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INSTITUTE OF FOREST GENETICS AND TREE BREEDING

(Indian Council of Forestry Research and Education)

From the Director's Desk

As per FAO, Forest Genetic Resources are the heritable materials maintained within and among trees and other woody plant species that are of actual or potential economic, environmental, scientific or societal value. Their conservation and sustainable management is therefore a must to ensure that present and future generations continue to benefit from forests and trees.

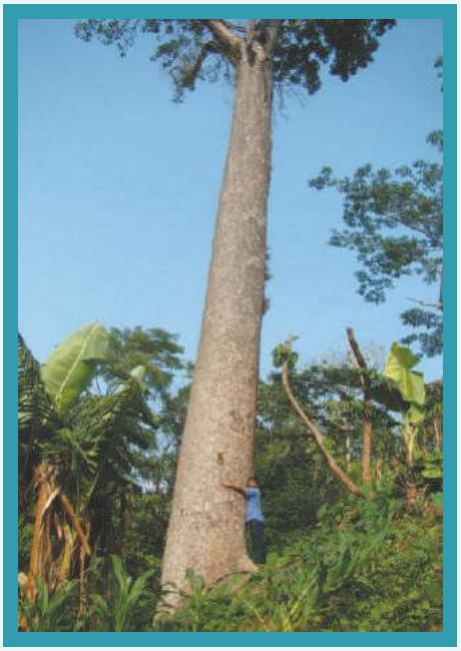
The ENVIS newsletter at IFGTB aims to enrich the readers' knowledge on the importance of forest genetic resources of our country. Starting from this newsletter, we will also be including a new section, which will provide detailed information on various tree species playing a significant role in food security and poverty alleviation.

I sincerely hope that the information provided in our newsletter would be of interest to tree researchers all over the country.

Mohit Gera
Director, IFGTB

In this issue

Know Your Trees - Magnolia champaca (L.) Baill. ex Pierre



Taxonomic classification

Kingdom	:	Plantae
Phylum	:	Tracheophyta
Class	:	Magnoliopsida
Order	:	Magnoliales
Family	:	Magnoliaceae
Genus	:	*Magnolia*
Species	:	*M. champaca* (L.) Baill. ex Pierre

Synonyms

Champaca michelia Noronha, *Magnolia membranacea* P. Parm., *Michelia aurantiaca* Wall., *Michelia blumei* Steud., *Michelia champaca* L., *Michelia euonymoides* Burm.f., *Michelia rheedei* Wight., *Michelia rufinervis* DC., *Michelia sericea* Pers., *Sampacca euonymoides* (Burm. F.) Kuntze, *Sampacca suaveolens* (Pers.) Kuntze

Common names

English : Joy perfume tree

India : Tita sopa (Assamese) Champa (Bengali, Hindi, Oriya, Punjabi, Urdu); Rae-champo (Gujarati); Sampige (Kannada); Pud champa (Konkani); Champakam (Malayalam); Leihao (Manipuri); Kud champa (Marathi); Ngiau (Mizo); Champaca (Sanskrit); Shenbagam (Tamil); Champangi (Telegu).

Introduction

Magnolia champaca is a well known tree species of family Magnoliaceae, native to Bangladesh, Cambodia, China, India, Indonesia, Laos, Myanmar, Nepal, Thailand and Vietnam. There are two varieties viz. *M. champaca* var. *pubinervia* and *M. champaca* var. *champaca*, both having distinct form and uses. However, in literature there is a mix-up of the description, in most of the cases. *M. champaca* var. *pubinervia* wood is greatly sought after for building and furniture and is naturally distributed in South East Asia, India and Bangladesh. In India it occurs in eastern sub- Himalayan zone, along the foothills. *M. champaca* var. *champaca* on the other hand occurs in Western Ghats, and is well known for its fragrant flowers, and is also commonly cultivated throughout the tropics in

the temples of Jains and Hindus. It is also reportedly introduced to other parts of India and Southeast Asia, including China (Khela, 2014). There is also *Magnolia* x *alba* with white flowers, considered to be a hybrid of *Magnolia champaca* and *M. montana*, found only in cultivation, in the tropical and subtropical regions of India and Southeast Asia, as an ornamental.

M. champaca var. *pubinervia* is valued for timber and is excellent for light furniture and indoors. It is a fairly fast growing tree, with a cylindrical, self-pruned straight bole. Wood is light to moderately hard, olive brown coloured, durable and takes good polish. The wood is highly esteemed for building and furniture. The properties are at least the same as teak (*Tectona grandis*). The tree can easily be cultivated and a mature tree can reach a height of more than 50 m and a diameter of 300 cm.

M. champaca var. champaca is well known for its fragrant flowers and is mostly cultivated especially in and around temples for the flowers, which are used in religious ceremonies. The flowers from the species are used to extract an essential oil which is one of the ingredients in the world's most expensive perfume "Joy". Recent pharmacological studies also indicate that the flower, bark and leaves of the species have huge potential in medicine.

Botanical description (Nooteboom, 1986)

Twigs (appressedly) pubescent, glabrescent. Stipules pubescent, adnate to petiole at least for one third of its length. Leaves spirally arranged, (long) elliptic or ovate, pubescent below especially on midrib and nerves, often glabrescent, 10-30 by 4-10 cm; acumen 7-13 (-25) mm; base cuneate to more often rounded; nerves in 14-23 pairs, intramarginal vein often hardly more prominent than fine reticulation. Petiole 14-36 (-40) mm. Brachyblast densely pubescent, (5-) 10-18 (-25) mm long; spathaceous bracts pubescent. Flowers light yellow becoming dark orange, axillary, rarely terminal, solitary, 3-4.6 cm long, 5-6.4 cm in diameter; tepals 15, 20-45 mm long. Stamens 6-8 mm, incl. the up to 1 mm connective appendage; carpels c. 30, the c. 3 mm long gynophores densely pubescent.

Key to the varieties (Nooteboom and Chalermglin, 2009)

a. *M. champaca* var. *champaca*: Leaves ovate with cuneate-attenuate base; the acumen often quite long. Petiole with a stipular scar up to shortly below its middle to up to its apex. Tree grows up to 30 m height and 50 cm diameter.

b. *M. champaca* var. *pubinervia* leaves more or less elliptic with cuneate to rounded base, the acumen often rather short, oblique. Petiole with a stipular scar from 0.3 up to 0.7 of its length. Tree grows up to 50 m height and 180 cm dia.

Silviculture of the species (Troup, 1921, 1975)

M. champaca var. *pubinervia* is an evergreen to semi-deciduous, tall, emergent canopy tree up to 50 m in height and 300 cm in diameter, found at an elevation ranging from 200 to 1600 m asl. In its natural habitat, the tree is ordinarily found in

regions where the absolute maximum shade temperature varies from 37^0 C to 47.5^0 C, the absolute minimum from 0^0 to 17^0 C and the normal rainfall from 2250-5000 mm or more. It is found at an altitude of 600-2000 m asl. It grows well under very moist conditions on deep, fertile, well drained, sandy loam soils.

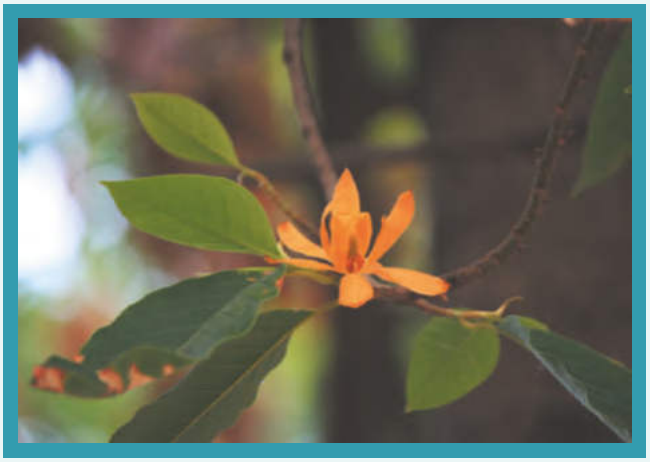
In India it is reported in various forest types as below, though its number might have diminished in many of these forests under anthropogenic pressure now:

(a) Assam valley tropical wet evergreen forest (1B/C1), in association with *Dipterocarpus macrocarpus, Shorea assamica, Mesua ferrea, Altingia excelsa, Artocarpus chaplasa, Amoora wallichii, Canarium* sp. etc.

(b) Assam valley plains semi-evergreen forest (2B/C1a)

(c) Eastern Sub-montane semi-evergreen forest (2B/C1b)

(d) Sub-Himalayan light alluvial semi-evergreen forest (2B/C1/1S1)



(e) Sub- Himalayan secondary wet mixed forest (2B/C1/2S3)

(f) Orissa tropical semi-evergreen forest (2B/C3) in association with the typical dominants of the various types.

(g) Eastern terai sal forest (3C/C1c), in association with *Shorea robusta* and other typical semi-evergreen and deciduous species.

(h) East-Himalayan sub-tropical wet hill forest (8B/C1), in association with *Schima wallichii, Castanopsis indica, Phoebe attenuata* etc.

(I) Naga Hills wet temperate forest (11B/C2) in association with *Magnolia, Manglietia, Quercus, Acer, Prunus, Alnus nepalensis, Betula alnoides* etc.

M. champaca var. *champaca* is found naturally in Western Ghats from Kanara to Kerala. Occasional trees are found in low and medium elevation evergreen forests, up to 2400 m. It is commonly cultivated throughout the tropics.

Phenology and Reproductive biology

In *M. champaca*, the annual growth in terms of elongation of the branches apices commonly consist of new apical buds being formed from the middle of February. The process of formation of new leaves and buds continues up to November. Leaf senescence is initiated from December and leaf fall continues up to the end of January. The old leaves abscise before the arrival of new leaves and the tree remains barren for nearly 15 to 20 days; therefore, it is of brevi-deciduous type (Borchert, 1999).

The flowers are protogynous and are pollinated by beetles which feed on the stigma, pollen nectar and secretion from the petals. In *M. champaca* var. *pubinervia* flowering begins from the first week of February up to March. The fruit formation takes place in April-June and fruit maturation takes place from July to September. After dehiscence it exposes red-oily arillated seeds that remain attached to the fruit. Magnolia follows alternate fruit bearing habit, but it varies with locations. Natural regeneration is poor due to dormancy of seed and seed deterioration during the dormancy period.

Plantation technique (Kundu, 2012)

Collection of seeds

M. champaca var. *pubinervia* follows alternate fruit bearing behaviour, and seed will not be available every year, in a location. The best time for fruit collection is when they turn greyish brown and start to dehisce exposing the soft, red pulp inside. Seeds should be collected

from mid-July to September, heaped in the shade for 2-3 days till they open completely and then the seeds should be removed by gentle beating and washing out the red pulp. The number of seeds per kg ranges from 8400 to 12000. In *M. champaca* var. *champaca* flowering starts in April and fruit ripening takes place from August to September.

Processing and handling

Fruits should be collected and transported in cloth or hessian sacks, and not in polythene bags, as they will get warm and mouldy very quickly, spoiling the seeds inside. It should always be stored in sacks in shady, cool, dry place and off the ground by placing on planks of wood, or by hanging them. As much as possible care should be taken to avoid damage of fruits, since fermentation will start among the damaged fruits. Depulping must be done before storage. It can be done manually by soaking the seeds in water and then rubbing the soft fruits together, or on wire net or hard cloth so that the flesh comes away. At the time of washing the light seeds that float on water can be discarded. Once cleaned, the seeds must be properly dried well in

shade and stored in air-tight metal containers to avoid rodent damage.

Seed Storage

Magnolia seed loses viability very rapidly. Seeds are orthodox and can tolerate desiccation to 4-5% moisture content and storage under freezing (-20°C) conditions. The seed viability can be maintained up to 6 months by storing at subzero temperature but germination drastically declines after this period. At ambient temperature of moderate cooling to 10°C seeds remain viable for about 6 months at any moisture content. However seeds can be viable for more than one and a half year in aerated moist storage at 5°C (Kundu, 2012).

Pre-treatment

Germination percentage is low when freshly collected seeds are sown. Seeds have physiological dormancy and pre-treatment with GA-3 500 ppm for 24 hours can improve the germination up to 80 %. Dormancy can also be overcome by cold stratification at 5-12°C.

Sowing and germination

Sand is the appropriate medium for initial raising of seedlings in mother bed. Seeds should be sown in mother beds immediately after the collection and cleaning (de-pulping) of fruits, either by broadcasting or in drills 8-10 cm apart, with a thin layer of earth sprinkled over the seeds. Nursery bed should be well drained and under shade. Seed should be either mixed with red lead or nursery bed should be covered with iron mesh to prevent the predation by rodents and birds.

Germination starts after 15 to 20 days of sowing and continues up to 45 days. Germination ranges from 20 to 70%. Seedlings should be transplanted to beds at a spacing of 10 cm or to polybag filled with 3:1 soil and compost, when they attain three- leaf stage and kept in shade at initial stage. Growth of the seedlings in the nursery is very fast and so watering should be controlled after germination. Seedlings become ready for planting in the field by the next rainy season.

Planting in the field

One year old seedlings are ready for planting. Seedlings from beds can be planted with a ball of earth. Stump planting is also reportedly successful. *M. champaca* prefers well drained and fertile soil and does not stand water logging. The species are very sensitive to fire and even large trees die after exposure to low ground fire. The seedling should be planted in a pit (45x45x45 cm) with basal application of 5 kg FYM. The spacing of 1.8 x 1.8 to 2.4 x 2.4 m is

generally adopted under monoculture plantation. Under the 1.8 x 1.8 m spacing first thinning is required in the 5th year. The first thinning should be fairly heavy (C to D grade) and subsequent thinning heavier (D grade). The dominant stems per hectare after the age of 20 years should be around 300 per hectare (Troup, 1975). Under mixed plantation *M. champaca* can be grown in alternate row with *Shorea assamica, Gmelina arborea, Schima* and other species. In Assam *M. champaca* is also occasionally planted along the border of tea garden. It is also seen planted along the road side in Assam. In heavy wind prone area field border/avenue plantation of the species is not desirable as top of the plant tends to break.

Pest and disease management

M. champaca is subject to attack by *Urostylis punctigera*, the champ bug, causing considerable damage in pure plantations. The nymphs suck the sap of newly formed leaves and tender shoots which ultimately wither. The adult sucks the petioles and green shoots, as also the main stem of the young tree. Because of its size and longer life, the adult causes more damage than the nymph. Spraying a suitable mixture, such as nicotine sulphate 1 kg and soap 1.8 kg in 450 liters of water is helpful for control of *Urostylis*. Biological control by *Pachyneuron pentatomivora*, a parasite or by *Calvia tricolor*, a predator or using red ant are possible.

Graphium doson (Common jay) and *G. agamemnon* (Tailed jay) caterpillars are also major defoliators both in nursery and field. They attack tender shoot and fresh leaves and cause heavy damage if unchecked, and the plants tend to become bushy. *Rhyncothrips champaceae*, another insect attacks the leaves resulting in dying off. *Podothrips* sp. causes galls in the stem and twigs of the plant (Nalini *et al*., 2015).

Among the diseases, *Phomopsis micheliae* attack causes leaf spot and *Prociphilus micheliae* causes leaf curling in trees. *Rhizoctonia solani* causes leaf spot and blight of seedlings in the nursery and can be controlled by sanitation and cultural practices.

Uses

M. champaca var. *pubinervia*

It is logged for its valuable timber. It has a

finely textured, light yellow to olive brown wood used for making furniture, cabinet, carvings, doors and windows, and general carpentry. It is straight grained and medium-fine-textured, lustrous with smooth feel. It is beautiful in its natural colour and can also be polished easily. The properties are the same as *Tectona grandis*. It has also been used for making cement-bonded wood wool board.

M. champaca var. *champaca*

It is known for its strongly fragrant yellow or white flowers and is used as an ornamental tree and for urban landscaping. Its flowers are also used for perfume and worn as hair decoration and room decoration. The flowers are used to make the world's most expensive perfume 'Joy'. The leaves are eaten by silkworms. Its leaves produce toxins which are poisonous to the rice fungus, *Pyricularia oryzae*. It also has ethnomedicinal values: a decoction of the bark and leaves is given after childbirth; the bark is used as a febrifuge. In Myanmar the flowers are used to treat leprosy and leaves used against colic. Its fatty oils extracted from the seeds show antibacterial activity. In addition to that the flower bud extract is useful in the treatment of diabetes and related complications. The tree is being used to reforest badly eroded areas in Java. In Thailand, it is commonly planted since very long time as temple tree.

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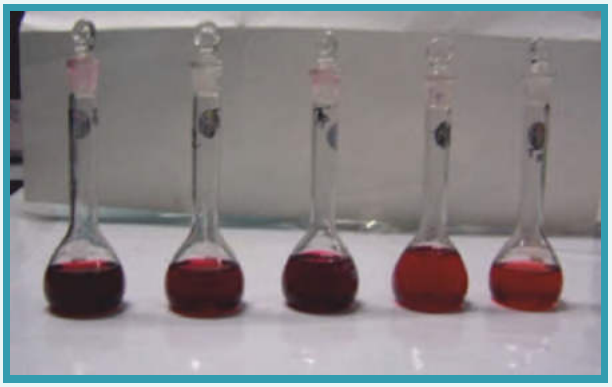
Tamarind - A Promising Genetic Resource

Tamarindus indica L. is a multipurpose tree species grown in backyards, roadsides, community lands, wasteland and agroforestry systems, (Gunasena and Hughes, 2000). The wood is used for making furniture, tool handles, charcoal and fuelwood. The leaves are an important source of food and herbal medicine and the edible pulp of ripe fruits are used as flavoring agent in soups, jams, chutneys, sauces, and juices (Ishola *et al.*, 1990). The fruit pulp is the richest natural source of tartaric acid (8 - 18%). It is the main acidulant used in the preparation of foods in India and other Asian countries. The seed kernel powder, an important material used in the sizing of textiles, paper, and jute. Fruit pulps used to prepare tamarind juice, concentrate, powder, pickles, and paste (Shankaracharya, 1998). The seeds are rich in protein, have several amino acids and are a cheap source of protein to alleviate protein malnutrition.

Conservation and Commercialization of Rare Tamarind Genetic Resources

Wide variation in tree growth, canopy size,



Extraction of Anthocyanin from different growth stages of red tamarind

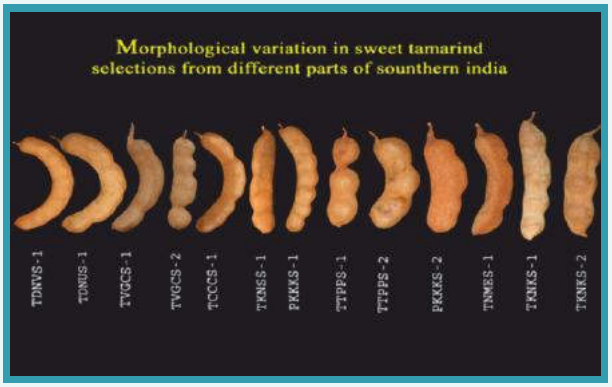
Color variation between unripe fruits of normal and red tamarind.

flowering pattern, fruit productivity, pulp colour and sweetness exists in tamarind. Based on the pulp colour tamarind has been delineated as red tamarind and brown tamarind. The red pulp colour in unripe fruits is due to the presence of anthocyanin present cell vacuoles which is a natural water soluble, nontoxic pigment. The high potential of red tamarind as biocolourant in food processing, pharmaceutical, brewery and confectionery industries to replace the use of carcinogenic inorganic colorants provide scope for large scale commercial utilization. Based on variation in acidity level in fruit pulp sweet and sour tamarind are recognized. The sweet tamarind pulp is rich in minerals and vitamins and used for the preparation of jam, jelly, candy, and chocolate. The red and sweet varieties are rare mutants with scattered distribution preventing their commercial utilization. In order to conserve and utilize these rare and valuable genetic resources, a research programme on Selection and conservation of Red and Sweet Tamarind have been implemented in the Institute of Forest Genetics and Tree Breeding.

Extensive surveys were carried out in Tamil Nadu, Karnataka, Andhra Pradesh, and Puducherry to identify and select red and sweet tamarind trees. Selected 47 red tamarind trees with unripe fruit pulp containing anthocyanin ranging from 123.00 mg/l to 246.90 mg/l in comparison with normal brown tamarind pulp contained no anthocyanin, similarly 30 sweet tamarind trees with pulp containing total sugar ranging from 30.50% to 48.60% as compared to 27.60% in widely grown variety PKM-1. The Thailand sweet tamarind varieties available in the market contains 68.30% of total sugar. The Institute of Genetics and Tree Breeding assembled 60 accessions of red and sweet tamarind in a germplasm bank at Kurumbapatti, Salem (District) in Tamil Nadu. This is the first initiative made to conserve these rare phenotypic variants of tamarind in the country. Bioprospecting of bio colors from red tamarind has been done and successfully integrated into the fruit jam.

Hybridization for Qualitative Improvement

Improving the qualitative and quantitative value of tamarind clones is possible through hybridization. The Institute of Forest Genetics and Tree Breeding initiated hybridization programme for qualitative improvement of high yielding tamarind clone. The main objective is to combine red colour (Anthocyanine) from red tamarind into high yielding tamarind clones. The



Variation in Fruit Morphometric Characers of Sweet Tamarind

full diallel matting design was followed for executing control hybridization (Zobel and Talbert, 1984). About nine high yielding clones of tamarind were selected from clonal assemblages at Theni and Vaigai Dam Flowers were emasculated using a clean fine tip forceps (from 15.00 hrs to 20.00 hrs) and red tamarind pollen was collected from red Jayamangalam clone. Flowers were dusted with red tamarind pollen with a dry paintbrush or needle from 6.00 hrs to 11.00 hrs on the next day. In apomictic treatments, the emasculated flowers were not dusted with pollen. In an inflorescence, only the treated flower was retained. In each clone, 100 flowers were operated per day per treatment and all treatments were repeated for seven days. Operated flowers were caged in paper covers (size of 12 cm x 7 cm) and tagged properly. Bags were removed on the seventh day for recording fruit setting. About 180 days after crossing fruits were harvested and seed extracted. Hybrid trails were established at State Forest Research Institute, Kolapakkam and Forest campus, Coimbatore, Tamil Nadu. The hybrid seedlings were planted in 10 x 10 m spacing in a randomized block design with four replications. The hybrid progenies initiated flowering and fruiting 6 years after planting. Among different combination of hybrid progenies, Vembrampattu 416 (VEP 416) x Red Jayamangalam (RJ 403) found to be superior in qualitative and quantitative traits.

Regulation of Flowering and Fruiting in Unproductive Orchards

The Tamarind plantations established by different stakeholders often encountered the problem of nonflowering, irregular flowering and fruit drop. It leads to low productivity and uncertainty to the farmer's income. The research experiments were conducted to evolve the suitable silviculture technique for improving flowering and fruiting of Tamarind orchard. The field experiment was carried out in 20 years old Tamarind plantation and about 30 different physical, chemical, cultural and growth regulator treatments were imposed in Tamarind plantation. Among different treatment imposed in the orchard canopy management (25% pruning), application of organic and inorganic manures (farmyard manure (25 kg/tree), urea (1kg/tree), SSP (0.5kg/tree) and MOP (1.5kg/tree)) and soil trenching of Cultar (3000ppm) followed by heavy irrigation for enhanced flowering and fruiting of unproductive Tamarind orchard.

Evaluation of Promising genotypes of Tamarind for Yield and Quality

Institute of Forest Genetics and Tree Breeding have evaluated the 175 clones in 7 clonal assemblages established by Tamil Nadu Forest Department for qualitative and quantitative traits and shortlisted 10 outstanding clones for multi-location testing. In order to broaden the genetic base of tamarind Germplasm new high yielding, selections were made in different parts of Tamil Nadu and the

elite genetic resources will be tested in multilocation for releasing of high yielding clones.

Future Prospects

- Systematic Germplasm collection from Center of origin and other tamarind growing areas.
- Selection tamarind trees with desirable characters like higher fruit yield, regular bearing habit and resistance to pest and disease
- Introduction of high yielding sweet tamarind from Thailand and Philippines
- Standardization of precision silviculture techniques for enhancing flowering and fruiting.
- Detailed investigation of taxonomic status of red and sweet tamarind
- Qualitative and quantative improvement through control hybridization and testing of hybrids
- Developing descriptors for tamarind germplasm
- Systematic tree improvement/breeding program with multi location testing of superior clones
- Identification of tamarind clones suited for degraded soil and waste land for rural employment generation and poverty allivation.

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Quality Planting Stock Production of high yielding Red and Sweet Tamarind through Approach Grafting

A. Mayavel
Institute of Forest Genetics and Tree Breeding
Coimbatore

ENVIS ACTIVITIES

WORLD SOIL DAY 2018

The ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore celebrated the World Soil Day on 5th December 2018. Dr.Rekha R. Warrier, Scientist - E welcomed the gathering and gave an overview of the World Soil Day 2018 theme viz "Be the Solution to Soil Pollution". Dr S.Murugesan, Group Coordinator Research gave opening remarks and discussed about the importance of soil. Dr.K.Kumaraswamy, Retd. Professor & Head, Dept. of Soil Science, Tamilnadu Agricultural University (TNAU), Coimbatore graced the function as Chief Guest and delivered a talk on the theme and highlighted the importance of our soil resources and the necessity for their management and conservation. Dr. Mohit Gera, IFS., Director in his closing remarks emphasised the importance of conservation and management of the soil resources in the country. Shri.S.Vigneswaran, Programme Officer, ENVIS proposed the vote of thanks. All the Technical Staff of IFGTB, Supporting Research Staff including SRFs, JRFs and FAs participated in the event.

Upcoming Events

Event	:	18th Symposium on Systems Analysis in Forest Resources (SSAFR)
Venue	:	Puerto Varas, Chile
Date	:	March 3-7, 2019
Symposium details	:	http://www.ssafr2019.cl/13/en/inicio

Event	:	World Conference on "Forests for Public Health"
Venue	:	Athens, Greece,
Date	:	May 8-11, 2019
Conference details	:	https://fph2019.org/

Event	:	IAWA-IUFRO International Symposium: Challenges and Opportunities for Updating Wood Identification
Venue	:	Beijing,China
Date	:	May 20-22, 2019
Symposium details	:	http://www.iawa website.org/en/Meeting/Future_Meetings/IAWA_IUFRO_International_ Symposium_for_Updating_Wood_Identification_May_20_22_2019_ Beijing_China.shtml

Event	:	4th World Congress on Agroforestry
Venue	:	Le Corum Conference Centre Montpellier, France
Date	:	May 20-22, 2019
Congress details	:	https://agroforestry2019.cirad.fr/

Event	:	Transforming approaches to forests and forestry through Indigenous and Local Knowledges: Reciprocity, relationship-building, and Traditional Ecological Knowledge (TEK) in forest ecosystems
Venue	:	University of British Columbia, Vancouver, Canada
Date	:	June 24-28, 2019
Conference details	:	https://ubc.ca1.qualtrics.com/jfe/form/SV_6D4zplu8pBeGiWN

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, Forest and Climate Change.

INSTRUCTIONS TO CONTRIBUTORS

Dear Author/ Subscriber/ Contributor,

We invite contributions to the ENVIS Newsletter issues! The ENVIS Resource Partner 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 Resource Partner. 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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