

Importance of Forestry Extension in India

The purpose of extension is to extend, reach out or spread knowledge, technology or benefit to rural communities. Depending on circumstances, extension as a vehicle of rural development can involve: information dissemination; technology transfer (linking lab to land); packaging research results into implementable systems; delivery of inputs (seeds, seedlings, fertilizer); provision of advice regarding marketing and price information. A national forestry extension programme normally covers: forest protection, land and water conservation, agro-forestry, rationalization of shifting cultivation, greening campaigns, and forestry information. Since an important target of extension is to expand tree planting, information being sought by farmers and other people would cover a broad range - choice of species, information on best species, their uses, how to plant and manure, possible inter-crops, expected yields, marketing options, potential for value adding and so on. Along with technology transfer, communication and conflict resolution are important aspects of extension. Involvement of media networks, exhibitions, competitions and other promotional activities can assist in making extension more effective.

Forestry extension is a relatively new phenomenon in comparison to agriculture extension initiated mainly through the social forestry and wasteland development projects. Forestry extension in India is to be seen in the context of achieving a forest and 'tree cover equivalent to 33 % of total area of the country which calls for people's participation as defined in National Forest Policy 1988. Similarly the Joint Forest Management, agroforestry and social forestry programmes involve community participation where continuous technology input is required. Development of forest-based small-scale enterprises can sustain only if there is adequate incentives in the form of profit and value addition through technology support. Even with legal hassles removed and market infrastructure created, people will still require extension and support concerning the value of trees, technical questions and their rights. After all, tree planting for profit is often a new economic activity.

MAJOR FINDINGS/TECHNIQUES OF IWST:

1. Better utilization of lesser known and plantation grown timbers from South India.

In order to reduce pressure on use of primary timbers from natural forests, lesser known timbers and also timbers from plantations have been tested for their strength properties to find various end uses. The species from southern states tested and their uses are:

1. *Acacia auriculaeformis* (kari jali): Door and window frames, carom coins, chess mate, and rural furniture and turnery articles.
2. *Cocos nucifera* (coconut wood): Used in construction purpose especially for door and windows, roofing and load bearing components.
3. *Cupressus goveniana*: Crates and packing cases.
4. *Cupressus lusitanica*: Light packing cases and rural housing.
5. *Dalbergia sissoo* (plantation): Heavy duty utility block, flooring, board flooring, parquet, furniture and carving.
6. *Enterlobium contorisiliquim*: Drawing boards, toys, light packing cases, picture frames and boxes.
7. *Eucalyptus camaldulensis*: Poles, poles, columns, beams, tool handles and crates.
8. *Eucalyptus hybrid*: Beams, columns, poles, posts, heavy packing cases, picture frames and boxes.

9. *Ghironnera reticulata* (churchi): Structural uses, cheap furniture, railway sleepers, tool handles, packing cases and crates.
10. *Gyrocarpus jacquini* (tanaku): Model craft floats, catamarans, slate frames, light packing cases and handicrafts.
11. *Hevea brasiliensis* (Rubber wood): Furniture, door and window frames and shutters, match splints, veneer for plywood, light and heavy packing cases after proper treatment with preservative.
12. *Leucaena leucocephala*: Door and windows frames, tool handles and turnery articles.
13. *Maesopsis eminii* (musuzi): Toys, light furniture, cabinet, packing cases and turnery.
14. *Mastixia arborea*: Light packing cases, slate frames, moulding.
15. *Morus alba*: Sports goods.
16. *Protium serratum* (murtenga): Structural purposes, beams house posts, ploughs, carts, photo and mirror frames, railway sleepers.
17. *Sterculia urens*(karkar): Door and window frames, furniture and joinery works.
18. *Swietenia mahagoni*: Turnery articles, panelling work, precision wood making and excellent type of cabinet making.
19. *Tecomella undulata*: Furniture, doors, windows shutters and frames, tool handles, agricultural implements, pallets, parquet flooring.

Practical Utility: Utilisation of secondary/plantation grown species for value addition.

Potential Users: Construction sectors and builders, furniture manufacturers, packing units, handicrafts, artisans, agriculture sector, manufactures of sports goods, mines and constructions, navy, port trusts, board builders, ship builders, fishermen, army, coastal industries, small scale industries (picture and slat frames manufactures), railways, paper manufacturers, panel product industries etc.

2. Alternate timbers for wood handicrafts:

Karnataka and other states of South are famous for making carving and turnery of the wood. A large number of populations depend on this craft for which the timber is the main source of the raw material. Shortage of traditional timber resulted in finding suitable substitutes.

Traditional timber used in Karnataka

Wrightia tinctoria (dudhi)

Alternate timbers

Adina cordifolia (haldu)

Alstonia scholaris (chatian)

Acacia auriculaeformis (Bengali jaali)

Eucalyptus tereticornis

Grevillea robusta (silver oak)

Hevea brasiliensis (rubberwood)

Maesopsis eminii

Santalum album (sandal sapwood)

In addition, about 45 timber species available both in plantations and natural forests identified as potential alternate timbers for Rosewood, Sandalwood and Red sanders.

Practical Utility: Utilisation of secondary/plantation grown species for value addition.

Potential users: Handicraft Department, Toy makers.

3. Seasoning of timber:

The institute has developed seasoning schedule of *Acacia auriculaeformis* and *Vateria indica*. A solar seasoning kiln was established by the institute at KSFIC, Bangalore . This kiln was

used for nearly 10 years and has been dismantled recently. At present, institute is working on studying the drying characteristics of plantation grown timbers using chemical desiccant based dehumidification kiln.

Practical Utility: Seasoning of timber is useful for small saw millers in drying timber and enhancing its life.

Potential users: Forest Industries Corporations, Sawmills, Wood industries.

4. Prevention of extractive leaching in wood:

Pterocarpus marsupium (Bijasal) is recommended for door frames, shutters and construction. It contains high content of dark coloured water leachable extractives. When its wood comes in contact of water, extractives leach out and mar the beauty of paint coatings applied over the wood by staining. In order to overcome this problem, surface of wood of *Pterocarpus marsupium* was treated with various inorganic compounds solutions and was tested for extractives leaching. It was found that simple brush coat of dilute aqueous solution of Chromic Acid (2-5%) before any finishing was very effective to check the process of leaching.

Practical Utility: The technique of arresting the problem of extractive leaching does the value addition to the wood.

Potential Users: Wood industry.

5. Simple on site technique of treating poles and bamboos for enhanced durability (Sap Displacement Method):

Conventional method of treating wood material is by subjecting it to pressure treatment or by diffusion treatment, which involve machinery and skilled labor. Since investment on these is high in cost, many wood processing industries are reluctant to adopt the technology. A simple SAP DISPLACEMENT TECHNIQUE which does away with the elaborate plant and skilled man power and which can be carried out at felling sites obviating transportation of pole to a centralized pressure treatment plant has been standardized at our Institute. Species that can be treated by this technique are: Bamboo, Eucalyptus etc., the service life of treated poles and bamboos are increased by 2-5 times in exposed condition and 7-10 times in closed conditions. Cost of treating a bamboo (length: ~15 ft, girth: ~40 cms) works out to be Rs.25.

Practical Utility: As structural material, fence posts, rafters etc.,

Potential users: Rural people and forest departments.

6. Grave yard testing of plantation grown timber

Plantation grown timbers namely *Eucalyptus camaldulensis*, *Eucalyptus tereticornis*, *Ficus bengaliensis*, *Hevea brasiliensis* and *Acacia auriculaeformis* were treated with water borne preservatives (CCA and CCB) and exposed to test yard to study the efficacy of the preservative along with the untreated controls.

The treatment with wood preservatives increases the life of the timber even after 90 months compared to the untreated ones which got destroyed within 6-24 months.

Practical Utility: Useful to small scale applications.

Potential users: Rural people and forest departments.

7. Wood polymer composites:

In recent years, wood fibers have gained significant interest as reinforcing material for commercial thermoplastics. They are now fast evolving as a potential alternative to inorganic fillers for various applications. However poor interfacial adhesion between wood and plastics results in poor mechanical properties of the final product. The interfacial adhesion can be improved by using compatibilizers or coupling agents. The modification of wood with coupling agent brings down the surface energy of wood close to that of matrix polymer, resulting improved adhesion and effective wetting of wood component by polymer melt.

a twin screw extrusion system for producing bio-fiber based composites has been successfully designed and commissioned. Wood fiber filled PP composite materials with varying wt % of wood fibers were prepared in the co-rotating twin screw extrusion system. Tensile strength, flexural strength, MOE and elongation at break provide an excellent measure of the degree of reinforcement provided by the fiber to the composite. The tensile strength increased linearly with fiber content from 30.5 to 44.2 N/mm² representing a 45% increase, and tensile modulus increases by nearly 100%. Flexural strength exhibits an increase of 85% from 49.8 to 91.9 N/m². The increase in mechanical properties demonstrates that m-TMI-g-PP is an effective compatibilizer.

Practical Utility : The final product of the research will be advanced composites filled with upto 60% of natural fibers. These composites are expected to have superior mechanical properties (Stiffness, toughness, tensile strength etc.) and could be molded to any shaped articles or can be calendared into sheets. The applications are in the field of molded products (Furniture components, automobile interior, electrical/electronic appliances etc.).

Potential users: Packaging industry, automobile industry, Furniture industry

8. Portable essential oil distillation unit:

The Institute has designed and developed a portable distillation unit (50 kg capacity) distilling oil from leaves etc. of species like at the felling site. It is more efficient than stationary distillation units due to increased oil yield upto 30%. It costs about Rs.40,000/- per unit. It has generated interest among essential oil distillers and a number of small-scale distillers are impressed with its performance. Recently an Australian firm has also evinced keen interest in this compact field unit.

Practical Utility: The unit is simple, economical and can be easily shifted to user end.

Potential users: Essential oil distillers, NGOs and State Forest departments/Corporations.

9. Jingham (*Lannea coromandelica*) gum as a partial substitute for jigat (bark of *Persea macrantha*) and adhesive in agarbathi

Agarbathi industry is facing acute shortage of "Jigat" the binding material (bark powder of *Persea macrantha*). *Lannea coromandelica* Syn. *Odina wodier* (Jingham gum) in combination with "Jigat" bark (in 1:1 ratio) was found to be a good substitute. *Lannea coromandelica* is found to grow in many places unlike *Persea macrantha*, which grows only in high rainfall areas. Increase use of Jigat:Jingham gum in 1:1 ratio as adhesive will save over exploited *Persea macrantha* trees. The cost of gum is less than 50% that of "Jigat" resulting in a saving of about 8% in the cost of adhesive.

As the industry requires the gum in tones, its production and availability should be increased; thereby finding better use for this gum whose potential is not fully exploited.

Potential Utility: The substitute gum helps Agarbathi industry to meet the growing needs of binding material.

Potential users: Agarbathi Industries, State Forest Departments, Girijan Co-operative Corporations etc.

10. Scientific extraction of bark of *Persea macrantha*:

Experiments were undertaken with success to get maximum yield of bark (Jigat) with least damage to living trees. This is to create awareness about the benefit of this method among agencies that collect the bark annually or periodically.

Practical Utility: The method is simple which helps to get maximum yield of bark with least damage to living trees.

Potential users: State Forest Departments, Agarbathi Industries of Karnataka, Kerala.

11. Development of simple, less expensive colour reagents to distinguish high and low oil yielders of sandal in field :

Sandal oil is one of the important criteria for selection of trees in breeding study or in selection of plus trees (CPT's) for clonal seed orchards (CSO's). Earlier methods of estimating oil content in sandal wood by steam distillation and by rapid method are rather time consuming and non field oriented. Keeping this in view, a simple field method to distinguish high and low yielders of sandal has been developed by modifying and simplifying the earlier methods

Based on peroxidase isoenzyme reaction, following two reagents were developed for detecting high yielders.

- **Guaiacol Peroxidase Reagent (GPR)**
A colour of light brownish yellow was developed for high yielder and Reddish brown for low yielders.
- **Benzidine Peroxidase Reagent (BPR)**
A colour of light brownish pink is developed for high yielders and colour of dark brownish pink for low yielders.

Practical Utility : The method is simple, user friendly, less expensive and field oriented which could be useful for rapid screening of sandal plants in the field for selection of high yielder in breeding study or in general use.

Potential End users : Forest Departments, NGO's, Tree Farmers

12. New aroma products developed from less utilized Eucalyptus hybrid oil by simple chemical modification

Eucalyptus hybrid (mostly *E.tereticornis*) leaf oil is mixture of pinenes, cineol and p-cymene and is not put to any major use at present. Pleasant smelling oils of perfumery value were prepared from this oil by treating with less expensive laboratory chemicals resulting in value addition of this practically underutilized oil of large potential availability.

Practical Utility : The modified oils will be useful in perfumery and cosmetic industries.

Potential End users : Fragrance Industry, Odorant sprays

13. Treated catamaran to benefit poor, traditional fishermen:

Catamarans or log-rafts are the most extensively used traditional fishing craft in India. There are about 2,00,000 units currently operating in the country each requiring 2 cum wood. The conventionally preferred timber, like *Albizia chinensis* (local name: siris) and *Albizia falcataria* are getting scarce due to fungal and borer attack, and have to be frequently repaired or replaced. In recent years, catamaran timbers have become so costly that poor fishermen ill-afford to purchase them.

This Institute gave catamarans treated with CCA preservative to fishermen for service trials. Catamarans made from *Albizia chinensis* treated with CCA have given a service life of 26 years as against their normal life of 5 years. Catamarans, made of even a highly non-durable timber like *Bombax ceiba* (semul), have given a service life of more than 15 years, whereas untreated wood of this species hardly last for 6 months to 1 year in the sea. These trials show that cheaper timber can be used after preservative treatment, thus widening the choice of species. This would help preserve our scarce forest resources, as well as improve the economic conditions of poor fisherfolk. Cost of treated *Bombax ceiba* catamaran is 50% of the cost of untreated catamarans made of conventional timbers.

Demonstration-cum-field trials of treated catamarans have been conducted by the Institute by distributing 100 units under the World Bank Aided FREE (Forestry Research Education & Extension) Project. These units are made of hitherto under-utilized or unutilized cheaper, secondary species of timber.

Practical utility: enhancement of choice of timber, Tree (biodiversity) conservation, economic catamarans

Potential users: Fishermen, Fisheries Department.

14. Developed modern root trainer based nursery technique for production of quality planting stock of Sandal:

Standardized container size, type, potting medium, sieve size of potting medium, stage of host requirement, screening of primary host, biofertilizer and supplementary nutrition for mass production of quality planting stock of Sandal in 270 cc root trainers/600 cc poly bags within 6 months period.

Practical Utility: Protocol developed will be useful for the production of relatively uniform seedlings with more root surface area in small containers in shorter time for afforestation and plantation programme. SFDs, plantation companies can use the results for raising quality planting stock of sandal.

Potential Users: State Forest Department, Farmers, NGOs, Plantation companies.

15. Refinement in the macro propagation protocol of teak:

Standardized period of collection of stem cuttings, age and size of cuttings, auxin type and concentrations, rooting medium and transplanting stage in containers after root induction. Under ideal conditions about 60 per cent cuttings induce roots and within 5-6 months period, plantable clonal planting stock can be raised.

Practical Utility: Protocol can be used for production of clonal planting material for clonal trials as well as clonal forestry for improved productivity.

Potential Users: State Forest Department, teak plantation companies, NGOs and Farmers.

16. Refinement in the macro propagation of clones of *Eucalyptus tereticornis*.

Standardized age of source cuttings, size, type, concentration of auxin, potting medium, fertilizer application regime/interval, hardening conditions and durations. Under ideal conditions on an average 70 per cent of leafy green stem cuttings will induce roots within 2-3 weeks. Plantable clonal planting material can be obtained within 4 - 5 months period.

Practical Utility: Production of clonal planting material for clonal trials as well as clonal forestry for improved productivity.

Potential Users: State Forest Department, teak plantation companies, NGOs and Farmers.

17. Rapid and simplified method of *in vitro* cloning of teak.

Optimized physico-chemical conditions for shoot induction and rapid shoot multiplication. About four-fold shoot multiplication can be achieved within 4 weeks period. *In vitro* root induction could be achieved within three weeks period on MS/4/white basal medium with IBA.

High frequency (above 90 percent) *ex vitro* rooting could be obtained from *in vitro* shoots. Cloned plants of plantable size can be obtained within 4 - 5 months period from *ex vitro* rooting and hardening stage.

Practical Utility: Results will be useful for rejuvenation and rapid production of clonal planting material of superior clones of teak for improved productivity.

Potential Users: State Forest Departments, tree plantation companies, NGOs, Farmers.

18. Rapid *in vitro* cloning of *Eucalyptus tereticornis*

Rapid shoot multiplication rate (4-5 fold) achieved within 4 weeks period from 4-5th passage onwards on modified MS medium with BAP and additives. Sub-culturing was found essential within 4 weeks period. Shoots can be multiplied without deterioration on shoot multiplication medium. *In vitro* rooting could be achieved on MS/4 or white basal medium with IBA.

Ex vitro rooting of more than 90 per cent *in vitro* shoots, could be obtained by pulse treatment with IBA and later on transferred in soil rite in bottles or trays under mist chamber/Green house conditions. Rooted plants grow vigorously in containers. Plantable clonal planting material can be obtained within 4 months period from *ex vitro* rooting onwards.

Practical Utility: Results will be useful for rejuvenation and production of clonal planting material of superior clones of *E. tereticornis* for improved productivity.

Potential Users: State Forest Departments, tree plantation companies, NGOs, Farmers.

EXPERTISE AVAILABLE WITH THE INSTITUTE:

19. Identification of timber:

Timber identification has always been a service in great demand from users in Industry, Government departments, forest departments, Police, Vigilance, Lokayukta, CBI, Port Trust,

Defence, Railways, handicrafts and common man. This Institute has been rendering service to all these user agencies.

During last ten years, this Institute has received more than 1000 enquiries and attended confidential cases related to police , CBI etc.

Xylarium: This Institute has a collection of more than 3500 wood samples from India and other countries. It also has a rich collection of microscopic slides for research purpose.

20. Data base on natural durability of Indian timbers and durability after preservative treatment:

(i) Land:

Information on durability of sixty two South Indian species of timber including some of the important plantation species (Eucalypts, Rubber wood, *Acacia auriculaeformis*) in un-treated and treated conditions are available for right choice of timbers for different end uses and necessary dosage of treatment for the given end use.

Potential users: All departments and individual users of timber.

(ii) Mines:

For the first time in the country, performance of timber, a preferred material in underground mines has been evaluated. Lagging poles and posts of *Eucalyptus tereticornis* and *Casuarina equisetifolia* in treated and untreated conditions were exposed to different humid conditions and found that treated timbers last for more than eight years, whereas untreated ones were destroyed in less than two years.

This is an effort in conservation of timber resource.

Potential users: Mining Departments

(iii) Marine Environs :

- (i) An unique activity of the Institute concerns studies on marine wood biodeterioration and protection. Over the years natural resistance of over 270 timber species to marine borer attack was assessed. Timber species such as *Artocarpus hirsutus*, *A. lakoocha*, *Dalbergia latifolia*, *Dipterocarpus indicus*, *Hardwickia binata*, *Hopea parviflora*, *Lagerstroemia hypoleuca*, *L. parviflora*, *Lannea coromandelica*, *Mimusops littoralis*, *Pterocarpus dalbergioides*, *P. marsupium*, *Schleichera oleosa*, *Shorea robusta*, *Tectona grandis*, *Terminalia paniculata*, *Xylia xylocarpa*, *Madhuca longifolia* and *Cleistanthus collinus* and comparatively durable.
- (ii) Similarly, long-term trials, using panels of 45 timber species treated with eight preservative in different absorption were conducted at selected location along the Indian coasts. Panels of various timber species treated with CCA and CCB gain a life about 20 times their normal untreated life. Performance of treated non-durable timber was as good (or sometimes better) as that of treated componential durable timbers. Based on the data generated, technology of wood protection under marine conditions was perfected and field trials on actual structures were undertaken.
- (iii) Database was developed in the systematic, distribution, ecology, biology and physiology of marine wood-boring and fouling organisms. So far about 63 species of wood-borers and over 250 species of marine foulers are identified.

Potential users: Fisheries Department and Fishermen, Communities of Maritime state of India, Port Trusts, Navy, Coastal Industrial establishments, Coastal Universities and Colleges.

21. Estimation of sandal oil content by NDT:

A simple and rapid method of estimating sandal oil content in small sample of sandalwood by UV spectroscopy of hexane extract of 100 mg of sandalwood powder at 219 nm was developed. It will help in screening large number of trees by taking small (core) samples instead of cutting the trees to get the heartwood for oil analysis.

Potential users: State Forest Depts. Research Organizations.

22. Pest and disease problems of natural forests and plantations and their control

Pests and diseases of Sandal were studied in detail and a package of practices for controlling the spike disease was evolved. Fifteen new pests of Sandal were recorded and biology of important ones was studied.

A recent out-break of lac insect on sandal trees at the Institute's clonal seed orchard at Gottipura and Nallal was effectively controlled with the package of practices developed by I.W.S.T. scientists.

Diseases and pests of seedlings in nurseries, plantations and of natural forests were surveyed and monitored regularly. Control measures were evolved and suggested to Forest Departments and to private planters. Major tree species investigated include Teak, Albizias, Eucalyptus etc.

Potential users: Private planters, Forest Departments.