं तथा मानवता के उपयोगी समृद्ध होते हैं।
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P.O. RFRC, Mandla Road
Jabalpur – 482021, M.P. India
Phone: 91-761-2840484
Fax: 91-761-2840484
E-mail: vansangyan_tfri@icfre.org, vansangyan@gmail.com
Visit us at: http://tfri.icfre.org or http://tfri.icfre.org