

**TROPICAL FOREST RESEARCH INSTITUTE  
JABALPUR**

Tropical Forest Research Institute (TFRI) is one of the eight Institutes under the Indian Council of Forestry Research and Education (ICFRE). It came into existence in April 1988. TFRI has equipped itself for undertaking diverse and intensive research on forestry and related problems of tropical forest of Madhya Pradesh, Chhattisgarh, Maharashtra and Orissa.

**PROJECTS COMPLETED DURING THE YEAR 2000-2001****Project 1: Screening of the species tolerant in lime kiln area of M.P. (TFRI-96/Chem-9)**

**Objectives:** (a) To study the impact of lime kiln pollutants (SPM, SO<sub>2</sub>, NO<sub>2</sub>) on the chemical and biochemical parameters of plant species in Jhukehi region of Katni district, M.P. (b) To analyse the soil samples collected from different grid points in the lime kiln area.

**Results:** Leaf samples of 12 tree species were collected in different seasons from the lime kiln area and quantitatively analysed for various chemical and bio-chemical parameters and seasonal variations were observed for pollutants. Most of the species collected exhibited reduction in chlorophyll, protein, starch and total sugar content in all the seasons. All exhibited significant reduction in ascorbic acid content, however, in monsoon, irregular pattern was observed. Enzymatic parameters like peroxidase, super oxide dismutase increased significantly in most of the plant species collect from the lime kiln area.

Soil samples collected from different grid points in different seasons were analysed for various chemical parameters. All the parameters varied significantly and showed adverse effect of lime kiln pollutants on soil. The result has been published in various National and International journals.

**Project 2: Screening of phytochemicals of forest species and their utility in pest control. (TFRI-97/Chem-8)**

**Objectives:** (a) To isolate the biologically active chemicals. (b) To assess the biological activities.

**Results:** Biologically active constituents from *Jatropha curcas* seed oil separated with the help of chromatographic techniques and evaluated for their stability / persistency by testing against insects. Phenolic acids from stored and fresh *J. curcas* seeds were isolated and estimated with the help of HPLC. Pesticidal activities of *J. curcas* seed components were evaluated against insect fungi and nematode pests.

**Project 3: Allelopathic effect of some forest tree species on agricultural crops. (TFRI-96/Chem-9)**

**Objectives :** (a) To study the activity of different agroforestry / forestry tree leaf and root extracts on growth and germination of agricultural crop. (b) To evaluate alteration in chemical contents of leaves and seeds of crop, yield of seed and weight of seeds. (c) To study chemical factors responsible for stimulatory

and inhibitory activity of tree species. (d) To assess the compatibility of trees species of agricultural crop.

**Results:** Allelopathic activity of tree species *Madhuca indica*, *Ailanthus excelsa* and *Butea monosperma* were studied for bioassays on germination, seedling growth, yield and biochemical changes in soyabean 10, 20% leaf and root extracts adversely affected germination of soyabean seeds. Mixed response was observed on nitrate reductase activity and plant growth. Concentration dependent effect was observed. Phenolic acids, free sugars, glycosides and alkaloids were present in major quantity in extracts of all species while small amount of terpene and aminoacids were present in *A. excelsa*.

#### **Project 4: Studies on the diseases of important tree seeds, nurseries, plantations, stored wood and bamboos and their control measures.**

**Objectives:** (a) To study the various seed storage techniques to reduce seed borne fungal flora, increase viability and germination. (b) To workout suitable control measures for nursery and plantation diseases. (c) To evaluate the natural factors in disease control. (d) To evolve biological control for important soil borne plant pathogens.

**Results:** Extensive survey in the study area was conducted and new diseases / problems and recommendations regarding disease management were also suggested to forest departments of M.P., Maharashtra and Orissa. Important research findings have been compiled and published in the form of research paper, handbook and brochures.

### **OLD PROJECTS CONTINUED DURING THE YEAR 2000 - 2001**

#### **Project 1: Research on tree farming models in association with instant income yielding crops. (TFRI-92/Agro-5)**

**Objectives :** (a) To develop agroforestry systems for the best combination of tree and crops. (b) To retain and demonstrate the proven models to user groups.

##### **Achievements :**

**Silvi-pastoral system:** Tree species *Dalbergia sissoo* and *Pongamia pinnata* were tried with *Panicum maximum*, *Pennisetum pedicellatum*, *Vetiveria zizanioides* and Rosa grass. The growth of Sissoo was significantly superior with *Sesbania sesban* and *Pennisetum pedicellatum* (Deenanath), *Sesbania sesban* and *Penicum maximum*. In the 6<sup>th</sup> year productivity of Deenanath (*Pennisetum pedicellatum*) has remained constant at 6 t/yr./ha where as Ginni grass (*Penicum maximum*) attained upto 10 t/yr./ha.

**Silvi - olericultural system:** Five tree species *Acacia nilotica*, *Albizia procera*, *Dalbergia sissoo*, *Gmelina arborea* and *Tectona grandis* were tried with vegetable species Lady finger, Carrot, Tomato, Radish, Palak and Brinjal.

**Vegetables :** Tomato, brinjal, carrot and radish performed better under trees than in open on soils prone to erosion. *Albizia procera*, *Acacia nilotica* and *Dalbergia sissoo* were found more suitable than *Gmelina arborea* or Teak arranged in descending order of suitability. Vegetable seed production of carrot (*Daucus carota*) and radish (*Raphanus sativus*) was done more successfully under *Albizia procera* and *Dalbergia sissoo* than *Acacia nilotica*, *Gmelina arborea* and Teak.

**Silvi - horti - agri. system:** Poplar, *Albizia procera*, Kinnow, Lemon and Orange were tried with

soyabean / wheat rotation. Wheat and soybean yield was found maximum under a particular direction of the tree canopy e.g. Populus towards East and Citrus towards West. The growth of Poplar was found to be uneconomical in V<sup>th</sup> year (<1.6 cum/ha/yr.). Kinnows could be introduced successfully, bearing fruits in third year. In oranges fruit set was found to be a problem, as evidenced from low fruit bearing.



A promising Silvi-Horti -Agri Model - Poplar with Kinnow and Wheat

**Project 2 : Market survey of prevailing tree species and forest products. (TFRI-94/Econ/Agro-3)**

**Objectives :** (a) To find out the market rates of forest products such as round and sawn timbers of *Shorea robusta*, *Tectona grandis*, *Eucalyptus* and *Bamboo* spp. at the end of each quarter from Nagpur, Raipur and Jabalpur. (b) To find out the market rates of other forest products like fuel wood from the above mentioned three markets on quarterly basis. (c) Compilation and analysis of data.

**Achievements:** Market rates of *Tectona grandis*, *Shorea robusta*, *Eucalyptus* and *Bamboo* species from Raipur, Nagpur and Jabalpur markets were collected and sent to ICFRE, Dehra Dun. Market rates for different fuelwood species for the quarter ending from the Nagpur, Raipur and Jabalpur market were conducted and sent to ICFRE, Dehra Dun. On the basis of survey information quarterly "Timber / Bamboo Trade Bulletin" upto Dec. 2000 has been published by ICFRE, Dehra Dun.

**Project 3 : Multi Purpose Trees for Agroforestry. (TFRI-94/Agro-2)**

**Sub-Project : Trials of MPTs in Agroforestry Systems in Chhattisgarh State.**

**Objectives :** (a) To study some traditional agroforestry model in Chhattisgarh region. (b) To establish on farm trials of Babul model on selected farmer's field in Chhattisgarh region. (c) Trial of promising models in experimental area of Tropical Forest Research Institute, Jabalpur.

**Sub-Project : Study of allelopathic effects, if any, of tree growth on Agricultural crops, root growth pattern under different plantation geometry and development of suitable agroforestry models.**

**Objectives :** (a) To find out the allelopathic interactions, if any, of existing agroforestry systems and Paddy-babul model, by bioassay methods. (b) To study the soil phytotoxicity of decomposed litter of trees in associated agricultural crop. (c) To quantify the allelochemicals and correlate their growths with such chemicals.

**Achievements :** Extensive survey conducted, most popular model identified was rice + babul followed by line planting of *Albizia procera* and Paddy-butea model for lack cultivation. Farmer's with higher income level have preference for fruit trees such as Mango, Guava and Papaya. On farm trials were laid out on the fields of 10 farmers in Chhattisgarh. Upland improved rice variety JR-75 was sown as broadcast crop on all the OFR. Scientific evaluation of rice-babul system in respect of density of trees, tree management practices (Root and canopy pruning), improved varieties of trees (*Acacia nilotica* ssp. *cupressiformis* vs. *Acacia nilotica* ssp. *indica*) and traditional long duration rainfed varieties like JR-75 and JR-353 have been used in order to standardize the system. Financial analysis showed a higher side in favour of Rice-babul system under rainfed condition. Difference in growth parameters (gbh, height) between the tree sub species (*indica* and *cupressiformis*) was found to be insignificant. Pot culture studies to study soil phototoxins and litter decomposition have been completed for 12 agricultural crops and 7 tree crops. Quantification of Allelochemicals in *Pongamia pinnata* and *Sesbania sesban* with some selected crops were completed. Agricultural crops like rice, soyabean, wheat, carrot, radish, tomato and brinjal were allelopathically suitable to the 5 MPTs in order of *A. procera*>*A. nilotica*>*D. sissoo*>*G. arborea*>*T. grandis*.

**Project 4: Optimum land use through mixed cropping of Bach (*Acorus calamus* Linn.) with paddy. (TFRI-99/Agro-9)**

**Objectives:** (a) To standardise the cultivation technique of Bach (*Acorus calamus*) with paddy. (b) Transfer of technology to user agencies.

**Achievements :** Viability of paddy cultivation with Bach established. Five chemotypes of Bach collected from Mandla (M.P.), Kullu-Manali (H.P.), Dudhwa (U.P.), Jharsuguda (Orissa), Tarai region (U.P.) and established in experimental area.

**Project 5: Development of agroforestry model for Teak plantations with medicinal plants. (TFRI-99/Agro-14)**

**Objectives:** (a) To Standardize the cultivation technique of Safed Musli under Teak plantations on sustainable basis. (b) To transfer the technique to user agencies.

**Achievements :** Four different canopy pruning levels of Teak tested- 25%, 50%, 75% and control (no pruning). 50% canopy was found to be most encouraging for growth of tuber.

**Project 6: Identification of the markets of NTFP's, their potential, prices and marketing pattern in M.P. (TFRI-2000/Econ/Agro-25)**

**Objectives:** (a) To identify the markets of NWFP's in Madhya Pradesh. (b) To identify the economic importance of NWFP's in M.P.

**Achievements :** Major NWFP markets were identified. Seasonal prices of NWFPs – Mahua flower and seed, Kumbhi flower, Dhawai flower, Baiberang, Bahera (with and without seed), Tasar cocoon, Tamarind, Ajmoda, Kusum seed, Kusum lac, Dhawra gum and Chironji etc. were collected.

**Project 7: Collection of ethnobotanical data from various tribes of Central India. (TFRI-97/Bot-18)**

**Objectives :** (a) To survey, inventory collect, identify and documentation the plants used by the tribes. (b) To collect and conservation of plants used by the tribes with special reference to primitive cultivars and wild relatives. (c) To study the impact of tribal culture on vegetation. (d) To study social structure of the tribal people and find out means for their livelihood and upliftment.

**Achievements :** Ethnobotanical studies and survey were conducted in Madhya Pradesh. About 260 plant species were documented which are used by the tribes for various purposes. Ethnobiology of the tribal groups were studied. Specimens of plants, fruits and seeds of trees used by tribals were collected and maintained in carpological museum alongwith photographs.

**Project 8: Development of afforestation methodology for mined areas in Central India and Ecological evaluation of rehabilitation area. (TFRI-98/Ecol-8)**

**Objectives:** (a) To find out the nature and characteristics of soils, occurrences of native species, testing different species for their suitability. (b) To select soil and water conservation methods for checking erosion and increasing moisture regime. (c) To test different boosters and fertilizers for initial nutrient support. (d) To initiate the microbial activities for biodegradation of organic matter and overall development of a suitable ecosystem.

**Achievements :** Experiment conducted on nutrient accumulation in *Albizia procera* as influenced by application of compost and fertilizers in copper mine overburden reveals that compost served as better medium for biomass production, nutrient availability and uptake by plants, which were further augmented by supplementing it with NPK fertilizers and the ratio were standardized. It has been observed that while afforesting iron mine overburden with NFT species either of the three treatments viz. - 1 gm  $\text{CaCO}_3$  + 5 gm neem cake + 20 ml (0.3M) EDTA or 2 gm  $\text{CaCO}_3$  or 2 mg superminal per 2.5 kg spoil should be applied to obtain better results. Results exhibited significant higher root values of *A. auriculiformis* as compared to *E. camaldulensis*. It also increased with age of plants to a certain extent. Soil attributes have better status under *A. auriculiformis* in all age group plantations than *E. camaldulensis*.

**Project 9: Development of Neem in various agro-ecological regions of India (M.P. & Orissa). (TFRI-99/Ecol-11)**

**Objectives:** (a) To assess the seed source, collect and storage. (b) To evaluate the phonological behaviour and seed characteristics. (c) To study the tree improvement to get quality and reliable seed source. (d) To standardize techniques for macro and micro propagation for mass multiplication. (e) To develop village model plantations and agroforestry models. (f) To study the chemical evaluation of seeds, standardize oil extraction methodology etc. (g) To develop database for information and resources. (h) To train the target groups.

**Achievements:** Seed production areas have been identified in Madhya Pradesh and Orissa. 20 Plus Trees have been selected in each provenance in majority of the Agroclimatic zones of M.P. and Orissa. Nursery infrastructures have been developed both at Jabalpur and Chhindwara. 50,000 seedlings have

been raised during the current financial year at Jabalpur. Some experiments on fertilizer trials have also been conducted. Seed morphological properties in respect of different provenances and growth observations of seedlings from different provenances have been completed. Vegetative propagation method for Neem has been standardized. model plantation is being raised in about 5 ha area. Two training programmes on Neem have been conducted,

**Project 10 : Forest Entomology : Identify pests on forest seeds, in nurseries and plantations and assess levels of damage and, to develop practical technique for the control of pests through cultural practices and biocontrol technique. (TFRI-94/Ento-04)**

**Objectives:** (a) To investigate the key insect pests of Teak, *Albizia* spp. and bamboo, the damage caused by them. (b) To develop practical, feasible, economical pest management system for nurseries, plantations and forests.

**Achievements :** Seeds of *Albizia procera* were observed to have been seriously damaged by a bruchid beetle, 3 field trials were laid out at TFRI campus and doses of 8 insecticides were prepared and sprayed on seed-pod bearing trees of Albizia. Result showed that foliar spraying of 0.01, 0.03 and 0.05 percent of endosulfan, 0.002 percent alphamethrin and 0.002 percent deltamethrin are equally effective to suppress the infestation of seed borer. In storage, the experiment showed that carbondisulphide, carbon tetrachloride and chloroform all @ 1 ml insecticide/kg are effective to suppress the infestation of seed borer. Pathogenicity of a fungus isolated and identified as *Beauveria bassiana* was tested against the fourth instar larvae of teak leaf skeletonizer. Laboratory and field experiments to investigate the lowest effective dose of fungi viz., *B. bassiana* and *Metarrhizium anisopliae* against teak leaf skeletonizer was studied. A field trial was also laid out against the teak defoliator, *B. thuringiensis* Kurstaki 1.0, B.t. Kurstaki 1.5 per cent, deltamethrin 0.002 per cent and alphamethrin 0.0002 per cent proved equally effective to suppress the pest population. Different quantities of egg parasitoid, *Trichogramma brasiliensis* were also introduced in Teak forests to suppress the infestation of Teak leaf skeletonizer. The results showed that release of at least 1.5 lakhs parasites / ha is effective to minimise the infestation.

**Project 11: Population dynamics, behaviour of Sal heartwood borer and development of its control measures. (TFRI-97/Ento-06)**

**Objectives:** To investigate the flight range, longevity, oviposition behaviour and response to the kairomones from sal sap, oviposition behaviour of beetles and to develop control measures.

**Achievements :** During the assessment of borer affected Sal forests, it was observed that some of the compartments have more than 1.5 per cent attack. Laboratory and field experiments were also laid out to investigate the kairomonal effect isolated from Sal bark. The methanolic extract proved effective to attract the beetles in laboratory. The extract was sent to CDRI for chemical analysis.



Grub predator of Sal Borer



Sal tree attacked by borer *Hoplocerambyx spinicornis*

**Project 12: Research on mass production of Biofertilizers (VAM, Rhizobium and other beneficial organisms) and their field application. (TFRI-94/Patho-3)**

**Objectives:** (a) To produce inocula in bulk in glass house using trap species for field application. (b) To layout of field experiments of various agroclimatic conditions to examine the efficacy of VAM fungi in plantations. (c) To maintain cultures of different biofertilizer agents.

**Achievements :** Inoculum of VAM fungi for Teak, bamboo, *A. procera* and *D. sissoo* were prepared in bulk using maize as a trap species in glass house. Inocula of VAM fungi, N<sub>2</sub> fixers, Phosphate Solubilizing Bacteria (PSB) were produced in glass house and in the laboratory. Field experiments were conducted by using VAM fungi Azospirillum, PSB in Teak and Bamboo. Cultures of VAM fungi, rhizobia, PSB, Azatobacter and other beneficial bacteria and microbe are maintained in the laboratory for their further use. Spores population and species diversity of VAM fungi was found to be less in unprotected areas for both teak and bamboo.

**Project 13: Cultivation of Non-Wood Forest Products. (TFRI-94/NWFP-19)**

**Objectives:** (a) To establish germplasm collection. (b) standardize multiplication methods. (c) To establish demonstration plots. (d) To conduct performance trial for introduction to Central India.

**Achievements:**

**Bamboo:** Collected germplasm of 17 species. Standardized multiplication methods through seeds, vegetative propagation and macroproliferation of rhizomes. Established demonstration plots at TFRI campus. Performance trials are being conducted at TFRI, Kanker & Chhindwara in collaboration with MP Forest Departments.

**Grass (*C. martinii*):** Collected germplasm from 20 localities of MP, Maharashtra, Orissa, Karnataka, Kerala and Tamil Nadu. Conducted multiplication trials. Evaluated germplasm in terms of geraniol contents. Established demonstration plots.

**Fruit Yielding Tree Species:** Collected germplasm of *A. marmelos*, *P. emblica* and *M. indica* from 37, 32 & 52 localities respectively from MP, Maharashtra and Orissa. Conducted multiplication trials. Analysed fatty acids, vitamin C and marmalasin contents in respective species. Identified best germplasm for further multiplication in term of growth and active ingredient.

**Project 14: Central scheme for development of agro-techniques and cultivation of medicinal plants. (TFRI-98/NWFP-10)**

**Objectives:** (a) To conduct germination trials on seeds to assess the viability and germination percentage. (b) To assess the rooting percentage for standardizing vegetative propagation technique in field and mist chamber conditions. (c) To prepare the field for raising demonstration plantations of allotted species. (d) To raise seedlings in poly-bags for undertaking plantations. (e) To evaluate chemical active constituents of wild and cultivated varieties. (f) To record data, compilation, analysis, interpretation and writing reports.

**Achievements :** Surveyed various localities for occurrence and collection of planting material of *Alstonia scholaris*, *Craeteva nurvala*, *Gmelina arborea* and *Strychnos potatorum*. 100 root shoots of cracteva were planted and cuttings were planted in poly-bags for vegetative propagation trial. Collected seedlings were planted in poly-bags for their growth and seeds tested for germination study. Seed germination trials of *Gmelina arborea* showed better result without any treatment as compared to treatments. Stone germination was found 29.25% in control. 12% seed germination was recorded for seeds of *S. potatorum*.

Root-shoot suckers of *C. nurvala* shows better performance for root development as compared to cuttings from other portions of the tree. Cuttings of *S. potatorum* did not sprout, *C. nurvala* cuttings initially sprouted but roots development did not occur. Chemical analysis of various parts of the selected species have been carried out.

**Project 15: Integrated development of tree borne oil seeds of forest origin: *Jatropha curcas*, *Pongamia pinnata* and *Madhuca latifolia*. (TFRI-99/NWFP-12)**

**Objectives:** (a) To survey and collect seeds from different climatic zones. (b) To standardize the nursery and planting technology to produce quality planting material in different agro-climatic zones. (c) To develop technologies for storage and processing of seeds. (d) To arrange training and workshop for extension workers and to prepare pamphlets.

**Achievements:** The collected seedlings have been planted in the beds as well as in polybags in NWFP nursery of TFRI, the results have indicated that best time for sprouting and rooting of *Jatropha* cuttings is Feb.-April. Cuttings planted in rainy seasons resulted in large scale mortality. Karanj seeds collected during April-May give very good percentage of germination. The seeds remain viable for 8-10 months after maturity. Karanj also give encouraging response to vegetative propagation through branch cuttings. Mahua seeds collected during the end of June to second week of July, showed maximum germination percent and retained of their viability for 1-2 months after maturity, thereafter, the percentage of germination decreases rapidly. However, maximum oil content was observed from the seed collected in the month of May. Mahua gave very poor response to vegetative propagation methods though air layering is partially successful. Preliminary investigations on seed oil quality has indicated that the fatty acid contents decreases along during the storage. Investigations are in progress to determine best method of storage in the form of selection of containers and godowning conditions.

**Project 16: Role of Mycorrhizae in the Establishment of tissue culture raised plants. (TFRI/99-2001/Patho-3/DST/4)**

**Objectives:** To study the growth performance of *Tectona grandis* and Safed Musli (*Chlorophytum borivillianum*) by application of mycorrhiza.

**Achievements:** A large number of VAM fungi are found associated with musli. The infection varies in different locality. The spore populations also varied accordingly. The VAM flora including species of *Glomus*, *Scutellospora*, *Gigaspora* and *Acaulospora* were found associated with the roots of *C. borivillianum*. The culture of all these species were prepared by using maize as the trap plant. The spore population and the root infection were high in VAM and VAM + Phosphorus treatment. The yield of musli root was also high in both these treatments as compare to control. VAM and VAM + Phosphorus treatments were found highly significant. The number of spores were more in VAM + Phosphorus treatment. Shoot length was also more in this treatment.

**NEW PROJECTS TAKEN UP DURING THE YEAR 2000-2001**

**Project 1: Social and Livelihood Analysis of Dependence of Tribal People on Forests. (TFRI-2000/Econ-23)**

**Objectives:** (a) To study the socio-cultural relations of Primitive Tribe Groups (PTGs) in Central India. (b) To study the current level of dependence of these PTGs on forests in Central India. (c) To identify



problems of PTGs related to availability / access of forest produce. (d) To suggest an appropriate model for upliftment of PTGs.

**Progress made :** Selection of PTGs for study – Korku in M.P., Kolam in Maharashtra, Khond in Orissa and Kavar in Chhattisgarh.

**Project 2: Biodiversity study in protected areas- (a) Nauradehi Wild Life Sanctuary M.P. (b) Debrigarh Wild Life Sanctuary, Orissa. (TFRI-2000/BD-16)**

**Objectives :** (a) To ascertain the extent of species richness through communities identification and their structure. (b) To study the regeneration status of major tree species. (c) To demarcate biodiversity rich areas and their status in sanctuary. (d) To identify species of ethnobotanical importance. (e) To identify species which are rare, endangered, threatened or abundant in sanctuary. (f) To study the soil chemical properties, soil microflora and fauna of the sanctuary.

**Progress made:** Phytosociological studies were carried out by quadrat method. 28 trees, 6 shrubs and 40 herbs and their regeneration were identified and recorded. Soil samples were collected for chemical analysis. Samples have been analysed and data has been tabulated.

**Project 3: Eco-rehabilitation of degraded forests. (TFRI-2000/Eco-20)**

**Objectives :** (a) To identify the stress factors related with degraded forests and other degraded lands. (b) To study and underline the recourse measures to be taken for ecorestoration by analyzing the action taken by JFM etc. in this field and response of degraded forests and surrounding areas. (c) To study the sustainability limit of harvesting. (d) To develop model ecorestoration and advise measures to be taken for ecorestoration of degraded forests.

**Progress made :** Field study was conducted to know the effect of spacing on ground flora diversity and productivity in a *Dalbergia sissoo* plantation on degraded land at 2x2 m and 4x4 m spacings on a highly eroded piece of land (TFRI Campus). It has been suggested that for site with high biological diversity, species rich ground flora plantation of *D. sissoo* in highly degraded land, the spacing should be 4x4 m spacing. Soil samples were collected and analysed for their chemical constituents. Biomass study of ground flora and microbial population analysis of soils are in progress. Conducted training on Rehabilitation of degraded land and mined out areas Forest Guards / Foresters at TFRI.

**Project 4: Ecological and Economic evaluation of Teak monoculture and mixed plantation. (TFRI-2000-2001/Ecol-2)**

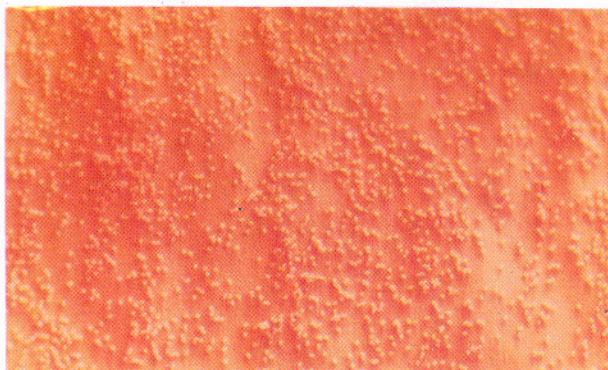
**Objectives:** (a) To find out ecological changes associated with Teak monoculture and mixed plantations with respect to age. (b) To find out factors responsible for sustainability on the basis of ecological studies and peoples requirement. (c) To find out economic values of plantation of different age. (d) To find out more appropriate site specific land management system which will be sustainable economically, more beneficial and ecologically stable.

**Progress made:** Growth performance of Teak at different age intervals were studied, soil profiles excavated and studied in different age plantations and in adjoining open land for comparison. Soil samples were collected from the area and analysed for physicochemical attributes. Biomass study of some plants was also carried out and representative samples collected for detailed chemical analysis.

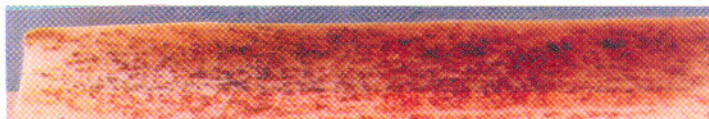
**Project 5: Mass multiplication of *Trichogramma* spp. and their efficacy against key pests of Teak forests. (TFRI-2000/Ento-24)**

**Objectives:** (a) To identify the parasitoids. (b) To evaluate a potential species for suppressing the pest population in Teak forests. (c) To investigate an effective, long lasting, feasible control measures without any deleterious effective on environment in large forest areas.

**Progress made :** Identified 4 egg parasitoids belonging to the genus *Trichogramma* and *Trichogrammatoides*. 4 species of exotic parasitoids viz. *T. brasiliensis*, *T. pretiosum*, *T. chilensis* and *T. japonicum* multiplied in the laboratory. Two field trials were conducted during pre and post monsoon season by releasing 4 species of parasitoids separately at Bijadandi and Kalpi ranges. The data showed that *T. pretiosum* is highly effective to suppress the pest population irrespective to their period of release.



Multiplication of egg parasitoid trichogramma spp. unparasitised eggs



Trichogramma spp. unparasitised eggs

**Project 6: Investigations into the nature of inheritance and breeding of Teak. (TFRI-2000/Gen-21)**

**Objectives :** (a) To select superior phenotypes from natural / derived sources for use in production and breeding populations. (b) To establish genetic test to derive information on inheritance pattern and selection of good general combiners. (c) To establish breeding population for isolation of transgressive segregants. (d) To establish advanced generation production populations for natural crossing to take place among highly selected parents and production of genetically improved seeds. (e) To undertake controlled hybridization between promising parents.

**Progress made :** Extensive survey of some plantations in the Vidarbha region of Maharashtra undertaken to select and mark Candidate Plus Trees. Total twenty-five CPTs of different age group have been identified from five different locations using comparison tree methods. A seed from previously selected twenty-five Plus Trees was obtained from FDCM, Nagpur. Data on different seed characters viz. Fruit size, No. of filled and unfilled locules / fruit, and seed weight etc. were collected and compiled.

**Project 7: Development of tissue culture protocol for important forestry tree species. (TFRI-2000/Gen-22)**

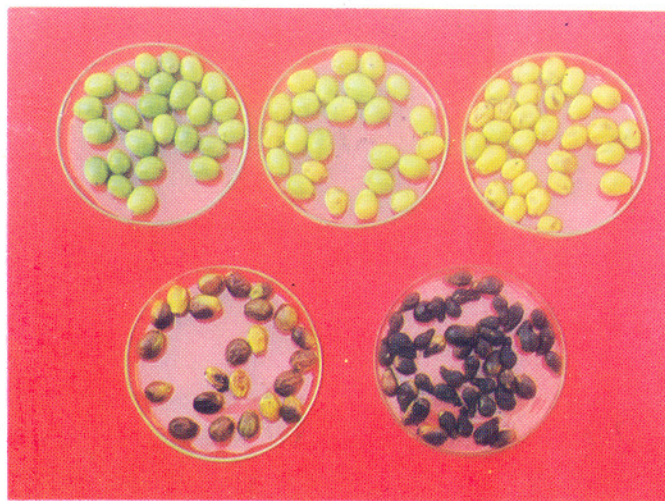
**Sub-project : Teak and *Gmelina arborea*.**

**Objectives:** (a) To establish shoot cultures using different explants viz., seeds, nodal segments, apical buds, leaves etc. (b) To establish sterilization procedure, culture media, plant growth regulators and carbohydrates for *in vitro* shoot multiplication elongation and rhizogenesis. (c) To standardize hardening and transfer techniques

of *in vitro* raised plantlets. (d) To estimate peroxidase activity, nitrate reductase activity, soluble sugar and phenol in relation to shoot multiplication and rooting.

**Objectives:** (a) To standardize protocol for shoot multiplication, rooting and hardening. (b) To establish clonal propagation with *in vitro* system for high multiplication and rooting rates. (c) To standardize sterilization procedure for explants, media, growth regulators, carbohydrates and various physical condition for shoot initiation, shoot multiplication and *in vitro* rooting. (d) To standardize *in vitro* and *in vivo* hardening and transfer techniques. (e) To study the physiological and biochemical analysis. (f) To establish field trials to compare *in vitro* and *in vivo* plantlets.

**Progress made:** Surface sterilization of half-sib seeds was carried out through different treatments. The treatment of 0.1 %  $\text{HgCl}_2$  solution for 7 minutes was found to be most effective. Shoot multiplication experiments were conducted to select suitable basal media. Murashige and Skoog's medium (1962) was found to be most suitable. Different cytokinins were compared for shoot multiplication and BA was found to be most effective. Experiments were conducted with different doses of silver nitrate in order to minimize the callus growth at base of shoots. The callus development was retarded in the range of 30 – 60  $\mu\text{M}$   $\text{AgNO}_3$ , along with enhancement in shoot multiplication and elongation. Sterilization techniques for both the explants (i.e. seed and axillary bud) have been standardized. Higher multiplication rate of the shoots has been obtained by using graded doses of cytokinins and other hormones. Callus formation in the cultures media has been minimized by addition of different concentrations of silver nitrate.



Variation in pericarp colour - *Gmelina arborea*

#### **Project 8: Screening of NWFP yielding species for saponin potential and their value addition. (TFRI-2000/Chem-18)**

**Objectives:** (a) To isolate and quantitate saponins from forest species. (b) To assess biological activities / value addition of saponins.

**Progress made:** Different extracts were prepared, quantified and examined for the presence of saponins with the help of Thin Layer Chromatography for the seeds of *Madhuca indica* and *Sapindus mukrosi*. Further separation and purification of saponins is under progress. Leaves and flowers of *Calotropis procera*, tubers of *Chlorophytus tuberosum* and *Asparagus racemosus* and *Jatropha curcas* seeds were collected and processed for the saponins isolation. Phenolic acids were isolated and estimate from fresh and stored seeds of *J. curcas* with the help of HPLC. *J. curcas* seeds were analyzed for the presence the saponins and isolation of saponins is going on.

#### **Project 9: Establishment of Advance Centre of NWFP. (TFRI-2000/NWFP-19)**

**Sub-Project:** Germplasm collection, conservation biology, domestication and commercial cultivation of threatened species of medicinal plants of India.

**Sub-Project:** Resource assessment of Non-Wood Forest Produce, documentation and development of NWFP information system.

**Sub-Project:** Utilization of Non-Wood Forest Produce wastes for making composites.

**Sub-Project:** Qualitative and quantitative variations in tree borne oil seeds with references to geographical and climatic factors.

**Sub-Project:** Standardization of methodologies for extraction and value addition of NWFP's providing sustenance to tribals.

**Objectives:** (a) To identify the potential NWFP's species for undertaking large-scale plantations on degraded forests and agriculture lands. (b) Survey, collection and conservation of rare and endangered medicinal and NWFP species of potential economic value. (c) To develop technology packages for the cultivation of Non-Wood Forest Products. (d) Silviculture and Management of NWFP and Medicinal Plants. (e) Improved utilization of NWFP wastes through development of composites using polymer resin matrix. (f) To establish the research and marketing strategies of NWFP's. (g) Market study of Non-Wood Forest Products. (h) Extension of forestry research through promoting Non-Wood Forest Products.

**Progress made:** Survey conducted in eight different areas in Madhya Pradesh. Seed weight of *Terminalia chebula* and germination studies were carried out after the fruit pulp was soaked in the water for 24 hours. It found that tree of Shahpura area gave 100% germination. *Celastrus paniculatus* seeds were collected from Amarkantak area and sown in polybags. The seedlings of both the species are being maintained. Surveyed and collected plant materials of *Hamiltonia suaveolens* and *Cymbopoyon martinii* collected from the surrounding areas of Jabalpur and separated its fibre for making composites. Literature survey on availability, potential production of NWFP species were carried out and the data available on NWFP species from different sources were entered for database / web site. Survey and selection of Kusum (*Schleichera oleosa*) trees from eight different areas were carried out and seeds of Kusum collected. The germination percentage was analysed. Surveyed and selected *Garcinia indica* plants from Sindhudurg and Ratnagiri districts of Maharashtra State. Collected *Butea monosperma* from 18 selected trees of TFRI campus and girth, height, weight of total dried flower(s) of trees were recorded and dye extracted. Surveyed different areas of Jabalpur and Maneri forest area and collected flowers of *Woodfordia fruticosa* and dye extracted. Selection of tubers of species of forest origin was done.

**Project 10: Studies on population structure dynamics and efficacy of existing Silviculture system for the management of Teak forest in Central India. (TFRI-2000/Silvi-15)**

**Objectives:** (a) To study the population structure dynamics and regeneration pattern of teak forests in Central India. (b) To evaluate the existing silvicultural system being practiced for the management of Teak forests. (c) To find out the effective exploitable girths for the management of Teak forests under selection cum improvement fellings for different site quality. (d) To establish age-height, age-diameter, age volume, diameter – volume and diameter – height relationship for the prediction and regulation of the yield in order to improve the existing silvicultural system of Teak in Central India.

**Progress made:** Sites were selected in M.P., Chhattishgarh and Maharashtra. Trees of each sample plot were enumerated, measured for height, girth etc. and marked. Soil samples brought from the fields were processed for their overall estimations of various soil properties. Physiochemical analysis of soil

samples collected from sample plots was done. Phyto-sociological studies and regeneration survey in Teak forests of some selected areas was carried out.

**Project 11: Standardization of improved nursery techniques for different multipurpose forest tree species of Central India. (a) Standardization of root trainer seedling producing system. (b) Studies on compost production and its evaluation. (TFRI-2000/Silvi-17)**

**Objectives:** (a) To standardize and to evaluate the root trainer production system for different multipurpose tree species of central India. (b) To study the suitability of leaves of different plant species in compost making, and evaluation of its effectiveness for raising different tree species under root trainer seedling production system.

**Progress made:** Root trainer seedling production protocol for *Albizia procera*, *Dalbergia sissoo* and *Acacia nilotica* has been standardized. Seedling production technology for *Albizia lebbek* and *Dalbergia latifolia* concluded. Approximately 1500 cft. compost from abundantly available local species like Bamboos, Luceana, Neem, *Butea monosperma*, Lantana prepared and tested against 6 MPT species. Nutrient analysis of vegetative compost prepared from five species was carried out for organic carbon, nitrogen, pH & moisture content. Two experiments on clonal propagation of *Tectona grandis* through cuttings obtained from vegetative multiplication garden (VMG) have been initiated. An experiment on vegetative propagation of teak through shoot cuttings employing various treatment combinations of auxins and vitamins concluded. Macroproliferation of *Bambusa nutans* carried out and 2000 plants produced. Plants of *Bambusa vulgaris* were produced through adventitious rooting of cuttings in low cost mist chamber. Physical parameters viz. initial germination, moisture content and viability of *Pterocarpus marsupium* and *Acacia catechu* seeds studied. Experiment on seed pre-treatment of these species was also carried out. Phenological studies on *Pterocarpus marsupium* conducted.

## EXTENSION

### Facilities generated and services rendered.

- A Video film on 'mushroom cultivation techniques' was completed.
- Leaflets containing information about facilities available on rental basis at TFRI prepared and distributed to various departments / agencies.
- Queries from tree growers and farmers were taken care of with evitable replies in respect to medicinal plants and mushroom cultivation.
- **TFRI publications** worth Rs. 2,414 were sold during the year.

✓ **Other Extension Activities are reported in the Introduction - Forestry Extension, ICFRE.**

## FINANCIAL STATEMENT DURING 2000-2001

<b>I. PLAN</b>		<b>EXPENDITURE (RS. IN LAKH)</b>
A.	REVENUE EXPENDITURE	
	(a) Research	162.70
	(b) Administrative Support	50.00
	(c) Others specify	36.53
B.	LOAN AND ADVANCES	
	(a) Loan Advances (Conveyance)	1.00
	(b) House Building Advance	2.00
C.	CAPITAL EXPENDITURE	
	(a) Building & Roads	- -
	(b) Equipments, Library Books	0.35
	(c) Vehicles	- -
	(d) Others specify	13.48
<b>TOTAL FOR PLAN (A+B+C)</b>		<b>266.06</b>
<b>II. NON-PLAN</b>		
A.	REVENUE EXPENDITURE	
	(a) Research	18.71
	(b) Administrative Support (Salary)	12.01
<b>TOTAL FOR NON-PLAN</b>		<b>30.72</b>
<b>III. FUNDED PROJECT</b>		
A.	World Bank Project	164.14
	UNDP Project	0.34
	NABARD Project	0.86
	FORTIP	- -
	Ford Foundation Project	2.54
	Neem Project (NOVOD)	7.50
	DBT Project	0.31
	Agrotech Project	1.91
	NOVOD Project	4.15
	SAIL	0.66
	IGNFA	0.04
	IDRC (INBAR)	0.73
	SFD (Bhopal, M.P.)	0.006
<b>TOTAL FOR FUNDED PROJECT</b>		<b>183.186</b>