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VAN VIGYAN

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In this issue

From the
Director's Desk

IFGTB-ENVIS, the thematic Centre hosted by the Institute of Forest Genetics and Tree Breeding that actively works in the field of forestry research, conservation and management aims to provide information on all aspects of forest genetic resources and tree improvement in the country. The current issue of the newsletter published by IFGTB-ENVIS focuses on *Pterocarpus marsupium,* a potential multipurpose leguminous tree of peninsular India in the 'Know Your Trees' section. Apart from the timber and ecological value, this large deciduous tree has long been recognized in Ayurveda medicine to manage diabetes.

In addition to this, the issue holds two research articles. The first one emphasizes the significance of bio-fertilizers and promotion of a tree growth booster developed by IFGTB. The other research article describes about the identified teak progenitors in south Western Ghats. In order to exploit new challenges and opportunities in the area of forest genetic resources, a list of recent research publications relevant to the field has also been provided.

R.S. Prashanth
Director

Know Your Trees - *Pterocarpus marsupium* Roxb.

Systematics

Kingdom	Plantae	– Plants
Sub kingdom	Tracheobionta	– Vascular plants
Super division	Spermatophyta	– Seed plants
Division	Magnoliophyta	– Flowering plants
Class	Magnoliopsida	– Dicotyledons
Subclass	Rosidae	–
Order	Fabales	–
Family	Fabaceae	– Pea family
Genus	*Pterocarpus* Jacq.	
Species	*marsupium* Roxb.	

Distribution

Pterocarpus marsupium occurs in the Southern tropical Semi-evergreen forests, South and North Indian Tropical Moist Deciduous forests, Southern Tropical Dry Deciduous forests and Western Tropical Dry Deciduous forests of Champion and Seth's classification. The tree occurs throughout the greater parts of the Indian Peninsula extending from Gujarat via Mount Abu in Rajasthan, Bundelkhand in Uttarpradesh and Mandhya Pradesh upto Bihar and Orissa. The longitudinal limits are 69 in the west and 88 in the east. It is not recorded west of Haldwani. It is especially common in Madhya Pradesh (Balaghat, Saugor and Damoh), Maharashtra (Chandrapur and Bhandara), Andhra Pradesh, Orissa, Karnataka, Kerala and Tamilnadu States. It is absent from the northern part of Bihar though common in the central and southern areas. It is also common in West Bengal, occurring in the sal forests of the laterite zone. It is totally absent from Assam, western portion of Rajasthan and Punjab.

It is found in association with *Terminalia* spp., *Xylia xylocarpa, Dalbergia latifolia, Kydia calycina, Lagerstroemia, Adina cordifolia,* etc in mixed deciduous forests and with *Tectona grandis, Anogeissus latifolia, Sterculia urens, Boswellia serrata, Diospyros tomentosa, Pterocarpus santalinus, Adina cordifolia,*

Lagerstromeia parviflora, etc in the dry deciduous forests (Luna, 1996). It occurs in the greater parts of the Peninsular India, extending from Gujarat upto West Bengal (FRI, 1983). In Kerala and Tamil Nadu it occurs in moist, dry deciduous and semi-evergreen forests upto 1300 m and is less common in lower elevations.

Botanical description

P. marsupium is a medium-sized to large tree that reaches up to 30 m height. The tree usually has a large and well-spread crown borne by a stout and cylindrical clean bole ranging from 5-10

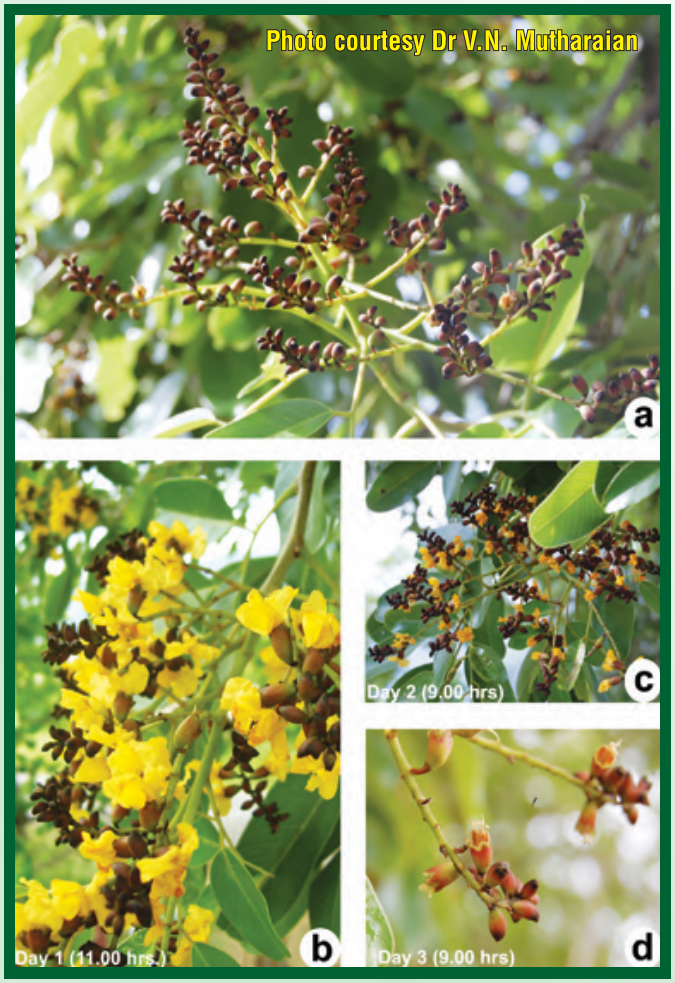
m in length. Stem is woody and un-buttressed. Bark is rough, dark grey (in dry deciduous forests) or brown (in moist deciduous forests) and longitudinally fissured with the outer corky layers. A cut-bark yields a typical blood red gum (Kino) in droplets which later on turn into deep dark-red brittle particles.

Leaves are alternate, imparipinnate; leaf rachis 13-15 cm long. Leaflets are usually 5-7, alternate, elliptical to oblong in shape, petiole 5-10 mm long. Each leaflet measures approximately 5-15 cm in length and 3.5-9 cm in width. Leaf venation is almost parallel. Apex of the leaflet is either emarginated or retuse; base is obtuse. Flowers are yellowish, produce fragrance and usually borne in terminal panicles. Each flower has a very short pedicel followed by a calyx of 5 mm long. Corolla is 1.3 cm long with crisp margin. Fruit is a winged pod (Samara), flat, indehiscent, posses a long stipe, convexly curved between the stipe and style. Fruit is by and large, single seeded. Seed is dolabriform or oblong, 1-1.3 cm long, red or yellowish-brown, fairly hard with a leathery testa.

Phenology

The tree is nearly evergreen in moist areas whereas it sheds leaves for a short period in the hot season (April–May) with new leaves occurring during May-June. The flowering season is irregular. Flowering usually takes place during July-October while in Maharashtra it is during May-June while in Madhya Pradesh it is in October – November. Mature fruits are generally found during February – May across India though it varies across locations. In Peechi, Thrissur District, the fruits are available from February to April while in Chinnar, Idukki District it is available from October – December. In

Floral biology of *Pterocarpus marsupium*.



a) An inflorescence bearing mature buds that are about to bloom.
b) An inflorescence in full bloom.
c) Wilting of petals during the next day.
d) Remnants of flower during the third day after flowering.

Karnataka it is generally available during January – February. The ripen pods hang in clusters for a few months and fall down during the hot season with the hot winds disseminating them far and wide. Good seed years are reported in intervals of 2-3 years when pods are produced in abundance.

Nursery techniques

The pods are collected from February-May by beating them off the trees or from the ground. They are then well dried in the sun and stored in

gunny bags. For sowing, the entire pods are used without extracting the seeds. The pods store well up to 9 months, sometimes a year, in gunny bags.

The initial moisture content of *P.* marsupium seeds is 9.14%. Germination percentage of fresh seeds is poor with only 2%. Cold water soaking for 72 hrs helps in improving germination significantly as the seeds undergoes a state of dormancy. The first emergence is observed on the 19th day of sowing. The seeds could be stored at ambient temperature for a year (Warrier *et al.,* 2007)

Healthy planting stock after 1 year in nursery are generally used for field planting either with a ball of earth or by making them into stumps before out-planting. The optimum size of the plants for stump making is found to be with 25-30 cm root length and 1-2 cm collar diameter. Kadambi and Dabral (1955) have reported stump planting to be superior compared to seed sowing and transplanting entire seedlings.

Silviculture

The development of the seedling during the first year is comparatively slow, a height of about 5-15 cm being attained by the end of the first season under natural conditions. However in seed-beds regularly watered and weeded, a height of as much as 0.9 m or more may be reached. During the second season the growth is faster, a height of about 0.6-1.5 m or more being attained under favorable natural conditions and as much as 1.5.-2.4 m or more in the case of plants regularly watered and weeded. A long taproot is produced at an early stage, which sometimes reaches a length of 30 cm in the first month. Natural forest seedlings generally show little stem development, die back annually for several years, and ultimately shoot up after they have developed a long stout taproot. Although the seedlings are capable of struggling successfully against a moderate growth of low weeds and grass, their development is greatly stimulated by weeding and soil working. They are very frost-tender, suffering particularly among grass and less so in beds kept weeded and watered. They are also sensitive to drought in their earlier stages, and benefit by protection from the sun or dry ground.

The tree is a moderate light demander,

seedlings and saplings are exceptionally tolerant of weeds and shrub growth. Saplings and poles can stand a fair amount of lateral shade; but will not to legate any buy the slightest overhead

shade. Complete freedom overhead is essential for proper development from the pole stage onwards. Young plants are frost-tender. The species, however, is some what hardy and its natural distribution extends to localities where frost is unknown. The tree produces root-suckers, as a rule sparingly. It usually coppices fairly well, in coppicing and pollarding, it was inferior to teak and far inferior to *Lagerstroemia parviflora*. Pollarding power was found better than coppicing power. Regarding the best season for a coppicing, experiments showed that success was almost cent per cent from April to June, was almost nil in August, and only 33% stumps having sprouted in July.

Natural regeneration

P. marsupium is a light demander and is frost and drought - tender. The fruit which escapes fire or insect damage and are dispersed by wind generally germinate in the same rainy season. In order to improve natural regeneration, partial burial of fruits in loose soil, weed removal and protection from drought and grazing are found to be helpful.

Growth and Yield

The rate of growth of *P. marsupium* in natural forests is very slow. Mean annual girth increment of 3.8 cm has been recorded over a period of 7 years in Kerala. In Wayanad, Kerala, the mean annual increment recorded was only 1.5 cm at an age of 65 years while in North Kanara it was 1.4 cm at 70 years. In South and North Raipur Divisions of Madhya Pradesh the rate of growth of coppice crop was found to be comparatively faster. Under favourable conditions trees have reportedly reached 214 cm girth in 30 years with a mean annual increment of 7.1 cm.

Insect pests

A large number of insects have been recorded on *bijasal,* but none of them are serious pests. The living tree is susceptible to injuries of following insects.

The lac insect, *Kerria lacca* feeds on the sap of twigs and branches. Several larvae of the insects of order Lepidotera that defoliate are namely *Orgyia postica, Plecoptera reflexa, Neptis jumbak jumbah, Clanis bilineata, Clanistitan titan and Atractmorppha cremulata.* (Mathur and Singh, 1961). The beetle *Xylotrechus subsutellatus* sometimes bores sapwood of standing dying trees and is even reported to have caused death of standing trees in Coorg (Karnataka) though it is doubtful if the tree is capable of primary attack of healthy trees (Beeson, 1941).

Economic value

The timber of *P. marsupium* is extensively used and valued for construction and furniture. After teak and rosewood it is the most preferred timber for construction work. It was commonly used for door and window frames, posts, pillars, agricultural implements, for handles, cart building, railway sleepers, carriage and wagons. It was prized for making drums and also used in lorry body-building and occasionally ship-building joinery. It was widely used for making timber bridges and making sporting gun stock and butts. With calorific value of sapwood at 4904 kcal/kg and heartwood at 5141 kcal/kg, the lops and tops were used as fuel.

The bark, wood and flowers have various medicinal uses. Leaves were used as fodder. The heartwood of *P. marsupium* is astringent, bitter acrid, anti inflammatory, anthelmintic and anodyne. It is considered magical for diabetes

and an aqueous infusion of the wood is used for treating diabetes. Wood turns water blue as soon as it comes in contact with water. It is good for elephantiasis, leucoderma, diarrhoea, dysentery, rectalgia, cough and greyness of hair. The bark is used as an astringent and in toothache. The leaves are good fodder and are valuable as manure in areca nut plantations while bruised leaves are considered useful as an external application for boils, sores and skin diseases. The bark on wounding gives an astringent, blood-red or ruby coloured gum, known as kino or Malabar kino which is used in medicinal systems, paper printing and dyeing industry. As gum extraction is found to have unfavourable effect on the tree as well as on timber, quality, its extraction is generally discouraged. Studies have shown that only trees over 1.8 m gbh should be tapped with one tree yielding about 1.4 kg of liquid or 0.4 kg of dry gum. Parts of the Indian kino (heart wood, leaves, and flowers) have long been used for their medicinal properties in Ayurveda. Similipal Kol tribes in Orissa, India pound a paste mixture of the bark of *P. marsupium* with the barks of *Mangifera indica*, *Shorea robusta* and *Spondias pinnata* to treat dysentery.

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VAM BIO-FERTILIZER – IFGTB TREE GROWTH BOOSTER

INTRODUCTION

Today our country is engaged in the gigantic task of feeding about more than 100 million people. The task could have been impossible but for the Green Revolution of 1960 which has given reasonable hope for the country being self sufficient in the production of adequate food for feeding the teeming millions. Chemical fertilizers have been in the forefront of the struggle to increase the world food production. They have become vital for crop production. But the use of costly chemical fertilizers for large scale production of agricultural crops in the fields and fungicides & pesticides for preserving grains bring about physical and chemical alterations to the land, thereby bringing soil pollution. Hence, such soil pollution can be prevented by treating the soil with bio-fertilizers or bio-inoculants instead of chemical fertilizers.

BIO-FERTILIZERS

Bio-fertilizers or microbial inoculants can be generally defined as preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulolytic microorganisms used for application to the seed, soil or composting areas with the objectives of increasing the numbers of such beneficial microorganisms and accelerate certain microbial processes to augment the extent of availability of nutrients in a form which can be easily assimilated by plants. The bio-fertilizers constitute beneficial microorganisms both symbiotic and free living forms in the soil that provide nutrients to the plants in available form through natural processes.

ADVANTAGES OF BIO-FERTILIZERS

- Eco-friendly.
- Cost effective.
- Renewable.
- Components in Integrated Nutrient Management.
- Sustainability in production
- Restore natural soil fertility and improve soil health.
- Make the nutrients available to plants
- Provide protection to plants against drought and some soil or root-borne diseases. Improves rhizosphere beneficial microbes by synergistic interaction.
- Activate the soil biologically.
- Solve problems such as increased salinity and soil run-off from the fields.
- Replace the application of chemical nitrogen and phosphorus fertilizers by 25%.
- Synthesize plant growth promoting substances and antibiotics for improved seedling growth as well as health.
- No residual toxicity in food products and soil.

CONSTRAINTS IN BIO-FERTILIZERS PRODUCTION AND USAGE

- Use of ineffective isolates/ strains.
- More demand and less production.
- Lack of knowledge on its importance and usage methodology.
- Mutation during fermentation.
- Quality control – lack of quality assurance.
- Short shelf life of the product.
- Non availability of good quality carrier material.
- Lack of standardization in packaging.
- Under performance in real life due to handling errors.

DIFFERENT KINDS OF BIO-FERTILIZERS

The product biofertilizer comprises of the specified microorganism(s) blended in carrier material like charcoal, vermiculite, talcum powder,

etc. They are: (1) Nitrogen Fixers (*Azospirillum, Azotobacter, Frankia, Rhizobium* etc.); (2) Phosphorus solubilizers (*Bacillus megaterium, Bacillus polymyxa, Pseudomonas striata* etc.), (3) Phosphorus Mobilizer (Mycorrhizal fungi – Ecto and VAM fungi), (4) Potash Mobilizer (*Frateuria aurentia*).

MYCORRHIZAL FUNGI (FUNGAL BIO-FERTILIZERS)

The term "mycorrhiza" is literally meaning "Fungus Root" to denote the beneficial association between certain soil fungi and plant roots. The mycorrhizal colonization is known to be significantly beneficial for the nutritional uptake of host plants (especially phosphorus, zinc and other essential elements) from deficient soils.

Types of Mycorrhizal Fungi

There are different kinds of mycorrhizal fungi. Among them, the most widespread and relevant to agriculture, horticulture and forest trees are endomycorrhizal fungi and ectomycorrhizal (ECM) fungi are very much used in forestry crops.

ECTOMYCORRHIZAL (ECM) FUNGI

This type of symbiotic association occurs mostly in Gymnosperms and few Angiosperm families. The ECM fungi mostly belong to the higher fungi (Basidiomycetes and Ascomycetes). It protects the host plant from soil and root-borne pathogens. Few examples of these fungi are *Amanita muscaria, Laccaria laccata, L. fraterna, Pitholithus albus, Rhizopogon luteolus, Scleroderma citrinum, Suillus brevipes, S. subluteus,* etc reported in India (Vijayakumar *et al*., 1999; Mohan, 2002, 2005, 2008, 2013; Mohan *et al.,* 2011). Among these, the most widespread one is the *Pisolithus albus.*

Crops for which the ECM fungus *Pisolithus albus* is intended

The ECM fungal bio-fertilizer can be used for *Acacia* spp., *Casuarina* spp., *Eucalyptus s*pp. and *Pinus* spp. in tree nurseries for quality and healthy seedling production.

ENDOMYCORRHIZAL FUNGI

This group is one of the major types of mycorrhizal fungi which differ from ECM fungi, in structure. Unlike ECM fungi, which form a system of hyphae that grow around the cells of the root, the hyphae of the endomycorrhizal fungi not only grow inside the root of the plant but penetrate the root cell walls and become enclosed in the cell membrane as well and it makes for a more invasive symbiotic relationship between the fungi and the plant. The penetrating hyphae create a greater contact surface area between the hyphae of the fungi and the host plants. Endomycorrhizal fungi have further been classified into five major groups: Vesicular Arbuscular (presently it has been referred as Arbuscular), Ericoid, Arbutoid, Monotropoid and Orchid mycorrhizae.

VESICULAR ARBUSCULAR MYCORRHIZAL (VAM) FUNGI

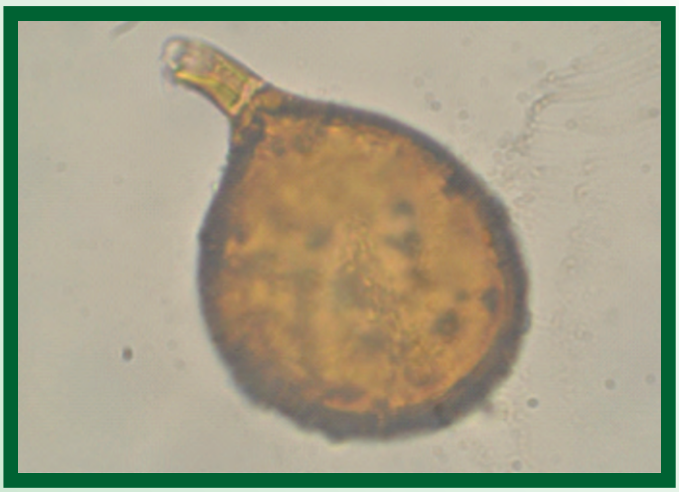
Vesicular Arbuscular Mycorrhizal (VAM) fungi belong to endomycorrhizal group (presently it has been referred as Arbuscular Mycorrhzial (AM) fungi). They are most prevalent and distributed in varied ecosystems. VAM fungi occur in almost all families of flowering plants. Hence, plants with VAM fungi are common in most habitats. The VAM fungi produce single, thick-walled spores which are present in the crop rhizosphere. Unlike the ECM fungi, VAM fungi cannot be grown on synthetic medium. They require living host root system for their mass multiplication. The important VAM fungal genera are :

1. *Acaulospora*
2. *Glomus*
3. *Gigaspora*
4. *Scutellospora*
5. *Entrophospora*

IFGTB has taken up research on VAM fungi and studied the occurrence and distribution of these fungi in association with different forestry crops in varied ecosystems in Southern India. Potential isolates of these fungi have been identified after screening their efficacy on growth enhancement of economically important tree species in nursery and field.

IFGTB TREE GROWTH BOOSTER (VAM BIO-

Glomus geosporum



Glomus fasciculatum

Glomus fasciculatum

Glomus aggregatum

Gigaspora gigantea

Acaulospora scrobiculata

VAM spores isolated from different forest ecosystems in Tamil Nadu

FERTILIZER)

Microbes play an important role in maintaining the biological equilibrium of the forest ecosystem. The beneficial microbes are considered as bio-fertilizers or bio-inoculants. They can make a significant contribution towards production of high quality seedlings and better plantations which will help greening wastelands of the country (Mohan *et al*., 2011). Research works were carried out in different forest ecosystems in South India and various VAM fungi were isolated, identified and listed for efficacy on growth improvement in nurseries and field (Mohan *et al.,* 2007; Munusamy *et al*., 2010; Tamil Selvi *et al.,* 2010; Revathi *et al*., 2013; Sreedhar and Mohan, 2014). Towards these goals, attempt was made and the institute has developed a VAM bio-fertilizer product and named as **"IFGTB – Tree Growth Booster (VAM Bio-fertilizer)"**. The product was released by the then Hon'ble Minister for Environment and Forests, Govt. of India during "Tree Growers Mela-2012" The products is being supplied to various end users from time to time. It helps to strengthen seedlings to withstand dry land conditions and support the Trees Outside Forests (ToF) and Tree Cultivation in Private Lands (TCPL) efforts, thereby promoting wood based entrepreneurs of the country.

Special Features of VAM bio-fertilizer product

- Enhances plant / tree growth through increased uptake of Phosphorus, Sulphur, Calcium and Zinc.
- Recommended for various tree crops at the time of raising seedlings in nursery and planting in the field/ plantation.
- Restores natural soil fertility and improves soil health.
- Provides protection to plants against drought and some soil or root-borne diseases and also improves other rhizosphere beneficial microorganisms by synergistic interaction.
- Components in Integrated Nutrient Management. It can be mixed with other organic manures like farmyard manure, vermicompost, leafy compost, etc.
- It is compatible with all other bio-fertilizers like *Azospirillum, Azotobacter, Rhizobium, Frankia,* Phosphobacteria and Potash mobilizer.
- Sustainability in production and Eco-friendly.

METHODS OF APPLICATION OF VAM BIO FERTILIZER

1) Layering method

In this method, VAM bio-fertilizer should be applied in the form of layer or pad below the seed in nursery beds. It ensures the colonization of VAM fungi in roots immediately after seed germination, because the developing roots will penetrate in to the VAM bio-fertilizer. 3-5 gm of VAM bio-fertilizer (viable and healthy) per poly bag/root trainer can be added to

Tree Growth Booster – (VAM Bio-fertilizer) product developed at IFGTB, Coimbatore

the size of the containers.

(2) Banding or Side Dressing Method

VAM bio-fertilizer can also be banded or side dressed next to the seeds or seedlings. This method is effective, when VAM bio-fertilizer quantity is limited. For best results, bands should be placed in the area of root proliferation usually about 3-5 cm from seeds or seedlings.

(3) Mixing VAM bio-fertilizer with nursery potting mixture

This method is quite close to natural conditions. In this case, entire VAM bio-fertilizer is thoroughly mixed with nursery potting mixture and the population of inoculated soil is maintained close to the population of the VAM fungi existing in nature.

Cost of VAM bio-fertilizer: Rs. 100/ per Kg

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Rediscovering Teak Natural Populations and Tracing Progenitors

Natural populations in plants are progenitor reservoirs, managing these in pristine condition could be pivotal to steer effective domestication strategies (Fig. 1). A well demarcated population within the natural distribution range of a species will be of immense support to the ensuing needs of breeding programs of native trees such as teak in posterity. In this article we trace the importance and implication of early flowering on wood annual increment with reference to teak. Canal Bank Teak Planting (CBTP) is a silviculture method unique to the Cauvery delta region of Tamilnadu. Canal irrigation method with bunds over five meters high has been in practise over centuries that are traceable to the later Cholas period.

Growing teak along canal banks was innovated during the mid-fifties. It continues to be one of the high economic returning silviculture systems within our Indian forestry scenario. With over 4.0 meters depth of calcium enriched alluvium as topsoil and almost year-round fertigation, CBTP happens to be one of the most productive naturalised environments in the domestication history of teak.

Fig. 1. Documenting a natural tree in Mundanthurai

However, recently lowering of wood increment and prevalence of trunk water blisters are widely noted within the CBTP system. In most plantations developed in the 1980s onset of first flowering happens within a period 5-6 years of planting. In traditional teak planting flowering is normally noted after 15 years within teak block plantations. It is of common knowledge that, flowering leads to loss of apical dominance and thus retards height. Eventually this also implicates wood increments in girth and lowers the pace of CAI and MAI. In our recent survey at the Karaikal region we noted CBTP to exhibit these signs very prominently. Trees in this location vary 10-12 metres in height and 120 - 140 cm in girth after a growth span of 15-20 years. The wood increment appears to be poor for the given site conditions. The reasons for growth retardation are attributed to the quality of

Fig. 2. Teak nursery at SFRI, Kolapakkam showing varying growth rates (Left – Walayar population; Right – Attapady)

planting material deployed within the region. Seeds used as propagules to these plantations were collected from canal bank plantations of the neighbouring Tiruvarur and Nagapattinam districts. It is presumable that large plantation targets in the region would have forced managers to deploy locally available CBTP seeds.

Reproductive processes of teak under wild and canal bank conditions are diametrically different. In the wild, reproductive effort and output is scanty and bio-economical. On the contrary, the canal bank with its fertigated environment happens to reproduce throughout the year. With extended flowering duration and increased inflorescence sizes, related selfing seems inevitable under CBTP conditions. These seeds that are lesser outcrossed seem to have packaged early flowering. Thus in future deploying seeds collected from CBTP needs to be discouraged and strategies should be framed for deploying seeds from natural populations.

In order to meet the said situation, recently, IFGTB and Tamilnadu Forest Department have initiated a collaborative project on teak seed source matching. This work aims to strengthen the process of deploying seeds from natural populations. Reconnaissance surveys were initiated within the teak natural populations at Sathyamangalam, Kalakkad, Mundanthurai and Walayar regions. About forty trees in each of the sites have been demarcated. Reproductive processes such as fitness and success ratios are being quantified in these populations. We find flowers in May - June in most populations and fruits mature by late January; however in the Kalakkad population flowering is initiated by October and fruit maturation extends up to early May. In terms of nursery performance, Walayar population with its large leaves and heavy rootstocks was found to be the best (Fig. 2). Provenance resource stands and linear plots under CTBP are to be developed from these resources within the research stations across the states.

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Recent literature on FGRs & TIP

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Upcoming Events

Event	:	Precision Forestry 2017: Producing more from less. Towards Optimising Value in the Bio-economy from Data Driven Decisions
Venue	:	Wallenberg Research Centre, Stellenbosch University, South Africa
Date	:	February 28 - 02 March 2017
Conference details	:	http://conferences.sun.ac.za/index.php/pf/2017

Event	:	Phytophthora in Forests and Natural Ecosystems
Venue	:	Sapa, Vietnam
Date	:	19-25 March 2017
Conference website	:	http://www.iufrophytophthora2017.org/

Event	:	Green infrastructure: Nature-based solutions for sustainable and resilient cities
Venue	:	Orvieto, Italy
Date	:	4 – 7 April 2017
Conference website	:	http://www.greeninurbs.com/finalconference/

Event	:	Sustainable restoration of Mediterranean forests- Analysis and perspective within the context of bio-based economy development under global changes
Venue	:	Palermo, Italy
Date	:	19-21 April 2017
Registration details	:	https://www.palermocongress2017.com/

Event	:	IUFRO Conference on Invasive Forest Pathogens & Implications for Biology & Policy
Venue	:	Niagara Falls, Ontario, Canada
Date	:	07-11 May 2017
Conference details	:	http://www.cif-ifc.org/iufroworkingparty2017/

ABOUT IFGTB

Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore is a National Research Institute under the Indian Council of Forestry Research and Education. IFGTB envisions a wood secure society. The Institute primarily aims to carry out research to improve productivity of forest tree species through conventional breeding programmes and biotechnological interventions. The major areas of research include tree improvement , breeding, planting stock improvement, marker assisted selection, genomics, clonal propagation, agroforestry systems, climate change research, integrated disease and pest management, seed handling and testing, eco restoration and conservation.

ABOUT ENVIS

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Details may be sent to: ifgtb@envis.nic.in.

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