

CHAPTER-VII

TROPICAL FOREST RESEARCH INSTITUTE JABALPUR

INTRODUCTION

The Tropical Forest Research Institute (TFRI) came into existence as an institute in April 1988, though its origin goes back to 1973 as a regional centre of FRI, Dehra Dun. The TFRI is fast developing to undertake diverse and intensive research on tropical forests.

The institute has the mandate of carrying out research on issues like rehabilitation of mined areas, eco-restoration of Vindhyan, Satpura, Maikal hills, western ghats; planting stock improvement; agroforestry; non-wood forest products; and forest protection. For enhancing forest productivity, research activities of the institute have been aimed at production of quality planting materials, use of biofertilizers, use of biopesticides etc. A comprehensive programme of research and development to maximise the sustainable productive use of degraded agricultural lands has been formulated and work on these aspects has been initiated in all twelve divisions of the institute.

PROJECT COMPLETED DURING 1998-99

NIL

OLD PROJECT CONTINUED DURING 1998-99

Project 1: Establishment and management of clonal seed orchards, seedling seed production areas and multiplication gardens of Teak.

Objectives: To establish of clonal seed orchards, seedling production areas and multiplication garden of Teak.

Achievements

CSO, SSPA and multiplication gardens of teak raised in previous years were maintained by executing various operations like weeding, soil working, etc.

Project 2: Development of Model Research Nursery and studies on improved nursery technology and vegetative propagation of MPT spp.

Objectives: (a) To establish Model Research Nursery with latest facilities for carrying out nursery research and production of quality planting stock. (b) To standardize nursery technology and vegetative propagation for important MPT. (c) To standardize Root-Trainer Seedling Production System for *Albizia procera*, *Acacia nilotica* and *Dalbergia sissoo*.

Achievements

Experiments were started on *Albizia procera*, *Acacia nilotica* and *Dalbergia sissoo*. Various potting mixtures were standardised for species like *A. procera*, *A. nilotica* and *D. sissoo* in root trainer seedling production system. Growth performance of seedlings was almost the same in equal volume of root trainers and

poly bags on MAI bed. Thrice a day irrigation favoured maximum growth of such seedlings. Potting mixture passed through sieve having mesh size of 49 holes/square inch produced better quality seedlings of *Albizia procera* and *Dalbergia sissoo*. On the other hand *Acacia nilotica* produced better quality seedlings in root trainers having potting mix passed through sieve of 100 mesh/square inch as compared to other sieve sizes. Last week of February was found to be the optimum time for sowing seeds of *A. procera* and *A. nilotica* in Jabalpur condition.

Vegetative propagation studies have been conducted on *Azadirachta indica*, *Acacia nilotica*, *Dalbergia sissoo*, *Tectona grandis* etc. Rooting behaviour of branch cuttings of *Dalbergia sissoo*, *Derris indica* and *Azadirachta indica* was studied under low cost misting environment.

Project 3: Development of seed technology for *Albizia procera* and *Gmelina arborea*.

Objectives: (a) Designing and layout of experiments for conducting studies on viability, germination and vigour in *Albizia procera* and *Gmelina arborea* seeds. (b) To standardize the seed storage condition with particular reference to storage temperature and storage containers.

Achievements

Fruits collected from Jabalpur, Bilaspur and Gondia were tested for fruit parameters, seed parameters, initial moisture content and germination per cent. Both the species gave better germination results in sand medium. Seeds of *A. procera* and *G. arborea* kept in air tight plastic bottles at 5°C gave better germination percent even after six months of storage as compared to containers of cotton, jute, polybag and tin.

Project 4: Study of nutritional value of some forest species.

Objectives: Estimation of nutritional and anti-nutritional constituents and removal of toxic factors.

Achievements

Garuga pinnata fruits were evaluated for nutritional value. Crude protein in fruits was 30.81% and total carbohydrate content was 5.30%. Total free amino acids, reducing sugars, vitamins viz. ascorbic acid, thiamine and pyridoxine were also found along with good mineral content.

Anti-nutritional constituents viz., total phenols and tannins were found in traces whereas cyanogens were absent.

Project 5: Allelopathic effect of forestry tree species on seed yield, quality and chemical changes in soybean.

Objectives: To study influence of aqueous extract of forest tree species on soybean.

Achievements

Effects of *Azadirachta indica* (Neem), *Pongamia pinnata* (Karanj) leaves and root extract (10 and 20 percent) with or without nitrogen were studied on germination and seedling growth of *Glycine max* (L) merrill soybean variety.

Study reveals promotory effect of karanj and neem leaf extract along with nitrogen on soybean. Root extract has exhibited inhibitory effect in few cases.



Vegetative Multiplication Garden of Teak at TFRI Campus



Seedling Seed Orchard of Acacia sps., Midnapur

Nine multipurpose tree species, Eucalyptus, Karanj, Neem, Poplar, *Albizia procera*, *Albizia lebbek*, Teak, *D. sissoo* and *Gmelina arborea* (arborea), planted at Barha experimental area, were studied for tree crop interactions.

Project 6: Screening of phytochemicals of forest plants and their utility in pest control.

Objectives: To study bio-chemical constituents of plant origin for pest control.

Achievements

Parthenin, a major constituent of *Parthenium hysterophorous* was isolated and evaluated for its possible bio-activity against pests. Parthenin was found to be effective at 2% concentration against teak defoliator under laboratory conditions.

Toxic constituents from *Jatropha curcas* seed oil and cake were isolated, purified, and tested against insect and fungus pests.

Formulations were prepared using different additives, toxic constituents of *J. curcas* seeds and tested against teak insect (*Eutectona machearalis*) under laboratory and field-conditions and against stored seed insect pest of *Bambusa arundinacea* and *Albizia procera*. 1% solution of preparation showed complete antifedancy.

Viability of stored phyto-chemicals was also evaluated by testing their bio-activities against pests.

Project 7: Screening of species tolerant in lime kiln areas of Madhya Pradesh.

Objectives: To study bio-chemical changes in plants as influenced by pollution.

Achievements

Pongamia pinnata, *Azadirachta indica*, *Albizia procera*, *Acacia nilotica* and *Dalbergia sissoo* are not commonly present in the lime kiln polluted area. Six months old seedlings were transferred from TFRI campus to Jhukhahi and planted at 10, 50 and 100 meter distance from lime kiln. Observations were taken after four month of establishment of seedlings.

Project 8: Chemical screening of different clones and provenances of *Tectona grandis*, *Albizia procera* and Bamboo in relation to resistance against their key defoliators.

Objectives: To study bio-components in leaves responsible for resistance.

Achievements

Nine clones of teak from Maharashtra, Orissa, Andhra Pradesh and Uttar Pradesh (Namely MHAL-A5, MYHV-5, MHAL-A1, ORANP-7, APNPL-5, MHAL-P1, MHSC-A3, MHAL-A6 and Up-D) were selected for their saponins content in the leaves. Data on saponins content were correlated with data on feeding tests. Saponins showed antagonistic effect against the teak leaf skeletonizer (*Eutectona machaeralis* Walker).

Chemical composition in the leaves of ten clones of teak (viz. KLN-4, ORANR-4, APT-8, ORANR-5, CSC-9, TNT-14, TNT-11, TNT-6, ST-48, APKEC-2) from Kerala, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu and Karnataka was found to be correlated with geographical variation.

Project 9: Non Wood Forest Products.

Sub-project 9(1): Germplasm collection of different species of bamboo, *Diospyros melanoxylon* and grasses for introduction into Central India. Location of high yielding species and varieties and their distribution for further multiplication.

Sub-project 9(2): Selection of fruit yielding trees of forest origin and edible bamboos. Developing multiplication techniques and establishment of demonstration plots and seed orchards.

Objectives: Survey, selection and evaluation of germplasms, propagation and standardization of multiplication techniques.

Achievements

Multipled germplasms of *Bambusa bambos*, *B. nutans*, *Bambusa polymorpha*, *B. tulda*, *B. vulgaris* var. *vulgaris*, *Dendrocalamus gigantea*, *D. membranaceus* were established in blocks of 16 plants each for assessing their performance in Central Indian climate. Growth observations were recorded.

50 selected 'tendu' bushes have been coppiced on monthly basis for the study of vegetative propagation. The cuttings were dipped in solutions of IAA, IBA, NAA and thiamine with concentrations of 100, 200 and 500 ppm over night and planted in mist chamber for rooting.

Cymbopogon martinii slips were planted under *Dalbergia sissoo* plantation at TFRI campus to find out the feasibility of inter-cropping.

Mahua flowers and seeds collected from selected trees at Abhanpur, Rajim, Atan and Sher (Raipur); Devri Road, Baputola (Rajanandgaon); Lalbarra (Balaghat); Durg in M.P.; Tirora (Bhandara) and Gondia in Maharashtra were estimated for sugar (in flowers), oil and protein percentage (in seeds). Growth performance data from multilocational trials were recorded. Demonstration plantation raised at NWFP garden in TFRI campus was maintained.

Project 10: "Market survey of important tree species and forest products".

Objectives: To find out the market rates of forest products such as round timbers and sawn timbers and market survey of other forest products like fuelwood, fodder available from forests.

Achievements

Market surveys were carried out to obtain market rates of sawn and round timber of selected species viz. *Tectona grandis*, *Shorea robusta*, *Eucalyptus* spp. and Bamboos from Raipur, Nagpur, Jabalpur districts on quarterly basis. Data were compiled, tabulated and analysed for publication of quarterly bulletin at ICFRE, Dehra Dun.

Project 11: "Socio-economic studies on multipurpose forest tree species for use in Agroforestry".

Objectives: To conduct socio-economic survey and compile the data.

Achievements

Conducted socio-economic survey in 13 villages of Jabalpur and Seoni on the basis of economically viable agroforestry models. It is noted that the main species were babul, palash and mango which are raised with the agricultural crops of wheat, paddy, soyabean, gram and urad, mainly on the boundaries of agricultural fields.

Project 12: "Production and management of bamboo agroforestry model on degraded agricultural lands in Central India".

Objectives: To record growth performance of agricultural crops under bamboo and also the yield of bamboo.

Achievements

Seven bamboo based agroforestry models were maintained and regular growth measurements of bamboo and yield of agricultural crops were recorded.

Project 13: Genetics and Breeding of Forest Tree species.

Sub-project 13(1): Genetic analysis of quantitative characters in teak.

Objectives: (a) To find out inheritance pattern of traits of economic importance. (b) To estimate genetic parameters. (c) To find out parents with general combining ability.

Achievements

The experiment was established with 27 half-sib families of teak in 1982 at Dhandatopa, Orissa. Data were recorded on height, diameter at breast height and basal area during the period under report and analysed for analysis of variance, resulting in significant amount of genetic variation for all the traits. Family alone accounted for more than 50 percent variation of the total. This indicates scope for family selection and converting the present materials into a productive seedling seed orchard for immediate genetic gain. Height recorded highest genetic gain.

Project 14: Vegetative propagation of forestry species.

Sub-project 14(1): Evolving vegetative propagation technology for teak (*Tectona grandis*).

Objectives: To investigate the effect of IBA, thiamine and their all possible interaction on induction and growth of adventitious roots in shoot cuttings of teak.

Achievements

Branches with growth of one year were collected from vegetative multiplication garden of *Tectona grandis* maintained at TFRI, Jabalpur. The branches were made into shoot cuttings of 25-30 cm length and 1.5-2.0 cm diameter and randomly arranged in groups each of 25 cuttings. The basal cut end upto 2.0 cm of the cuttings was treated for 18 hr with IBA and thiamine individually or in their all possible combination. Thus in all, there were 20 treatments each with three replicates arranged into factorial randomized design. Among all combinations; 1000 ppm IBA x 800 ppm thiamine significantly enhanced root induction (upto 60 %) and promoted luxuriant growth of adventitious roots. This treatment has been recommended for clonal propagation of teak on a large scale.

Project 15: Developing tissue culture protocols for *Bambusa vulgaris* and *Kaempferia galanga*.

Sub-project 15(1): Micropropagation of *Bambusa vulgaris* (green) schard ex Wendl. and *Kaempferia galanga*.

Objectives: (a) To establish shoot cultures using nodal segments and rhizomes as explants. (b) To standardize the sterilization procedure, culture media, plant growth regulators and carbohydrates for shoot initiation, shoot multiplication and *in vitro* rooting. (c) To standardize hardening and transfer techniques of *in vitro* raised plantlets. (d) To estimate different biochemical parameters.

Achievements

A high shoot multiplication rate of 7 fold has been achieved in *B. vulgaris* through axillary bud proliferation from nodal segments collected from mature culms. Almost 100 % *in vitro* rooting has been achieved in *B. vulgaris* in MS medium supplemented with 25 mm NAA. About 80 % transplantation success has been achieved with *B. vulgaris* plantlets when an intermediate stage of hardening in soilrite was followed. A large number of plantlets have been produced in *Kaempferia galanga* using rhizomes as explants. A very high shoot multiplication rate of 13 fold has been obtained on MS medium supplemented with 12 mm BA and 3mm NAA. A single medium has been formulated in which both shoot multiplication and rooting take place simultaneously.

Project 16: Developing tissue culture protocols for *Dendrocalamus strictus*.

Sub-project 16(1): Micro propagation of *Dendrocalamus strictus*.

Objectives : (a) To develop protocol for *in vitro* propagation through axillary bud proliferation. (b) To standardize sterilization procedure for explants, media growth regulator, carbohydrates, and various physical conditions for shoot initiation, multiplication and rooting. (c) To achieve highest multiplication rate and rooting percentage. (d) To standardize *in vitro* and *ex vitro* hardening and transfer techniques.

Achievements

4.59 fold multiplication rate has been achieved in *Dendrocalamus strictus*, which is the highest so far reported. 50 percent rooting has been achieved from the mature explant.

Project 17: Studies on diseases of forestry spp. seeds, nurseries, plantation, natural forest, non-wood forest produce and their control.

Objectives: (a) To study diseases. (b) To estimate damages. (c) To find out control measures.

Achievements

Seed mycoflora of *Gmelina arborea*, *Tectona grandis*, *Bixa oryliana* and *Phyllanthus emblica* was recorded and control measures suggested. Three seed borne pathogens i.e. *Fusarium oxysporum*, *F. unoniliforme* and *Graptium* spp. were observed as potential seed rot agents which would reduce seed germination significantly.

Rhizoctonia solani and *Macrophomina phaseolina* causing damping off disease on 11 hosts and foliage diseases caused by various leaf spotting fungi including powdery mildews were recorded. It has been observed that seedling wilt disease is favoured by high temperature and acidic soil conditions with high nitrogen and low potassium content. Integrated disease management approach was applied to control nursery diseases.

Root rot mortality in *Albizia procera* plantation trees caused by *Spongipellis spumeus* has been studied. The detailed symptoms, spread of disease and predisposing factor were analyzed. *Ganoderma colosum* causes root rot in *Delonix regia* and *Albizia lebbek* plantations (20 % - 25 %). *Phomopsis albizae* was the causes of twig blight branch canker which is followed by die back in 5 years old plantation of *Albizia procera*. Ground fire and repeated cutting of branches are the main predisposing factor for the disease incidence. Six treatment combination including *Trichoderma* formulation were applied to manage the disease in field condition. Status of stem wilt of *Casuarina* by *Trichosporium vesiculosum* was studied.

Wood block tests were conducted with a white rot fungus *Pycnoporus sanguineus* and a brown rot fungus *Gloeophyllum striatum* to test the efficacy of zinc borate preservative received from Wood Preservation Branch of FRI, Dehra Dun. Biocontrol formulations were tested to control root diseases of neem and teak in nursery. Leaf extract of marie gold was tested for the control of decay fungi.

Projects 18: Studies on the role of mycorrhizae and biofertilizers, their mass production and field application in raising multipurpose tree species.

Objectives: To study VAM fungi rhizobium and bacteria associated with important species and their role in tree productivity.

Achievements

VAM fungi occurring in rhizospheres of teak, bamboo, *Albizia procera* and *Casuarina* were isolated and identified. Cultures of these fungi are maintained in specially designed cemented/concrete beds, plastic and earthen pots at the institute.

Sand, soil and soilrite in 16 different combinations were tested for production of VAM inocula for teak using teak as trap plants. Soilrite and soil in 1:1 was found to be the best combination followed by sand : soil in 2:1 (v/v) for production of VAM inocula for teak.

An experiment with the treatments of VAM fungi and associated N_2 fixing bacteria has been designed in root trainers to study the impact on dry biomass, root colonization, phosphorus and nitrogen uptake.

A field experiment is in progress to study the effect of VAM fungi and associated N_2 fixing bacteria (*Azospirillum* sp.) on growth of teak.

VAM fungi applied during macroproliferation of *Dendrocalamus strictus*, *D. asper* and *Bambusa arundinacea* showed positive effects.

Application of VAM fungi alongwith phosphorus was very effective in enhancing height and culms numbers in *D. strictus*, *D. membranaceus*, *D. asper* and *Bambusa arundinacea* in the field. In the field experiment, the local VAM population becomes active and plays an important role in root colonization and additional growth.

An experiment was started to study the periodic development of effective propagules of VAM isolated from *Albizia procera*. It showed 650 propagules/100 g soil within 8 weeks.

Project 19: Development of afforestation methodology for different types of mined areas in Central India.

Objectives: (a) To find out the nature and characteristics of spoils. (b) To study the occurrences of native species, devise suitable conservation methods for increasing moisture regime, test different booster fertilizers for initial nutrient support and development of suitable ecosystem. (c) To initiate microbial activities for biodegradation of organic matter.

Achievements

The first phase of rehabilitation of iron ore mine overburden has been completed. The work included characterisation of iron mine overburdens, such as studies of soil properties of natural surrounding forests and overburdens, succession development, diversity, spatial variability etc. Species suitability has been worked

out. Biomass production in copper mine overburdens of Malajkhand under various treatments has been studied. Suitability index has been prepared for selected species. Similar work has also been started for manganese mine overburden of Bharweli (Balaghat). Spore population, percent infection of VAM in different trees and in rhizosphere surroundings were studied and relationship with soil nutrient was worked out.

Project 20: Studies on pollution absorbing efficiency of different forest species in industrial area.

Objectives: (a) To assess pollution load in industrial areas, enumerate native species occurrences at different grid points from the pollution sources. (b) Study of chemical and biochemical characteristics of plant species present at different grid points. (c) To screen plant species according to pollution tolerance. (d) To develop models for planting and expanding sink areas.

Achievements

The present study was confined to specific localities viz. Korba (Thermal Power Plant) and Katni - Satna (Lime kiln area). Pollution status in all four directions from central grid point was measured in all seasons. Vegetation parameters of plants occurring at grid points were measured. Injury due to exposure to pollution was measured both in qualitative and quantitative terms. Changes in chemical and biochemical constituents of leaves and their seasonal variations are being assessed. Seasonal variation in soil physico-chemical properties at different grid points is also being recorded.

Project 21: Development of afforestation methodology for different types of mined overburden areas, degraded and waste lands (phase-II). Ecological evaluation of rehabilitated area.

Objectives: (a) To determine present level of productivity of the plantations and projection of growth. (b) To determine present and projected value of nutrient enrichment. (c) To determine environmental benefits of plantation in economic terms and, (d) To find out benefit cost ratio at present level and projected value for future.

Achievements

Growth performance and biomass production of *Dalbergia sissoo* planted in highly degraded eroded land under different set of management practices and treatments were studied. Litter production and return under different treatments were estimated. Soil samples from different treatments have been collected and are being analysed for their physico-chemical properties. Primary productivity (ground flora biomass), species diversity, importance value index, concentration of dominance, similarity index etc., were estimated at different spacings and compared with floral status out side plantation to assess changes.

Project 22: Post afforestation influence on soil properties and moisture regime under some selected species in M.P.

Objectives: (a) To ascertain the impact of different vegetation on soil attributes with special reference to its physico-chemical properties. (b) To assess the rate of litter production and decomposition due to vegetation of varying ages. (c) To study the spatial variability of soil physico-chemical attributes under some selected species.

Achievements

Sequential growth performance of different NFT and non NFT species were studied in loamy skeletal soil of Jabalpur. Changes in physico-chemical properties of soils under even aged plantations were assessed. Root zone generally showed slightly lower moisture status than the lower and surrounding spaces. Slightly lowering of pH and increase in organic matter were observed under plantations. However, there were variations in differences with species and their densities. There was considerable increase in organic matter and nutrients due to plantations in coal mine overburden at Jayant near Singrauli.

Project 23: To develop practical techniques for control of pests through cultural practices and biological techniques.

Objectives: To quantify cultural and biological techniques for pest control.

Achievements

Natural relative resistance in teak clones (ORANR - 2, ORANR - 3, ORANR - 4, ORANP - 7, ORPB - 15, APT - 8, APT - 14, TNT - 2 AND MHSC - A3) to its defoliator, *Spodoptera litura* was worked out through field observations and feeding bioassay in laboratory.

Bio-pesticidal property of crude water and methanolic extracts of leaves of 4 plant species viz., *Annona squamosa*, *Lantana camara*, *Calotropis procera* and *Ipomoea cornea* was evaluated against teak defoliator and skeletonizer and bamboo leaf roller, *Crypsiptya coclesalis* under field conditions. Leaf extract of *Annona squamosa* showed strong feeding inhibition activity.

Field efficacy of three varietal strains of *Bacillus thuringiensis*, such as var. *kurstaki* endotoxin (Bioasp), *B.t.* var. *dendrolimus* endotoxin, *B. t.* var. *thuringiensis* endotoxin and 6 - 8%β exotoxin and dipel *B. t.* var. *kurstaki* were tested against *Albizia* foliage feeder, *Spirama retorta*. The results shows that foliar spraying of *B. t.* is significantly effective in killing the larvae over the control. The action or efficacy of this microbial pesticides is however slow but enhances on increasing the exposure period.

Natural enemies: Natural enemies such as parasitoids and predators of teak defoliator, leaf skeletonizer and bamboo leaf roller, were reared from larvae and pupae, collected from various localities of Madhya Pradesh and Maharashtra. Details regarding potential parasitoids and predators, their active period, and parasitization percentage were recorded.

Project 24: Training in Computer Awareness.

Objectives: To enhance computer skill of scientists/officers/staff of the Institute.

Achievements

In order to acquaint research workers with the latest developments in Information Technology and to enhance their computer skill, two training courses were organised training on "Basic Computer Skills" and Computer Network/Internet & E-mail for 20 Scientists/Officers.

Project 25: Hard ware/soft ware maintenance, upgradation and procurement and technical support to officers/scientists and staff.

Objectives: To extend software facility and provide technical support/statistical analysis through SPSS and MS Excel.

Achievements

Software and hard ware facility was extended to all research workers of the institute throughout the year successfully.

Project 26: To provide international connectivity through Internet.

Objectives: To exchange information over Internet.

Achievements

Online facility was extended to whole Institute throughout the year successfully.

Project 27: Programme budgeting.

Objectives: To create package for retrieval and maintenance of accounts of the Institute.

Achievements

Computerization of account of the institute was initiated. Structure of the package has been defined based on various expenditure head.

Project 28: Study of Biodiversity in Tropical forest ecosystem of Sapurha National Park, M.P.

Objectives: (a) To study the floristic composition of various communities in the park. (b) To study physio-chemical attributes and vegetation dynamics. (c) To study regeneration status of important species in the park. (d) To study physico-chemical properties of soils occurring in plant communities with special reference to soil microbial diversity, and (e) To study biological spectrum of the park.

Achievements

A general reconnaissance survey of forest and soil was conducted. Soil profile were exposed and sample were collected for physico-chemical analysis. Vegetation dynamics study was conducted in quadrates of various sizes.

Plant communities in different elevations were identified through importance value index-IVI.

Project 29: Catalytic effect of tree planting on rehabilitation of native forest biodiversity on degraded tropical land.

Objectives: (a) To find out the variations in ground flora diversity between plantations of different species and adjoining area. (b) To estimate the variation in soil properties and fauna between adjoining area and plantation of different species.

Achievements

Following the concept that tree planting on degraded land can dramatically increase the native ground flora species diversity, an investigation was taken up to estimate and compare diversity of ground flora grown under various plantations raised on degraded (lateritic) land near Raipur in Madhya Pradesh.

The higher value of diversity index under plantations indicates that ground flora community in plantations is more stable than in open bhata land. The index of dissimilarity between plantations and open bhata land is high, which indicates remarkable degree of dissimilarity of ground flora species. Bacterial and fungal population, number of nematodes, VAM fungi spores in soil are far more under plantations than in open bhata land. Soil pH, electrical conductivity, organic matter and nutrients are also higher under plantations.

Project 30: Biodiversity study in JFM areas.

Objectives: (a) To assess the growth of major tree species in protected and unprotected area. (b) To study the regeneration status of major tree species. (c) To study the status of ground flora and (d) To study the population structure of major tree species.

Achievements

Analysed the data obtained from vegetation study in JFM area of Sambalpur (Orissa).

Diversity index was maximum in areas under 3 years protection. This may be attributed to better protection in this area and better micro-climatic situation. Diversity index was found to be the least in 4 years protection areas which gradually increases in areas protected for 13 yrs.

The electrical conductivity and pH were studied in protected and unprotected site. Socio-economic survey in Radhiapali (Sambalpur) was conducted to assess the demand and supply position of forest produce. Fuelwood consumption was 4-5 kg/day per family collected in 6-8 trip in a month. Villagers were mostly dependent on agriculture and collected NTFPs like tendu leaves, *mahua* flower, fruit, mushroom, neem seed, Terminalia seed, sal leaves and seeds and broom grass from forest.

Project 31: MPTs for Agroforestry.

Objectives: (a) Evaluation of some traditional agroforestry systems in Chhattisgarh region of M.P. with emphasis on Babul+rice system. (b) Evaluation of the system with two varieties (traditional long duration vs improved JR-75) and two *Acacia nilotica* varieties (Telia Babul vs Ramkanta babul). (c) To study tree crop interactions in the system. (d) Studies on socio-economic aspects and financial analysis of the system. (e) To find out allelopathic interactions if any in existing agroforestry systems and babul+rice model by bioassay methods. (f) To study soil phytotoxicity of decomposed litter of trees in associated agricultural crops.

Achievements

An extensive survey was conducted on existing agroforestry practices in Bilaspur district of Chhattisgarh region covering 200 farmers by adopting stratified random sampling method. The most popular models identified were rice+babul followed by line planting of *Albizia procera*. It was observed that no standard management practices were adopted for these models. In general under the rice+babul model, the trees were maintained at high densities inside crop fields on a 10-12 year rotation. The rice varieties were of long duration and low yielding capacity (1 to 1.5 t/ha). Farmers who practised root and canopy pruning measures in babul tree could obtain higher crop yields. Scientific evaluation of these systems with respect of density of trees (spacing), tree management practices (root and canopy pruning), and improved varieties of trees and agricultural crop have to be carried out for improvement/standardization of the system. Line planting of *Albizia procera* was taken up to standardise spacing and management practices. Data on various

parameters like soil sample, growth and yield of kharif rice crop has been recorded. Data were collected on pruned biomass from third year onwards in *Acacia nilotica* var. *indica* (Telia) and *Acacia nilotica* var. *cuppersiformis* (Ramkanta).

An analytical model to predict density of babul trees/ha in upland rice fields in Chhattisgarh in the traditional system was developed through RRA & PRA techniques in Devri and Pendri Khamariya villages in Bilaspur district. A preliminary financial analysis of even aged Telia babul-rice, Ramkanta babul-rice and sole rice cropping system was done on the basis of IRR, NPV and B/C ratios. Rainfed rice varieties were sown in these trials by farmers. In OSR trials in Barha, to quantify litter fall, litter traps were laid out and observations are being recorded at monthly intervals.

In order to study the allelopathic relationship of tree growth on agricultural crop, two species *Acacia nilotica* and *Albizia procera* were selected while the agricultural crops studied were rice, soybean, carrot and radish. Bioassay studies on seed germination aspects were conducted. Major nutrient concentrations in leaves, branches and roots of babul and *Albizia procera* have been studied. Phenolic compounds in *Acacia nilotica* var. *indica* have been worked out quantitatively for 24 trees in leaves, branches and roots. In a related study root systems 5 MPTs at 2 x 2 m spacing in a 3yr old plantation of *Acacia nilotica*, *Albizia procera*, *Dalbergia sissoo*, *Gmelina arborea* and *Tectona grandis* growing in a degraded soil with hard pan (murrum soil) were uprooted and rooting patterns and root characteristics were studied. Pot-culture studies with known quantities of decomposed litter of *Acacia* and *Albizia* were initiated to study the effect on rice, carrot, radish and soybean. Studies on biomass production of 5 MPTs revealed that the trend in above ground biomass production was *D. sissoo* > *A. nilotica* > *T. grandis* > *A. procera* > *G. arborea*. The trend in below ground biomass was *D. sissoo* > *A. nilotica* > *T. grandis* > *G. arborea* > *A. procera*. The impact of soil physico-chemical properties of soils under the 5 MPTs was also worked out. Leaf leachate inhibitory activity on wheat crop under 4 MPTs (*A. nilotica*, *L. leucocephala*, *Eucalyptus* sp. and *Bauhinia variegata*) was studied. Phenolic activity in *A. nilotica* with various agricultural crops was quantified. The data on pot-culture experiments are being analysed.

Project 32: Development of tree farming models in association with instant income yielding crops like medicinal plants, grasses, fodder crops, perennial pigeon pea etc. to motivate farmers to Agroforestry.

Objectives: (a) To obtain progressively increasing yields per unit area per unit time on sustained basis. (b) To find out the best combination of forest trees and vegetable/pulse crop/cereal or millet crop/medicinal and aromatic plants and grasses. (c) To establish demonstration plots and seek people's participation. (d) To optimise/standardize the best tree associates.

Achievements

One of the most promising agroforestry models under rainfed system with minimum inputs and maximum outputs has been found to be *D. sissoo* (5x5 m) + *Sesbania sesban* alternated with sisoo in the same row + perennial pigeon pea at 1x1 m spacing.

A silvi-olericultural model has been conceived and tried over the past 5 years across 9 vegetable crops and 5 tree species viz., *Acacia nilotica*, *Albizia procera*, *Dalbergia sissoo*, *Gmelina arborea* and *Tectona grandis*. These 5 MPT's have been found to give yield greater than two Land Equivalent Ratios i.e. the tree + crops combined performance is equal to two separate pieces of land. Observations on biomass, root and shoot ratios, stem and branch were made. Also, rooting pattern data have been tabulated for vertical and horizontal spreads.

A horti-silvi-agri system based on seedless lemon, poplars, and soybean + wheat rotation in kharif and rabi season respectively is also being studied.

Project 33: Studies on the productivity and decomposition patterns of some tree species in alley cropping under tropical sub-humid conditions of Central India.

Objectives: (a) To compare and evaluate of 4 hedgerow species in alleycropping. (b) To optimize hedgerow management in terms of spacing, cutting regime, and mulch placement. (c) To study decomposition patterns and N mineralization rates. (d) To study the changes in mycorrhizal populations associated with hedgerow species.

Achievements

Sesbania sesban (a short duration perennial woody species) has proved its capability as hedgerow species in alley cropping in sub humid regions of Central India under rainfed conditions. Best results can be obtained when it is maintained as hedgerow species at 3-4 m spacing and a cutting height of 1-2 m. The pruned biomass obtained from annual prunings (4-6 t/ha) and the high N content (3-4%) of leafy biomass can meet most of the N requirements of Kharif maize crop. The Land Equivalent ratio (LER) compares favourably with some of the promising AF systems found in the tropics. *Cassia siamea* and *Leucaena* can be recommended to farmers for alleycropping in subhumid zones of Central India in view of its higher rate of biomass turnover and survival % in field conditions.

Project 34: "Seed collection and storage in seed bank and supply".

Objectives: Survey and identification of seed sources/provenances followed by seed processing, storing and testing for viability.

Achievements

Identification of seed sources for collection of quality seeds of 29 forestry species was made. 270 kg seeds from 15 forestry species were collected, processed and kept in storage. 106 Kg quality and certified seeds viz. *Albizia procera*, *Acacia nilotica*, *Tectona grandis*, *Bambusa nutans* and *Dalbergia sissoo*, etc. were distributed for provenance/plantations trials to various Research Organisations. Germination and viability tests of all the stored seeds are being conducted periodically. Phenological behavior concerning leaf initiation, occurrence, leaf fall, flowering and fruiting was recorded for *Tectona grandis* from this region.

Neem seed stored in sawdust at 30°C can maintain seed moisture of 30-35% upto 3-4 months without significant loss of viability.

Project 35: Collection of ethnobotanical data from various tribes of Central India.

Objectives: Survey, collection, identification and documentation of plants used by various tribes.

Achievements

Ethnobotanical studies were conducted in Central Madhya Pradesh. About 150 plant species of ethnobotanical importance were documented along with ethnobotanical uses.

Project 36: Vegetative propagation of fruit yielding and ornamental species.

Objectives: To improve planting stock of fruit yielding and ornamental species and develop mass propagation techniques.

Achievements

Studies were conducted to enhance the rooting percentage of fruit yielding spp. Large number of fruit yielding, avenue trees (1500) and Ornamentals (4000) were multiplied through application of low-cost phytohormones.

About 4000 Herbarium specimens and 60 fruit specimen have been preserved in carpological museum. Preparation of pictorial Atlas of forest wealth of Central India, is in progress.

NEW PROJECT TAKEN IN HAND DURING 1998-99

NIL

ICFRE-FORD FOUNDATION PROJECT

Project 37: "Productivity Enhancement - Management for People's Participation".

Objectives: (a) Socio-economic Surveys for documentation of short term and long term needs and expectations of the people to evolve socially acceptable and economically viable technologies. (b) To develop site specific models of rehabilitations for maximum production of goods and services (including wood and non-wood products). (c) Evaluation of various production alternatives and trade-off thereunder. (d) To study existing channels of flow for forest products to markets to identify bottlenecks and suggest means of improving their marketability. (e) To develop locally feasible processing technologies for value addition, storage and marketability of non-wood forest products.

Achievements

Madhya Pradesh Site: On the basis of vegetation survey and Socio-economic studies, the open patches in the forest area were identified with the help of the villagers of Kundwara and Reoria. Preferred species of fodder grasses were short-listed. Accordingly *Stylosanthes hamata* (an exotic sp.) and *dinanath* i.e. *Pennisetium pedicellatum* (an indigenous sp.) were grown in the identified open patches. This would help to prevent cattle entry into forested areas as the favoured grass will be harvested for stall feeding to the cattle. In consultation with the M.P. Fish Development Corporation, fish breeding material was introduced in the existing pond at Reoria village and necessary additional inputs for rearing the fish were also added. The marketing of the fish produce would be done by the Forest Protection Committee. Mushroom cultivation demonstration were held. A workshop was conducted to develop the skills of local villagers for sustainable collection of medicinal plant products available in the forests. The productivity yield tables for *mahua* flowers and seeds and *char* have been prepared to predict output and market rates.

Orissa site: Vegetation data of adjoining forests of five villages Radiapali, Kunjapali, Gadgadbahal, Krishnanagar and Ghikundi were analysed. It was found that after protection by the village committees, the number of species have increased in the protected forest area. After repeated discussions, planting of MPTs on farm bunds and homesteads, was carried out. The planting materials of many species like lemon, *Dalbergia sissoo*, *Dalbergia latifolia*, *Dendrocalamus strictus*, *Tectona grandis*, *Gmelina arborea*, *Albizia lebbek* and *Azadirachta indica*, etc. were distributed among villagers. After the survey of medicinal plants/marketing products and villagers interest in cultivation of medicinal plants, two medicinal planting material Ashwagandha and Senoy was distributed among villagers. Socio-Economic Survey Phase-II has been completed. Market survey (for off season) of all seven markets located around the site area was conducted and tabulation and analysis of the same are in progress. Studies on Gender-conflicts were conducted in two selected villages.

NABARD PROJECT

Project 38: Development of agroforestry models for various agro-ecological regions.

Objectives: (a) Socio-economic survey of selected micro watersheds. (b) Economic analysis of existing Agroforestry systems. (c) Selection of MPTs for integration in Agroforestry systems. (d) Introduction of biofertilizers in Agroforestry plantations and evaluation of their potentiality in enhancing productivity. (e) To design experiments for improving land use. (f) To design appropriate land use for selected watersheds.

Sites: Saliwara micro-watershed- Jabalpur, Karaboh micro-watershed - Chhindwara, Gandagouri micro-watersheds - Kanker.

Achievements

Raising and maintenance 5000 seedlings in Gandagouri micro-watershed was done. Seedlings of some horticultural and forestry species were procured from State horticultural nurseries, and TFRI and SFD nurseries of Chhindwara and Kanker. Approx. 10000 seedlings were procured for each site including seedlings raised in NABARD nurseries. The cultures for *Albizia procera*, *Dalbergia sissoo*, *Acacia nilotica* were prepared by pathology Div. of TFRI, Jabalpur. Various doses of rhizobium and VAM were applied in the field.

Height and girth observations of plants are being recorded and tabulated in all micro-watersheds. Layout of experiments and digging of pits under different A/P models in all the three micro-watersheds were carried out. This includes 23836 forestry species and 7061 horticultural species. A total number of 30, 897 seedlings of Saliwara, Gandagouri, Kraboh were planted.

Experiments pertaining to watering, soil working and cultivation of vegetables within Silvi-Horti. Systems and their effect on growth of plants have been laid out and observations are being recorded. Casualty replacement of seedlings was carried out. Since the soils of the region contain sufficient amount of potassium, only nitrogenous and phosphatic fertilizers were applied for both leguminous and non-leguminous plants in all the three micro watersheds.

Initial height and Collar diameter (before application of fertilizers) have been measured. Quarterly observations of height and girth are being recorded. 670 staggered trenches were dug in sloppy-lands to conserve soil and water in Saliwara micro-watershed.

EXTENSION

Project 39: Extension.

Technology Demonstration

Presently 2 projects of State forest Research Institute, Jabalpur on "Mass propagation of Bamboo's" and "Developing Cultivation Techniques of Medicinal Plants" are being implemented. The bamboo project has been successfully completed.

One project, " Demonstration of Technology for manufacture of Eucalyptus furniture and joinery", being implemented by Yavatmal Zilha Nilgiri Vriksha Utpadak and Prakiya Sahkari Sansthan Yavatmal, is being regularly monitored by the TFRI, Jabalpur.

Film/Video preparation

Under WB (FREE) Project, two Betacam Films of telecast quality, titled - "Bamboo, a Gift of Nature", meant for general public and "Bamboo, Promising Gains", for technology users, have been completed.

This institute has started making another film entitled - "Rehabilitation of Stress sites".

Besides, VHS Video film titled - "Forestry at your Doorstep", and VHS video - "Bamboo, from Forests to Farmers' Fields", have been prepared.

A VHS video film - "A Film on Forestry Research", of 40 min. highlighting all the research and extension activities, during the past 5 years of the institute, has also been completed.

Contract Printing :

Brochures on "Bamboo" and "Neem", have been translated and printed in Marathi. These brochures are regularly distributed to SFD, FDCM, farmers, and NGOs of Maharashtra.

Brochures on "Neem", has also been translated and printed in Oriya. It is regularly distributed to SFD, Forest Corporation, farmers, and NGOs of Orissa.

Following Leaflets technical Brochures were published and distributed by the Institute :

a) Leaflets

1. Mushroom Cultivation Techniques
2. Cost Analysis for establishing Tissue Culture Lab.
3. Nursery and Plantation Techniques of MPTs (in Hindi)
4. *Dandrocalamus asper* (in Hindi & English)
5. Genetic Conservation and Clonal Propagation of Bamboos (in Hindi & English)
6. Tropical Forest Research Institute, Jabalpur, its Mandate and Strengths.
7. Conservation & Production techniques of NTFPs of Jabalpur district, in Hindi is under publication.
8. Soils of TFRI, Barha and adjoining areas.
9. Plant Tissue Culture.
10. Vegetative propagation of trees.
11. Meteorological Data of TFRI, Jabalpur - July, 1995 to July, 1998, has recently been published.
12. Draught type Drum Drier.

b) Brochures

1. Afforestation of Important stress sites.
2. Some Improvised forest Nursery equipment.
3. Seed orchard.
4. Root Diseases in Forest Nurseries of M.P. and their Control
5. Plant tissue culture.
6. Vegetative propagation of trees.
7. Hand book of Diseases in tropical tree species.
8. Ecorestoration of Iron Mined Area.
9. Application of rhizobium in forest tree species.
10. Hand Book on Nursery and Plantation Technology
11. Ecorestoration of Line stone mined Area.
12. Hand book on seed collection Processing and storage.
13. Provenance Testing
14. Characteristics & Environmental impact of Flyash.

15. Meteorological Data of TFRI, Jabalpur.
16. Plant Diversity in Preservation Plots of Orissa.
17. Draught type Drum Drier.
18. Plant Diversity in Preservation Plots of Maharashtra.

The manuscripts of following brochures/books are ready and are to printed soon :

1. Biofertilisers
2. JFM in Orissa & M.P., Case Studies & Recommendations Workshops/Seminars/Trainings/ Demonstrations.

“Survey, planning, selection of site and raising of modern nursery” demonstration workshop was organised on 14 and 15 Feb. '96.

Training cum demonstration was organised for SAIL Executives on “Ecorestoration of Mined over areas” - 30 to 13 Oct. '96.

Demonstrated TFRI technologies on “Medicinal Plants, Agroforestry Models, Silviculture and Biofertilizer techniques” to 56 members of forestry cooperative organized by IFFDC project Sagar.

“Low cost drum type driers” were established for demonstration in four selected villages of M.P. and two villages of Orissa.

Demonstration of technology on “Biofertilisers” was made at Yavatmal, M.S.

“Low cost mushroom production huts” were established in selected villages of M.P. & Orissa.

Demonstration and research plots of selected “Agroforestry Models” were established at Bilaspur, Balaghat and Raipur.

A group of farmers was given information on “Low cost technology for cultivation of edible mushroom”.

Demonstration on “Nursery and Plantation technology” was imparted to the Forest Ranger Trainees from Rangers' College, Balaghat.

Training on Seed Technology was organised for farmers and trainees sent by Jawaharlal Nehru Krishi Vishwa Vidyalay, Jabalpur.

Demonstration and lectures were organised for 38 students of IIFM, Bhopal.

Demonstration and lecture was arranged for a group of 28 Lecturers and Teachers of Universities of M.P., on a visit.

A National Conference on “Teak” was organised from 26th to 27 May 1998, the Theme Tree of the Institute, for 50th Year of Independence Celebrations.

A computer training programme was organised for the scientists and staff of the Institute, from 14-19 Sept. '98.

To commemorate the 50th year of India's Independence, a painting competition for local school children from class I to class XII on “Environmental awareness” was organised.

FINANCIAL STATEMENT

| I. PLAN | | |
|----------------------------|--|---|
| Sl.No. | SUB-HEAD | Expenditure (Rs. in lakh) |
| 1. | A. REVENUE EXPENDITURE (a) Research (b) Administrative Support (c) Minor works | 206.84 41.74 7.50 |
| | Total for Revenue Expenditure 'A' | 256.08 |
| | B. LOAN AND ADVANCES (a) Loan Advances (Conveyance) (b) House Building Advance | 1.00 6.98 |
| | Total for 'B' | 7.98 |
| | C. CAPITAL EXPENDITURE (a) Building & Roads (b) Equipments, Library Books (c) Vehicles (d) Maintenance of Building & Roads. Maintenance (Civil & Electrical) (e) Civil works (Construction of boundary wall) (f) (Electrical Maintenance) | - 0.99 - 32.67 52.96 13.74 |
| | Total for 'C' | 100.36 |
| | GRAND TOTAL FOR A+B+C(PLAN) | 364.42 |
| II. NON-PLAN | | |
| 1. | A. REVENUE EXPENDITURE (a) Research (b) Administrative Support (Salary) (c) Payment to KVS | 20.41 4.29 23.00 |
| | Total Non-Plan | 47.70 |
| | TOTAL FOR PLAN + NON-PLAN | 412.12 |
| III. FUNDED PROJECT | | |
| | A. World Bank Project | 69.20 |
| | B. UNDP Project | 0.52 |
| | C. NABARD Project | 5.00 |
| | D. FORTIP | - |
| | E. FORSPA | 0.35 |
| | F. SAIL | 0.68 |
| | G. NCL | 0.03 |
| | GRAND TOTAL for (A TO G) FUNDED PROJECT | 75.78 |