

CHAPTER-V

INSTITUTE OF FOREST GENETICS AND TREE BREEDING COIMBATORE

The Institute of Forest Genetics & Tree Breeding has the mandate to develop genetically superior planting stock suitable for different eco-climatic zones. The Institute has seven divisions namely: Genetics & Tree Breeding, Plant Biotechnology, Seed Technology, Silviculture, Forest Productivity and Agroforestry, Forest Protection and Economics and Sociology.

PROJECTS COMPLETED DURING 1997-98

Project 1: Production of high yielding propagules of Casuarina and Eucalyptus.

Objectives: To establish infrastructural facilities for vegetative propagation and develop basic protocol for production of quality planting stock of Eucalyptus and Casuarina.

Results

Clonal accessions of Eucalypts and Casuarina from different areas of the state are maintained in the clone bank of IFGTB. Using the rooted cuttings obtained from these clones, clonal multiplication areas of *Eucalyptus camaldulensis*, *E. tereticornis* and *Casuarina equisetifolia* were established during the month of July, 1997 at Panampally, Palakkad District, Kerala State.

A Clonal Testing Area of *E. tereticornis* was established during the month of July, 1997 at Panampally to test the performance of six clones. To test the performance of the half sibs of *E. camaldulensis*, a trial was laid out at Panampally using the seeds collected from 12 clones maintained in the clone bank of IFGTB, during the month of July, 1997.

Uniformity in growth was observed in all the clones maintained in the Clonal Seed Orchard of Casuarina. Flowering and fruiting behaviour were also found to be uniform for all the four female clones. The seeds collected from the CSO were subjected to germination tests.

Project 2: Reclamation of quartz dumps.

Objectives: To develop a package of suitable species and soil amendments for reclamation of quartz dumps.

Results

The quartz is produced as a waste product in the floatation process in the manufacture of cement by ACC Cements. It is an inert material devoid of nutrients. The initial observations indicate that *Casuarina equisetifolia* performs best with the amendment containing coirpith, Frankia, Phosphobacterium and gypsum and *Acacia auriculiformis* performs best with amendment containing Jalshakti (a synthetic water holding polymer), Rhizobium, VAM and gypsum.

OLD PROJECTS CONTINUED DURING 1997-98

Project 3: Characterisation of the phenotypes and genotypes of *Emblica officinalis* natural populations in Tamil Nadu and Kerala.

Objectives: Survey on the distribution of the species in Tamil Nadu and Kerala, to develop herbaria of distinct phenotypes, genotypic evaluation using biomolecular markers.

Achievements

Forty-five populations were surveyed in seven districts of Tamil Nadu namely Coimbatore, Udhamandalam, Periyar, Kanyakumari, Madurai, Salem and Dharmapuri. Twenty-five distinct phenotypes were characterised on the basis of bark, branchlet, leaf, fruit and seed characteristics. Herbarium samples have been documented for all the selected phenotypes. Leaf and fruit samples from all the locations have been stored for molecular and biochemical analyses.

Project 4: Genetic improvement of forest trees (WB-GTB-RP1).

Objectives : To carry out genetic improvement of *Eucalyptus camaldulensis* and *Casuarina equisetifolia* through selection and breeding.

Achievements

Seedling Seed Production Areas (SSPAs) of *Eucalyptus camaldulensis* established during the year 1995 with bulked seeds of 514 plus trees have been evaluated for their early growth characteristics. Three progeny trials with 182 half sib families of *E. camaldulensis* were established at Panampally (Kerala), Pudukkottai (Tamil Nadu) and Sathyavedu (Andhra Pradesh). The trials have been evaluated at six months of age to assess the early growth variation between the seedlots and locations. Seeds of nearly 350 half sib families from entire range of natural and introduced populations of *Casuarina equisetifolia* were obtained from ATSC (Australian Tree Seed Centre) through IFGTB's selection programmes. Using these seedlots, three progeny trials were established at Rajamundry (Andhra Pradesh), Balukhand (Orissa) and Neyveli (Tamil Nadu).

Project 5: Reproductive biology of tropical trees (WB-GTB-RP2).

Objectives: To understand phenology and floral biology, to know the breeding system and pollen biology, and to develop hybridisation techniques in respect of tropical trees.

Achievements

Effect of reproductive isolation in clonal seed orchards was studied in *Tectona grandis* through controlled crossing and natural selfing in a selected teak clone SBL1 of Andhra Pradesh origin. Controlled crossing experiments have revealed that the clone is self compatible.

Project 6: Evaluation of genetic variability in Teak in Peninsular India (WB-GTB-RP 3.1).

Objectives : To identify the natural populations of teak in peninsular India and record morphological and physiological variability. To estimate genetic variability and to evolve appropriate selection and breeding strategies for genetic improvement of the species.



View of afforestation trials in limestone minespoil



Acacia nilotica seeds treated with *Parthenium* powder
(dead individuals of *Caryedon serratus* are
seen at the foreground of seeds)



Casuarina in agroforestry



Farmers being trained to apply biofertilizers in agroforestry

Achievements

Field studies were conducted in different geographical locations. Variations in wood, growth, morphology and phenology in natural and captive populations were recorded. So far the States of Kerala, Tamil Nadu and Maharashtra have been covered. Distinct variations have been observed in fruit characteristics such as size, shape and seed filling between clonal population of Maharashtra origin. Methodologies have been standardised for extraction of DNA and a few isozymes to understand genetic variation at molecular level.

Project 7: Assessing growth and physiological variations like photosynthesis in fast growing tree species for improving yield.

Objectives : Survey and selection of superior performing plants of *Casuarina equisetifolia* and *Eucalyptus* spp. and standardisation of the procedure of cloning them. To find out interclonal variations in the identified superior performers. To identify the salinity tolerant clones of *Casuarina equisetifolia*.

Achievements

Genetic divergence studies in *Casuarina equisetifolia*: Thirty nine clones, assembled from the Tiruchandur area were subjected to D2 statistics. The analysis resolved these 39 genotypes into 10 clusters. Height, girth at breast height, and collar girth contributed the maximum to the genetic divergence.

Salinity studies in *Casuarina equisetifolia*: Of the 106 clones, 20 were subjected to salinity studies. Various responses like morphological, photosynthetic behaviour of the clones as well as biochemical responses of the clones under saline condition were investigated in addition to chlorophyll a and chlorophyll b levels.

Project 8: Development of tissue culture/micropropagation techniques for selected tree species including procedure for hardening, weaning and outplanting.

Objectives: To standardise micropropagation protocols for neem, eucalyptus, bamboos and teak.

Achievements

Micropropagation of *Oxytenanthera stocksii*: *Oxytenanthera stocksii* being a non flowering bamboo, micropropagation is one of the alternate techniques for large scale propagation. The institute has developed an efficient method of *in vitro* propagation for continuous supply of propagules.

***In vitro* Rhizome formation in *Dendrocalamus strictus* and *Bambusa nutans* :** Experiments were carried out to induce consistent rhizome production in the multiple shoots of *Bambusa nutans*. Murashige and Skoog medium supplemented with various concentrations of Benzyl Adenine (BA) and Naphtalene acetic acid (NAA) were tested. It was found that 2 mg/l Benzyl Adenine and 0.5 mg/l NAA induced rhizome formation. Similarly rhizomes were induced in the *in vitro* grown seedlings of *Dendrocalamus strictus*.

Project 9: Biotechnology of trees (WB Project 4).

Objectives: To establish a nucleus of scientists and develop laboratory facilities for non-conventional tree improvement programme.

Achievements

Commercialization of micropropagation techniques in bamboos

Micropropagation techniques for mass multiplication of bamboos have been perfected at the institute. Attempts were made to translate the technique into commercial situations. The starter cultures were established from the selected seeds of four species of bamboos namely *Bambusa arundinacea*, *Bambusa nutans*, *Dendrocalamus strictus* and *Dendrocalamus membranaceus*. Shoot multiplication of all the four bamboo species was carried out in the Murashige and Skoog medium with 2.22 μM BAP. The rooting was done in MS liquid medium with 0.49 μM or 2.46 μM Indole Butyric Acid. The laboratory starts supplying the planting stock after 28 weeks of the receipt of starter cultures. Forty flasks of multicultures are required to produce 5000 plantlets in a period of 28 weeks. In the case of *Bambusa arundinacea* the technology developed enables the mass micropropagation of bamboos with exponential multiplication rate of 24 shoots in successive months. *Ex vitro* rooting and acclimatisation were achieved using polytunnels with 90% success. All the micropropagated plantlets developed rhizomes within two month's period in nursery.

Project 10: Standardisation of optimum storage condition for *Azadirachta indica* and methods to prolong the viability.

Objectives: To fix the optimum time for seed collection and standardize collection methods. Study the effect of seed moisture content on the viability of the seeds. Study the biochemical changes associated with seed deterioration. Study the genetic variation within and between populations using bio-chemical/molecular markers.

Achievements

Seeds were stored with and without endocarp in 3 different conditions viz. Ambient, +5°C and -5°C for assessing the viability. Observations show that seeds stored with endocarp at ambient condition give better results. The maximum amount of variation was found with respect to germination percent and the minimum variation was recorded in respect of breadth of seeds. Most of the seed traits correlated positively with seed germination and vigour of the seedlings.

Project 11: Studies on the seedlife of *Casuarina equisetifolia* and working out the germination capacity.

Objectives: Fix the optimum time and age for seed collection. Study the life of seeds in different conditions. Study the variation in fruit and seed characteristics for different sources.

Achievements

The study revealed that the seeds of *C. equisetifolia* can be conveniently stored at ambient conditions for 1-2 years. For storing upto 3 years, storage at +10°C is advisable.

Correlation of seed size with seedling vigour and performance in the field is being studied. Seeds were collected from 3 years old trees and studied for their germination behaviour.

Project 12: Standardisation of germination methods in *Tectona grandis* and evaluation of vigour for seeds of different sources.

Objectives: Work out pretreatment requirement to get optimum germination. Study the factors associated with germination capacity. Study source to source variation in germination capacity. Study the dormancy mechanism operating in the seeds.

Achievements

Alternate soaking and drying of seeds gave fairly consistent results. The effect of time of seed collection on germination percent has been studied. The fruits collected in the later part i.e. March-April gave better germination percent. Other factors which influence the germination such as medium, light, etc. are being studied.

Project 13: Studies on seed deterioration of oil yielding species viz. *Pongamia pinnata* and *Jatropha curcas* under different environment conditions and standardisation of germination methods.

Objectives: To study the different environmental parameters which influence the rate of deterioration of seeds under different storage conditions and find out suitable control measures. To find out suitable collection methods, time, processing, treatment and storage for prolonging viability of seeds. To determine the oil content and their effects on germination. Estimation of biochemical contents of seeds collected from different sources.

Achievements

Source to source variations in weight, purity, germination, vigour index and oil content of seeds were studied. Significant variation in seed germination was observed compared to other parameter. Seeds of *Jatropha curcas* collected from various localities are being assessed for germination capacity and their viability.

Variations in weight, purity, germination, vigour index and oil content of *Pongamia pinnata* seeds collected from different agro-climatic zone were studied. Observations show that the seeds collected from Salem (Western zone) were better than seeds from other zones.

Project 14: Standardisation of seed handling procedures for commercially important forest medicinal plants.

Objectives: To determine the optimum period of seed collection, extraction procedures and pretreatment requirements for different species.

Achievements

Studies on drying of seeds at various temperature for *Feronia elephantum* revealed that the seeds dried at 40°C for 3 days gave 90% germination and high vigour index. Different pretreatments were tried to enhance the germination of *Terminalia arjuna* and *T. bellerica*. Seeds of *T. arjuna* soaked in water for 3 days followed by 50 ppm Gibberellic Acid (GA3) gave better germination compared to control. Fruits of *T. bellerica* treated with con. sulphuric acid for 30 minute after depulping gave 90% germination, whereas control gave a germination of only 30%.

Seeds stored in glass bottle, plastic container were found viable for 2 months. Those stored in moist mud pot were viable for 3 months. Seed stored at 100% Relative humidity and + 5°C gave better results even after 2 months compared to control.

Project 15: Reclamation of magnesite minespoils.

Objectives: To develop a package of suitable species and soil amendments for reclamation of magnesite minespoils.

Achievements

The field trials have indicated that *Casuarina equisetifolia*, *Syzygium cumini* and *Pterocarpus santalinus* survive and grow well on the magnesite minespoils. The nursery trials with four species - *Casuarina equisetifolia*, *Acacia nilotica*, *Delonix regia* and *Samanea saman*, indicated that *Acacia nilotica* performs better than all the other species in terms of biomass accumulation, biomass index and rooting potential, under irrigation.

Project 16: Reclamation of limestone minespoils.

Objectives: To develop a package of suitable species and soil amendments for reclamation of limestone minespoils.

Achievements

At the request of ACC Cements Co. Ltd., Madukarai, species trials for reclamation of limestone minespoils were laid out in 1996 with *Casuarina equisetifolia*, *Acacia auriculiformis*, *Acacia nilotica*, *Cassia siamea*, *Eucalyptus camaldulensis* and *Azadirachta indica*. Amendments were carried out by addition of composted coirpith, biofertilizers and inorganic fertilizers.

Project 17: Screening of *Casuarina equisetifolia* and *C. junghuniana* genotypes for plantation in problem soils of Tamil Nadu.

Objectives: The project aims at carrying out selections in the plantations of *Casuarina equisetifolia* and *C. junghuniana* and their hybrids raised under rainfed conditions under conditions of drought, salinity and minespoils.

Achievements

34 Candidate Plus trees of *Casuarina equisetifolia* have been selected from the salinity and drought affected areas of Rameswaram, Thanjavur, Chengalpet, Nagapattinam and Tiruvallur districts and magnesite minespoils of Burn Standard Co., Salem at a selection intensity of 1 in 10,000. Further selections are in progress.

Project 18: Standardisation of root trainer size, potting mixture, watering regime and shade requirement for major plantation species of South India.

Objectives: To standardize the root trainer size, potting mixture, watering regime and shade requirement of Teak, *Casuarina*, Neem and *Eucalyptus* spp.

Achievements

There was significant difference between the 150 cc and the 300 cc root-trainers with respect to the following parameters, namely, root length, shoot length collar diameter, dry root weight, dry shoot weight, total dry weight, root-shoot ratio, rooting potential, biomass index, and seedling quality index with all the parameters increasing with increase in the root trainer size. This is due to increased availability of nutrients in the root trainers of larger volume. However, there was no significant difference between the 150 cc and the 300 cc root trainers

with regard to the number of primary root laterals produced by the seedling, which determines its success in the establishment and growth in the field. The present study indicates that this parameter is not affected by the root trainer size, though all other characters conventionally used in the assessment of seedling quality are affected.

The potting mixture containing Sand and Mushroom waste in the ratio 2:1 (0.485) had higher seedling quality index than the control (0.348). The same potting mixture also had significantly lower root: shoot ratio (1.03) than the control/nursery potting mixture (1.31).

Project 19: Development of Agroforestry models for the various agro-ecological regions. (ICFRE- NABARD Project on Agroforestry).

Objectives: Conduct D & D survey in selected micro watersheds. Conduct economic analysis of existing agroforestry systems in the selected villages. Design appropriate land use management plan for selected villages. Develop Agroforestry models based on research findings.

Achievements

In the identified category of lands from class I to class VIII both in rainfed and irrigated conditions, biofertilizer inoculated seedlings of different tree species, namely, Teak, Casuarina, Acacia, Neem, Tamarind, Moringa, Annona etc. were planted for establishing different agroforestry models viz. Agri-silviculture; Silvi-horticulture; Agri-silvi-horticulture; and bund, boundary and block planting with different combinations, pattern and spacings. About 42000 numbers of seedlings of different forestry and horticulture species were planted in three micro watersheds. Soil working, application of chemical fertilizers and biofertilizers, (*Azospirillum*, *Phosphobacterium* and VAM) are being carried out.

Measurement on growth parameters of trees and agricultural crops are being recorded at regular intervals. Soil samples collected from selected plots are being analyzed for their initial physico-chemical properties, which are also indicators to measure the impact of the project.

Horticulture species such as Mango, *Moringa oleifera*, *Annona squamosa*, *Tamarindus indica* and Coconut were planted in few of the farmers fields in Silvi-Horticulture systems, along bunds, boundaries and homesteads. The agroforestry models developed in farmers field were replicated in the Institute campus. Periodical growth observations of tree species are being recorded.

Project 20: Nutrient Cycling (WB Project 5).

Objectives: To study the productivity and nutrient cycling in teak plantation of Tamil Nadu.

Achievements

Biomass and productivity studies were conducted in eight Teak plantations in different age groups at Tirunelveli Forest Division during the year 1997. One hundred sixty sample plots were laid out and growth parameters of trees were measured and recorded. Soil samples were collected from sample plots and analysed for various physico-chemical properties.

Litter plots were laid out and periodical collection of litter was carried out. Fresh and dry weights were recorded and samples analysed for major nutrients. Litter decomposition study was also conducted by adopting two methods viz. Bag method and non-bag method. Studies on rainfall interception, stemflow, throughfall, and etc. are being carried out.

Project 21: Survey and evaluation of insect pests of forest tree species in nurseries and plantations with reference to Teak, *Eucalyptus* spp., *Casuarina equisetifolia*, *Tamarindus indica* and *Azadirachta indica* (Neem).

Objectives: To conduct studies on pests spectrum and detection of key pests, biology of important pests, damage caused, population dynamics and biotic and abiotic factors responsible for building up of pest population.

Achievements

Teak : Survey revealed the attack of the stem borer, *Indarbela* sp. on 60% of the saplings in agro-forestry plantations raised in the villages of Coimbatore in Tamil Nadu. The incidence of sap sucking insects, viz. *Ptyelus nebulus* (Frog hopper), *Flata ferrugata* (Green hopper) and *Erthesina fullo* (Pentatomid Bug) was frequent on seedlings and saplings in the village areas.

***Casuarina equisetifolia* :** Attack of bark feeding borer, *Indarbela quadrinotata* attained serious proportions in the dry inland areas of Tamil Nadu. Infestation of this borer was sporadic in plantations raised along Kerala coast and didn't reach epidemic proportion. Spread of the 'cottony cushion scale' insect, *Icerya purchasi* at a fast rate to nurseries and young plantations raised in the arid tracts of Kerala and Tamil Nadu turned out to be an important pest problem. Needle feeders, *Dasychira mendosa* and the bagworm, *Cryptothelia crameri* were the other pests problems recorded in clonal nurseries and plantations.

***Tamarindus indica* :** Grubs of a buprestid beetle, *Sternocera* sp. caused 10% mortality among saplings at Coimbatore, during the dry months.

Project 22: Studies on seed pests of forest trees and evolving prophylactic seed treatments against pest attack during storage, with reference to Teak, *Eucalyptus* spp., *Casuarina equisetifolia*, Bamboos, *Tamarindus indica* and *Azadirachta indica*.

Objectives: Enumeration of pre-harvest and post-harvest pests and identification of key pests. Developing suitable prophylactic seed treatments and storage practices, especially by using botanical insecticides.

Achievements

Biology of two seed infesting beetles, *Caryedon serratus* and *Bruchidius* sp. was studied in the laboratory condition on the seeds of *Tamarindus indica* and *Acacia nilotica*, ssp. *indica*.

A commercial Neem formulation, Fortune-aza 0.15% was tested on the seed pests, *C. serratus* and *Bruchidius* sp. in laboratory conditions. The Neem formulation at 75 and 100 ppm was found to cause 40-50% mortality of the pests within 1 to 3 days, and 100% mortality between 8 to 10 days of application.

Studies conducted on the phytopesticidal properties of the dry powders of *Parthenium hysterophorus* and *Ocimum teniflorum* on *C. serratus* and *Bruchidius* sp. revealed that the *Parthenium* at 5 and 10gms, and *Ocimum* at 1 and 2gms /200gms of seed were highly effective. Neem seed kernel powder @ 80 gm/kg seed as well as Neem oil @ 4 ml/kg seed were found to be the optimum treatment to control the pest during storage.

Project 23: Selection of pest resistant trees from wild population, provenances and exotic trials and progeny test in respect of *Casuarina equisetifolia*, *Acacia nilotica* ssp. *indica* and *Albizia lebbek*.

Objectives: Detection of resistant individuals or races and differentiating true resistance from pseudo-resistance.

Achievements

The provenance trial of *Albizia lebbek* established at Sethumadai, having plants raised from six seed sources was studied for resistance against the infestation of Psyllids (*Psylla hyalina* and *Acizzia indica*) and the Aphid (*Aphis* s. nr. *craccivora*) causing bunching of shoots and stunting of growth. It revealed that Coimbatore and Pudukottai provenances are comparatively resistant. Further, provenances like Neyveli, Salem and Vellore are found moderately resistant, while the provenances of Ramanathapuram are highly susceptible.

Pattern of incidence of the Bagworm, *Pteroma plagiophleps* in the national provenance trial laid out at Elachipalayam, having 24 provenances of *Acacia nilotica* ssp. *indica* indicates that plants raised from 'Sind' provenance suffered highest intensity of infestation leading to complete denudation.

Project 24: Evolving biological control strategies for key pests of Teak, *Eucalyptus* spp., *Casuarina equisetifolia*, Bamboo, *Tamarindus indica* and *Azadirachta indica*.

Objectives: Enumeration of predators, parasites, and entomopathogenic microorganisms at field level and field application of promising bio-control agents.

Achievements

A commercial product of *Bacillus thuringiensis*, var. *kurstaki* tested on the early instar of the defoliator, *Hyblaea puera* showed that the product at a concentration of 4% was highly effective in laboratory conditions. The bacterial formulation at 1% concentration was also found to effect high mortality of the stem borer larvae of *Indarbela* sp. in the laboratory conditions. Preliminary studies conducted on the parasitic potential of the egg parasitoid, *Trichogramma* strain *citri*, on the eggs of *H. puera* have yielded promising results.

Project 25: Evaluation of plant derivatives for insect pest control.

Objectives: To study efficacy of various plant products on key pests and impact of the active components on the natural enemies of target species.

Achievements

A commercial Neem product (Neem azal 1%) was tested for its efficacy on the defoliators of teak viz., *Hyblaea puera* and *Eutectoana machaeralis*. The product at 30-40 ppm concentrations had significant effect on the larval stages of *H. puera* and *E. machaeralis*.

Project 26: Survey and evaluation of the diseases of Teak, *Casuarina equisetifolia* and *Tamarindus indica*.

Objectives: Studies on disease spectrum and damage caused.

Achievements

Casuarina equisetifolia: A 1-1/2 year old clonal plantation raised at Panampally (Kerala) was affected by *Ganoderma* sp., which caused root and collar infection, and *Colletotrichum gloeosporioides*, which resulted in needle blight of about 5% of the plants.

Project 27: Evaluation, selection, and application of Mycorrhizae and root nodule micro-symbionts (biofertilizers) in forest tree species.

Objectives: Recording the range of colonisation of mycorrhizae and root nodulating microbial strains in nurseries, plantations, and natural forests.

Achievements

Teak : Spores of three genera of VAM viz. *Glomus*, *Acaulospora* and *Sclerocystis* were detected in the rhizosphere soil and root samples. The spores of *Glomus* were predominant in the samples studied.

Eucalyptus camaldulensis : The ectomycorrhizal fungus, *Pisolithus tinctorius* was detected in the plantations raised at Walayar (Kerala) and Pondicherry (Tamil Nadu). Its pure culture has been developed for further studies.

Casuarina equisetifolia : The ectomycorrhizal fungus, *Thelephora ramarioides* was collected from plantations raised in Kerala and Tamil Nadu.

Santalum album (Sandal) : The root colonisation of seedlings was estimated at 23% and that of the trees at 42%. The rhizosphere soil of seedlings had a spore population of 431, while the spore population of trees was estimated to be 1152. Ten species of VAM fungi belonging to three genera viz. *Glomus*, *Acaulospora* and *Sclerocystis* were recorded during the study. Among them, the genus, *Glomus* was found to be dominant one.

Project 28: Studies of Teak plantations in farm land and waste lands in different agro-climatic regions of Tamil Nadu (WB Project 3.3).

Objectives: To study the growth pattern of teak plantations under different agro-climatic regions of Tamil Nadu and to study the impact of teak farming on socio-economic status of rural community.

Achievements

Teak plantations on irrigated and non-irrigated plantations in different agroclimatic regions of Tamil Nadu were studied with respect of cultural operations, spacing, tending, thinning, wood quality, and climatic and edaphic factors. Socio-economic impact of teak farming, marketing, social and institutional acceptance of the technology and, man-forest interaction were also studied. Training was imparted to farmers on management practices and economics of teak.

Project 29: Socio-economic studies of important medicinal plants in the tribal areas of Tamil Nadu.

Objectives: To create a database for commercially exploited medicinal plants, work out cost benefit analyses and socio-economic impact of medicinal plants among the growers.

Achievements

1. Database is being created for the commercially exploited medicinal plants.
2. Cost benefit analysis for few cultivable medicinal plants has been worked out.
3. Conducted training for farmers regarding the importance of medicinal plants and provided packages for cultivation of few cultivable medicinal plants *Glorisa superba* and *Gymnema sylvestre*.

Project 30: Market survey on prices and utilization pattern of Timber products.

Objectives: To collect data on market trend and prevailing prices of timber products in South India.

Achievements

Data were collected quarterly and sent to headquarters for publication.

Project 31: Studies on the impact of Joint Forest Management.

Objectives: (a) To study the socio-economic impact of forest plantations in consultation with Tamil Nadu Forest Department. (b) To educate the villages about economically and ecologically important trees for sustainable development of natural resources.

Achievements

Part of the survey has been completed in Tholampalayam and Marudamalai areas in Coimbatore District.

Project 32: Planting stock improvement programme under World Bank.

Objectives : Establishment of clonal banks, multiplication gardens, model nurseries, seedling seed orchards, clonal seed orchards, and identification of seed production area.

Achievements

1. **Establishment of clone banks and multiplication gardens:** A Clone Bank of teak (2.8 ha) was established at Nilambur with 97 clones from Andhra Pradesh and Karnataka. Multiplication garden of *Casuarina equisetifolia* (1 ha) was established at Neyveli and another of at Coimbatore (0.2 ha) within the campus. The clones were obtained from Orissa, Andhra Pradesh, Tamil Nadu and Pondicherry. Multiplication garden of *Eucalyptus* (1 ha) was established at Neyveli with clones from Tamil Nadu and Andhra Pradesh. These are being expanded with selections.
2. **Establishment of a model nursery:** A model nursery for the purpose of research and demonstration is being established. Seedling production facilities were established and about 3,28,000 seedlings were supplied for the Planting Stock Improvement Programme.
3. **Seedling Seed Orchard:** A Seedling Seed Orchard of *Eucalyptus camaldulensis* was established at Sathyavedu in Andhra Pradesh (3.0 ha). Another Seedling Seed Orchard of *E. tereticornis* was established at Karunya Nagar (1.0 ha) in Tamil Nadu. Seedling Seed Orchards of *Casuarina equisetifolia* were established at Neyveli (8.0 ha), Marakkanam (1.0 ha), Vedaranyam (1.0 ha) in Tamil Nadu and Balukhand (2.0 ha) in Orissa. At Panampally in Kerala a Seedling Seed Orchard of *Acacia mangium* (0.5 ha) was established.

4. **Clonal Seed Orchard** : One Clonal Seed Orchard of *Eucalyptus tereticornis* (3.5 ha) was established with 55 clones and another of *Casuarina equisetifolia* (2.5 ha) was established with 66 clones such a way that one male is surrounded by six females.

5. **Seed Production Area**: A total of 90 ha of Teak plantation in Kerala was identified for converting into Seed Production Areas.

After survey of *Eucalyptus grandis* plantations in Kerala (Munnar), and in Mavadappu (Kadambarai), Tamil Nadu, 2 ha were selected for converting into Seed Production Area at each site. Five ha plantation of *Acacia planifrons* was selected for converting into Seed Production Area at Chinnar, Tamil Nadu.

Project 33: ODA (Overseas Development Agency) technical support project.

Objectives: Train IFGTB staff in the relevant aspects of forest genetics and tree breeding; increase the exposure of IFGTB staff to contemporary theory and practice in forest genetics and tree breeding; provide continuing advice and support to IFGTB's Director and Heads of Division; provide specific equipment that is essential for IFGTB to fulfil its mandate; acquire comprehensive collections of the genetic resources of its priority species.

The Tree-CD facility established in the Institute is being extensively used by the Scientists of IFGTB and other institutes. The two database management programmes BRAHMS and SISTEM+ are now routinely used for herbarium management and seed handling respectively. The Tree-CD facility is now extended for five years.

Achievements

During the year various trainings and participation in workshop were supported by ODA.

Project 34: UNDP/FAO regional project on "improving productivity of the man-made forests through application of technological advances in tree breeding and propagation (FORTIP) (RAS/91/004).

Objectives: The Institute of Forest Genetics and Tree Breeding is the National Focal Point for FORTIP's activities in India. Work on Tree Improvement began with linking the research institutions, State Forest Departments and Universities through a network inception Workshop. Later, these linkages were extended to international research organisations like CSIRO, Australia and DFSC, Denmark. IFGTB's collaboration with these organisations through FORTIP's networking resulted in acquisition of large quantity of seeds of tree species, formulation of breeding programmes, establishment of genetic trials and seed producing plantations, collection of recent literature and minor field equipment, conduction of workshops and publication of technical and field manuals.

Achievements

Several provenance trials of eucalypts were established in India with the seeds obtained from CSIRO, Australia. Four of the provenance trials were assessed by IFGTB and the superior provenances (e.g. Laura and Kennedy River, for *E. tereticornis*) were identified. With FORTIP's assistance, seeds of these provenances were again obtained from CSIRO in bulk. Using these seeds, 4 ha. of SPAs of each species have been raised in two locations. These plantations are to be culled during 1997 and 1998 and are expected to start seed production from 1999 onwards. The seeds collected will be used for raising commercial plantations by various agencies.

Under the FORTIP project there is a provision for comprehensive National Provenance Trial on neem and an International provenance trial on neem. This work is coordinated by Arid Forest Research Institute, Jodhpur. Under this project, Forest Research Institute has also maintained and expanded the poplar germplasm bank. Nearly 190 clonal accessions were developed and maintained.

During the year 1997-1998, IFGTB brought out a Field Document on "Clonal Multiplication of Eucalyptus" under this project.

NEW PROJECTS TAKEN UP IN HAND DURING 1997-98

Project 35: Selection of pest/disease resistant phenotypes of Teak, Casuarina and Eucalyptus (WB Project 3.2).

Objectives: Screening and identification of resistant clones/progenies/provenances of the target tree species to the key insect pests/diseases.

Progress made

Casuarina equisetifolia : Occurrence of stem borer, *Inderbela quadrinotata* and stem canker and die-back diseases were studied in the International Provenance Trial laid out at Pondicherry. The provenances from Australia and Kenya remained least affected by the borer, whereas the Sarawak provenances had maximum infestation.

The progeny trial cum seedling seed orchards of *Casuarina equisetifolia* and *Eucalyptus camaldulensis* were surveyed for incidence of the Cottony cushion scale (*Icerya purchasi*) and bark feeding beetle respectively.

EXTENSION

a) Facilities generated and services rendered

i) Consultancy to various agencies e.g. testing of samples etc.

Consultation was imparted to the west zone farmers on silvicultural operations.

Networking was initiated between farmers and Protection Division of IFGTB for pest and disease problems.

Consultancy was offered by the Scientists to Andhra Pradesh Forest Development Corporation in pest and disease management of Eucalyptus clonal nurseries and plantations.

Plants and plant products like tissue culture plants, cut flowers, rhizomes, seeds etc. were subjected to the plant quarantine measures and about 25 necessary certificates were issued to various exporters during the year 1997-98.

ii) Library and documentation - computer facilities

The IFGTB Library is a repository of literature on Forestry, Biotechnology, Genetics, Environment and Ecology. The library caters to the needs of Foresters/Researchers of this institute, State Forest Departments and Research Institutes, Universities and Colleges.

Computer facilities

The Institute has 40 Computers (IBM Compatible PCs ranging from 286 based to Pentium based systems) and printers distributed across different divisions and units.

iii) Video films

Filming on "Cultivation and improvement on Casuarina" is in the pipe line.

b) Transfer of Technology

Under extension activities, several one day demonstration classes, exhibitions were conducted for the benefit of State Forest Department officials, University students, Farmers and Hill tribes. The subjects taken up for the purpose are, pest management, micro-macro propagation, nursery practice, biofertilizer applications etc.

c) Linkages with other organizations/Institute/States etc. - e.g. collaborative ventures etc.

The ICFRE brochures viz. *Casuarina equisetifolia*, *Tamarindus indica*, sandal and *Pongamia pinnata* printed in Tamil, English and Malayalam were distributed to the target groups.

Queries on pest and disease problems referred by the State Forest Departments, Government/Private organizations and farmers were investigated and suitable management strategies were suggested.

Extension literature

Four ICFRE brochures on tree species of *Casuarina equisetifolia*, Sandal, *Tamarindus indica* and *Pongamia pinnata* were printed in Tamil and Malayalam, and the publications have been distributed to the end users, State Forest Departments, Universities, Research Institutes, NGOs, farmers and Industries in Tamil Nadu and Kerala. Economic editions in English were also and distributed to the target groups. Other tree species like Eucalyptus, Moringa, Neem, *Prosopis juliflora*, *Acacia nilotica* and *Sesbania* were also taken up for printing of brochures in Tamil and Malayalam. Tamil translation of Eucalyptus and Moringa has been completed.

Technical consultancy on turnkey basis

A deal on consultancy was finalized with the Andhra Pradesh Forest Development Corporation for clonal technologies of eucalypts. The consultancy earns revenue of Rs. 12 lakhs. The following works were done under this arrangement.

- Eight lakhs cuttings of different clones produced
- 200 ha of clonal plants out planted
- 10 ha of Clonal Multiplication Area developed
- 8 ha of Seedling Seed Orchard developed
- All Plantation managers and Dy. Plantation Managers given hands on training
- Over 50 skilled labourers given "on field" training
- Infrastructure development for clonal production for planting 2500 ha per year with clonal material completed
- New clonal planting stock identified

In addition to the above, a low cost technology for mass multiplication of eucalypts was also provided to APFDC and nearly 100 polytunnels with 600 cuttings in each are being raised by APFDC on a 30 days turn over period. This cost effective approach, has enabled APFDC to supplement multiplication of clones in mist chambers.

Gass Forest Museum

Magnificent collection of rare, exotic and educative exhibits related to Forestry and Natural History housed at the Museum was maintained creation of awareness among the public and students. About 25432 people including many high dignitaries from India and abroad visited the Museum during the year.

FINANCIAL STATEMENT

SL. NO.	SUB-HEAD	EXPENDITURE UPTO MARCH 1998
I	PLAN	
	A. REVENUE EXPENDITURE	
	a. Research	12171921
	b. Administrative Support	4071207
	Total for Revenue Expenditure 'A'	16243128
	B. LOANS AND ADVANCES	
	Loans & Advances (Conveyance)	285900
	House Building Advance	75000
	Total for 'B'	360900
	C. CAPITAL EXPENDITURE	
	Building & Roads	4185600
	Equipments, Lib. Books	272407
	Vehicles	
	Total for 'C'	4458007
	Grand Total for 'A+B+C' (PLAN)	21062035
	a. FORTIP	85224
	b. UNDP	437971
	c. WORLD BANK	7642917
II	NON-PLAN	
	A. REVENUE EXPENDITURE	
	a. Research	807691
	b. Administrative Support	
	(Salaries)	3358271
	TOTAL NON-PLAN	4165962