CHAPTER IV

TROPICAL FOREST RESEARCH INSTITUTE, JABALPUR

Tropical Forest Research Institute (TFRI), Jabalpur is working as a regional institute of ICFRE since 1988. It caters to the forestry research needs of four central states viz., Madhya Pradesh, Chhattisgarh, Maharashtra and Orissa. Thrust areas of the institute are non-wood forest products, rehabilitation of mined areas and other stress sites, research and demonstration in agroforestry models, planting stock improvement, including developing tissue culture protocols for difficult species of central India and control of forest diseases and pests. During the recent years, TFRI has established constant liaison with forest departments of different states besides the four states of its jurisdiction, NGOs working in the field of forestry and allied areas, universities imparting education in forestry and forest based industries. This has helped the institute in imbibing in its research programme ideas and concepts from various user groups.

PROJECTS COMPLETED DURING THE YEAR 2002-03

Project 1: Population dynamics and behaviour of sal heartwood borer and its control measures [007/TFRI-97/Ento-06; 1997-2002]. *For technical report contact, Principal Investigator - Dr. K.C. Joshi.*

Findings: Beetles of sal heart wood borer, *Hoplocerambyx spinicornis* lay the eggs on sal trees just after the onset of monsoon from mid of June to September. After 2-8 days of egg period, hatching takes place. The viability of eggs varies from 40-100 percent according to the climatic conditions. The grubs bore the bark, feed on the sapwood and later on form the tunnels in heartwood for pupation. The pupation begins from the last week of December and continues upto April. After few days of pupal period, the beetles develop which wait inside tunnels till the onset of monsoon in the month of June. The beetles attract to the smell of freshly cut or broken sal trees, bark or sapwood. It has one generation in a year. Spraying of endosulfan (0.025%) on trap sal logs does not influence the efficiency of traps to attract the beetles. A crystalline compound extracted from sal bark is proved effective to attract the beetles in laboratory. Two potential entomopathogenic fungi viz. *Beauveria bassiana* and *Metarhyzium anisopliae* have been investigated to kill the freshly hatched grubs of sal heartwood borer.

A sal tree killed by borer

Grubs of sal borer

Project 2: Establishment of advance centre for non-wood forest produce [022/TFRI-2000/NWFP-19(2); 2000-2002]. *For technical report contact, Principal Investigator - Dr. S.S. Bisen.*

Sub-project : Utilisation of non-wood forest product waste for making composites (Species: *Hyptis suaveolens* and *Cymbopogon maritnii*).

Findings: Technology has been developed to utilise the industrial refuge of *Hyptis suaveolens* and *Cymbopogon maritnii* for preparing composites. The composite has been found suitable for making hardboard on the basis of its mechanical properties.

PROJECTS CONTINUED DURING THE YEAR 2002-2003

Project 1: Social and livelihood analysis of dependence of tribal people on forests [015/TFRI-2000/Econ-23; 2000-2005]. *Principle Investigator- Dr. Nanita Berry.*

Status: Total 55 households have been surveyed in five villages of Hoshangabad and Betul districts of Madhya Pradesh. Study shows that members of Korku tribe earn their livelihood mainly from agriculture (25%), NTFP collection (20%) and as hired labourers (35%). Other income generating activities including poultry and mushroom cultivation, etc. account for about 15% earnings.

Project 2: Biodiversity studies in protected areas viz. (a) Nauradehi wildlife sanctuary, Madhya Pradesh, (b) Debrigarh wildlife sanctuary, Orissa [016/TFRI-2000/BD-16; 2000-2005]. *Principal Investigator - Dr. D.K. Shadangi.*

Status: Studies on biodiversity status in Nauradehi, WLS is complete. Phyto-sociological studies were conducted in Jhapan, Sarra and Nauradehi ranges of Nauradehi wildlife sanctuary. A total of 29 species are recorded in Jhapan, 34 in

Sarra and 35 in Nauradehi range. The diversity index of plants was calculated to be 1.103 in Jhapan and 1.233 in Sarra range. Soil samples were analysed for soil chemical composition, electrical conductivity and available NPK.

Project 3 : Collection of ethnobotanical data from various tribes of central India [006/TFRI-97/Bot-7; 2000-2005]. *Principal Investigator - Dr. Rajiv Rai.*

Status: Ethnobotanical study on Baiga tribe has been completed, while data related to Bhariya, Gond, Korku and Hill Korwa tribes has been collected and are being analised . 158 uses of various plants of forest origin have been documented. Information related to the social structure, tribal culture and interrelationship of tribes and forest vegetation have also been studied. Interviewed 28 local medicine men for documentation of ethnomedicinal uses of forest vegetation.

Project 4: Impact of eco-restoration of degraded forests [017/TFRI-2000/Ecol-20; 2000-2005]. *Principal Investigator - Dr. S.K. Banerjee.*

Status: Vegetation survey, physico-chemical characteristics of soils and assessment of causative factors for forest degradation have been studied at three sites, each in Madhya Pradesh, Orissa and Chhattisgarh.

Study of importance value index shows that coppice growth of mixed species, namely *Anogeissus latifolia, Terminalia tomentosa* and *Buchanania lanzan,* tendu etc. has converted the areas into well-stocked forest having density of 2516.5/ha, average height of the crop is 8.9 m at many places. Physico-chemical changes of surface soil due to protection and soil conservation measures have been recorded. Among the ground flora, *Heteropogon contortus, Lobelia nicotianaefolia* (wild tobacco), *Hemidesmus indicus* and *Triampheta rhombodia* etc. were dominant in FPC protected sites, while in control area (unprotected site) *Heteropogon contortus, Casia tora* and *Tridex procumbence* were found common. In Chhattisgarh and Orissa, quadrate method was used to find dominant herbs, shrubs and tree species. Sal dominates most of the degraded forests that are being protected by VFCs.

In Orissa a site protected since 2000-01 (80 ha), has been enriched with species like teak, bamboo, *Acacia mangium.* On the base of hillocks agave has been planted. Teak, tendu, *Phoenix* and *Hollarrhena antidysenterica* were found to be dominant species on the lower hill slopes; *Terminalia tomentosa, Shorea robusta, Pterocarpus marsupium,* tendu, *Hollarrhena antidysenterica, Combretum decandum, Dalbergia paniculata* and *Morinda tinctoria* on the middle portions and *Combretum decandum, Semecarpus anacardium, Shorea robusta, Terminalia tomentosa, Asparagus racemosus, Helicteres isora, Hollarrhena antidysenterica* and *Smilax macrophylla* on the upper slopes of the hill. In unprotected (control) site, almost the same vegetation was found but with low density. At another site (51.46 acres), protected for about 15 years, sal was the main species, its associates are *Hollarrhena antidysenterica, Phoenix, Buchanania lanzan*, tendu, *Terminalia tomentosa* and Gunja, etc.

Project 5: Ecological and economic evaluation of teak monoculture and mixed plantation [032/TFRI-(2000)2001/Ecol-2(5); 2000-2005]. *Principal Investigator - Mr. P.K. Shukla.*

Status: Growth and biomass studies were carried out in age series plantations of *Tectona grandis* (1.5 to 23.5 years) at Behrai in Seoni district of Madhya Pradesh Mean height and GBH varied between 1.6 m to 14.3 m. The contribution of different components to total biomass varied considerably. Regression equations were worked out for different components of biomass incorporating; age, height and girth; age and height as well as age and GBH were compared with the data of standard volume tables (class III/IV).

Project 6 : Investigation into the nature of inheritance and breeding of teak (*Tectona grandis*) [TFRI-2000/Gen-21; 2000-2005]. *Principal Investigator - Dr. A.K. Mandal.*

Status : The genetic test trial established during 2001-02 was managed and maintained to give opportunity to all progenies to express their full genetic potential. Data recorded on height growth and survival indicated 100 % field survival and differences in height growth within and between families. The results of genetic analysis of fruit and seed parameters of teak of Andhra Pradesh, Maharashtra and Orissa indicated significant variation for all characters, studied.

Project 7 : Developing tissue culture protocol for some important forest tree species. [TFRI-2000/Gen-22; 2000-2003].

Sub-project : (a) Teak, (b) *Gmelina arborea*. *Principal Investigators - Dr. Fatima Shirin.*

Status : (a) Teak : Experiments conducted to study the effect of carbohydrates on shoot multiplication indicated that the rate of shoot multiplication was maximum on glucose (4.45 fold) and sucrose (4.40 fold) and elongation was best on glucose. The shoots turned brown and died on mannitol and surbitol. The treatment of 50 ml/l KH_2PO_4 along with 10 μM NAA resulted in highest percentage of rooting as well as maximum number of roots.

(b) *Gmelina arborea* : Of the three basal media (MS, B_5 and WPM) used, WPM medium was found to be most suitable, resulted in 60-70 % *in vitro* rooting. Basal media (MS, B_5 and WPM) used in strength of ¾, ½ and ¼ indicated that MS basal medium having ½ strength significantly increased rooting percentage, which is higher than (or equal to) that of full strength of WPM basal medium.

Project 8 : Studies on differential adventitious rooting response vis-à-vis clonal propagation of economically important forestry species [038 / TFRI 2001 / Gen 2(4); 2000-2004]. *Principal Investigator - Dr. S.A. Ansari.*

Status : Air layering was done in approximately 7-10 years old plantation of *Anogiessus latifolia, Boswellia serrata, Dalbergia latifolia, Dalbergia sissoo* and *Gmelina arborea* in the third week of August at TFRI campus for 45 days. Response of air layering was found to be highly variable and good amount of air-layered shoots remained alive at the time of sampling. Live air-layers were most in *Dalbergia sissoo* followed by *Anogiessus latifolia* and *Dalbergia latifolia*. Formation of callus was also observed especially in *Dalbergia latifolia*. However, variation in live air-layers and callusing (%) was not statistically significant among different species. Out of the five species, only *Boswellia serrata* and *Dalbergia sissoo* responded positively to air layering treatment. Thus, propagation *Boswellia serrata* and *Dalbergia sissoo* is possible by air layering to obtain clonal planting stock.

Project 9: Mass multiplication of *Trichogramma* sp. and their efficacy against key pests of teak forests [018/TFRI-2000/Ento-24; 2000-2005]. *Principal Investigator - Dr. Mohd. Yousuf.*

Status: Out of 16 species of *Trichogrammatid* egg parasitoids, recorded from teak growing areas, one indigenous species *Trichogramma raoi* was collected alive and multiplied in the laboratory. In order to enhance percentage of parasitism, an experiment was laid by exposing the eggs at -8°, 4° and 10°C; exposed eggs at -8°C proved most effective. Seventy three lakhs of parasitoids (*Trichogramma* sp.) were multiplied and introduced in forests. Four exotic egg parasitoids viz. *Trichogramma brasiliensis*, *T. pretiosum*, *T. japonicum*, *T. chilonis* and an indigenous species *Trichogramma raoi* have been reared in laboratory. Storage of exotic egg parasitoid at 4°C for 15 days has a little effect on their efficiency. Beyond this period it was reduced. Egg parasitoids were introduced separately in 42 ha area of teak forest. It was observed that the exotics *T. chilonis*, *T. japonicum* and indigenous *T. raoi* are equally effective to minimise (50%) defoliation caused by larvae of teak skeletonizer.

Project 10 : Integrated management of diseases of seeds, nurseries and plantations [035/TFRI-2001/Path-4(5); 2001-2006]. *Principal Investigator - Dr. Jamaluddin.*

Status: Six fungi and one bacteria from *A. procera* seeds and ten fungi from neem seeds were isolated and identified. Occurrence of fungi, *Chaetomium* sp. was found to be the maximum. Captan (trade name), 0.2 % was found to be most effective in controlling mycoflora and enhancing germination. Soil solarization completely eliminated population of pathogens, drastically reduced nematode and weed population and increased nutrient (NPK) availability of soil. Same are the finding with *D. sissoo*. Extracts of *Eucalyptus tereticornis* and *Azadirachta indica* were found most effective in inhibiting growth of *F. solani* and *F. oxysporum* causing wilt of *D. sissoo* and *G. arborea*, respectively. Neem leaves had more pronounced effect in reducing sporulation of both the pathogens. Application of the formulation of *Streptomyces* increased germination, enhanced height of seedlings and suppressed diseases caused by *Fusarium oxysporum* in *A. procera* at TFRI nursery. Pathogen causing collar rot in teak was identified as *Pseudomonas tectonae*. Tetracycline and Plantomycin were found effective to control the pathogen *in vitro*.

AM fungi rhizobium and *T. polysporum*, in combination were found to be best in controlling disease and promoting growth of *A. nilotica* and *G. arborea* seedlings. Use of *Trichoderma* sp., phosphate solubilizing bacteria and VAM fungi against *Fusarium* wilt of *Gmelina arborea* resulted in increased germination, higher survival rate and better growth of seedlings. *Streptomyces* sp. (*Actinomycete*) controlled the wilt disease of *A. procera*, *D. sissoo* and *A. lebbek* caused by *Fusarium oxysporum* in pot experiments. *Ganoderma lucidum* root rot of *A. procera* was successfully controlled *in vitro* by using Bordeaux mixture + *Trichoderma polysporum*.

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 [024/TFRI-2000/Silvi-17; 2000-2004]. *Principal Investigator - Mr. R.K. Shrivastava.*

Status: Data for root trainer seedling production of *Acacia catechu, Pongamia pinnata, Azadirachta indica* and *Emblica officinalis* were collected, compiled and analysed. Field trials of these species are in progress. Approximately 800 cft. of compost from abundantly available local species like bamboo, lucaena, neem, *Butea monosperma* and lantana was prepared for internal use and sale.

Project 12: Evaluation of various NWFP species for saponin potential and their value addition [021/TFRI-2000/NWFP-18; 2000-2005]. *Principal Investigator - Mrs. Neelu Singh.*

Status: Isolated and estimated saponin glycosides from the seeds of *Sapindus mukrossi*, *Madhuca indica* and *Asparagus racemosus* roots and insecticidal and fungicidal activities of isolates were assessed. *Chlorophytum borivillianum* was collected from Damoh forest area, Madhya Pradesh and transplanted it in NWFP garden to study the seasonal variation in saponin content.

Project 13 : Establishment of advance centre of NWFPs [022/TFRI-2000/NWFP-19(1, 3, 4 & 5); 2000-2005]. *Principal Investigator - Mr. Hori Lal.*

Sub-project 1: Germplasm collection, biology, domestication and commercial cultivation of threatened species of medicinal plants of India.

Status: Surveyed and collected fruits/seeds of Harra and cutting of Guggal. Transplanted 176 seedlings of Harra, 100 seedlings of Malkangini and 70 cuttings of Guggal (*Commiphora vitae*) at NWFP nursery. Analyzed *T. chebula* fruits and *C. paniculatus* seeds for phenols, phenolic acids, tannins, carbohydrates and oil contents. Physico-chemical properties of the oil were determined. Germination of *T. chebula* was very poor in all the treatment, studied.

Sub-project 2: Resource assessment of NWFP, documentation and develop NWFP information system.

Status: Modified the previous data entry format, entered data for 50 species in the package, errors have been rectified in the main exe file and database save module. The project is envisaged to compile the available information on cultivation, collection, utilization and exploitation of various NWFP species found in Madhya Pradesh, Maharashtra, Chhattisgarh and Orissa.

Sub-project 3: Qualitative and quantitative variations in tree borne oilseeds in India.

Status: Surveyed and collected Kusum seeds and transplanted 400 seedling of Kusum and 50 seedlings of Kokam at TFRI Jabalpur. Estimated fatty oil and physico-chemical properties were determined. Protein, phenolic acid, tannins, total phenols and carbohydrate contents of Kusum seeds were also estimated.

Selected *Garcinia indica* plants in different region and collected 2 kg seeds. Maximum germination was 84% and minimum was 25%. Collected fruits/seeds of *S. oleosa*. Germination was 61.5% for seeds collected from Sheotarai. 21.5% was minimum for seed collected from Kundam and Jabalapur.

Sub-project 4: Standardization of methodologies for extraction and value addition of NWFP providing sustenance to tribals (starch, mucilage, resins and vegetable dyes).

Status: Surveyed and collected plants of *Curcum angustifolia* and *Curculigo orchioides* and transplanted in NWFP nursery for their multiplication. Standardized the methodology for extraction of mucilage from tubers of *Eulophia nuda* and oleo-gum-resin from *Gardenia gummifera*. The extracted starch of *Curcuma angustifolia,* and mucilage of *Hyptis suaveolens* was subjected to physico-chemical analysis. Extracted dye from the flower *B. monosperma* and *Woodfordia fruticosa*. 20 shades were developed for eco-friendly *B. monosperma* dye.

Project 14: Studies on population structure dynamics and efficacy of existing silvicultural systems for management of teak forests in central India [023/TFRI-2000/Silvi-15; 1999-2003]. *Principal Investigator- Mr. Sandeep Kumar.*

Status: In two selected sites, sample plots were laid, trees were enumerated and measured for height, girth, etc. phyto-sociological study and regeneration surveys in the selected areas were carried out. Soil samples are being analysed for various soil properties. Litter samples were analysed for biochemical properties. Entomological and pathological observations were also taken. The project is being modified for evaluation of carbon sequestration potential of different silvicultural system for the management of teak forests in central India.

NEW PROJECTS INITIATED DURING THE YEAR 2002-2003

Project 1: Development and standardization of management practices for most promising existing agroforestry systems in central Narmada valley [043/TFRI-2002/Agro-1(8); 2002-2007]. *Principal Investigator- Mr. A. K. Sah.*

Status: Initial study has shown that in Narsingpur district, tree species like teak, bamboo, subabul and babul are common on farmers' fields with agricultural crops like wheat, gram, arhar and mustard. Small and marginal farmers (landholdings 2 to 5 ha) have preference for subabul, babul and teak while big farmers (above 5 ha) have planted teak in their farms. In Jabalpur district palas is found to be the most common tree species followed by teak and subabul. Small and marginal farmers also prefer jamun, guava, ber and mango among horticulture crops.

Project 2: Economic evaluation of NTFPs in tribal belt of Madhya Pradesh [044/TFRI-2002/Agro 2 (9); 2002-2005]. *Principal Investigator - Mr. Akhilesh Argal.*

Status: Ten districts have been identified for the study, viz. Mandla, Jabalpur, Betul, Chhindwara, Khargone, Sheopur Kalan, Neemuch, Damoh, Umaria and Shadol. Weekly markets have been identified for three districts: Chhindwara, Betul and Mandla. Range wise five important NTFPs have been identified for these districts.

Project 3: Germplasm conservation and investigation on inheritance pattern of *Gmelina arborea* [040/TFRI2002/Gen1(5)]. *Principal Investigator - Mr. P.H. Chawhaan.*

Status : Information regarding availability of plus trees of *Gmelina arborea* and details of plantations raised by different state forest departments and ICFRE institutes was sought and requests were made to supply clonal materials and seeds to conduct genetic test. Details of plus trees are as under:

S. No.	Name of state/organization	No. of plus trees	Remarks
1.	West Bengal Forest Dept.	15	Clonal planting material of 8 trees is to be transported seeds will be supplied in the coming season.
2.	Orissa Forest Dept.	09	
3.	Maharashtra Forest Dept.(FDCM)	13	
4	Maharashtra Forest Dept.(MVSS)	11	
5.	SFR, Jabalpur	38	

Project 4: Management of insect pests of forest nurseries in central India [045/TFRI-2002/Ento-1(5)/2002-2005]. *Principal Investigator- Dr. N. Kulkarni.*

Status: Teak defoliator and skeletonizer in Madhya Pradesh, white grubs in Maharashtra and termites in Orissa were recorded as major pests. The incidence of teak defoliator, skeletonizer, white grubs and termites were recorded 8-20%, 14-42% and 6-54% in Madhya Pradesh, Maharashtra and Orissa respectively. A field experiment conducted at Ramdongari nursery (FDCM, Nagpur) revealed that phorate 10 g @ 200 g/bed (10 m x 1 m) and chloropyriphos 20 EC @ 50 ml/bed (10 m x 1 m), followed by bio-pesticides like *Beauveria bassiana* (Braveguard) and *Metarhizium anisopliae* (Metaguard) were effective to check the infestation of white grubs in nursery.

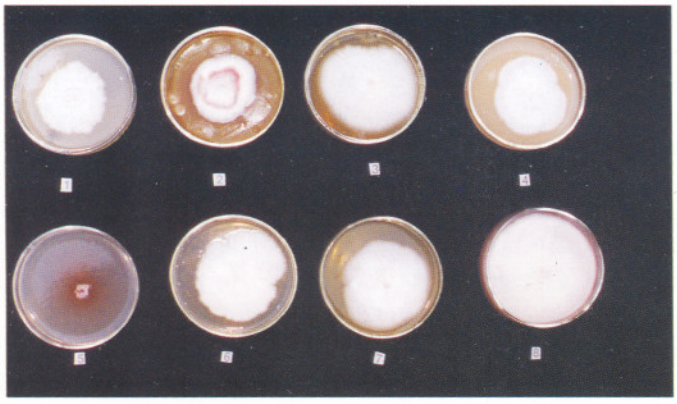
Seedlings of Gmelina damaged by termites at Sambalpur

Damaged roots of Gmelina seedlings

Project 5 : Development of germplasm bank of biofertilizers and field application of effective strains on important tree species [046 / TFRI 2002 / Path 1(6) / 2002- 2005]. *Principal Investigator - Dr. R.K. Verma.*

Status : An experiment was laid out at Belkund to study the effect of VAM fungi and bacterial biofertilizers on teak seedlings. Maximum height and collar diameter was recorded in VAM + *Azospirillum* treated seedlings. Twelve species of VAM fungi belonging to 3 genera occurring in *Rhizosphere* of 25 species of bamboos at Amravati (M.S.) were identified. Among VAM species, *A. scrobiculata* showed maximum frequency followed by *G. intraradices, A. laevis* and *G. etunicatum*. Biofertilizers were isolated in pure culture. Rhizobia, Azotobacter, PSB and VAM fungi have been isolated and cultured. Culture of VAM fungi and *Azospirillum* were supplied for trials in teak, *Gmelina arborea*, *D. sissoo* and bamboo.

Fungicidal operation in teak high tech plantation (1998) to control top dying caused by *Phomopsis tectonac* at Belkumd.



Effect of different plant products, on growth of *Fusarium oxysporum* causing wilt of *Gmelina arborea in vitro* (1) Mustard Cake (2) Neem leaf extract (3) Marigold (4) *Vitex nigundo* (5) Bavistin 0.2% (6) *Lantana camara* (7) *Calotropis procera* (8) Control.

Project 6 : Standardization of macropropagation protocol for mass multiplication of bamboo species [042/TFRI-2002/Silvi-3 (5); 2002 - 2005]. *Principal Investigator - Mr. N.P. Singh Nain.*

Status: Data for seasonal variation in adventitious rooting in culm and culm-branch cuttings of different bamboos viz. *Bambusa tulda, B. vulgaris* var. green, *Dendrocalamus membranaceous* and *Bambusa nana* have been collected and compiled.

Project 7: Standardization of seed handling and storage techniques for improvement of tree species of central India [041/TFRI-2002/Silvi-2(4); 2002-2005]. *Principal Investigator - Mr. R.K. Srivastava.*

Status: Sites have been selected; collected seeds from selected trees; seeds have been extracted from collected pods; seeds are stored in different containers viz. plastic jars, jute bags and polythene bags at different temperature.

Project 8 : Investigations on methodologies for determination of elapsed period after felling of teak and bamboo [47/TFRI-2002/NWFP-1(7)/2002-04]. *Principal Investigator - Mr. Hori Lal.*

Status: Surveyed and collected samples of teak wood of different girth classes and bamboos (*Dendrocalamus strictus* and *Bambusa arundinacea*).

Project 9: Studies on gum and resin characteristics in relation to their identification, purity and age. Gums: *Acacia nilotica, Anogeissus latifolia* and *Sterculia urens*. Resins: *Boswellia serrata* and *Shorea robusta* [48/TFRI-2002/NWFP-2(8)/2002-04]. *Principal Investigator - Dr. Abha Rani.*

Status: 10 trees of each species; *A. nilotica, A. latifolia* for gums and *B. serrata* and *S. robusta* were tapped. Samples were collected at weekly interval. Resin samples for resin were sorted, graded and analyzed for impurities, moisture, ash, etc. Volatile oil, gum, resin were separated in *Boswellia serrata* and *Shorea robusta* samples.

EXTERNALLY AIDED PROJECTS

PROJECTS COMPLETED DURING THE YEAR 2002-2003

Project 1: Development of neem in various agro-ecological regions of India [011/TFRI-99/(NWFP) Ecol-11(NOVOD); 1999-2002]. *For technical report contact, Principal Investigator - Dr. S. K. Banerjee.*

Findings: One thousand one hundred fifty six plus trees of neem were identified in different agro-climatic zones of Madhya Pradesh, Chhattisgarh and Orissa. Neem nurseries were developed at TFRI, Jabalpur and CFRHRD, Chhindwara, where about 2.45 lakh seedlings were raised and distributed to SFD, MP and farmers. Provenance variation in seed characteristics was observed and correlated for climatic conditions. Seed germination, growth behaviour and biomass study of seeds of different provenance was observed.

Vegetative propagation method for neem has been standardised. Phenological study of neem trees in different agro-climatic zones has been conducted. Chemical and biochemical composition of neem leaves has been determined. Physio-chemical and nutritional characteristics of soils from the rhizospheres of neem trees were determined.

Project 2: Integrated development of tree borne oil seeds of forest origin (compact plantation) jatropha, karanj, neem and mahua. [036/TFRI-2001/NWFP-1 (NOVOD)(6). *For technical report contact, Principal Investigator - Mr. R.K. Shrivastava.*

Findings: One lakh four thousand two hundred eighty four plants; 26682 - karanj, 15881 - mahua, 15161- neem and 46560 - jatropha) have been planted with the help of SFDs and local committees and the plantations are also being look after them.

PROJECTS CONTINUED DURING THE YEAR 2002-2003

Project 1: Improving infrastructure facilities for *ex-situ* conservation of rare/threatened plants in the botanical garden, TFRI, Jabalpur [037/TFRI-2001/BD-1(MOEF)(3); 2002-2004]. *Principal Investigator - Dr. V. Nath.*

Status: Infrastructure facilities have been created and necessary garden equipments were procured. 58 plants species of different families, including 12 species of bamboo that existed in the garden are being maintained. Rare plants like *Commiphora wrightti, Mappia foetida, Rauvolfia serpentina, Calotropis gigantea, Chlorophytum tuberosum, Schleichera oleosa, Aloe barbendensis, Acacia concinna, Cinnamomum zeylanicum* and *Sapindus laurifolius* have been collected and maintained in the mist chamber/shade house for plantation in the garden site at appropriate time.

Project 2 : Studies on carbonic anhydrase and its relationship with photosynthesis and productivity in teak (*Tectona grandis*) [TFRI 2001 / Gen 1 (CSIR) (3); 2001-2004]. *Principal Investigator - Dr. S.A. Ansari.*

Status : Carbonic Anhydrase (CA) activity in relation to leaf position, season and stability in storage was investigated. The enzyme activity in top five leaves designated sequentially as L_1 L_5 with one unexpanded (youngest) leaf, i.e. L_0 was monitored. The maximum activity (26, 678 U mg^{-1} chlorophyll) was recorded in L_1 and the lowest (5,567 U mg^{-1} chlorophyll) in L_0. For seasonal variation, CA activity in leaves collected in the months of February, May, August and November was estimated and found to follow a pattern : May > February > November > August. As for stability of CA stored for whole year, the enzyme activity remained stable for first three week; subsequently, gradually declined during other months of the year. Thus, the maximum recorded initially was to be 22990.6 U mg^{-1} chlorophyll, which came down to 5573.2 U mg^{-1} chlorophyll in the end of the year.

Project 3: Screening and identification of teak of Madhya Pradesh for resistance against major insect pests [034/TFRI-2001/Ento-1(MPCST)(4); 2001-2004]. *Principal Investigator - Dr. N. Roychoudhury.*

Status: Teak Seed Orchards (TSOs) at Jabalpur, Behrai and Nanditola (Seoni) of Madhya Pradesh have been surveyed to study leaf flushing behaviour and assess damage impact of major insect pests on about 150 teak trees of Madhya Pradesh origin. Collected seeds and examined seed vigour of 29 known trees of Madhya Pradesh teak. Compiled data on 73 plus trees and 3 seed production areas (SPAs) and carried out descriptive analysis of data. Feeding potentiality of teak defoliator and leaf skeletonizer on 5 Madhya Pradesh clones and 20 plus tree progeny of Madhya Pradesh teak studied. Measured defoliation impact of major defoliators on 135 teak clones in TSO, Behrai (Seoni), out of which 18 teak clones were observed to be less attacked by defoliator and skeletonizer.

NEW PROJECTS INITIATED DURING THE YEAR 2002-2003

Project 1: Developing coalition approach to non-timber forest produce for better livelihoods of tribal communities of Madhya Pradesh [053/TFRI-2003/Agro-1(DFID)(10)]. *Principal Investigator- Mr. Akhilesh Argal.*

Status: A collaborative project with Mahatma Gandhi State Institute of Rural Development, Jabalpur has got approval w.e.f. January 2003. Initial survey of project areas in Jabalpur district have been jointly conducted and future strategy regarding scope of partner-wise tasks has been finalised.

Education and trainings

Trainings organised

- Training organized on 'Biofertilizer' at Ramdongri's Nursery, Nagpur for personnel's of Maharashtra State Forest Development Corporation.
- Two days training workshop for extension of technologies was conducted on 26th and 28th Dec., 2002 at Raipur and Jagadalpur.
- Organised a National Seminar on 'Management of degraded forests for productivity enhancement and carbon sink expansion' on 15th & 16th January, 2003 at TFRI, Jabalpur.

Trainings received

1. Shri P.K. Shukla, IFS, Director attended International Workshop on 'Forestry and Climate Change - Assessing Mitigation Potential and Cost' at New Delhi.
2. Shri P.K. Shukla, IFS, Director and Dr. S.K. Banerjee, attended workshop on 'Biofarming' at Jawahar Lal Nehru Krishi Vishwa Vidyalay (JNKVV), Jabalpur.
3. Shri A. Argal, IFS, attended 3 days workshop on 'Building Effective Collision' DFID-CPHP, South Asia held from 23rd - 25th Oct,02 at ICRISAT, Hyderabad.
4. Shri A. Argal, IFS, attended 7 days workshop on 'TOT on Organisational management for participatory development' at NIRD, Hyderabad.
5. Shri P.K. Shukla, IFS, Director and Shri A. Argal, IFS, attended National workshop on 'Agro-forestry Prospects & Challenges' at IFGTB, Coimbatore on 22nd November, 02.
6. Dr. S.K. Banerjee attended 'World Neem Conference' at Mumbai, India.
7. Shri P.K. Shukla, IFS, Director, Shri A. Argal, IFS, and Shri R.K. Shrivastava, IFS, attended FORSPA, Bangkok sponsored National Workshop on "Technological Innovation and Research Advancement for Application in JFM" at FRI, Dehradun.
8. Shri P.K. Chawdhry, IFS, attended workshop on 'Management of Teak' held at Nagpur, Maharashtra.

9. Dr. R.K. Verma, participated in the National symposium on "Prospecting of Fungal Diversity and Emerging Technologies" from 6-7, February, 2003 at Agarkar Research Institute, Pune.

10. Dr. Nanita Berry, participated in National Symposium on 'Agroforestry in 21st century' held on 11-14, February, 2003 at Punjab Agricultural University, Ludhiana (Punjab).

11. Shri Anurag Mishra, attended National workshop on 'Environmental Economics' held from 16th to 20th December, 2002 at IIFM, Bhopal.

12. Shri Anurag Mishra, attended training on 'Management of Changes in different sectors' held from 20th to 24th January, 2003 at Forest Institute, Jaipur, India.

13. Shri Sandeep Kumar, attended one week compulsory training programme on 'Forest Tribal Interference' from 20th to 24th January, 2003 organised by IIPA, New Delhi.

14. Shri S.K. Karan, Shri N.P.S. Nain, Shri Rajesh Kumar, attended one week training programme on 'JFM Tools and Techniques' from 10th to15th February, 2003 organised by National Institute of Rural Development, Hyderabad at Jabalpur.

Publications

Books

1. Jamaluddin; Dadwal, V.S. and Soni, K.K. (2002). The diseases in forest nurseries caused by *Macrophomina phaseolina* and their management, pp. 367-375. In frontiers of fungal diversity in India International Book Distributors Co., 906 pp.

2. Verma, R.K. and Singh, Y. (2002). Fungal diversity and diseases of central India pp. 791-819. In frontiers of fungal diversity in India, *Ed. By Rao, G.P. Manoharachari, C.; Bhat, D.J.; Rajak, R.C. and Lankhanpal, T.N. International Book Distributors Co., 906 pp.*

Research paper s

1. Dadwal, V.S. and Jamaluddin (2002). A note on sheath blight of *Dendrocalamus asper* and its control. *Indian Forester,* 128(4) : 470-472.

2. Dadwal, V. S. and Jamaluddin (2002). Ecology and distribution of Agarics at Jabalpur. *J. Basic and Appl. Mycol.* 1(1) : 16-18.

3. Jamaluddin and Dadwal, V.S. (2001). Studies on charcoal root rot of *Acacia auriculiformis*. *Indian Jour. Trop. Biod.* 9(1-4) : 61-64.

4. Roychoudhury, N., Joshi, K.C. and Chourasia, M. (2002). Insect pests of *Tectona grandis* L.f. : an update. *Adv. For. Res*. India, 25 : 196-224.

5. Singh, Y. (2002). Nursery diseases of *Dipterocarpus macrocarpus* and *Gmelina arborea* in Assam New Records. *Indian Forester,* 128(9) : 965-970.

6. Singh, Y.; Verma, R.K. and Jamaluddin (2002). An integrated approach to control *Fusarium* wilt of *Dalbergia sissoo*. *Indian Forester*, 128(4) : 432-438.

7. Soni, K.K. and Jamaluddin (2002). *Amylosporus campbellii* - A new root rot of teak from India. *TEAKNET* Issue No. 27, 5-6.

8. Soni, K.K. and Jamaluddin (2002). Susceptibility of clones of *Casuarina equisetifolia* to blister bark disease. *J. Basic and Appl. Mycol.*, 1(1) : 50-54.

9. Verma, R.K. (2002). *Aecidium kamali* sp. nov. on *Terminalia tomentosa* from India. *J. Basic* and *Appl. Mycol.* 1(1) : 23.

10. Yousuf, M. and Joshi, K.C. (2003). Description of a new species of *Oligosita* Haliday (Hymenoptera : Trichogrammatidae) from India. *Shashpa*, 10(1): 7-8.

Brochures

- करंज
- रतन जोत एवं जेट्रोफा
- पीला बॉस (बेम्बूसा वेल्गेरिस)
- धान के साथ बच की खेती
- सागौन के साथ सफेद मुसली की खेती
- टिशू कल्चर तकनीक द्वारा बाँस की उन्नत किस्म का उत्पादन
- नीम
- वृक्षों के साथ सब्जियों की खेती
- बबूल के साथ धान की खेती
- Establishment and management of vegetative multiplication garden
- Micro propagation of bamboos
- Macro propagation of teak

Conferences/meetings/workshops/seminars/symposia

1. Jamaluddin (2003). Microbes in the management of mine degraded land. Paper presented in seminar on Management of degraded forest for productivity enhancement and carbon sink expansion, 15, 16, January, 2003.

2. Jamaluddin; Verma, Ajit and Shukla, P.K. (2003). Effect of VAM and bacterial biofertilizers on growth and production of *Chlorophytum borivillianum*, paper presented in INDO-US Workshop and National Congress o Molecular Biology and Biotechnologial Symbiosis, New Delhi, 23- 28, March, 2003.

3 डडवाल, व्ही.एस., सिंग, रामबीर एवं जमालुद्दीन 2003 मध्य भारत की कृषि वानिकी प्रजातियों में होने वाले रोग एवं उनका निदान. अष्टम राष्ट्रीय वैज्ञानिक संगोष्ठी 17–19 जनवरी, 2003, ज.ने.कृ.वि.वि., जबलपुर.

4. Soni, K.K. and Jamaluddin (2003). Role of cultural and sanitation practices in the management of diseases in degraded forest. Paper presented in seminar on Management of degraded forest for productivity enhancement and carbon sink expansion, 15-16, January, 2003.

5. Verma, R.K. (2002). Taxonomic grouping of *Pseudocercospora* species. Paper presented in National seminar on Frontiers of fungal diversity in Indian sub continent, August, 24-25, 2002 organized at DDU, Gorakhpur University.

6. Verma, R.K. and Jamaluddin (2002). Fungal diversity in tropical forest of central India. Paper presented in National seminar on Frontiers of fungal diversity in Indian sub continent, August, 24- 25, 2002 organized at DDU, Gorakhpur University.

7. Verma, R.K. and Jamaluddin (2003). Application of VAM fungi to produce quality seedlings of teak for plantation at degrades sites. Paper presented in seminar on Management of degraded forest for productivity enhancement and carbon sink expansion, 15 16 January, 2003.

Exhibition/Mela

- Demonstration and exhibition of TFRI Technologies in Laghu Van Upaj Mela at Bhopal on 46, November, 2002.
- Dr. A.K. Mandal, Shri Yogeshwar Mishra and Shri Sanjay Singh, participated and represented ICFRE in 'BIOTECH 2003' Ist International exhibition and seminar at New Delhi from February, 5-8, 2003.

Awards

- Dr. A.K. Singh, awarded Vishist Vaigyanik Puraskar 2000- 2001 in the area of Biological Rehabilitation of degraded areas and wasteland.
- Dr. Nanita Berry, awarded best poster in National Symposium on "Agroforestry in 21st century" held on 11th to 14th February, 2003 at Punjab Agricultural University, Ludhiana (Punjab).