RAIN FOREST RESEARCH INSTITUTE JORHAT

The Rain Forest Research Institute (RFRI), Jorhat, Assam, a constituent Institute of Indian Council of Forestry Research and Education (ICFRE), Dehradun (An autonomous Council) under Ministry of Environment and Forests, Govt. of India is mandated to cater the forestry related research needs of North-Eastern India. It has been pursuing research in the areas of shifting cultivation, ecology and biodiversity, propagation, cultivation and performance trial of important forest species, integrated management of pests and diseases, bio-prospecting of bio-resources, genetic improvement and biotechnology. The total human resource of the Institute is 132.

The Institute has an Advanced Research Centre for Bamboo and Rattan at Aizawl, Mizoram.

RFRI has a well stocked Library having a good collection of forestry and allied sciences related literature. RFRI is connected to other ICFRE Institutes through a Virtual Private Networking (VPN). A 256 Kbps internet service available through this network is also shared with all users at Institute level. Video phone and video conferencing services have also been commissioned recently. The RFRI is tuning its research, education, training and developmental efforts to contribute effectively to bring prosperity to the North-Eastern region.

An abstract of projects run by the Institute is as follows:

	No. of projects completed in 2007-08	No. of ongoing projects in 2007-08	No. of projects initiated in 2007-08
Plan Projects	3	12	9
Externally Aided Projects	5	7	2
Total	**8**	**19**	**11**

PROJECTS COMPLETED DURING THE YEAR 2007–2008

PLAN PROJECTS

Project 1: Stability test of various clones and progenies for different characters in *Gmelina arborea* [RFRI/ TI-10/2003-06]

Findings: Progeny trial studies of selected families revealed better performance of progenies at Teliamura, Tripura (with 69% survival, 5.9 m height and 17.0 cm collar diameter) as compared to Imphal, Manipur (with 62% survival, height 3.4m and collar diameter 10.4 cm). Genetic and environment interaction was found significant at 0.001 level of significance both for height and

collar diameter. This shows that progenies differ significantly in their performance at these two different sites. Half-sib progenies of RRI/GA31 clone registered maximum germination per cent. The overall germination was recoded to be 26%. The tetrazolium test revealed 12 % partially viable and 1% non-viable seeds. Seeds of progeny number RFRI/GA/43 were found to be most (93%) viable compared to other progenies.

Project 2: Bioecological studies of seed insect pests of *Dipterocarpus retusus* [RFRI/FE-12/2005-08]

Findings: A total of 9 species with seven genera belong to the order Coleoptera and Lepidoptera was recorded as insect pests on the seeds of *D. retusus*. *Thamnurgides monoceros* Beeson (Coleoptera: Scolytidae) and *Enarmonia pulverulla* Meyrick (Lepidoptera: Tortricidae) were recorded 100% frequency, correspondingly the relative density was also recorded high values for *E. pulverulla* (38.68) followed by *T. monoceros* (25.79) during the survey periods. Damage loss of seeds due to seed insect pests of Dipterocarps was made. The percent insect infestation on seeds of *D. retusus* collected from forest floor ranges between 42.86 and 77.40%. However, only 37.5 to 58.18 % of insects' infestation was observed in aerial collection.

Project 3: Genetic improvement and clonal propagation of *Dipterocarpus retusus* [RFRI/TI-11/2004-07]

Findings: Among seventeen progenies and check planted in Seedling Seed Orchard (SSO) at RFRI campus the progenies DMP-9, DMP-2, and JKG-2 were found to be superior for traits viz. plant height (Ht), Diameter at Breast Height (DBH), height at first branching and Crown Diameter (CD). Under development of clonal propagation protocol 17-20% rooting was achieved in shoot cuttings of three genotypes of *D. retusus.* There is no report of rooting of the species. A follow up project on clonal propagation has been continued from 2007-10.

EXTERNALLY AIDED PROJECTS

Project 1: Conservation of productive land and promising flora of Majuli Island in Brahmaputra River [RFRI/EP-05/2003-08]

Findings: Planting of grasses with *Ipomea* spp. were found to be effective in checking sand deposition on productive lands. Banana also performed better with grasses. High density planting of flood tolerant nitrogen fixing leguminous species *Sesbania sesban* during May-June (Flood time) was found to enrich soil fertility status and its harvesting in October- November provided fuel wood and fibre for local use. Thereafter, farmers were advised to cultivate mustard, potato, vegetables and other crops to utilize the land resources properly. These reclaimed areas have shown very encouraging results when put under different agroforestry models. The local people have very much appreciated and adopted the method for replication in other nearby areas.

Project 2: Control of soil and river bank erosion in Majuli through bamboo based vegetative embankment [RFRI/EP-08/2004-07]

Findings: Zero zone plantation of *Ipomea* spp. and grasses gave good results in arresting soils from surface erosion. Bamboo mats provided shelter to sandy soil. First zone plantations of *Bambusa nana*, *Dalbergia sissoo*, *Bombax ceiba* and second zone plantation of *Bambusa bambos*, *B. nutans*, *B. tulda* and *Dendrocalamus hamiltonii* showed good performance. Bamboo treatment unit provided to Bamboo Co-operative Society, Majuli had motivated local people to a great extent and more than one hundred seventy people have used this facility.

Project 3: Study of the current market prices of timber in Nagaland [RFRI/EP-17/ 2007-08]

Findings: Current market price of different timbers was collected from Tizit, Mokokchang and Dimapur (Nagaland) timber markets and submitted to Resource Survey and Management Division, Forest Research Institute (FRI), Dehradun for further processing.

Project 4: Improvement of infrastructure facilities in Botanical Garden /Centres of *ex-situ* conservation at, Rain Forest Research Institute Jorhat, Assam [RFRI/EP/09/2003-06]

Findings: Introduced as many as 7 species each of bamboo and Rattan, more than 39 of orchid species, 24 commercially important tree species and 12 species of endangered and rare plants of North-East India in the botanical garden at RFRI campus.

Orchids in shade house

General view of RFRI Botanical garden

Project 5: Augmentation of entomopathogenic fungi for the management of *Calopepla leayana* on *Gmelina arborea*: an eco-friendly approach [RFRI/EP-10/2005-07]

Findings: Population dynamics of *Calopepla leayana* was monitored in the study areas. The population trends were correlated with abiotic factors (temperature, relative humidity, and rain fall) of the study site, which exhibited a significant dependence on the abiotic factors such as temperature, relative humidity, and rain fall. Regression equation was also arrived to predict population of *C. leayana* based on abiotic factors. Entomopathogenic fungi viz., *Beauveria bassiana* and *Metarhizium anisopliae* were isolated and identified as natural enemies of *Calopepla leayana* from different insect groups. It was found that both the fungi were effective against both larval and adult stages of *C. leayana.* Mass production of *B. bassiana* using different substrates was tried to harvest ample amount of spores. Bakery waste/desolate bread was identified as one of the suitable substrates for the mass production of *B. bassiana*. 72-93% mortality of targeted insect was observed in field condition**.** Isolates of *B. bassiana* was harmless to silkworm and all of them attained healthy pupa (cocoon).

PROJECTS ONGOING DURING THE YEAR 2007–2008

PLAN PROJECTS

Project 1: Development of Patchouli based viable agroforestry models for North-East region of India [RFRI/CFE-04/2005-08]

Status: Based on the ideas generated in reference to better management, through interactions with the farmers, the participating farmers were facilitated for implementation of on-farm experimentation. As observed and also reported by the farmers, weed management in patchouli is a major factor affecting the economics at higher degree. Trials on mulching of leaves of bamboos, areca nut, neem and paddy straw separately to compare their response to discourage weed growth. Paddy straw was found to be the effective material to suppress weeds and after decomposition, facilitates the patchouli branches to penetrate into the ground for better survival and growth.

Organized farmer visits to the on-farm trials for demonstration of the patchouli agroforestry practices. The willing farmers were registered for attending the training programme organized at two different sites. Training was imparted through lectures by the experts and technical know how was also provided by organizing practical sessions during field visits. The local entrepreneurs were also invited in the program to facilitate liaisoning with the farmers. The farmers were assured 30 % higher price by these entrepreneurs for the raw material (dry leaves) to be supplied to their industries with a purchase guarantee.

Under the technical guidance of RFRI, the farmers have already started growing patchouli in their tree gardens. Primary observations reveal that the practice will be highly beneficial on sustainable basis.

Project 2: Evaluation of different existing land use systems for development of viable economic models in North-East India [RFRI/ SC-06/2003-08]

Status: The activity calendar depicting schedule of different management practices pertaining to various Land Use Systems (LUSs) identified at different jhum areas in Assam, Nagaland and Meghalaya have been prepared and analyzed for their Benefit Cost Ratios. In Assam, *Trichosanthes dioca* cultivation (3.75) followed by *Anona comosus* plantation (3.23) is found to be the potential LUSs among other in the list, whereas in Meghalaya *Citrus* sp. plantation (6.09) followed by *A. comosus* plantation (4.8) as well accepted LUSs because of its prospective characteristics. The data collected from various LUSs in Nagaland revealed the *Areca catechu* plantation (11.4) followed by *Musa paradisiaca* plantation (10.78) as highly sustainable LUSs among other in the list.

Project 3: Development of nursery practices for production of quality planting stock of Bamboo in North-East region [RFRI/SM-06/2005-08]

Status: Observations on survival and growth parameters on bamboo seedlings raised in polybags with different media combinations were recorded and data analyzed. Among the substrate media, sand, soil, FYM and vermicasting (cultured) were found to be the best media combination. The bamboo seedlings were planted in the field and observation are being taken to evaluate their performance.

Project 4: Management of *Bambusa nutans* for enhancing the productivity of marketable culms through silvicultural practices [RFRI/ TI-13/2005-08]

Status: Necessary field works related to the project have been completed. The data generated has been analyzed and final report preparation is in progress.

Project 5: Comparative studies on natural resistance of bamboos to biodegradation in Assam [RFRI/FP-08/2005-08]

Status: Data on the effect of biodegradation of eleven bamboo species of north-eastern India are being collected from three different experimental sites located at RFRI campus, Jorhat; Salna in Nagaon District and Burnihat in Kamrup District.

Project 6: The potential role of bamboo species with reference to carbon sequestration in Assam and Mizoram [RFRI/EE-07/2005-08]

Status: Biomass estimation of 3 age groups (1, 2 and 3 years) of *Bambusa tulda* and *Dendrocalamus hamiltonii* was done in selected locations at Assam and Mizoram. Data on clump dynamics, above and below ground (woody), biomass production was recorded for carbon sequestration potential of bamboo species under study. The dry biomass was recorded to be 50% of the fresh weight in *D. hamiltonii* and was found to be fluctuating in *B. tulda*.

Project 7: Diversity and dynamics of arbuscular mycorrhizal fungi and their influence on biomass production of some medicinal and aromatic plants of Assam [RFRI/FP-10/ 2005-08]

Status: The plant samples (medicinal and aromatic plants) were collected from Sibasagar, Kamrup, Nalbari and Barpeta districts of Assam and analyzed for mycorrhizal association. Mycorrhizal spores were isolated from the collected samples and quantified (root infection percentage). It was found that AM fungi infect the plants with varying degree.

Project 8: Studies on structural formation of vegetation for the conservation of Biodiversity in Gibbon Wildlife Sanctuary Assam [RFRI/SC-08/2005-08]

Status: Ecological enumerations of vegetation were carried out and classified into three major plant communities. Total of 219 plant species were enumerated from the forest (91 tree species, 18 shrub species, 74 herb species and 36 species of climber/ scandant shrub). Dicotyledons comprised 177 species, amongst them family Euphorbiaceae, Lauraceae and Moraceae maintained highest position that occupied similar number of species in upper canopy level. Total 32 targeted species were recorded such as *Artocarpus chaplasha, Castanopsis indica, Ficus* sp. and *Dysoxylum procerum* etc. Diversity and phenological observation of targeted species were carried out. Due to biotic disturbances; the accessibility of gibbons to these food plants has decreased in the disturbed sites.

Project 9: Investigation on the formation of agarwood in *Aquillaria malaccensis* Lamk. [RFRI/FP-11/2006-09]

Status: Keys for field identification of infected agar trees have been developed. Dominant fungi were isolated and maintained as pure cultures for artificial inoculation. Larvae of borer, *Zeuzera conferia* Walker were collected from infected agar trees for artificial inoculation. Artificial inoculations of agar trees were carried out at selected sites and periodical observations were made for agar formation.

Project 10: Investigation on propagation and cultivation of selected rattan species [RFRI/EE-10/2006-09]

Status: Survey and collection of planting materials of rattans has been completed. Nursery of selected rattan species has been raised and plantation in 2.5 ha area has been established for further investigations.

Project 11: Improvement of degraded shifting cultivation lands through introduction of *Thysanolaena maxima* (Broom Grass) along with *Cajanas cajan* as N_2 fixing plant [RFRI/SC-09/2006-09]

Status: Plantation of *Thysanolaena maxima* (Broom Grass) was successfully done along with *Cajanas cajan* (Arhar) in degraded shifting cultivation areas of Assam. Soil samples from the experimental plots were collected at different stages and analyzed. Growth data were recorded at regular intervals and yield analysis were done at harvesting stage of Broom Grass. Soil fertility and productivity were found to be better when *Thysanolaena maxima* (Broom Grass) was planted with *Cajanas cajan* than *Thysanolaena maxima* as sole crop.

Project 12: Standardization of nursery practices of *Bambusa pallida* [RFRI/SM-07/2006-08]

Status: Two node culm cuttings of 15 different clones of *Bambusa pallida* were collected from the RFRI Gene bank. Culm cuttings were treated with IBA solution and planted in the raised nursery beds prepared by mixing sand, soil and FYM (1:1:1) along with control. The cuttings were irrigated regularly. Macro proliferation was carried out after 5 or 6 months, when rhizome and shoots from the nodes of the cuttings develop properly. Data on survival and growth parameters was recorded at regular interval.

EXTERNALLY AIDED PROJECTS

Project 1: Validation, testing and locational trial of micro/macro propagated planting stock of selected bamboo species in North-East India [RFRI/EP-08/ 2004-07]

Status: Maintained liaison with Nodal Officers of all the 8 Field Implementing Agencies (FIAs) of North-East States, TERI (Collaborating Organization) and NMBA (Supporting Agency). Expedited the supply of 24000 tissue culture plants of target Bamboo species from Growmore Biotech, Hosur to HPC Jagi Road and hardened plants to all the implementing states. Expedited establishment of Demo and Experimental Trail plantations of target *Bamboo* spp. covering 70 ha area out of the total target 160 ha in different North-East States. Technical support and guidance shall be extended to these FIAs for execution of plantation maintenance. Monitored the trail plantations established in different North-East States and recorded data as per monitoring and data recording schedule. Growth and performance of *B. balcooa* (Tissue cultured plants) is found to be much better than other two species at all the 8 sites. At the two sites of Assam and Arunachal Pradesh, *B. balcooa* is performing better than *B. nutans* and *D. hamiltonii*. At the sites of Arunachal Pradesh, Mizoram and Tripura, *B. balcooa* showed maximum culm height followed by *D. hamiltonii* whereas number of culm is higher in *D. hamiltonii* as compared to *B. balcooa*. *B. nutans* is also showing good results. In Nagaland, performance of *B. balcooa* and *D. hamiltonii* are at par. One and half year old plants

of the two species have attained height of 5-8 m and no. of culms 15-18 per clump. In Manipur, due to long dry spell during the growth period growth of plants becomes stunted. *B. balcooa* (Tissue cultured plants) showing better result than other species. Under experimental trial, the fertilizer combination FYM-NPK has been found to be producing better results as compared to other treatments.

Project 2: Sustained capacity enhancement of economically backward scheduled tribes of North-East Region through composite R & D technologies [RFRI/EP-11/2006-09]

Status: An intercropping trial of *Cajanus cajan* (Arhar) in between the rows of Bamboo - *G. arborea* plantation has been established in 3 ha area and ginger and turmeric in 1.5 ha in mixed plantation of bamboo and *G. arborea*. A training has also been organized for skill development of 5 artisan at Cane and Bamboo Technology Centre, Guwahati, Assam.

Project 3: Biological control of *Mimosa invisa*, a destructive alien weed threatening Kaziranga National Park (grasslands) [RFRI/EP-12/2006-09]

Status: Laboratory studies of collected biological agents were done. Survey of various *Mimosa* infested areas was done for association of bio-agents. Pot culture experiment was conducted to test the efficacy of the isolated fungi against *Mimosa*.

Project 4: Genetic improvement and conservation of genetic resources of some economically more important bamboo species of North-eastern India [RFRI/EP-13/2006-09]

Status: Bamboo growing areas in Deomali, Jeyrampur, Chessa and Itanagar area of Arunanchal Pradesh, Sibsagar, Tinsukia, Titabor, Borhola, Makum, Doomdooma, Jeypur, Borhat, Digboi, Sonari Nalbari and Borpeta area of Assam, Amarpur and Kanchanpur area of Tripura, Garo Hills area of Meghalaya and Imphal, Thoubal, Bishnupur, Noney areas of Manipur have been surveyed and superior clumps of target bamboo spp. selected. Statistical Design and operational Guideline for Gene Bank to be established at the two sites have been prepared. *M. baccifera* growing area situated in Assam (Jorhat, Tinsukia, Sibsagar, North Cachar hill, Hailakandi and Silchar districts), Manipur (Imphal west and East and Tmenglong districts), Mehgalaya (East, West Garo hills and west Jaintia Hills districts), Mizoram (Aizawl, Mamit, Thenzawl, Kolasib and Champhai districts), and Tripura (South, West, and North Tripura districts) surveyed and germplasm selected by using random sampling method. Seeds were collected as half sib progenies of selected individual bamboo culms. Clonal materials from the selected CPCs of bamboo have been collected from the surveyed area brought to RFRI. These clones have been multiplied and conserved in Gene Bank. Monitoring of survival, growth and performance of species cum clonal trial plantations established at all the 6 sites in different north-east states have been carried out and observation/data have been recorded. In general, performance trial plantation is better in Tripura. Nagaland and Assam (Kamrup) sites as compared to Hailakandi site of Assam and Aizawl sadar and Virengte sites of Mizoram. Among the species, survival of *B. balcooa* found to be highest at all the sites followed by *D. hamiltonii*. Overall growth found to be the best in Tripura (Teliamin) followed by Nagaland (Jalukie) and Assam (Kamrup). Among all species most vigorous growth was observed in *Bambusa balcooa* at all sites. Analysis and detailed interpretation of data is continued. Gene Bank plantation and conservation

trial of *M. baccifera* established in RFRI campus have been maintained. Weeding and cleaning were undertaken at regular interval. Three sites have been selected for field trial of *M. baccifera* for the purpose of conservation staggered flowering germplasms from various year seed produced. Staggering trial plantation of *M. baccifera* established on permanent plots in RFRI campus. Hundred per cent survival in all blocks of plantation raised from seeds collected in four different years has been recorded. A new block has been prepared for 2008 flowering, seeds of which are being collected. Observation for incidence of diseases, insects and pests were recorded in bamboo nursery at RFRI. No infection of insect was observed in any seedling stock of muli bamboo (*M. baccifera*). Few leaves were found brightened which subsequently defoliated. No termite infestation recorded in all targeted species. On-site meeting were organized with Nodal officers and his supporting officials of concerned Forest Divisions associated with species-cum-clonal trial at their respective sites for technical guidance and discussion on planting operation, management practices and monitoring and observations as per operational guidelines.

Project 5: Biodiversity studies of Orthoptera in Kaziranga National Park, Assam [RFRI/EP-14/2006-09]

Status: A total of 36 species of Orthoptera belonging to 30 genera, and 4 families were recorded in different habitats viz., forestlands, savannahs and grasslands of Kaziranga National Park (KNP). Host range studies of commonly available orthopteran species such as *Xenocatantops humilis* (Serv.), *Phlaeoba infumata* Brun. and *Conocephalus maculatus* (Le Gouillon), revealed that they feed on a few monocot plants. Observations revealed that most of them are herbivores, of which *C. maculatus* is carnivorous in habit. Population dynamics of Orthopteran species was monitored on different vegetation type forestland, grass land and savannahs. The population trends were correlated with abiotic factors of KNP which exhibited a significant dependence on the abiotic factors.

Project 6: Establishment of a network to facilitate collection, processing and dissemination of statistics pertaining to tropical timber and other forestry parameters in India [RFRI/EP-16/2006-08]

Status: Data on Forestry Statistics from North-Eastern States was collected for the year 2004-05 and 2005-06 from Assam, Meghalaya, Mizoram, Tripura, Nagaland and Arunachal Pradesh except Manipur and for the year 2006-07 from Sikkim and submitted to Directorate of Extension, Division of Statistics, ICFRE Dehradun.

Project 7: Mapping and quantitative assessment of geographic distribution and population status of plant resources of Eastern Himalayan region [RFRI/EF-15/2006-09]

Status: Standardization of methodology and reconnaissance survey of the study area (i.e. the nine districts of Upper Assam region) has been completed. Survey and sampling of about 40 (forty) numbers of sampling grid (of 3.75′ x 3.75′ size) have been completed. Data entry for these sampling grids has been completed. Integration of these spatial and attribute information in GIS environment is in progress. Plant specimen collection, preservation and maintenance of Herbarium sheets are in progress.

NEW PROJECTS INITIATED DURING THE YEAR 2007–2008

PLAN PROJECTS

Project 1: Improvement of agar/agarwood production in *Aquilaria malaccensis* [RFRI/BG-20/2007-10]

Sub-project 1a: *In vitro* induction of essential oil components of *Aquilaria malaccensis* [RFRI/BG-20-I/2007-10]

Status: A callus inducing medium has been standardized for leaf explants of *Aquilaria malaccensis*. Friable callus was transferred to liquid medium and cell growth observed in suspension.

Callus from leaf

Sub-project 1b: Survey and selection of desirable genotypes of *Aquilaria malaccensis* and establishment of their field genebank [RFRI/BG-20-II/2007-10]

Status: Survey for infected agar trees at Golaghat (Naharoni), Nagaon (Hojai) and Sibsagar (Amguri and Namti) districts of Assam State has been compeleted. A total of 26 infected agar trees were selected and branch cuttings were collected for rooting trial. Seeds were also collected from selected trees and tested for their germination potential. Nursery was raised to establish Seedling Seed Orchard (SSO) at RFRI campus.

Sub-project 1c: Clonal multiplication of *Aquilaria malaccensis* through *in vitro* culture including hardening and out planting [RFRI/BG-20–III/ 2007-10]

Status: Direct shoot regeneration was observed from node explants in three different media concentrations. Experiments continued for standardization of optimal shoot regeneration media. Callus regeneration was achieved for somatic embryogenesis.

Leaf callus regeneration for somatic embryogenesis

Sub-project 1d: Evaluation of insecticidal properties of some plants extracts against *Heortia vitessoides* Moore (Lep. Pyralidae) a major pest of *Aquilaria malaccensis* [RFRI/BG-20-IV/2007-10]

Status: Plant samples of *Azadirachta indica, Melia azedirach, Adhatoda vesica, Clerodendron viscosum* and *Acorus calamus* were collected and extracts prepared for bioassay test. Data collection on population dynamics of *H. vitessoides* from three selected sites at monthly interval is in progress.

Project 2: Documentation of baseline information and restoration of selected stress sites under shifting cultivation through agroforestry in North-East India [RFRI/ SC-11/2007-10]

Sub-project I: Documentation of baseline information on shifting cultivation in North-East India

Sub-project II: Restoration of jhum land through intercropping *Rhizobium* inoculated legume trees with agricultural crops in Assam

Status:

Sub-project I: Collection (1st phase) of available literature on shifting cultivation (viz. area under shifting cultivation, number and distribution of jhumia tribal communities, land tenure systems, traditional institutions and customary laws, existing shifting cultivation practices, social and cultural life of major jhumia communities and, their socio-economic status and indigenous knowledge associated with shifting cultivation) has been completed from study area (7 North-East States). Analysis for trends/dynamics in shifting cultivation has been completed. Compilation of information is in progress. Schedules/questionnaires for field data collection on existing shifting cultivation practices and socio-economic survey have been developed and tested in the field. Survey for selection of sites in study area (7 North-East States) has been completed. A total of 14 sites have been selected representing 12 major Jhumia tribal communities. Baseline survey for existing shifting cultivation practices (viz. activity calendar, tree-crop combinations, cropping schedule, cultural operations, harvesting methods schedules and uses) and socio-economic status of selected Jhumia communities is in progress.

Sub-project II: Selection of sites for agroforestry trial and appraisal for tree-crop combinations has been completed. Two experimental sites have been selected at Phumen Ingti village (Rongmongwae Block) and Asot Teron village (Nilip Block) in Karbi Anglong district of Assam for establishment of agroforestry trial. Two leguminous tree species (viz. *Albizzia lucida* and *Indigofera erecta*) have been selected as tree component and hill paddy as crop component. *Rhizobium* strains have been isolated from the tree species under study and pure culture maintained. Five *Rhizobium* strains of *Albizia* and four *Rhizobium* strains of *Indigofera* have been found to be highly effective in screening studies. Nursery has been raised for *Rhizobium* inoculated and control seedlings of both the species under study for field plantation.

Project 3: Establishment of GIS laboratory for systematic creation, management and upgradation of GIS based forest-database of North-East India [RFRI/EE-13/2007-10]

Status: Collection of available spatial and non-spatial literature for North-East India has been completed. A total of 330 Survey of India Topographic sheets have been procured, scanned and geometrically rectified using appropriate projection parameters. The vector layer digitization of roads, drainage systems, habitats etc has already been completed. Digitization of protected area network (National Parks, Wild Life Sanctuaries, Reserved Forests etc) of North-East India is in progress. Soil Maps (10 nos.) of the entire North-East India have been procured, scanned and geometrically corrected. Digitization is in Progress. Training on Arc-GIS and ERDAS software packages have been completed as a part of Liveware (manpower) development at RFRI.

Project 4: Genetic improvement of *Acacia mangium* for growth characteristics, pulp and timber quality [RFRI/BG-15/2007-10]

Status: Sixteen Candidate Plus Trees (CPTs) of *Acacia mangium* have been selected from six provenances. Out of sixteen candidates plus trees, seven have been selected for progeny trial. Nursery has been raised from seeds of selected CPTs progeny trial. Vegetative propagation through cuttings has been also tried but with little success.

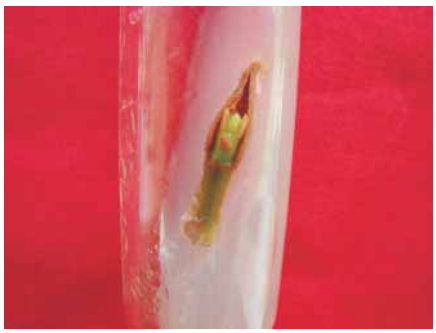
Project 5: Development of an efficient technique for *in-vitro* clonal propagation of superior or clone of *Bambusa tulda* [RFRI/BG-17/ 2007-10]

Status: An efficient shoot multiplication medium for superior clones of *Bambusa tulda* has been standardized. Experiments for standardization of rooting medium are in progress.

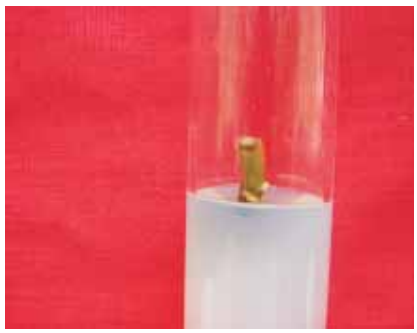
Multiple shoot proliferation in *B. tulda*

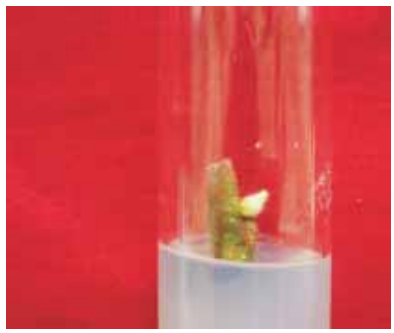
Project 6: Macro and micro propagation of selected germplasm (clones) of *Dipterocarpus retusus* Bl. (Syn *D. macrocarpus*) [RFRI/BG-21/ 2007-10]

Status: Axillary bud and shoot tip regeneration has been in observed in rooting trial of shoot cuttings from 12 genotypes of *D. retusus* in green house conditions. Basal media for regeneration has been standardized and standardization of optimal media is in progress.



Growing shoot tip of *D. retusus*





Growing auxiliary buds of *D. retusus*

Project 7: Assessment of Rattan diversity and conservation strategy with reference to Assam [RFRI/EE-12/2007-10]

Status: Survey, collection and population studies of selected Rattans has been carried out in three protected areas i.e. Nambor-Doigrung Wildlife Sanctuary, Gibbon Wildlife Sanctuary and Kaziranga National Park in Assam state. Herbarium samples of six *Calamus* species have been collected and identified. The population of *C. nambareinsis, C. latifolius, C. gracilis* and *C. erectus* has been found to be depleting alarmingly in the study areas. Nursery of *Calamus latifolius* and *C. flagellum* has also been raised at RFRI campus.

Rattan Nursery

Project 8: Standardization of harvesting and post harvesting methods for optimum yield of therapeutic ingredients of *Phyllanthus niruri* Hook. [RFRI/BIK-01/2007-10]

Status: Survey of forest areas of Assam for natural distribution of target species has been completed. Experiments for standardization of growth stages for harvesting and post harvesting storage has been completed. Second phase of experiment is under progress.

Project 9: Study of reproductive biology and seed production in clonal seed orchard of *Gmelina arborea* [RFRI/BG-22/2007-10]

Status: Observations on floral phenology of 20 clones of *Gmelina arborea* have been recorded at plant and inflorescence level with reference to day-to-day flowering pattern. Exclusion studies have been carried out to assess the success of a class or classes of visitors in pollinating different clones of *Gmelina arborea.* Flower buds collected, fixed and preserved for further studies.

EXTERNALLY AIDED PROJECTS

Project 1: On-farm innovation in macro-proliferation techniques and preparation of commercial plantation of edible bamboo shoot [RFRI/EP-18/2008-10]

Status: Selection of sites for establishment of demonstration plots for edible shoot production has been completed. Two sites at Rongbong Ghat and Deoither villages under Nilip block of Karbi Anglong District, Assam have been selected and SHGs constituted in each village. A training programme has been organized to selected SHG members on bamboo macro-proliferation technique for mass multiplication. Mother planting material of *Bambusa balcooa* has been procured.

Project 2: Sustainable Development of quality bamboo resource for employment generation and socio economic development in North-East India [RFRI/EP-19/2008-11]

Sub-project I: Development of suitable agroforestry models for promoting bamboo cultivation outside forests in North-East region.

Sub-project II: Development of clump management practices for economically important bamboo species for enhanced production of quality culm and edible shoots.

Status:

Sub-project I: Seven sites have been selected after an extensive survey and discussion with the local SFDs authorities in Arunachal Pradesh, Assam and Nagaland. Preparations of land at four places have already been completed. Layout designs for two sites have already been finalized. Appraisals for potential and suitable crop components have been conducted at four sites.

Sub-project II: Initiated site selection process in three locations in Assam.

EDUCATION AND TRAINING

Education

Dr. Anoop Kumar Sarkar, Research Officer, Biotechnology and Genetic Division, RFRI, Jorhat, Assam was awarded Ph.D. Degree from Rani Durgawati University, Jabalpur, M.P. on September 2007.

Trainings Organized

1. Fifty days Industrial Training of Pre-Final Year B.Sc. students of North-East Regional Institute of Science and Technology (NERIST), Arunachal Pradesh was organized from 28th May 2007 to 16th July 2007.
2. A training programme on Creation of Bamboo Nursery and Commercial Cultivation of Bamboo to the representatives of Dholla Tea Estate, Tinsukia (Assam) was organized on 24th July 2007.
3. A farmer's training programme was organized on Scientific Management of Bamboos in Nursery, Plantation and Storage on 19th September 2007 under DST sponsored project.
4. A two days training programme on Bamboo Propagation and Cultivation for Range Officers of Forest Corporation, Govt. of Bhutan was organized on 24th November 2007.
5. A training programme was organized on Bamboo Cultivation and Management to officials from State Forest Department Nagaland and Joint Forest Management Council members on 28th to 30th January 2008.
6. A training programme was organized for Bamboo Cultivation and Management to officials from State Forest Department of Assam on 6th to 8th February 2008.
7. Two on-site Farmers' Training programmes were organized to 60 jhumia farmer on Awareness generation for promotion of viable land use system in jhum land were organized at Kakochang village (7th March 2008) and Men Teron village (10th March 2008) of Karbi Anglong, Assam.
8. Two on-site training programmes were organized to 90 farmers for extension of Patchouli based agroforestry practices at Koliabor (8th March 2008) and Biswanath Chariali (14th March 2008).
9. One on-site Farmers' Training on Vermi-composting was organized at Kakojan village of Karbi-Anglong District Assam.

LINKAGES AND COLLABORATION

The linkages were established with State Forest Departments of all north-eastern states, Central/ State Universities, other research organizations, NMBA, MoEF, NBM, NABARD, DBT, NEC and NGOs working in the field of forestry and forestry research. Multilocational trials of 3 bamboo species and clonal trials of 6 Bamboo species are being conducted in association with SFDs.

CONSULTANCIES

1. Consultancy awarded by Director General, Archaeological Survey of India, Govt. of India, New Delhi for preparation of report on "Biodiversity and Vegetation Pattern of the "Majuli Island" for compilation of the nomination dossier in respect of "Majuli Island for its World Heritage status".
2. Successfully completed the consultancy on Mid-term Evaluation of National Afforestation Programme of all seven North-East States sponsored by National Afforestation and Eco-development Board (NAEB), Ministry of Environment and Forests (Govt. of India) i.e. Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland and Tripura.

CONFERENCE/MEETINGS/WORKSHOPS/SYMPOSIA/EXHIBITIONS

1. On-site Interactive Meetings were organized on Species-cum-Clonal Trail of Bamboo at Hailakandi (Assam) on 23rd July 2007 at Aizawl (Mizoram) on 25th July 2007; at Virengte (Mizoram) on 27th July 2007 and at Teliamura on 28th July 2007 for Nodal Officers and officials of Field Executing Agencies of the respective States.
2. A two days Expert Consultation Workshop on Shifting Cultivation was organized on 1st and 2nd August 2007.
3. The Project Formulation Meeting for All India Co-ordinated Project on Bamboo was organized on 22nd November 2007.
4. The Stakeholder's Meeting was organized on 26th November 2007.
5. Research Advisory Group (RAG) Meeting was organized at Rain Forest Research Institute, Jorhat (Assam) on 27th and 28th November 2007.
6. Regional Workshop on Forestry Statistics in India was organized on 11th December 2007.
7. A two days Regional Workshop on Bamboo Flowering: Status and Management Strategies was organized on 21st and 22nd February 2008 at RFRI campus.

DISTINGUISHED VISITORS

1. Dr. M. Islam, Professor of Life Science, Dibrugarh University visited RFRI, Jorhat during June 2007.
2. Shri Tarun Gogai, Hon'ble Chief Minister of Assam visited RFRI on 7th February 2008.

Shri Tarun Gogoi, Hon'ble Chief Minister of Assam visiting RFRI Jorhat

3. Dr. Keshav Rao, Air Commondant, 5 Air Force, Jorhat, Assam visited RFRI on 19th March 2007.

MISCELLANEOUS

1. Adopted Model Village Koliapani in Teok Block of Jorhat District (Assam) and extending technologies to villagers.
2. Van Vigyan Kendras have been established in six states of North-East India.

ADVANCED RESEARCH CENTRE FOR BAMBOO AND RATTANS, AIZAWL

The Advanced Research Centre for Bamboo and Rattans (ARCBR) at Aizawl formally started in November 2004 as a unit of RFRI under ICFRE is in the establishment stage. The office of the Centre is presently running in a hired building located at Kulikawn, Aizawl. However, the building construction including office-cum-research complex, residential quarters and farmers' hostel, etc. are being done by CPWD at Bethlehem Vengthlang, Aizawl.

For establishment of Field Experimental Station, about 100 ha area was selected at Khamrang (Kawnpui) under Kolasib Forest Division and proposal for allotment was submitted to the Govt. of Mizoram through State Forest Department. The proposal has been approved recently by the Cabinet of Mizoram State and the handing/taking over formalities will be completed shortly.

RESEARCH

Following research components of some externally aided projects of RFRI have been implemented by ARCBR in Mizoram state:

1. Validation of Micro-propagated Bamboo through Multi-locational Trial

With the objective to test and validate the field performance of micro-propagated bamboo, locational trial and demo plantation of *in-vitro* propagated plants of three commercially important bamboo species viz., *Bambusa balcooa, B. nutans* and *Dandrocalamus hemiltonii* have been laid out at Tuiral, under Aizawl Forest Division covering 20 ha area under the DBT sponsored project.

2. Selection of superior clones of Bamboo for restocking of flowered area

Evaluation trials of clonal materials collected from selected plus clumps of five bamboo species viz., *Bambusa balcooa, B. nutans, B. pallida, B. tulda* and *Dandrocalamus hemiltonii* have been laid out at two places, i.e., Tuiral, Aizawl Sadar under Aizawl Forest Division and Kharjawl, Vairangte under Kolasib Forest Division in Mizoram State so as to select best clone in terms of optimum performance, high productivity and suitable end-use linked physicochemical traits.

3. Establishment of Gene pool Nursery and Gene bank

Superior clumps of some commercially important bamboos have been selected from different parts of the north-east and clonal materials have been collected. A Genepool Nursery has been established in the premoses of ARCBR at Bethlehem Vengthlang, Aizawl wherein the clonal materials are being raised and multiplied for production of quality planting stock.

Ground works for establishment of Gene bank in ARCBR premises at Bethlehem Vengthlang, Aizawl is completed. Plantation of superior germplasms of commercially important bamboos will be done during ensuing planting season.

Establishment of Van Vigyan Kendra

For establishment of Van Vigyan Kendra in Mizoram State, liaison has been establishment with Environment and Forest Department of Mizoram and Nodal Officer has been assigned. Activities like nursery establishment and other extension activities have been taken up by VVK recently.