

Institute of Forest Genetics and Tree Breeding, Coimbatore 641 002

***Proceedings of the Webinar on
Advancements in Teak Cultivation: Genetic Resources and Technologies***

Date: 16 July 2021 Time: 9.30 am to 01.30 pm

In the recent past, the Annual General Body (AGB) and Board of Governors (BoG) of Indian Council of Forestry Research and Education (ICFRE), Dehradun have stressed the importance of "lab to land approach" in order to translate the results for economic, social and ecological well being. The main objective of the webinar was to share the research results by associating important stakeholders including state forest departments (SFDs), state forest development corporations (SFDCs), industries and farmers. Accordingly, ICFRE has provided directions (No. 2-3/Misc.(Res)/20-21/M & E/ADG/ICFRE/58 dated 04 March 2021) to conduct species/theme based webinars in a series. The webinar titled "Advancements in Teak Cultivation: Genetic Resources and Technologies" was organised by IFGTB, Coimbatore along with Institute of Wood Science and Technology, Bengaluru and Tropical Forest Research Institute, Jabalpur on 16th July 2021 to discuss the recent development in teak cultivation.

The webinar was attended by about 250 participants from various state forest departments (SFDs) including, Andhra Pradesh, Chhattisgarh, Odisha, Madhya Pradesh, Karnataka, Kerala, Telangana, Tamil Nadu, state forest development corporations (SFDCs) like Maharashtra, Scientists, Officers and researchers from ICFRE Head quarters and all ICFRE institutes, farmers, nursery entrepreneurs, commercial tissue culture laboratories, forestry colleges, post graduate and doctoral students.

In the welcome address, Dr. C. Kunhikannan, Director, IFGTB highlighted the status of wood demand in the country, possibilities for cultivation of tree crops and importance of infusion of modern methods in teak cultivation.

In the Introductory Address by Shri. A.S. Rawat, Director General, ICFRE Dehradun emphasised the necessity to gather key inputs of the work done on teak cultivation and conservation efforts at global and regional level. He has mentioned that teak was the glory of India till few decades ago. India holds a central place in global teak wood supply and demand projections. DG, ICFRE has informed that to achieve self sufficiency, challenges in production of quality planting stock need to be addressed and lab to land and to reality should be the priority. It is the responsibility of ICFRE scientists to draw the road map and execute systematically. DG, ICFRE encouraged proposing collaborative programs with all essential stakeholders to national and international agencies to deploy existing scientific innovations and wood technological solutions and look for funding support.

Shri. Sanjay Kumar, Director General (Forests) & Special Secretary, MoEF& CC, New Delhi delivered the inaugural address and highlighted that teak in India has very high genetic variability and urged ICFRE to utilize such genetic diversity for future research and development for trees outside the forest especially under agroforestry. He also suggested exploring alternative potential uses of teak other than timber value. Strength properties of teak provide multitude of products useful for human society. DGF & SS stressed the importance of development of teak clonal varieties for agroforestry. As harvesting from forest areas almost nil, the certification process in plantations and farm forestry situations need to be strengthened for sustainable forest management. He indicated the Government of India’s wood related programs and emphasised the need on more and more wood production and opportunities for tree cultivation. He concluded that we need to learn the innovations in forestry and work together to promote a socially conscious forestry sector.

The invited speaker lecture was delivered by Dr. Hwan-ok Ma, Projects Manager, International Tropical Timber Organization (ITTO), an intergovernmental organization based in Yokohama, Japan, promoting sustainable forest management (SFM) in the tropics. He is currently promoting the application of the ITTO guidelines for forest landscape restoration. His capacity building project work concentrated on the Asia-pacific region includes the conservation of biospheres, restoration of degraded forests and



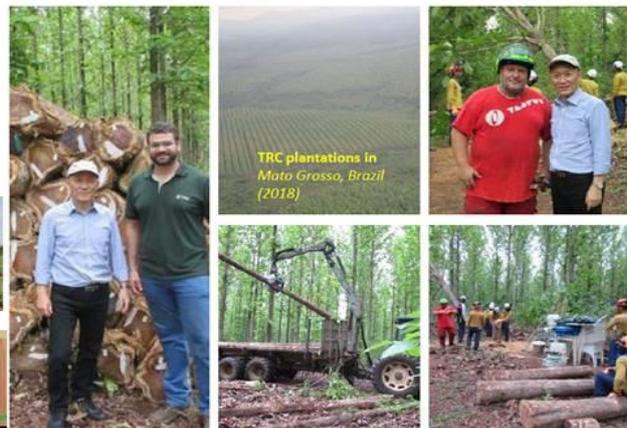
Brazil - TRC Agroforestral Ltd

- Brazil: teak introduced in 1920's; 80,000 ha planted teak; Avg productivity 0/m³/ha; Avg producer 300-500 ha
- TRC: over 40,000 ha of planted teak area on 100,000 ha of land; volume harvested: 190,000 m³/y, volume processed; 50,000m³/y (Mr Silvio Coutinho)
- FSC certification since 1997; costs of FSC certification

Year	Costs (R\$)	Area (ha)	ROI/ha
2016	R\$ 36.125,80	48.870,26	0,73
2017	R\$ 54.248,20	48.870,26	1,11
2018	R\$ 57.644,18	48.870,26	1,17
2019	R\$ 61.055,28	48.870,26	1,24

(Mr João Lucas Siqueira da Silva)

Plantations in 2018 (2 yrs old) @ João Lucas



Ghana – Form Ghana Ltd

- Established in 2007; 9,895 ha planted with commercial plantations; a certificate for sustainable forest management awarded by the FSC in 2010
- **Provenances:** 2001 pilot plantation in the Asubima FR, that originate from the SODEFOR plantations in Bouaké, Côte d'Ivoire, and its origin goes back via selections from Trinidad and India to Tenasserim (Myanmar), the provenance of the best teak; A mean annual increment of 14 - 16 m³.
- **Benefit sharing mechanism:**
 - The Forestry Commission shall receive **12%** of the Standing Tree Value of commercial thinnings and of the final harvest
 - Form Ghana Ltd. shall receive **80%**,
 - the Landowner shall receive **6%** and
 - the Local Community shall receive **2%**.



Form ghana	2007 Year Established	9895 Hectares planted with commercial plantations	2317 Hectares natural forest planted & protected	1086 Employees
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Smallholder Teak Plantations

mangroves, community forest management and forest fires, as well as legal supply of teak. Topic of the presentation was Advancements in Teak Plantations in the Tropics.

Dr. Ma put forward the two questions on teak plantation investments. The first question was related to future markets: will teakwood markets remain strong and sustainable in particular India and China? These two important markets will grow on the basis of a growing middle class, which is a large entity of the total population in terms of standard of living, although there are some uncertainties and challenges ahead. The second question was on how to maximize the productivity of teak plantations and the value addition of teakwood products.

Good quality seeds to produce stands with good growth and tree form are critical to the success of establishing teak plantations. In addition, good silviculture practices are essential to the full potential of increasing teak tree performance. He has shared the experiences on innovative teak plantations by private companies in Brazil, Ghana and Cambodia, as well as community plantations of teak in Java, Indonesia where it manages fast growing teak that can be harvested at 6 to 8 years. He also shared the lessons learned from the implementation of the ITTO teak project in Mekong that aims to promote legal and sustainable supply chains. One of the lessons was that many small woodlots of teak will become an important supply of teak in the future. He added the highlights on promotion of innovative certification systems for smallholder teak plantations and reduction in high transaction costs with relevance to Laos and Vietnam. Dr. Ma appreciated the importance of harnessing sustainable supply and consumption of quality teakwood and its significance to teak investments and actions required in supply and value chains.

The invited speaker Dr. Doreen Goh from YSG Bioscape Sdn Bhd, Kota Kinabalu, Sabah, Malaysia spoke on Production, cultivation and conservation of teak clones. She revealed the facts on continuous demand for teak wood on a global basis and establishment of large-scaled plantations in the tropical and sub-tropical regions of Africa, Latin America, Asia and Australia. She informed that clonal teak as planting materials selected for fast growth, shorter rotation and good wood quality with high commercial value are now widely accepted as the option to meeting the supply and demand chain. She presented the work flow of 30 years of research and development in YSG Bioscape, a commercial subsidiary of the Sabah Foundation. Dr. Goh provided a comprehensive overview on the propagation of teak clones using optimal tissue culture technologies, their cultivation in different but suitable geographical contexts, and the management of genetic resources at local and overseas levels. Dr. Goh identified the following as important factors for raising profitable teak plantations.



1. Soil conditions –soil depth, pH, composition, annual precipitation, temperature, elevation, drainage etc.
2. Source of planting materials – genetically superior quality seeds, high yielding clones, site adaptability, pest and disease resistance
3. Establishment and Management costs like setting up of nursery, land preparation, fertiliser requirements, silviculture and management costs
4. Harvesting operations such as length of rotation, value and sales of logs from thinnings, cost of operation, transportation
5. Marketing strategies like pricing of logs, selling methods, quality of wood etc.

Successful ex-vitro acclimatization of plantlets at nursery complements the in vitro multiplication of clones

> 90% survival rate

Rooting of tissue culture plantlets 3 weeks after ex-vitro transfer

Comparative mean scores of YSG Biotech clones vs clones from Thailand for height, diameter at breast height (DBH), volume index, bole length and straightness 7 years (est. 2005) after planting in North Queensland, Australia

Source & No of clones compared	Height (m)	DBH (cm)	Volume Index (m³)	Bole length (m)	Straightness (scale 1-6, 6 best)
YSG Biotech clones	19.2	21	0.23	12.1	4.4
Thailand clones	15.7	13.6	0.09	9.7	3.8

Areas under high precipitations (3000 to 4000mm/yr) within a 4-month period and 50 mm/month on average within three months towards the end of year

Phenotypic selection of clones is further refined via Wood and DNA analysis (advanced research with Cirad)

Destructive method – Plank sampling

Non-destructive method - Core sampling of standing trees

Near InfraRed Spectroscopy: is a fast, low-cost, easy-to-use, non-destructive, reliable and versatile analytical tool, which can handle heterogeneous wood samples, and detect minor chemically induced wood variations (Chai et al 2008a; Kokutse et al. 2016)

Demonstration plots have been est using clonal teak with qualities such as those observed for the Solomon clones and found to be well suited for smallholders in many regions

Maranta arundinacea (Arrowroot) planted under clonal teak trees in Garut, Indonesia

Intercropping with coffee and banana, French Guyane

Large-scale Plantation establishments using Clonal Teak

AUSTRALIA

- TC teak dispatched between 2002 – 2009
 - More than a million clonal plants were delivered and grown in North Queensland (ex-sugar cane areas)

Shri.M. Srinivasa Rao, APCCF & Chief General Manager, FDCM, Maharashtra spoke on the topic Research needs of Teak. He provided an overview on teak research carried out in Maharashtra, availability of clonal collections, activities in seed centre and nursery. He has also mentioned that the initial performance of tissue culture raised plants supplied by IFGTB, Coimbatore was good and field observations are in progress.

Dr. S.R. Shukla, Scientist G and Head, Wood Properties & Uses (WPU) Division from Institute of Wood Science and Technology, Bengaluru shared the research outputs on wood technology. The performance of teak in agroforestry conditions as blocks and in bund, managed and unmanaged plantations was discussed.

While sharing the research outputs Dr. Rajeswar Rao, Director, Tropical Forest Research Institute, Jabalpur elaborated on the different types of germplasm assembled which include clonal seed orchard, progeny trails and seedling seed orchards.

Dr. R. Yasodha, Scientist G IFGTB shared ongoing research activities. She provided the overview of tissue culture production of teak, studies on genecological zonation, population genetic structure and its importance in conservation of genetic resources, DUS testing guidelines and insect pests and disease management in nurseries.

Panel discussion was chaired by Dr. S.D.Pathak, APCCF (Research & Utilisation), Karnataka with members from SFDs, forestry scientists, farmers and commercial TC laboratories. Objective of the discussion was on removal of various types of barriers for raising high yielding short rotation plantations. Mr. Prem Lal Jain, a progressive farmer from Raipur Chhattisgarh mentioned about the concerns on transporting and marketing of teak timber after harvesting from the field and requested the interventions of concerned government department to ease out the procedures. It was observed that in India also clonal plantations are performing better and constraints in production of quality planting stock need to be addressed immediately to realise the potential of clonal teak by farmers and other large scale growers.

The webinar included a side event of signing of MoU. IFGTB has entered into MoU with three commercial tissue culture laboratories - Labland Biotech, Mysuru; HU Gugle Biotech, Bengaluru and Santhi Clonal Nursery, Cuddalore for commercial production of identified superior performers of teak through tissue culture.



The webinar was concluded with vote of thanks by Dr. C. Kunhikannan, Director, IFGTB, Coimbatore.
