ISSN: 2394-7543

■ Volume 2 Number 2
■ A Quarterly Issue
■ September 2015

ENVIS Newsletter
Forest Genetic Resources & Tree Improvement

VAN VIGYAN

INSTITUTE OF FOREST GENETICS AND TREE BREEDING

(Indian Council of Forestry Research and Education)

From the Director's Desk

We, at the Institute have been carrying out focussed research providing quality education, capacity building support and training to strengthen the field of forestry science. Research projects are taken up following deliberations with stakeholders, need based and best fits into the mandate of the Institute. This Institute has been continually providing solutions to the demands of tree growers. IFGTB supports good practices in tree cultivation, through genetics and tree breeding, biotechnology, soil health management, forest health management bio-manure application and other frontier technologies. I am sure IFGTB would continue to take up many more challenges and provide needy solutions for the cause of forestry in the country.

R.S. Prashanth
Director

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Know Your Trees - *Shorea robusta* Gaertn.f. (Sal)

Distribution and Habitat

Shorea robusta Gaertn.f. (Dipterocarpaceae) is a large deciduous tree dominating the Sal forests of south Asia. Native to Indian subcontinent, geographically the tree species extends from the southern slopes and lower foothills of the Himalayas to plains and valleys in India, Nepal, Bangladesh, Myanmar and South China. On a global scale, the natural range of Sal falls between 20-30° N latitude and 75-95° E longitude. According to Champion and Seth (1968a), Sal forests in India can be observed from Uttarakhand in the north to Andhra Pradesh in south and Tripura in East. In these regions, Sal forests occur gregariously and occupy almost 13% of the total forest area of. This species occurs in plains at altitudes as low as few metres above mean sea level (MSL) to 1500 m above MSL. However at higher elevations, *i.e.,* more than 1000 m, the individuals are found isolated, scattered and sometimes mixed with Chir pine (*Pinus roxburghii*).

The tree prefers the habitat of both moist and dry deciduous forests and to an extend the moist evergreen forests. Sal forests generally occur in association with other trees based on locations, climate and interspecific exchanges (Chitale and Behera, 2012). The major associated species of Sal reported in UP region are *Terminalia alata, Syzygium cumini, Anogeissus latifolia* and *Adina cordifolia.* It should be noted that in natural forests, Sal forms distinct communities along with its associates, exhibiting high genetic richness. The tree grows in a wide range of soils from alluvial to laterite. It thrives well in moist sandy loam soil with a pH slightly acidic to neutral (pH 5.1 to 6.8). The tree does not tolerate waterlogging and also cannot be spotted in riparian vegetation. The mean annual temperature of Sal forests ranges between 22-27° C and mean annual rainfall is between 1000-3000 mm.

Botanical Description

Shorea robusta is a moderate- to slow-growing, large deciduous or semi-evergreen tree that can grow up to 40-50 m high. The bark is dark brown, thick, longitudinally furrowed and provides effective protection against fire. The bole is clear, straight and cylindrical. Epicormic shoots are often spotted on tree trunk. Leaves are simple, ovate-oblong in shape, measure 7-20 X 4-12 cm with cordate or rounded base. They are leathery-in-texture, glabrous, shiny and short acuminate at the apex. Petioles are prominent, 2-2.5 cm long and stipules falcate, 7-8 mm long. Flowers are borne in axillary panicles, sub-sessile and fragrant. Sepals 5, ovate-triangular, measure 2 mm long and yellowish pubescent. Petals oblong-lanceolate, 1-1.5 cm long, yellow or cream coloured. Stamens are many (usually 35 and arranged compactly in three whorls) and are shorter than petals. Anthers are linear, measure about 1 mm in length and pilose (bears long soft hairs). Style is long with tridenticulate stigma. Ovary is pubescent and trilocular, each containing 2 ovules. Fruit is typical 'Samara' (winged seed) with 5 spathulate wings. Seeds are ovoid, measure 8-10 mm long and are wind-dispersed.

Reproductive Biology and Breeding System

It belongs to the category of trees that exhibit massive flowering when the trees are bare of leaves. The tree starts to bloom during late February and continues till mid April, comprising a peak flowering period of 7-15 days. Flowers are hermaphroditic, dichogamous and strongly protogyny (maturity of pistils precedes stamens) and lack nectar. The corolla is an inverted bowl structure. Each petal tapers down, recurve at end faces upward. Each anther produces approximately 1500-2000 pollens and their viability lasts for more than two days. Similarly the stigma receptivity also prolongs for about 50 hours. Nearly 70% of flowers remain open during light hours and remaining 30% during dark hours of a day (Atluri *et al.,* 2004). Under natural pollination, fruit set is low and mostly only one seed is observed per fruit with 6 ovules. Fruits take 5-6 weeks for full maturation. The persistent 5 sepals elongate further to form wings of fruit. Of the 5 sepals, 3 expand to form wings and are larger than the other 2 sepals. The fruit wall is free from sepals, woody, with a thin inner membranous lining invaginated into the folds of cotyledons and split into two parts at the apex. Each fruit weighs 1.41-1.75 gm and 1.18- gm with and without wings respectively.

S. robusta in full bloom

Unlike other Dipterocarp members, *S. robusta* is anemophilous (pollination by wind) exhibiting an explosive pollen release mechanism. This is highly supported by several characteristic features of wind

pollination such as copious pollen, release in air with high concentration, long viability period and prolonged stigma receptivity. Control pollination experiments by Atluri *et al.* (2004) indicate that this species is adapted to a mixed-mating system, thereby reflecting a high evolutionary significance. However, apomixis is not observed.

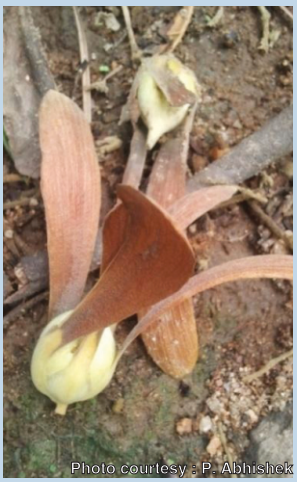
Seed Collection, Processing and Nursery Techniques

Sal seeds mature during mid of May to 1st week of June depending on locations. Strong wind aids in bumper fall of seeds towards the end of fruit maturation. During this period, seeds are generally collected forenoon, owing to unexpected storm or rainfall in the afternoon. The first step involved in seed processing is the de-winging of Sal seeds. Two major methods are generally followed for this purpose. In the first method, complete dried seeds are beaten on plain hard ground with a wooden stick in order to break the wings. The round seed pods with shell get separated in this process. This method is highly recommended for manual collection since the quality and nature of kernels are not changed. In the second method, the seeds spread are lighted up with fire. With a controlled and light fire, the wings are burnt. The round seedpods with shell and cover remain undamaged. Though this process is easy for de-winging, strong fire may cause damage to seed, particularly its oil content. Later the collected shells are subjected to pressure by a roller in order to break the pods and recover the kernel. Kernel, the final processed seed of Sal is kept dry or in sun for few hours and is ready for usage.

Seeds germinate in nursery under warm and moist conditions in 7-10 days after sowing. The root to shoot ratio is very high in *S. robusta.* At initial growth, Sal seedlings have shoot to root ratio of 3:1 and after five months it is 6:1. Usually such root coiling may cause damages to root. Hence in order to prevent root damage, germinating radicals are carefully transferred into potting mixture in poly bags. In addition, to protect the primary roots, ploy bags are cut open in bottom end and pasted with clay to keep the pot mixture intact. Later poly bags are kept over racks, few feet above the ground to facilitate aerial pruning of the roots. The seedlings are maintained in moisture and watered in regular intervals once-a-day from September and twice-a-day from December. In one year period, the saplings reach a height of 30 to 60 cm and are ready for planting at the end of rainy season.

Harvested seeds of Sal

Seed vigour and Germination



Winged fruit of Sal

Sal seeds shed from parent trees at a high moisture content of 42-50%. The recalcitrant nature of Sal seeds excludes all traditional methods of storage. Also there is no dormant or resting period for the seeds and they germinate soon after they mature. The recalcitrant seeds possess a very short viable period. Freshly collected Sal seeds lose their viability in just 6-7 days after harvest when stored at ambient or at 15° C. However during the viability period, seeds exhibit almost 100% germination. Chaitanya and Naithani (1998) observed that Sal seeds when treated with 10 ppm kinetin (maintained at 15° C) showed 100% germination up to 10 days compared with 3 days in controls. Moreover at similar conditions the viability can be made extended up to 35 days, but the germination is reduced to 20%. This prolonged viability is attributed to reducing the loss of seed leachates and enhancing superoxide dismutase activity by the kinetin.

Silviculture Management

Plantation efforts of *S. robusta* in India dates back to 19th century from a report of Sal plantation raised in 1860 at Barielly in Uttar Pradesh. Around 1890, *taungya* systems (a system in which villagers are provided the right to cultivate agricultural crops at early stages of forest plantation establishment) were started in West Bengal and UP. This system is practised till now, but not on a larger scale as clear-felling is highly receded. Efforts are continuing in India since 1900 to develop relevant silvicultural systems for management of *S. robusta.* Most of the management practices were oriented more towards

Sal regeneration (Troup, 1986; Tewari, 1995). Sal forests are being managed under both high forest and coppice system (Troup, 1952; Champion and Seth, 1968b). Selection, clear-felling and shelter-wood systems are practised under high forest systems. On the other hand, methods such as simple coppice, coppice-with-standards, coppice-with-reserves and selection coppice are practised under coppice systems. At several instances, improvement felling and climber cutting are being carried out to improve stand development.

A *Shorea robusta* plantation at the stage of flushing

Tewari (1995) has clearly indicated that all the silvicultural operations in Sal forest focus on Sal timber, with few exceptions in which trees of other species yielding non-timber products and fruits are retained. Coppice-with-reserves is practised in Sal forests that exist close to forest settlement areas, where a great demand prevails for poles, fuelwood, reaper wood, fodder, etc. Thus coppice systems of Sal forests in India are mainly found to fulfil major need of small- to medium-sized timber, poles, fuel and grazing. Coppice-with-standard system is used both in pure as well as mixed Sal forests nearer to cultivable land. These forests are generally managed under a rotation of 40-60 years and serve several purposes such as timber, fuelwood, fodder and grazing. The silvicultural operations of Sal forests focus on several benefits such as supply of intermittent products, creation of area for agroforestry and finally clean management of Sal trees. However, further efforts are required to plan and develop the silvicultural regions that will focus not only on timber, but also on other valuable diverse products obtained from Sal forests.

Agroforestry

In Assam region, artificial regeneration of Sal is practised in combination with several crops such as upland rice, maize, sesame and mustard. The species also exhibits good results when cultivated in mixed plantation with teak. In Madhupur National Park area of Bangladesh, banana-based agroforestry system is widely practised in degraded Sal forest areas. Similarly, farmers follow traditional ways to cultivate and harvest several other crops such as pineapple, papaya, lemon, etc. under participatory approach towards forest management and conservation. Though growers benefit from this agroforestry system, excessive application of fertilizers, pesticides and growth hormones has changed the soil properties thereby causing negative impacts on Sal forest biodiversity.

Growth and Yield

In general, Sal is a moderate-to-slow-growing tree. It regenerates through seed origin as well as by coppicing. Sprouting of young shoots from root suckers is also very common. It has been observed that trees of both coppice and seed origin produce fertile seeds, with no differences in their seedling vigour (Troup, 1986). Earlier workers on Sal growth (Champion ad Seth, 1968b; Kayastha, 1985) clearly stated that *S. robusta* is a light-demanding species, in particular during the early developmental stages. The carbon accumulation efficiency in above-ground parts of young Sal forests was higher (10.1 $t^{-1}ha^{-1}year^{-1}$) than the old-growth forests (Rana *et al.,* 1989). According to a report by Misra (1969), greater dry matter accumulation occurs between 30-50 years of age. Quantification studies in Sal forest had successfully utilized several parameters such as diameter at breast height (DBH), height, basal area and stem volume as good indicators of net productivity.

The tree exhibits faster growth during the young stage and reaches a height of up to 6 m at the age of 5-6 years. First thinning is done after 5 years of planting, followed by successive thinning in 5-10 years interval. In case of coppice regeneration a rotation of 25-35 years is practised, while it is 80-150 years for high forest management.

Major Pests and Diseases

The most destructive infestation caused to *S. robusta* is by the insect *Hoplocerambix spinicornis,* popularly known as Sal borer. The larva of this insect tunnels through the bark, sapwood and finally the heartwood, causing tree death. The pest is so harmful that it kills the tree silently without earlier symptoms, finally leaving sawdust indications at tree stumps and withering of branches from the top. Die-back of Sal seedlings were also reported due to attack of nematodes and root borer such as *Pammene*

theristhis. The major fungal diseases include those caused by *Polyporus shorea* and *P. gilvus.* Other than these, Mehrotra (2001) reported two fungal species namely *Cylindrocladium floridanum* and *C. scoparium* causing leaf spot and blight respectively in Sal. The semi-parasite *Loranthus scurrula* can also cause incremental losses.

Uses

Sal is highly valued for its timber. Its heartwood is hard, heavy and dark reddish-in-colour. The wood is highly durable and resistant to termite attack. The wood grain is strongly spiralled and structured coarsely. Though the wood is easy to saw, the high resin content makes it difficult to plane and turn. Rarely, it has tendency to split when driven by nails. During the past few decades, Sal forests witnessed huge deforestation as the wood was chiefly used for making railway sleepers, ship-building and other construction purposes in our country. The wood is also used for poles, railway ties and posts, household interiors as window frames, floors and for many other applications.

Plates made from Sal leaves

Besides serving as a potential source of timber, Sal also yields a number of non-timber forest products. It supports rural livelihood by providing cattle fodder (Gautam and Devkota, 1999), leaves for plate and cup-making (Rajan, 1995), seeds for oil (Sharma, 1981) and tannin and gum from bark (Karnik and Sharma, 1968). The tree yields an oleoresin popularly known as 'Sal Dammar'. It is used as incense and also in paints/varnishes, and for caulking boats. Sal leaves are fed to *Antheraea mylitta,* a tasar silk-producing worm. Twigs are used as tooth-sticks. Seeds are consumed after roasting. Evidences are there that the plant is used as a famine food and still in some parts of India Sal seeds are ground into coarse flour and used in bread-making. Moreover, the associates of Sal are known to yield edible fruits, fodder and compost, fibres, medicinal values, grass, brooms and other products based on species composition (Upadhyay, 1992; Webb and Sah, 2003).

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Selection of Candidate Plus Trees (CPTs) of Teak in the Canal Banks of Delta Districts in Tamilnadu

Teak was introduced to Cauvery Deltaic Region by the Europeans. Teak stumps from Malabar were planted in Korayar head, PWD office campus at the time of its construction. It's superior performance in the rich alluvial soil paved way for taking up massive Teak Plantation in the region. An 80 year old teak tree raised at Koraiyar Head, near Needamangalam, by an Engineer of the PWD caught the eye of late V.S.Krishnaswamy, IFS, the then CCF way back in 1950. The tree measured nearly 270 cm in girth. The girth of this tree and many other such trees raised in the same area indicated that they were better in quality than even the first quality teak trees in Malabar and proved that teak is successfully grown in the plains of Thanjavur which received an annual rainfall of 700 to 1100 mm.

This plantation inspired him to create Teak Plantations in Tanjore District over large areas. Today Teak avenues along the River and Canal banks have become part of the landscape of the delta. With more than 9000 Ha of teak plantation in the district, Tamilnadu Forest Department is the largest teak grower in the form canal plantations and there is scope for further extension of the area. The first teak plantation is dedicated to the memory of the Engineer who was the visionary for introducing teak and to Mr. V.S.Krishnasamy who followed it up with vigour and perseverance.

Canal Bank teak plantations have their own yield tables are of high demand as reflected by the state forest timber depots within the region. This is a unique teak forestry system in the country. The Tamil Nadu Forest Department has been actively involved in improvement programme of teak. Seed Orchards, Clonal Orchards, Seed Production Areas, Seed Stands and Germplasm Bank for Teak have been established in the State for this Genetic resource. Seeds are being collected and supplied for establishing large scale plantations along the canals. It has been observed that seeds collected from other localities not germinate or grow in the deltaic region as expected. To overcome this problem and to conserve the Genetic Resources available in the Deltaic Region the Department has identified CPT's in the region which has adapted to the soil. Seeds collected from this particular Agro Climatic Zone are now being distributed within the zone to meet the requirements of quality planting material (QPM).

This is the first time, an agro climatic zone specific selection of FGR is being carried out for production of QPM. The work has been initiated along the Canal Banks of Thanjavur, Tiruvarur, Nagapattinam and Kumbakonam.

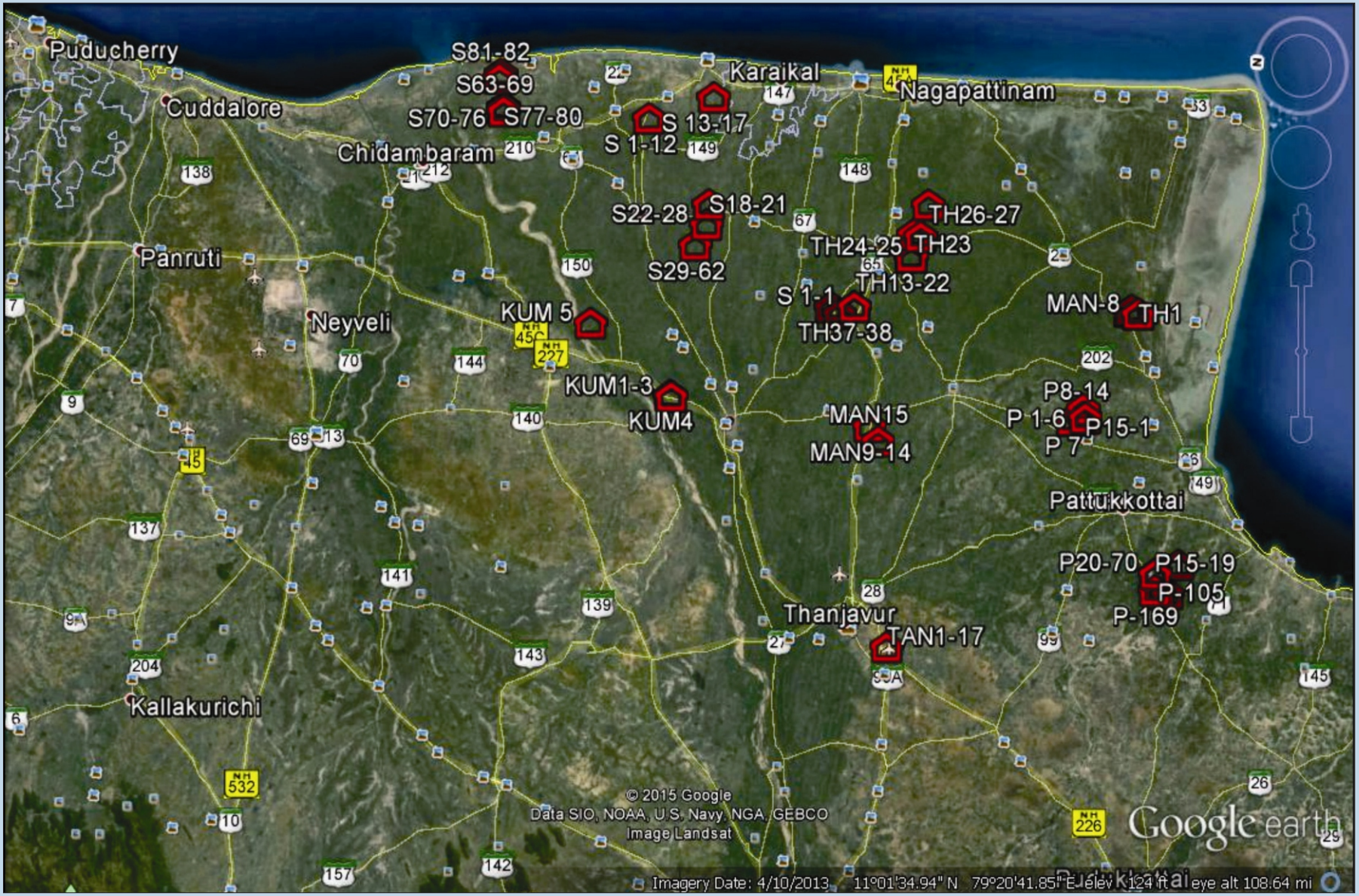
Since selection of CPTs is the first step towards any tree breeding programme, an experienced Technical officer Mr. Angamuthu, Retd Range Officer and his team spent almost two months surveying the entire belt of canal plantations to identify the CPTs. CPT's were selected from population aged 80-85 years.

Criteria for selection of teak CPTs

The parameters for genetic evaluation for selection of Candidate Plus Trees in Tamil Nadu are as follows

I. Straight and clear bole
ii. Height and girth
iii. Crown spread and branching pattern
iv. Resistance to disease and pest attack

Geo-informatics Map of Teak CPTs in Canal Banks, Trichy circle



Teak CPT-3, Sathiyavanan T.A.P in Sirkali Range

Teak CPT-4, Nadupadukai in Thanjavur Range

Teak CPT-14, Puthur vaikal in Mannarkudi Range

Teak CPT-20, Pandaiyar in Thiruvarur Range

Teak CPT-26, Valasakkadu vaikal in Pattukkottai Range

Teak CPT- 89, Pudupattinam vaikal in Pattukkottai Range

Selection of CPT's in Teak at Canal Banks

S. No.	Name of the District	Identified trees (in nos.)
1.	Tanjavur	17
2.	Kumbakonam	5
3	Pattukottai	300
4	Mannakudi	15
5	Nagapattinam Sirkali Forest	104
6	Tiruvarur	38
	TOTAL	**479**

v. Drought tolerance
vi. Absence of fluting and buttressing
vii. Capable of producing well-filled viable seeds

The Tamil Nadu Forest Department has been a pioneer in seed collection and supply, having established India's first 'Tree Seed Centre' during 1974. Seeds are regularly collected from genetically superior trees and distributed to Forest Departments, Institutions and public. In 2014-2015, a tonne of seeds were collected from the selected CPTs canal Teak Plantation, cleaned, graded in specific gravity separator into four grades (Grade I, II, III & IV) tested for germination status and distributed.

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Recent literature on FGRs & TIP

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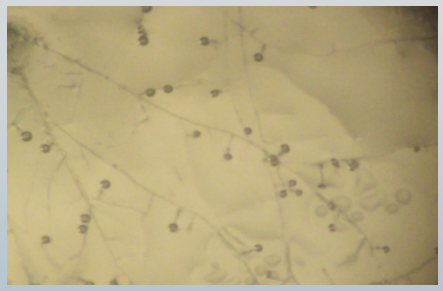
N fixer- superior growth promoting strains of *Frankia* for *Casuarina equisetifolia* and *C. junghuhniana*

Casuarina equisetifolia Forst and *C. junghuhniana* Miq. are being cultivated mostly in southern part of India mainly for pulp and paper production and scaffolding for construction. These tree crops fix atmospheric Nitrogen (N) through th symbiotic relationship with *Frankia,* a soil bacterium of actinomycete group. The roots of *C. equisetifolia* and *C. junghuhniana* normally produce root nodules where these bacteria fix atmospheric N which is an essential nutrient for all metabolic activities. Farmers of Pondicherry and Tamilnadu cultivate Casuarinas on a large scale as a means of livelihood. To create awareness among casuarinas growers, ten strains of *Frankia* isolated and cultured in artificial medium were inoculated in the seedlings of *C. equisetifolia* and *C. junghuhniana* at nursery conditions and planted in a Farmer's field at Karaikal, Pondicherry as a demonstration trial. Inoculated Casuarinas showed remarkable growth improvement over uninoculated seedlings under field conditions. Rooted stem cuttings inoculated with *Frankia* also showed 3 times higher growth and biomass than control uninoculated clones thus suggesting that application of *Frankia* for growth improvement of Casuarinas is an alternate to use of chemical fertilizers. A consortium of different strains of Frankia - N fixer was developed and is being distributed for the benefit of Casuarina growers.



Frankia

N fixer (Product)

Frankia inoculated Casuarina tree showing root nodules at the basal region of the trees

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Upcoming Events

Event	:	Global Bioeconomy Summit 2015
Venue	:	Berlin Congress Centre, Berlin, Germany
Date	:	25-26 November 2015
Abstract deadline	:	-
Registration deadline	:	Open now (http://gbs2015.com/home/)

Event	:	The 3rd ACMECS Bioenergy Workshop
Venue	:	Ubon Ratchathani, Thailand
Date	:	8-11 December 2015
Abstract deadline	:	-
Registration deadline	:	10 Nov. 2015 (http://kubiomass.kapi.ku.ac.th/index.php/en/)

Event	:	Plant Epigenetics: From Genotype to Phenotype (B1)
Venue	:	Taos, New Mexico, USA
Date	:	15-19 February 2016
Abstract deadline	:	16 November 2015
Registration deadline	:	15 December 2015 (http://www.keystonesymposia.org/16B1)

Event	:	Indian Ecological Society International Conference 2016: Natural Resource Management - Ecological Perspective
Venue	:	Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu, India
Date	:	18-20 February 2016
Full paper deadline	:	30 November 2015
Registration deadline	:	Open now (http://iesconf.com/)

Event	:	Forest Genetics for Productivity Conference
Venue	:	Rotorua, New Zealand
Date	:	14-18 March 2016
Abstract deadline	:	30 October 2015
Registration deadline	:	Open now (http://www.fgpc2016.nz/fgp16)

ENVIS ACTIVITIES

Customised Hands-on Bhuvan Training Programme for ENVIS Centres

Shri. T. Vamadevan, Information Officer from ENVIS Centre at IFGTB attended a two-days training on Bhuvan portal conducted by National Remote Sensing Centre (NRSC) at Hyderabad. The training was conducted on 28 & 29 July 2015 and 23 ENVIS Centres from various parts of our country participated in the event.

The event was inaugurated by NRSC Director Dr V.K. Dadhwal, Shri. Kannan IES, Economic Adviser, MOEF & CC. Dr P.G. Diwakar and other staff from NRSC Training and Education Division co-ordinated the programme. NRSC team gave hands-on training on Bhuvan ISRO's Geoportal overview, applications, data visualization, creation, Open layers overview, Bhuvan framework and QGIS data creation and visualization.

International Day of the World's Indigenous people

ENVIS Centre at IFGTB observed the "International Day of the World's Indigenous People" by organizing an event for University students to share the tribal traditional knowledge related to Forest Genetic Resources (FGR). A field visit was arranged for the post graduate students from Department of Botany, Bharathiar University at Coimbatore to Seengapahty, a tribal settlement situated in the foot of Western Ghats.

The Co-ordinator of ENVIS, Dr Kannan C.S. Warrier in his welcome speech highlighted the significance of ENVIS to the participants. During the field visit, students had an open interaction with tribal people and gathered information on tribal traditions of FGR utilization and conservation. The floristic diversity and taxonomic features of important tree species of the area were explained by Dr C. Kunhikannan, Head, Biodiversity Division of IFGTB.

International Day for the Preservation of the Ozone Layer

In view of the significance of Ozone Layer in protecting our planet from harmful ultraviolet radiations of sun, the United Nations observes 16th September as "International Day for the Preservation of the Ozone Layer". IFGTB-ENVIS celebrates this Day by releasing a poster on facts related to ozone layer in order to promote awareness on protecting this fragile layer. The Director of IFGTB Shri. R.S. Prashanth released the poster in presence of Group Co-ordinator Research, IFGTB and all Heads of various Divisions. This year's theme is '30 years of healing the ozone together', supported by the slogan, "Ozone: All there is between you and UV." Dr Kannan C.S. Warrier, Co-ordinator ENVIS, delivered the vote of thanks. On the occasion, the third issue of the newsletter (*Van Vigyan*) was also released.

In continuation of the International Ozone Day celebrations, Dr Kannan C.S. Warrier, Scientist - E and Coordinator ENVIS delivered a lecture on "Ecological significance of conservation of sacred groves" at Sri Ramakrishna College for Women, Coimbatore on 16th September 2015. He highlighted on the difference in floristic composition and cultural values of

sacred groves in different states of India. Dr Warrier stressed on the need for a comprehensive study to obtain adequate and accurate information on the sacred groves for formulating appropriate conservation strategies.

Advisory Committee Meeting of the ENVIS Centre

The first advisory committee meeting of the ENVIS Centre on Forest Genetic Resources and Tree Improvement was held at IFGTB on 23.09.2015. Shri R.S. Prashanth, Director, IFGTB chaired the meeting. Dr B. Gurudev Singh, Group Coordinator (Research) was the Co-Chair. Shri I. Anwardeen, Conservator of Forests, Coimbatore Circle, Dr A. Balasubramanian, Professor, Tamil Nadu Agricultural University, Shri K. Devarajan President, Coimbatore District Herbal and Tree Growers Association and Shri Narayana Swamy Secretary, Coimbatore District Herbal and Tree Growers Association functioned as external experts. All Heads of Divisions of the Institute were internal members and Dr Kannan C.S. Warrier, Scientist E and Coordinator ENVIS functioned as the member secretary. At the outset, Shri R.S. Prashanth, Director, IFGTB welcomed the members of the advisory committee. He highlighted on the importance of the meeting. Dr Kannan C.S. Warrier, Coordinator ENVIS gave an introduction about the mandate of the ENVIS Centre and about its formulation. Dr V.N. Mutharaian, Programme Officer presented the activities carried out by the ENVIS Centre in detail. While appreciating the various activities carried out by the ENVIS centre, all the members provided valuable inputs for the road ahead. Detailed minutes were drawn based on their suggestions.

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

ENVIS established by the Government of India, in 1982 has been on providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. all over the country. It is a comprehensive decentralized information system on environment involving effective participation of institutions / organisations in the country actively engaged in work relating to different subject areas of environment. A large number of nodes, known as ENVIS Centres, have been established in the network to cover the broad subject areas of environment with a Focal Point in the Ministry of Environment & Forests.

INSTRUCTIONS TO CONTRIBUTORS

Dear Author/ Subscriber/ Contributor,

We invite contributions to the ENVIS Newsletter issues! The ENVIS Centre at IFGTB focuses on Forest Genetic Resources and Tree Improvement. It aims to act as a window for quality scientific publications and a forum for presenting your thinking on the challenges in the fields of FGRs and tree improvement. The ENVIS Newsletter, Van Vigyan, a quarterly publication, publishes original research articles, reviews, reports, research highlights, news-scan etc., related to the thematic area of the ENVIS Centre. Original research and review articles, notes, research and meeting reports are invited for the newsletter. Details of forthcoming conferences / seminars / symposia /trainings / workshops also will be considered for publication in the newsletter. Articles may be sent in Times New Roman (with font size 12) in double spacing with a maximum of 5-6 typed pages. Photographs/line drawings and graphs need to be of good quality with clarity for reproduction in the newsletter. Only electronic submission will be accepted.

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

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