

ANNUAL RESEARCH PROGRESS: 2011 – 2012



Government of the people's Republic of Bangladesh
Bangladesh Forest Research Institute
Chittagong

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Summary of the Research Progress : 2011-12

Forest Management Wing

Sl.No.	Name of the Division/Section	Total Number of Studies		
		On-going	New	Total
01	Silviculture Research Division	07	0	07
02	Silviculture Genetics Division	04	0	04
03	Seed Orchard Division	06	0	06
04	Forest Botany Division	03	02	05
05	Forest Inventory Division	04	01	05
06	Forest Economics Division	0	02	02
07	Soil Science Division	04	0	04
08	Minor Forest Products Division	04	01	05
09	Mangrove Silviculture Division	08	01	09
10	Forest Protection Division	03	0	03
11	Plantation Trial Unit Division	08	0	08
12	Wildlife Section	02	0	02
13	Technology Transfer Unit	05	0	05
Sub-Total:		58	07	65
FOREST PRODUCTS WING				
14	Veneer and Composite Wood Products Division	03	0	03
15	Pulp and Paper Division	03	01	04
16	Wood Preservation Division	02	0	02
17	Forest Chemistry Division	01	01	02
18	Seasoning and Timber Physics Division	01	02	03
19	Wood Working and Timber Engineering Division	02	01	03
Sub-Total:		12	05	17
DEVELOPMENT/OTHER FUNDED PROJECT (Title of the study)				
1	Selection of plus trees of important agroforestry and forest tree species	01	0	01
2.	Establishment and management of seed orchards	01	0	01
3.	Transfer of Technology in Bamboo Shoot Production, Processing and Marketing from china to Bangladesh and Srilanka	01	0	01
4.	Enrichment and Conservation of Mangrove Ecosystem	0	01	01
5.	Coordinated project on improvement of Agro-forestry Practices for Better Livelihood and Environment: BFRI Component	0	01	01
Sub-Total:		03	02	05
Total:		72	16	88

SILVICULTURE RESEARCH DIVISION

1. Study : On-going

1.1 Programme Area : Biodiversity and Conservation.

1.2 Title of the Study : *Ex-situ* conservation of threatened forest tree species in different agro-ecological regions of Bangladesh.

1.3 Justification : Once Bangladesh was famous for its rich floral biodiversity. About 5,700 species of angiosperms were available in Bangladesh (Hossain, 2001). More than 800 forest tree species were reported from Bangladesh. But in course of time due to different reasons the number has been decreasing. In the mean time some forest tree species have already been extinct and many are in the verge of extinction. Now a day's conservation of biodiversity is an important issue over the world. As a national institute on forestry research BFRI has a responsibility and should take necessary steps to conserve all the endangered forest tree species of Bangladesh. Therefore, the study has been undertaken.

1.4 Objective(s) :

1.4.1 To conserve selected threatened forest tree species in different agroecological regions of Bangladesh.

1.4.2 To observe their growth and suitability in particular sites.

1.5 Expected output : Fifty threatened indigenous forest tree species will be conserved over an area of fifty hectare in four agroecological regions of the country.

1.6 Study Period :

1.6.1 Starting year : 2006-2007

1.6.2 Completion year : 2012-2013

1.7 Personnel :

1.7.1 Project Leader: N.G. Bhowmick, SRO.

1.7.2 Associates: Mohammed Shahid Ullah, DFO; Nasrat Begum, SRO and A. Haque, FI.

1.8 Progress:

1.8.1 Previous years, if any: Raised 29.0 ha experimental plantations at Charkai, Charaljani, Keochia and Lawachara Silviculture Research (SR) Stations with 30 threatened forest tree species viz. haldu (*Adina cordifolia*), boilam (*Anisoptera scaphula*), civit (*Swintonia floribunda*), uriam (*Mangifera sylvatica*), gandhi-gazari (*Miliusa velutina*), moos (*Brownlowia elata*), dholi-garjan (*Dipterocarpus gracilis*), raktan (*Lophopetalum fimbriatum*), kannyari (*Gardenia coronaria*), menda (*Litsea monopetala*), udal (*Firmiana colorata*), barun (*Crataeva magna*), gila-batna (*Castanopsis tribuloides*), shil-batna (*Castanopsis indica*), toon (*Toona ciliata*), tali (*Palaquium polyanthum*), kanaidinga (*Oroxylum indicum*), dharmara (*Stereospermum personatum*), kanak (*Schima wallichii*), chalmugra (*Gynocardia odorata*), banspata (*Podocarpus neriifolius*), banderhola (*Duabanga grandiflora*), putranjiva (*Putranjiva roxburghii*), parul (*Stereospermum suaveolens*), bhutum (*Hymenodictyon orixensis*), bazna (*Zanthoxylum rhetsa*), gurja-batna (*Lithocarpus pachyphylla*), goda/awal (*Vitex peduncularis*), hargaza (*dillenia pentagyna*), jawa/barela (*Holigarna caustica*).

1.8.2 This year:

Action plan as per annual research programme	Progress
a. Raising 15,000 seedlings of threatened forest tree species (banderhola, hargaja, dhup, karpur, bon-sonalu, goda, batna, jayna, dholi-garjan and tali. In addition other important species will be included based on the availability of seeds) at HQ, Charkai, Charaljani, Keochia and Lawachara Research Stations (3,000 in each location).	Raised 15,000 seedlings of different forest tree species such as dhup (<i>Canarium resiniferum</i>), sidha-jarul (<i>Lagerstroemia parviflora</i>), khayer (<i>Acacia catechu</i>), kainjal (<i>Bischofia javanica</i>), Karang (<i>Pongamia pinnata</i>), ban amra (<i>Spondias sp.</i>), udal (<i>Firmiana colorata</i>), kannyari (<i>Gardenia coronaria</i>), mahua (<i>Madhuca indica</i>), pitraj (<i>Aphanamixis polystachya</i>), sonalu (<i>Caccia fistula</i>), dharmara (<i>Stereospermum personatum</i>), haldu (<i>Adina cordifolia</i>), bohera (<i>Terminalia bellerica</i>), hartaki (<i>Terminalia chebula</i>), loha kath (<i>Xylia kerrii</i>), teligarjan (<i>Dipterocarpus turbinatus</i>), joyna (<i>Schleichera oleosa</i>), chukka kala (.....) at HQ, Charkai, Charaljani, Keochia and Lawachara Research Stations.
b. Maintenance of seedlings in the nursery through weeding, watering, sorting, rearrangement, etc.	Seedlings in the nursery were maintained through weeding, watering, sorting, rearrangement, etc.
c. Raising of 4.0 hectares new experimental plantations at Charkai, Charaljani, Keochia and Lawachara SR stations (1.00 ha in each station).	Raised 5.0 hectares experimental plantations at BFRI HQs, Charkai, Charaljani, Keochia and Lawachara SR stations (1.00 ha in each station).
d. Maintenance of 25.0 ha last years' experimental plantations (2006-07 6 ha, 2007-08 4 ha, 2008-09 4 ha, 2009-10 7 ha and 2010-11 4 ha) through weeding, cleaning, climber cutting, pruning, etc.	Maintained 25.0 hectare last years' experimental plantation by weeding at Charkai, Charaljani, Keochia and Lawachara SR Stations.
e. Collection of survival and growth (height and diameter at breast height) data at six months interval.	Survival and growth data from the experimental plantations were collected in the month of December 2011 and June 2012.
f. Compilation of data and reporting.	Field data were compiled.

1.9 Achievement (s), if any : Conserved 45 threatened species viz. haldu, boilam, civit, uriam, gandhi-gazari, moos, dholi-garjan, raktan, kannyari, menda, udal, barun, gila-batna, shil-batna, toon, tali, kanaidinga, dharmara, kanak, chalmugra, banspata, banderhola, putranjiva, parul, bhutum, bazna, gurja-batna, goda/awal, hargaza, jawa/barela, dhup, sidha-jarul, khayer, kainjal, Karang, ban amra, udal, kannyari, mahua, pitraj, sonalu, dharmara, haldu, bohera, hartaki in the conservation plots in four agro-ecological regions of Bangladesh.

1.10 Financial statement

1.10.1 Total cost	: Tk. 15,00,000.00
1.10.2 Cost of the year	: Tk. 2,90,000.00
1.10.3 Expenditure of the year	: Tk. 2,90,000.00
1.10.4 Source of fund	: GOB

1.11 Beneficiaries : FD, NGOs, Farmers, Educational institutions and other tree planting agencies.

2. Study : On-going

2.1 Programme Area : Plantation Techniques and Forest Management.

2.2 Title of the Study : **Development of planting technique of Sal (*Shorea robusta*).**

2.3 Justification : *Shorea robusta* is an important timber species of Bangladesh. It is a deciduous plant. It regenerates naturally through seed and coppice. Due to unregulated cutting and illicit felling and also due to encroachment, sal forest area has been decreasing day by day. Enrichment plantation is necessary to improve the vegetation cover of sal forest. In India it is reported that direct sowing is the cheapest and best method of artificial propagation of sal, although stump plantings, planting out entire plants with balls of earth, and planting out container-grown seedlings are also employed. However, there is no record of sal plantation in Bangladesh. For enrichment plantation, knowledge on nursery raising and plantation technique of that species is very much needed. So, the present study has been under taken.

2.4 Objective (s) of the Study :

2.4.1 To develop suitable planting technique of sal.

2.4.2 To enrich the degraded sal forest through aided regeneration.

2.4.3 To monitor the change of biodiversity of sal forest overtime after establishing the plantation.

2.5 Expected Output : Techniques for restoration of degraded sal forest will be developed

2.6 Study period :

2.6.1 Starting year : 2010-2011

2.6.2 Completion year : 2014-2015

2.7 Personnel :

2.7.1 Project Leader: Nasrat Begum, SRO.

2.7.2 Associates: Mohammed Shahid Ullah, DFO; N.G. Bhowmick, SRO and Azizul Haque, FI.

2.8 Progress:

2.8.1 Previous years, if any: One hectare experimental plantation was established at Charaljani (0.50 ha) and Charkai (0.50 ha) SR Stations through planting seedlings and sowing seeds in thallis.

2.8.2 This year:

Action plan as per annual research programme	Progress
a. Collection of 6,000 seeds from the selected mother trees and raising 2,400 seedlings at Charaljani and Charkai SR Stations.	Two thousand four hundred seedlings were raised at Charkai (1200 nos.) and Charaljani (1200 nos.) SR Stations.
b. Maintenance of seedlings in the nursery through weeding, watering, sorting, rearrangement, etc.	Seedlings were maintained in the nursery through watering, sorting, rearrangement, etc.
c. Raising of 1.0 ha experimental plantations at Charaljani (0.50 ha) and Charkai (0.50 ha) SR Stations by seedlings and direct seed sowing in thallis.	Raised of 1.0 ha experimental plantations at Charaljani (0.50 ha) and Charkai (0.50 ha) SR Stations by seedlings and direct seed sowing in thallis.

d. Maintainance of 1.0 ha last year's experimental plantations through weeding, cleaning, climber cutting, etc.	One hectare last year's experimental plantations were maintained through weeding at Charaljani and Charkai SR Stations.
e. Colletion of survival and height growth data at four months interval.	Survival and growth data were collected four timea. Last data collected during June 2012.
f. Analysis of data and reporting.	Field data were compiled.

2.9 Achievement (s), if any : NA

2.10 Financial Statement :

2.10.1 Total cost : Tk. 5, 00,000.00

2.10.2 Cost of the year : Tk. 40,000.00

2.10.3 Expenditure of the year : Tk. 40,000.00

2.10.4 Source of fund : GOB

2.11 Beneficiaries FD, NGOs, Farmers, Educational institutions and other tree planting agencies.

3. Study : On-going

3.1 Programme Area : Plantation techniques and forest management.

3.2 Title of the Study : **Study on the development of Oil Palm (*Elaeis guineensis*) cultivation in Bangladesh.**

3.3 Justification : There is a great potentiality of oil palm plantation and production of palm oil in Bangladesh. Climatic condition and different environmental requirements are also favourable for oil palm plantation in of Bangladesh. For the last few years oil palm has been planting in different places of Bangladesh which found very much encouraging. However, before going to large scale plantation of this commercial species, standardization of nursery and plantation technique for Bangladeshi environment is imperative. So, the present study has been undertaken.

3.4 Objective (s) of the Study :

3.4.1 To determine present status of oil palm plantation in Bangladesh.

3.4.2 To tandardize nursery raising technique and management.

3.4.3 To standardize plantation (spacing) and management technique of oil palm.

3.4.3 To study the reproductive biology of oil palm in plantations of Bangladesh.

3.4.4 To introduce and test the high yielding variety (HYV) of oil palm.

3.5 Expected output: Present status of oil palm in Bangladesh will be determined. Nursery and plantation technique will be standardized. Suitable variety of oil palm will be selected for large scale plantation in Bangladesh.

3.6 Study period :

3.6.1 Starting year : 2010-2011

3.6.2 Completion year : 2019-2020

3.7 Personnel :

3.7.1 Project Leader: Mohammed Shahid Ullah, DFO.

3.7.2 Associates: Nani Gopal Bhowmick, SRO, SRD; Rafiqul Islam, DO, FPD; Rafiqul Haider, DO, MFPD; Motiar Rahman, RO, SSD; Nusrat Begum, FI, SGD

3.8 Progress :

3.8.1 Previous years, if any: Raised 4.5 ha experimental plantations at Charaljani, Keochia and Hinguli Research Stations.

3.8.2 This year:

Action plan as per annual research programme	Progress
a. Visit of Satchari/Lawachara/Khadimnagar of Sylhet, Tangail, Morichapalong of Cox's Bazar and Bandarban for collection of information on flowering and fruiting behaviour of oil palm, etc.	Visited oil palm plantation at Satchari, Lawachara, Holodia, Lohagara and Chittagong Cantontment. Collected data on flowering, fruiting, leaf production, growth etc.
b. Collection of seeds and raising 1,500 seedlings in 9 X 6 polybag at Charaljani, Keochia and Hinguli Research Stations (500 in each station).	Collected oil palm seeds and raised one thousand fifteen hundred seedlings at Charaljani, Keochia and Hinguli Research Station.
c. Collection of data on germination period, germination percentage, survival, growth, disease infestation, etc. of the seedlings at nursery and field level.	Oil palm seeds were found to start germination after 25-30 days and complete within 85-90 days after sowing. Germination percentage was 35-40%. Within 6 months seedlings attain a average height of 22.5 cm.
d. Maintenance of seedlings in the nursery through weeding, watering, sorting, rearrangement, etc.	Maintained seedlings in the nursery through weeding, watering, sorting, rearrangement, etc.
e. Raising of 4.5 ha new oil palm plantation with three spacings (viz. 5m x 5m, 6m x 6m, and 7m x 7m) with RCBD design at Charaljani, Keochia and Hinguli Research Stations (1.5 ha in each station).	Raised 4.5 ha oil palm plantation with three spacings (viz. 5m x 5m, 6m x 6m, and 7m x 7m) with RCBD design at Charaljani, Keochia and Hinguli Research Stations (1.5 ha in each station).
f. Maintenance of 4.5 ha last year experimental plantations through weeding, cleaning, climber cutting, etc.	4.5 hectare last year's experimental plantations were maintained through weeding at Charaljani, Keochia and Hinguli Research Stations.
g. Watering the seedlings in the last year plantation during dry season (Feb – May) with different treatments.	Watering the seedlings in the last year plantation was made during dry season (Feb–May).
h. Collection of data on survival, growth, number of fronds, etc.	Collected survival and growth data.
i. Analysis of data and report writing.	Collected data were compiled.

3.9 Achievement (s), if any :

3.10 Financial statement :

3.10.1 Total cost : Tk. 15,00,000.00

3.10.2 Cost of the year : Tk. 2,00,000.00

3.10.3 Expenditure of the year : Tk. 2,00,000.00

3.10.4 Source of fund : GOB

3.11 Beneficiaries: FD, NGOs, Farmers, Educational institutions and other tree planting agencies.

- 4. Study** : On-going
- 4.1 Programme Area** : Breeding and Tree Improvement
- 4.2 Title of the Study** : **Growth performance of different forest tree species in research plots.**
- 4.3 Justification** :
- 4.4 Objective (s)** :
- 4.6.1 To assess the growth performance of different tree species in four agroecological regions of the country.
- 4.6.2 To determine the silvics of different forest tree species.
- 4.6.3 To develop future quality seed sources.
- 4.5 Expected output** : Site suitable species and provenances for plantation development will be selected for different site quality index in different agroecological regions of Bangladesh. Silvicultural techniques (spacing, weeding, fertilization, pruning, thinning and coppicing) for plantation management will be developed for maximizing yield of the plantation.
- 4.6 Study period** :
- 4.6.1 Starting year : 1996-1997
- 4.6.2 Completion year : 2014-2015
- 4.7 Personnel** :
- 4.7.1 Project Leader: Mohammed Shaid Ullah, DFO.
- 4.7.2 Associates : Nasrat Begum, SRO; N. G. Bhowmick, SRO and Azizul Haque, FI.

4.8 Progress:

4.8.1 Previous years, if any: Up to 2011, raised 101.0 ha experimental plantations (species elimination trials; provenance trials, coppicing trials, spacing trials, mixed planting trials, underplanting trials, planting technique, arboretum of 36 species, etc.) at four Silviculture Research Stations. Maintained those plantations by weeding, cleaning, climber cutting, pruning, etc. Assessed biomass of three eucalyptus species viz. *Eucalyptus camaldulensis*, *E. tereticornis* and *E. brassiana* (3rd rotation) at Charkai SR Station. Compiled phenological data of 240 indigenous and exotic tree species.

4.8.2 This year :

Action plan as per annual research programme	Progress
a. Maintenance of 50.0 ha experimental plantations (species elimination and site suitability trial, provenance trial, mixed species trial plantations, broom grass plantations, bamboo plantations, etc) raised up to 2011 at Keochia, Lawachara , Charaljani and Charkai SR stations.	Maintained 50.0 ha previously raised experimental plantations (growth trial, eucalyptus coppicing trial, spacing trial, site suitability trial, and mixed species trial plantations) by weeding at Keochia, Lawachara, Charaljani and Charkai SR stations.
b. Collection of data on survival, height, diameter at breast height, length of clean bole, straightness of stem, total biomass, coppicing ability etc.	Collected survival and height growth data on older plantations.
c. Data analysis and reporting.	Collected data were compiled.

4.9 Achievement (s), if any: Determined phenological characters of 240 indigenous and exotic species, selected site specific species/ provenance for large scale plantation (15 fast-growing species, 21 medium rotation species, 17 long rotation species, 4 provenance of *A. auriculiformis*, 6 provenance of *A. mangium*, 3 provenance of *P. caribaea*, 3 provenance of

P. oocarpa, 4 provenance of *Glericidia sepium*, 3, 2, 2, 2 provenance of *E. camaldulensis*, *E. brassiana*, *E. teriticornis*, *E. urophylla* respectively), established plantations of 70 indigenous and exotic tree species.

- 4.10 Financial statement** :
- 4.10.1 Total cost : Tk. 20, 00,000.00
- 4.10.2 Cost of the year : Tk. 2, 90,000.00
- 4.10.3 Expenditure of the year : Tk. 2,90,000.00
- 4.10.4 Source of fund : GOB

4.11 Beneficiaries : FD, Wood based industries, NGOs, Farmers, Educational Institutions and other tree planting agencies.

5. Study : On-going

5.1 Programme Area : Production of quality planting materials.

5.2 Title of the Study : **Large Scale Production of Quality Seedlings of important forest tree species.**

5.3 Justification : In Bangladesh every year government organizations, NGOs, private planters, etc. are raising plantation with different forest tree species. Most of the plantations are usually established by nursery raised seedlings. Quality seedling is the prime factor for the establishment of successful plantation with good economic return. However, the nursery owners do not pay much attention in production of quality seedlings and the planters are also not so much conscious about the quality seedlings. As a result the planters do not get expected timber production from their plantations. Therefore, the study has been undertaken for the production and supply of quality seedling to the planters as well as awareness development about quality planting materials.

5.4 Objective (s) :

5.4.1 To determine age, height and root-shoot ratio of seedlings for dispatch from nursery to plantation.

5.4.2 To provide quality seedlings to planters for successful plantation establishment.

5.4.3 To develop linkages with planters for awareness development about quality seedling.

5.5 Expected output: Awareness development about quality seeds and seedlings. b) Increased yield of timber and fuel wood.

5.6 Study period :

5.6.1 Starting year : 2006-2007

5.6.2 Completion year : 2014-2015

5.7 Personnel :

5.7.1 Project Leader: Nani Gopal Bhowmick SRO.

5.7.2 Associates : Mohammed Shaid Ullah, DFO and Nasrat Begum, SRO.

5.8 Progress :

5.8.1 Previous progress, if any : Raised and distributed more than 10 lakh quality seedlings of about more than 56 forest tree species raised viz- acacia hybrid (*Acacia auriculiformis* X *A. mangium*), banderhola (*Duabanga grandiflora* (Roxb. ex DC.) Wall.), civit (*Swintonia floribunda* Griff.), teli-garjan (*Dipterocarpus turbinatus* Gaertn.), gamar (*Gmelina arborea* Roxb.), sal (*Shorea robusta* Gaertn.f.), shegun (*Tectona grandis* L.), lohakat (*Xylia kerrii* Craib & Huta), chickrassi (*Chukrassia velutina* W & A), eucalyptus (*Eucalyptus camaldulensis* Dehnn.), raintree (*Samanea saman* (Jacq.) Merr.), mahogany

(*Swietenia mahagoni* (L.) N.J.Jacquin), sonalu (*Cassia fistula* L.), kala-koroi (*Albizia lebeck* (L.) Benth), raj-koroi (*A. richardiana* King & Prain), sil-koroi (*A. procera* (Roxb.) Benth), chakua-koroi (*Albizia chinensis*), motor-koroi (*Albizia lucida*), arjun (*Terminalia arjuna* (Roxb.) Wt. & Arn.), pitraj (*Aphanamixis polystachya*), bohera (*Terminalia bellirica* (Gaertn.) Roxb.), haritaki (*Terminalia chebula* (Gaertn.) Retz.), menda (*Litsea monopetala* (Roxb.) Pers.), haldu (*Adina cordifolia*), katbadam (*Terminalia catappa* L.), palas (*Butea monosperma* (Lam.) Taub.), khayer (*Acacia catechu*), tamal (*Diospyros montana* Roxb.), krishnachura (*Delonix regia* (Bojer) Rafin), kalo-jam (*Syzygium cumini*), kanchan (*Bauhinia racemosa* Lamk.), jarul (*Lagerstroemia speciosa* (L.) Pers.), parul (*Stereospermum suaveolens* A. DC.), dhakijam (*Syzygium grandis*), chapalish (*Artocarpus chama*), telsur (*Hopea odorata*), champa (*Michelia champaca*), cryptocarya (*Cryptocarpa amygdalina* and baobab (*Andansonia digitata*), kerung (Pongamia pinnata L.), boiam (*Anisoptera scaphula*), toon (*Toona ciliata*), chalmugra (*Gynocordia odorata*), goda/awal (*Vitex peduncularis*), raktan (*Lophopetalum fimbriatum*), udal (*Firmiana colorata*), sidha-jarul (*Lagerstroemia parviflora*), hargaza (*dillenia pentagina*), dholi-garjan (*Dipterocarpus alatus*), kanaidinga (*Oroxylum indicum*), agar (*Aquilaria agallocha*), gandhi-gazari (*Miliusa velutina*), pakhiara (*Thespesia populnea*), mailam (*Bouea oppositifolia*), pine (*Pinus caribaea*), dharmara (*Stereospermum personatum*), punnyal (*Calophyllum inophyllum*) etc.

5.8.2 This year

:

Action plan as per annual research programme	Progress
a. Development of nursery bed at HQs, Charkai, Lawachara and Charaljani SR Station.	Nursery bed for raising 40,000 seedlings at Lawachara, Charkai, Charaljani SR Stations and HQ Nursery have been developed.
b. Collection of seeds of dominant/popular forest tree species from seed orchards, plantations and natural forests.	Seeds were collected from selected mother trees.
c. Raising of 40,000 seedlings at HQs (30,000), Lawachara (5,000), Charkai (3,000) and Charaljani (2,000).	Raised 40,000 seedlings of different forest tree species such as mahogany (<i>Swietenia mahagoni</i>), raintree (<i>Samanea saman</i>), shegun (<i>Tectona grandis</i>), jarul (<i>Lagerstroemia speciosa</i>), arjun (<i>Terminalia arjuna</i>), bohera (<i>Terminalia bellirica</i>), amra (<i>Spondias pinnata</i>), sil-koroi (<i>A. procera</i>), hortoki (<i>Terminalia chebula</i>), kat-badam (<i>Terminalia catappa</i>), amloki (<i>Phyllanthus emblica</i>), chickrassi (<i>Chukrassia velutina</i>), eucalyptus (<i>Eucalyptus camaldulensis</i>), dhakijam (<i>Syzygium grandis</i>), toon (<i>Toona ciliata</i>), telsur (<i>Hopea odorata</i>), prosopis (<i>Prosopis juliflora</i>), sal (<i>Shorea robusta</i>), teli-garjan (<i>Dipterocarpus turbinatus</i>), acacia hybrid (<i>Acacia auriculiformis X A. mangium</i>) at HQ, Charkai, Charaljani, Keochia and Lawachara Research Stations (HQs (30,000), Lawachara (5,000), Charkai (3,000) and Charaljani (2,000).).
d. Maintenance of seedlings in the nursery through weeding, watering, sorting, rearrangement, etc.	Maintained last year left over and this year seedlings in the nursery through watering, weeding, sorting, rearrangement, etc.

e. Fencing of nursery area of Lawachra SR station with barbed wire to protect the seedlings from wild animals.	Fencing of nursery area with barbed wire at Lawachra SR station have been completed.
f. Collection of data on seedlings' growth, collar diameter, root-shoot ratio of different species.	Collected data on seed germination, survival %, seedlings growth recorded and collected data were compiled.

5.9 Achievement (s), if any : Developed appropriate nursery technique for 30 indigenous and exotic forest tree species.

5.10 Financial Statement :

5.10.1 Total cost : Tk. 15,00,000.00

5.10.2 Cost of the year : Tk. 1,80,000.00

5.10.3 Expenditure of the year : Tk. 1,80,000.00

5.10.4 Source of fund : GOB

5.11 Beneficiaries : FD, NGOs, Farmers, Educational institutions and other tree planting agencies.

6. Study : On-going

6.1 Programme Area : Plantation Techniques and Forest Management.

6.2 Title of the Study : **Spacing trial of agar plantation (*Aquillaria malacences*).**

6.3 Justification : In Bangladesh, specially in the Sylhet region history of agar plantation, production of agar oil, export of agar oil in the middle east country is from long ago. In recent years it gained great potentiality. Government of Bangladesh is also giving importance on this con-conventional exporting item. Bangladesh Forest Research Institute has been conducting research on various aspects for increasing production of agar oil in the plantation and modernizing its processing. As a general rule higher biomass (timber) will give higher production of agar oil. In Bangladesh various government and private planters are raising agar plantation with different spacing. But spacing has a great role on the biomass production. So, the study has been undertaken to observe the effect of spacing on the biomass production of agar plantations and agar accumulation in particular.

6.4 Objective (s) :

6.4.1 To determine the optimum spacing for agar plantation.

6.4.2 To assess biomass production and effect of spacing on agar formation.

6.5 Expected output : Optimum spacing for agar plantation will be determined. Biomass production and effect of spacing on agar formation will be determined.

6.6 Study period :

6.6.1 Starting year : 2010-2011

6.6.2 Completion year : 2016-2017

6.7 Personnel :

6.7.1 Project Leader: Mohammed Shaid Ullah, DFO.

6.7.2 Associates : Nasrat Begum, SRO and Nani Gopal Bhowmick, SRO.

6.8 Progress :

6.8.1 Previous progress, if any : Raised 2.32 ha experimental plantations at Keochia and Charaljani SRS.

6.8.2 This year :

Action plan as per annual research programme	Progress
a. Collection of agar seeds and raising 2000 seedlings at Charaljani and Keochia SR Stations.	Collected of agar seeds and raised two thousand seedlings at Charaljani (1000 nos.) and Keochia (1000 nos.) SR Stations.
b. Maintenance of seedlings in the nursery through weeding, watering, sorting, rearrangement, etc.	Maintained seedlings in the nursery through watering, sorting, rearrangement, etc.
c. Raising of 2.32 ha new agar plantation at four spacing (viz. 1.50m x 1.50m, 2.00m x 2.00m, 2.50m x 2.50m and 3.00m x 3.00m) at Charaljani and Keochia SR Stations.	Raised of 2.32 ha new agar plantation at four spacing (viz. 1.50m x 1.50m, 2.00m x 2.00m, 2.50m x 2.50m and 3.00m x 3.00m) at Charaljani and Keochia SR Stations.
d. Maintenance of 2.32 ha last year's experimental plantations through weeding, cleaning, climber cutting, pruning, etc.	Maintained 2.32 ha last year's experimental plantations through weeding at Charaljani and Keochia SR Stations.
e. Collection of data on survival and height growth of the seedlings in the plantations at six month interval.	Data on survival and height growth were recorded.
f. Analysis of data and reporting.	Collected data were compiled.

6.9 Achievement (s), if any :**6.10 Financial statement :**

6.10.1 Total cost : Tk.5,40,000.00

6.10.2 Cost of the year : Tk.60,000.00

6.10.3 Expenditure of the year : Tk. 60,000.00

6.10.4 Source of fund : GOB

6.11 Beneficiaries : FD, NGOs, Farmers, Educational institutions and other tree planting agencies.

7. Study : On-going

7.1 Programme Area : Biodiversity and Conservation.

7.2 Title of the Study : **Regeneration study of tree species in Chunati wild-life sanctuary.**

7.3 Justification : Documents of different working plans reveal that up to 1960s there was huge natural regeneration in different forests of Chunati. Unfortunately, after 1980s due to different biotic and abiotic interferences the biodiversity and forest resources of Chunati natural forest have destroyed drastically. In 1986 Government of Bangladesh declared Chunati forest (7,764ha) as Wildlife Sanctuary mainly to conserve the forest land as elephant corridor forest. Recently Chunati Wild life Sanctuary has been brought under co-

management system. The Chunati forest is still having good habitat for restoring its natural vegetation. However, there is no scientific information on important natural resources and trend of natural regeneration of tree species of this forest. In order to find out the species composition, status of natural regeneration and their trends as well as the formulation of enrichment strategy the study has been under taken.

7.4 Objective (s) :

7.4.1 To determine the regeneration status of tree species in chunati wild life sanctuary.

7.4.2 To determine the regeneration trends in chunati wild life sanctuary.

7.5 Expected output: Regeneration status of the species in chunati wild life sanctuary will be known. Regeneration trends of chunati wild life sanctuary will be determined. Enrichment planting strategy will be formulated.

7.6 Study period :

7.6.1 Starting year : 2010-2011

7.6.2 Completion year : 2012-2013

7.7 Personnel :

7.7.1 Project Leader: Nasrat Begum, SRO.

7.7.2 Associates: 1) Mohammed Shahid Ullah, DFO; 2) N.G. Bhowmick, SRO.

7.8 Progress:

7.8.1 Previous years, if any : Sites were selected at Chunati Beat, Lohagara, Cambul and Pnuichari Beat, Banskhali, Chittagong. Twenty seven plots (20m X 20m sized) were laid out at three locations (9 plots in each location). Regeneration data of tree species were collected once from each location. Soil samples were collected from Punichari, processed and sent to SRDI for analysis.

7.8.2 This year :

Action plan as per annual research programme	Progress
a. Data collection on regeneration from last year's selected plots at Chunati Beat, Chambol Beat and Puichari Beat in Chunati Wild Life Sanctuary.	Collected regeneration data from last year's selected plots at Chunati Beat, Chambol Beat and Puichari Beat in Chunati Wild Life Sanctuary.
b. Layout of plots (quadrates) to observe regeneration at Harbang Beat, Chunati Range and Napura Beat, Jaldi Range. Collection of regeneration data (seedlings of ≥ 20 cm in height and samplings of each species will be counted).	Surveyed, selected sites and plot (quadrates) layout at Harbang Beat, Chunati Range and Napura Beat, Jaldi Range. - Eighteen 20.0m x 20.0m sized plots were laid out (9 plots in each site) and marked to observe regenerations. - Collected regeneration data (seedlings of ≥ 20 cm in height and samplings of each species counted).
c. Collection and analysis of soil samples (micro and macro nutrients, soil texture, pH, moisture content, bulk density, water holding capacity, etc).	Soil samples were collected from Harbang Beat, Chunati Range and Napura Beat of Jaldi Range. Soil samples were processed and sent to SRDI for analysis.

7.9 Achievement (s), if any :

7.10 Financial statement :

710.1 Total cost : Tk.2,40,000.00

7.10.2 Cost of the year : Tk.40,000.00

7.10.3 Expenditure of the year : Tk.40,000.00

7.10.4 Source of fund : GOB

7.11 Beneficiaries : FD, NGOs, Farmers, Educational institutions and other tree planting agencies.

SILVICULTURE GENETICS DIVISION

1. **Study** : Ongoing
- 1.1 Programme Area : Bamboo and Non-Timber Economic Crops
- 1.2 Title of the Study : **Mass propagation of bamboos (*Dendrocalamus giganteus*, *B. tulda*, *B. vulgaris*, *B. bambos*, *B. balcooa*, and *Dendrocalamus brandisii*) through branch cuttings and seedlings proliferation.**
- 1.3 Justification : Bamboo has always been in great demand as raw materials for housing, agricultural implement and for handicrafts industries in the rural areas. Besides these, with the present rate of consumption and supply, bamboo has become a scarce commodity in Bangladesh. There is an urgent need to develop the bamboo resource base through massive programme for plantations with genetically improved planting stocks.
- 1.4 **Objectives** :
 - 1.4.1 : To make available bamboo propagules for wider distribution and dissemination with developed technology.
 - 1.4.2 : To develop linkage with different stakeholders.
- 1.5 Expected output : Increased bamboo cultivation and production.
- 1.6 **Study period** :
 - 1.6.1 Starting year : 2003-2004
 - 1.6.2 Completion year : 2011-2012
- 1.7. Personnel (s) :
 - 1.7.1 Study Leader : Sharmila Das, DO
 - 1.7.2 Associates : Nusrat sultana, FI
- 1.8 **Progress** :
 - 1.8.1 Previous years, if any (2010-11) : Five thousand and six hundred rooted cuttings and seedlings of *Dendrocalamus giganteus*, *Bambusa vulgaris*, *B. balcooa*, *B. bambos* and *B. tulda* were raised. About four thousand and five hundred cuttings and seedlings were distributed to the planters.

This year :

Activities of the study	Progress
a. Collection of planting materials of selected species.	a. Collected 8000 planting materials of selected species.
b. Production of ten thousand bamboo propagules (Five thousand through branch cuttings and five thousand through seed and seedling proliferation).	b. About 4500 propagules were raised through branch cuttings and 4000 through seed and seedling proliferation.
c. Data collection on survival rate of cuttings.	c. The survival rate of cuttings of <i>Dendrocalamus giganteus</i> was about 12% and 50 – 70% for other species.

1.9. Achievement(s), if any : People’s awareness increased for bamboo production through planting branch cuttings.

1.10. **Financial statement** :

1.10.1 Total cost : Tk. 7,47,840.00

1.10.2 Cost of the year : Tk. 1,30,200.00

1.10.3 Expenditure of the year : Tk. 1,30,200.00

1.10.4 Source of fund : GOB

1.11 **Beneficiaries** : BFRI, FD, NGO’s, Universities

2. **Study** : On going

2.1 Programme Area : Bio-diversity and Conservation

2.2 Title of the Study : Conservation of threatened plant species through domestication.

2.3 Justification : In Bangladesh some naturally grown tree species are gradually becoming threatened due to uncontrolled biotic interference. Forests of the humid tropics contain a large propagation of the plant genetic resources of the earth and therefore, their destruction implies the extinction of a large part of genetic resources of the earth. Thus it is noble duty of plant scientists to work in preventing such “genetic erosion” and in some case “species erosion”.

2.4 **Objectives** :

2.4.1 : To conserve and centralize the gene resource of threatened forest plant species.

2.4.2 : To domesticate the threatened species for conservation.

2.4.3 : To raise demonstration and resource plots for conservation purpose.

2.6 **Study period** :

2.6.1 Starting year : 2003-2004

2.6.2 Completion year : 2011-2012

2.7. Personnel (s) :

2.7.1 Study Leader : Sharmila Das, DO

- 2.7.2 Associates : Nusrat sultana, FI
- 2.8 **Progress** :
- 2.8.1 Previous years, if any (2010-11) : About six thousand seedlings were raised of collected seeds of dakrom (*Mitragyna parvifolia*), uriam (*Mangifera sylvatica*) and other available threatened species such as haldu (*Adina cordifolia*) and mkabhadi (*Engelhardtia spicata*) in nursery and are being maintained in the nursery for conservation plots.
- 2.8.2 This year :

Activities of the study	Progress
a. Collection of seeds and seedlings of five threatened species	a. Seeds of available threatened species such as latkon, ashok, tamal, civit, chalmugra and baria were collected and sown in nursery bed.
b. Raising of five thousands seedlings of selected species and maintenance of seedlings in the nursery.	b. About 3000 seedlings of collected species are being germinated in the nursery bed.
c. Raising one acre plantation as conservation plot in Sitakund Eco Park.	c.

- 2.9. Achievement(s), if any :
- 2.10. **Financial statement** :
- 2.10.1 Total cost : Tk. 318,160.00
- 2.10.2 Cost of the year : Tk. 84,200.00
- 2.10.3 Expenditure of the year : Tk. 84,200.00
- 2.10.4 Source of fund : GOB
- 2.11 **Beneficiaries** : BFRI, FD, NGO's, Universities

3. **Study** : Ongoing
- 3.1 Programme Area : Breeding and Tree Improvement
- 3.2 Title of the Study : Development of tissue culture techniques for different bamboo species viz. farua (*Bambusa polymorpha*), budum (*Dendrocalamus giganteus*), china bamboo (*D. latiflorus*), wappi (*Thyrsostachys sp.*) and pencha (*D. hamiltoni*).
- 3.3 Justification : With the passage of time the demand for bamboo are increasing while its availability is declining. Conventional bamboo propagation method is extremely difficult on account of long and often erratic flowering cycle. Micro-propagation of bamboo would be useful even with seed, seedling and adult tissue, as it would augment the supply of planting material and multiplying superior bamboo clumps on a large scale.

- 3.4 **Objectives** :
- 3.4.1 : To develop easy micro-propagation techniques for the bamboo species
- 3.4.2 : To produce a homogenous plant population
- 3.4.3 : *In vitro* conservation of plants
- 3.6 **Study period** :
- 3.6.1 Starting year : 2008-2009
- 3.6.2 Completion year : 2011-2012
- 3.7 Personnel (s) :
- 3.7.1 Study Leader : Shamila Das, DO
- 3.7.2 Associates : Nusrat sultana, F.I.
- 3.7.3 : Saiful Alam Md. Tareq, FI
- 3.8 **Progress** :
- 3.8.1 Previous years, if any (2010-11) : Culture establishment and multiple shoot production of different bamboo species viz. farua (*Bambusa polymorpha*), budum (*Dendrocalamus giganteus*), dolu (*Schizostachyum dullooa*), membra (*D. Membranaceus*) and ora (*D.longistathus*) have been done and rooted plantlets of brandisii were transferred to green house.

3.8.2 This year:

Activities of the study	Progress
a. Explants collection	a. Explants (nodal bud) of wappi bamboo (<i>Thyrsostachys sp.</i>) farua (<i>Bambusa polymorpha</i>), budum (<i>Dendrocalamus giganteus</i> and) pencha (<i>D. hamiltoni</i>) were collected from Khagrachari, Sylhet and Cox's bazaar.
b. Culture establishment and plantlets production.	b. Nodal bud culture of wappi (<i>Thyrsostachys sp.</i>), farua (<i>Bambusa polymorpha</i>), budum (<i>Dendrocalamus giganteus</i>), pencha (<i>D. hamiltoni</i>) and china bamboo (<i>D. latiflorus</i>) has been established using growth regulator. The effect of two concentration of BAP(6- Benzyl Amino Purine) in sprouting nodal bud is shown in Table 1. Multiple shoots of wappi, budum, china bamboo and farua have developed from the sprouted nodal buds.
c. Root induction and maintenance of the plantlets.	c. Developed multiple shoots of wappi, budum and china bamboo have transferred on rooting media for root induction. The rest of the multiple shoots are being maintained in the tissue culture laboratory for further shoot multiplication.
d. Transfer of the plantlets into soil for hardening.	d. Development of rooted plantlets is in progress.
e. One thousand tissue culture bamboo seedlings will be produced.	e.

- 3.9 Achievement(s), if any : Experimental plot raised by tissue culture plantlets having promising growth performance at different locations such as Paithong, Bandarban, Jahangirnagar University, IFESCU campus, BSRI, Ishwardi, and Rajshahi University.
- 3.10 **Financial statement** :
- 3.10.1 Total cost : Tk. 17,50,000.00
- 3.10.2 Cost of the year : Tk. 76,420.00
- 3.10.3 Expenditure of the year : Tk. 76,420.00
- 3.10.4 Source of fund : GOB
- 3.11 **Beneficiaries** : BFRI, FD, NGO's, Universities

Table 1. Percentage range of sprouted nodal bud as effect of two concentration of BAP (6-Benzyl Amino Purine) in three bamboo species

Species	Media without growth regulator		Media with growth regulator			
	MS	B5	BAP 0.5mg/l		BAP 1.0mg/l	
			MS	B5	MS	B5
<i>Dendrocalamus giganteus</i>	35 - 40	25 - 30	55 - 60	25 - 35	65 - 70	45 - 50
<i>D. latiflorus</i>	40 - 50	35 - 40	60 - 65	35 - 40	75 - 80	55 - 60
<i>Thyrsostachys sp.</i>	40 - 45	30 - 35	60 - 70	20 - 30	75 - 80	40 - 50

4. **Study** : On going
- 4.1 Programme Area : Breeding and Tree Improvement
- 4.2 Title of the Study : Development of tissue culture techniques for
1) Timber trees: boilam (*Anisoptera scaphula*), tamal (*Diospoyros montana*), 2) Medicinal plant: amloki (*Phyllanthus emblica*) and 3) Fruit tree: lotkon (*Baccaurea sapida*).
- 4.3 Justification : *In vitro* conservation and production of genetically unique huge plantlets of tree is possible for future demand.
- 4.4 **Objectives** :
- 4.4.1 : To develop easy micro-propagation techniques for the species
- 4.4.2 : To produce a homogenous plant population
- 4.4.3 : *In vitro* conservation of plants
- 4.6 **Study period** :
- 4.6.1 Starting year : 2008-2009
- 4.6.2 Completion year : 2011-2012
- 4.7. Personnel (s) :
- 4.7.1 Study Leader : Sharmila Das, DO
- 4.7.2 Associates : Nusrat sultana, FI
- 4.7.3 : Saiful Alam Md. Tareq, FI

- 4.8 **Progress** :
- 4.8.1 Previous years, if any (2010-11) : Culture establishment of boilam, lotkon and agar have been done.

4.8.2 This year :

Activities of the study	Progress
a. Selection of donor trees	a. Selected donor trees of the species.
b. Establishment of culture, production of multiple shoots.	b. Explant (shoot tip) culture of boilam and tamal have been established. Multiple shoots have developed from the established culture of tamal, boilam, and amloki. The shoots are being maintained for further multiplication.
c. Root induction and maintenance of the plant lets.	c. Developed multiple shoots of amloki and tamal have transferred on rooting media for root induction. The rest of the multiple shoots are being maintained in the tissue culture laboratory for further shoot multiplication.
d. Transfer of the plantlets into soil for hardening.	d. Development of rooted plantlets is in progress.

- 4.9. Achievement(s), if any : Two hundred seedlings of haldu have produced by tissue culture technique.
- 4.10. **Financial statement** :
- 4.10.1 Total cost : Tk 18,50,000.00
- 4.10.2 Cost of the year : Tk 1,33,805.00
- 4.10.3 Expenditure of the year : Tk 1,33,805.00
- 4.10.4 Source of fund : GOB
- 4.11 **Beneficiaries** : BFRI, FD, NGO's, Universities

SEED ORCHARD DIVISION

1. **Study** : **On going**
- 1.1 Programme area : Breeding and Tree improvement:
- 1.2 Title of the study : **Selection of plus trees of important agroforestry and forest tree species**
- 1.3 Justification : **Plus trees form the base population of tree breeding programme and provides quality planting materials for immediate planting programme**
- 1.4 **Objectives** :
- 1.4.1 To establish sources of superior quality seeds from selected clones or progenies.
- 1.4.2 To obtain best possible gains from the breeding programmes by testing progenies/clones of the selected plus trees.
- 1.4.3 To popularize superior quality seeds produced in seed orchards
- 1.5 Expected output : An interim source of superior quality seeds and breeding materials will be available for the planters.

1.6 Study period

Starting year : 1992-1993

Expected completion Year: 2015-2016

1.7 Personnel :

1.7.1 Study leader : Kabir Uddin Ahmed, DO

1.7.2 Associates : Sukla Rani Bashak, SRO
Md. Arifur Rahaman, RO
Md. Mezan-Ul-Haque, RO
A.K.M Azad, RO
Md. Kamaluddin, RO
Md. Mukhlesur Rahman, FI

1.8 Progress: :

1.8.1 Previous years : 2765 plus trees of 35 different forest tree species (List annexed) were scientifically verified, remarked and documented from previously selected plus trees of 50 different forest tree species. 1909 plus trees of 50 different forest tree species (civit (*Swintonia floribunda*), boilam (*Anisoptera glabra*), dholi garjan (*Dipterocarpus pilosus*), telsur (*Hopea odorata*), chapalish (*Artocarpus chaplasha*) hybrid *Acacia*, akashmoni (*Acacia auriculiformis*), gamar (*Gmelina arborea*), bakain (*Melia azedarach*), bahera (*Terminalia bellerica*), haritaki (*Terminalia chebula*), amloki (*Embelica officinalis*), arjun (*Terminalia arjuna*), neem (*Azadirachta indica*) etc. were selected and seeds are being collected. 7836 kg seeds of 24 different forest tree species (telsur, gamar, garjan, teak (*Tectona grandis*), dhakijam (*Syzygium grande*), kadam (*Anthocephalus chinensis*), bahera, haritaki, amloki, arjun, neem etc. were collected and distributed /sold to different tree planting agencies.

Seeds and scion were collected from selected PTs and used for raising plantation and orchards .

1.8.2 b.	This year	
	Activities of the study	Progress
a.	Selection of 120 plus trees of agar,akashmoni, bajna, batna, boilam, civit,dharmara, gamar, goda, gutgutya kadam, kanak, lohakath, mangium, pitraj, raktan, segun, sidaJarul and silkoroï .	a) A total 120 plus trees of agar,akashmoni, bajna, batna, boilam, civit,dharmara, gamar, goda, gutgutya kadam, kanak, lohakath, mangium, pitraj, raktan, segun, sidaJarul and silkoroï were selected at Hyankoo (16), Ukhia (13), Dulahazara (10), Ichamoti (31), Barshijura (10) ,Kaptai(29) ,Head quarter(5) and Salna (6) Seed Orchard Centres..
b.	Collection of 500 Kg seeds from plus trees for distribution to DNMS & other tree planters.	b) 500kg seeds of 38 different forest tree specics were collected from plus trees and supplied to private planters, DNMS and other private organizations.

1.9 Achievements : 2019 Plus trees of 50 species were selected and 9036 kg seeds were collected and distributed. Better quality seed sources with broader genetic base were created. Developed linkages with DNMS and private planters. Developed awareness about QPM among DNMS and private planters.

1.10 Financial statement

1.10.1 Total cost :

1.10.2 Cost of the year :Tk. 55996.00

1.10.3 Expenditure of the year :Tk. 55996.00

1.10.4 Source of the fund :GOB

1.11 **Beneficiaries** : Forest Department (FD), Non Government Organizations(NGOs) and other tree planting agencies and Private Land Owners.

2. Study On going

2.1 Programme area : Breeding and Tree improvement
 2.2 Title of the study : **Establishment and management of seed orchard**
 2.3 Justification : Easy and accessible source of quality seeds is created. Genetic worth of plus trees are identified

2.4 Objectives :

2.4.1 To establish and manage superior quality seed sources from selected clones or progenies.
 2.4.2 To preserve better genetic stocks under ex situ condition from the natural stands and plantations for future breeding and tree improvement programme
 2.4.3 To develop suitable techniques for mass production of clonal planting materials.
 2.4.4 To screen best clones/progenies.
 2.4.5 To supply quality seeds to FD, NGOs, DNMSs and planters.

2.5 Expected output: : Permanent source of quality seeds and improved planting materials will be available for the planters.

2.6 Study period :
 2.6.1 Starting year : 1992-1993
 2.6.2 Expected completion Year : 2014-2015

2.7 Personnel :
 2.7.1 Study leader : Kabir Uddin Ahmed, DO
 2.7.2 Associates : Sukla Rani Bashak, SRO
 Md. Arifur Rahaman, RO
 Md. Mezan-Ul-Haque, RO
 A.K.M Azad, RO
 Md. Kamaluddin, RO
 Md. Mukhlesur Rahman, FI

2.8 Progress :

2.8.1 Previous years : From different seed orchards 3337kg seeds of teak, gamar, pine, telser, eucalyptus etc were collected and distributed. 82,000 Nos. rootstocks were raised to establish clonal seed orchard of teak, mahogany, gamar, garjan, eucalyptus, akashmoni, dhakijam etc. 66 ha. seedling seed orchard of garjan, dholigarjan(*Dipterocarpus pilosus*), dhakijam, chapalish, eucalyptus (*Eucalyptus camaldulensis*, *E. tereticornis*, *E. europphylla*) akashmoni (*Acacia auriculiformis*) and gamar were raised and 39ha clonal seed orchard of teak (*Tectona grandis*), gamar (*Gmelina arborea*) and mahogany (*Swietenia mahogani*) were raised. Cultural operations viz. fertilizer application, weeding, mulching etc. was carried out in 105 ha orchards and experimental plantations. Nurseries at head quarters and 7 seed orchard centres were maintained .

2.8.2 b. This year

	Activities of the study	Progress
	a.Raising of 7000 seedlings from 40 plus trees of akashmoni selected at SPA of Kaptai and Ichamati SOC	7000 seedlings were raised from 40 plus trees of akashmoni selected at SPA of Kaptai and Ichamati SOC

<p>b. Establishment of 2 ha. seedling seed orchard of akashmoni (<i>Acacia auriculiformis</i>).</p> <p>c. Establishment of 3 ha seedling seed orchard of chickrassi, garjan, dhakijam and champa by using earlier raised seedlings at Ichamati, Salna, Dulahazara and Hyanko SOC.</p> <p>d. Removal of loranthus from gamar clonal seed orchard at Kaptai SOC</p> <p>e. Maintenance of existing 39 ha clonal seed orchard and 65.45 ha seedling seed orchards at Salna, Dulahazara, Ichamati and Hyankoo SOCs.</p> <p>f. Collection of 200 kg teak seed and 300 kg gamar seed from Kaptai Seed Orchard Centre, 40 kg telsur seed and 2 kg pine seed from Ichamati Seed Orchard Centre and 5 kg eucalyptus seed from Salna Seed Orchard Centre.</p> <p>g. Raising and maintenance of 17500 seedlings for establishment of 5 ha seedling seed orchard of jarul (1 ha), champa (1 ha), chickrassi (1 ha), toon (1 ha), goda (0.5 ha) and gutguty (0.5ha).</p> <p>h. Maintenance of previous years seedling at nursery of Head Quarter and Dulahazara, Ichamati, Hyankoo and Salna SOC.</p> <p>i. Maintenance by gap filling in previously raised one year old 13.5 ha orchard at Ichamati, Kaptai, Dulahazara and Hyanko SOC</p> <p>j. Maintenance of nurseries at Head Quarter and seven seed orchard centres.</p> <p>k. Production of 6000 rooted cuttings of hybrid <i>Acacia</i> at plant propagation unit of head quarter for distribution to DNMSs and 6 SOCs.</p> <p>l. Raising of 6000 seedlings for raising 6 ha teak seed orchard at Kaptai.</p> <p>m. Data collection from 4 hectare garjan SSO at Hyankoo and Dulahazara</p>	<p>1ha seedling seed orchard of akashmoni were established at Kaptai and 1ha at Ichamoti SOC (total 2 ha).</p> <p>Seedling seed orchard of garjan(1ha), dhakijam(1),champa(0.5),sida jarul(0.5) were established (Dulahazara 1ha and Hayanko 2ha).</p> <p>Loranthus from gamar clonal seed orchard at Kaptai SOC was removed .</p> <p>A total of 92.5 ha orchards of Dulahazara SOC (17.53 ha), Hyanko SOC (52.5 ha), Ichamati SOC (11 ha), Salna SOC (4) ha, kaptai SOC(7) were maintained and 8.5 ha plantation raised last year were maintained by gap filling.</p> <p>From Kaptai Seed Orchard Centre 200 kg teak seed, 350 kg gamar seed, from Ichamati Seed Orchard Centre 20 kg telsur and from Salna Seed Orchard Centre 5 kg eucalyptus seed were collected.</p> <p>17500 seedlings of jarul (3500), champa (3500), chickrassi (3500), toon (3500), goda (1760 ha) and gutguty (1750) were raised and maintained for establishment of 5 ha seedling seed orchard to the next year .</p> <p>Seedlings raised in previous years at nursery were maintained of Head Quarter , Dulahazara, Ichamati, Hyankoo and Salna SOC.</p> <p>13.5 ha orchard of one year old were maintained by gap filling at Ichamati, Kaptai, Dulahazara and Hyanko SOC</p>
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	<p>n. Fertilizing in the rubber clonal trial</p> <p>o. Expenditure for collecting left over illicitly cutted wood logs from orchards</p>	<p>Plant propagation unit produced 6000 rooted cuttings of hybrid <i>Acacia</i> and distributed to DNMSs and different tree planters .</p> <p>6000 rootstocks of teak (<i>Tectona grandis</i>) were raised for the establishment of 6 ha clonal seed orchard.at Kaptai.</p> <p>Data were collected.</p> <p>2 ha rubber clonal trial was fertilized.</p> <p>978 logs in different size of hybrid acacia species were collected .</p>
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2.9 Achievements : At Hyankoo, Dulahazara, Ichamati, Salna and Kaptai SOC 32ha. clonal seed orchard of teak,gamar, and mahogany and 25 ha. seedling seed orchard of garjan, doligarjan, dhakijam, chapalish, eucalyptus (*Eucalyptus camaldulensis*, *E. tereticornis*,*E. europhylla*) akashmoni and gamar were established and seeds are being collected from teak and gamar seed orchard at Kaptai.

2.10 Financial Statement

- 2.10.1 Total cost :
 2.10.2 Cost of the year : 8,80,884.00
 2.10.3 Expenditure of the year : 8,80884.00
 2.10.4 Source of the fund : GOB

2.11 Beneficiaries : Forest Department (FD), Non Government Organizations (NGOs) , other tree planting agencies and privat land owners .

3. Study On going

- 3.1 Programme area : Breeding and Tree improvement
 3.2 Title of the study : **Superior stand /woodlot selection and conversion into seed production area (SPA).**
 3.3 Justification : Easy accessible and better quality seed source will be created

3.4 Objectives

- 3.4.1 To develop an interim source of seeds
 3.4.2 To ensure supply of better quality seeds
 3.5 Expected output

3.6 Study period

- 3.6.1 Starting year : 1996-1997
 3.6.2 Expected completion Year : 2015-2016

3.7 Personnel

- 3.7.1 Project leader : Kabir Uddin Ahmed, DO
 3.7.2 Associates : Md. Mezan-Ul-Haque, RO
 Md. Mukhlesur Rahaman, FI

3.8 Progress

3.8.1 Previous years : 210 kg seeds of akashmoni from established seed production area and distributed. Inferior stock were removed from one hectare plantation of akashmoni at Kaptai and one hectare at Ichamati seed orchard centre.

3.8.2 b. This year

Activities of the study	Progress
a. Collection of 20 kg seeds from SPA of Kaptai and Ichamati SOCs	20 kg seeds of akashmoni were collected and distributed to DNMS, NGOs and planters
b. Maintenance of seed production area of akashmoni 1ha at Ichamati and 1 ha at Kaptai Seed Orchard Centre..	One ha seed production area of akashmoni at Ichamati and one ha at Kaptai were maintained by weeding and climber cutting.

3.9 Achievements : Two hectare SPA of *A. auriculiformis* were established and 220 Kg seed collection and production are going on .

3.10 Financial Statement:

Total cost :
 Cost of the year : 13280.00
 Expenditure of the year : 13280.00

3.11 Beneficiaries : Forest Department (FD), Non Government Organizations (NGOs) and other tree planting agencies.

4. Study

On going

- 4.1 Programme area : Production of quality planting materials
 4.2 Title of the study : **Popularizing quality planting materials through distribution**
 4.3 Justification : Awareness among the people about quality seeds will be created Linkage between BFRI and other organization will be strengthened

4.4 Objectives

- 4.4.1 To develop awareness about the importance and benefits of using quality seeds and seedlings
 4.4.2 To increase the quality and quantity of tree production in plantation and homesteads.
 4.5 Expected output : Awareness among the people about QPM will be increased and productivity of the plantation will be increased

4.6 Study period

- 4.6.1 Starting year : 2004-2005
 4.6.2 Expected completion Year : 2015-2016

4.7 Personnel

- 4.7.1 Study leader : Md. Mezan-Ul-Haque, RO
 4.7.2 Associate : Kabir Uddin Ahmed, DO

4.8 Progress

4.8.1 Previous Years:

During previous years 130000 quality seedlings of 19 species were distributed and nursery facilities improved :

4.8.2 This year

Activities of the year

Progress

Raising of 25000 seedlings of mahogany, gamar, hybrid acacia, akashmoni, kadam, toon, jarul, silkoroi, boilam, civit, champa, etc. considering the demands of earlier years.

25000 seedlings of 18 different forest tree species (akashmoni, arjun, chapalish, haritoki, mahogany, gamar, hybrid acacia, champa, neem, raintree, teak etc. were raised for distribution among tree planters

Distribution of seedlings among the farmers, planters and other users

25000 seedlings of different forest tree species were distributed among the farmers, planters and other users.

Improvement of nursery facilities at BFRI HQ.

4.9 Achievements : Awareness has developed about use of quality seed and seedlings. Production of forest plantation and homestead plantation has increased where quality seeds and seedlings used by farmers.

4.10 Financial Statement

4.10.1 Total cost :

4.10.2 Cost of the year : 75,000.00

4.10.3 Expenditure of the year : 75,000.00

4.10.4 Source of the fund : GOB

4.11 Beneficiaries : Forest Department (FD), Non Government Organizations (NGOs) and other tree planting agencies.

5. Study : On going

5.1 Programme area : Production of quality planting materials

5.2 Title of the study : **Testing of seeds before distribution and standardization of storage behavior.**

5.3 Justification : Quality of the QPM will be ensured

5.4 Objectives :

5.4.1 To develop a unified system of seed collection, storage, export, import, testing and distribution of forest tree seeds.

5.4.2 To ensure the supply of quality seeds to the planters

5.4.3 To strengthen the BFRI seed testing laboratory.

5.5 Expected output : Seeds with better physiological and physical quality will ensure the better productivity of the plantation

5.6 Study period

5.6.1 Starting year : 1992-1993

5.6.2 Expected completion Year : 2013-2014

5.7 Personnel (s) :

5.7.1 Study leader : Md. Mezan-Ul-Haque, RO

5.7.2 Associate : Kabir Uddin Ahmed, DO

5.8 Progress

5.8.1 Previous years : Routine testing of the collected seeds were done prior to distribution of seeds. Laboratory facilities were strengthened

5.8.2 This year

Activities of the year	Progress
Study on storage behavior of seeds of major forest tree species (e.g. agar, chapalish, civit, boilam)	Experiment set on to study the storage behaviour of agar and chapalish
Germination, purity and viability tests of the collected seeds from seed orchard centres before distribution	Germination, purity and viability tests of the sample collected from distributed seeds were done

5.9 Achievement : Unified systems of seed distribution for akashmoni were developed. Seed storage and testing facilities were developed

5.10 Financial Statement

Total cost	:
Cost of the year	: 25000.00
Expenditure of the year	: 25000.00
Source of fund	: GOB

5.11 Beneficiaries : Forest Department (FD), Non-Government Organizations (NGOs) and other Tree Planting Agencies and private land owners.

6 Study

On going

- 6.1.1 Programme area : Breeding and tree improvement
- 6.1.2 Title of the study : **Centralization of high yielding clones of rubber (*Hevea brasiliensis*) and establishment of orchard.**
- 6.1.3 Justification : To increase latex production screening of existing genotypes/clones in present rubber garden and introduction of high yielding clones.

6.4 Objectives

6.4.1 To increase the productivity of latex by selecting better yielding rubber plant/ clone.

6.4.2 Centralization of high yielding clones in hedge orchard.

6.5 Expected output : Latex production of rubber plant will be increase.

6.6 Study period :

6.6.1 Starting year : 2008-2009

6.6.2 Expected completion Year : 2015-2016

6.7 Personnels:

6.7.1 Study leader : Kabir Uddin Ahmed, DO

6.7.2 Associates : Sukla Rani Bashak, SRO
Md. Kamaluddin, RO
Md. Mezan-Ul-Haque, RO

6.8 Progress

6.8.1 Previous years : One hundred twenty 120 trees were selected at Datmara Rubber estate, 20000 seedlings were raised to produce ramets by using selected clones. From 32 plus trees selected on the basis of latex yield were used in raising 2 ha clonal trial at Datmara rubber estate.

- 6.8.1 This year : Progress
 Activities of the year
- a. Collection of 50 kg seeds of rubber from selected trees. 50 kg rubber seed were collected
- Raising and maintenance of 2000 seedlings at Hyanko SOCs 2000 rubber seedling were raised to make ramets for planting during June 2013
- Maintenances of previously raised trial plantation at Hyanko SOC 2 hectare clonal trial were maintained
- 6.9 Achievements :A clonal trial of 32 clones was established by Hyanko SOC at Datmara rubber estate, Fatickchari, Chittagong.
- 6.10 Financial Statement**
- 6.10.1 Total cost :
 6.10.2 Cost of the year : 49480.00
 6.10.3 Expenditure of the year : 49480.00
 6.10.4 Source of fund : GOB
 6.11 Beneficiaries : BFIDC and other government and private entrepreneurs will be benefited.

Forest Botany Division

1. **Study** : On-going
- 1.1 Programme Area : Biodiversity and Conservation
- 1.2 Title of the Study : **Community based tree biodiversity conservation in Bandarban Hill District**
- 1.3 Justification :

The Tribal communities of Bandarban Hill District traditionally conserve community reserve forest around their village. This type of forests is called as para or kowa or mouza reserve or para ban or village common forest. It is managed under the traditional norm and rules of the society. The community reserve is conserved for fire protection, perennial water supply, and source of wild food and to maintain the local environment. Traditional system of community reserve is becoming extinct due to land scarcity, urbanization and loss of social norms. The Murang community of Bandarban Hill District is still conserving some community forest for water source. Therefore, this study has taken to develop awareness among the local community members for biodiversity conservation and enrichment plantation in the community reserve.

- 1.4 **Objectives** :
- 1.4.1 To promote community based tree biodiversity conservation involving local people and community.

1.4.2 To establish demonstration plot for conservation of indigenous species.

1.5 Expected output:

- a) Awareness of local people about values of local biodiversity and their conservation will be developed and this will help for future research work.
- b) Motivation for community based tree biodiversity conservation will be helpful for their perennial water source and better livelihoods.

1.6 **Study period** :

1.6.1 Starting year : 2008 – 09

1.6.2 Completion year : 2012 – 13

1.7 **Personnel (s)** :

1.7.1 Study leader : M. Mohiuddin, D.O.

1.7.2 Associates : Asim Kumar Paul, R.O; A. H. M. Jahangir Alam, R.O.

1.8 **Progress** :

1.8.1 Previous years :

Five PRA meetings for new plantation site selection and two group meetings was conducted with the local people under the leaderships of Kabaries to motivate the local people for enrichment plantation and biodiversity conservation in the community reserve. Community people made a participatory list of 30 priority tree species for enrichment plantation and they also reported that these species enhance the water-holding capacity of the soil. Last year 5,000 seedlings of twenty indigenous species have been distributed in Chimbuk para, Sitapahar para and Empu para for enrichment plantation in the reserve. The species were uriam, sil-koroi, bahera, civit, chapalish, telsur, arjun, horitoki, kadam, jarul, garjan, champaful, neem, jolpai. Local people reported that awareness for biodiversity conservation has been enhanced among the community members after the enrichment planting in the reserve.

1.8.2 This year:

Activities of the study	Progress
a. Six group meetings with the Karbaries (local leaders) and local peoples of Empu para, Chimbukpara and Sitapahar para for awareness development for biodiversity conservation.	a. Six group meetings with the karbaries (local leaders) and local community people were conducted at Empu para, Chimbuk para and Sitapahar para in Bandarban Hill District for biodiversity conservation and importance of community reserve. Karbaries and local people agreed to conserve tree biodiversity in the reserve after the sensitizing meeting.
b. Motivate the local people for collection of wild indigenous	b. Local people committed to collect the wild seedlings from the natural forests and agreed to plant them in

species seedlings from natural forests and planting them in the community reserve.	the reserve. Growth and survival of the species has been collected and result is given in table 1.
c. Motivate the local people for maintenance and conservation of planted species.	c. A seven member's forest protection committee headed by the Karbari (local leader) has been formed in Empu para and Sitapahar para. For tree biodiversity conservation. Necessary suggestion has been given to community members for mulching and weeding.
d. Reporting (Draft report).	d. A draft report is in progress.

Table: Average height and survival % of the species (age 03 years) at three para of Bandarban

Species	Species Height (Average) cm			Survival (%)		
	Sita pahar	Empu para	Chimbuk para	Sitapahar	Empu para	Chimbuk para
Champaful	99.25	87.00	91.56	82.65	83.57	80.52
Garjan	82.35	80.63	75.35	76.45	73.75	80.63
Arjun	66.87	65.62	69.37	71.34	68.65	70.25
Chapalish	69.38	72.36	75.63	76.48	62.75	71.56
Menda	73.39	76.54	65.34	68.57	62.68	61.45
Rain tree	100.25	89.53	92.35	70.65	65.64	71.37
Kainjal bhadi	91.58	80.52	83.37	65.56	60.25	70.35
Bohera	70.36	65.45	71.45	63.24	70.56	63.27
Chickrassy	66.35	75.25	65.84	58.57	62.35	60.25
Neem	76.83	78.35	84.65	79.56	70.46	68.80
Mahogany	96.35	88.46	80.36	70.25	65.35	72.00
Telsur	67.25	62.45	72.64	65.50	60.45	68.30
Dhakijam	63.25	58.35	66.34	63.56	60.85	71.25
Lohakat	67.56	70.24	62.35	63.05	50.25	59.57
Civit	52.86	62.45	57.54	58.53	52.74	59.35
Uriam	63.57	61.20	56.63	67.00	60.25	63.54
Amloki	70.35	63.56	67.75	62.45	63.36	60.35
Haritaki	67.25	54.47	63.85	68.00	61.52	66.25
Ghoranim	76.35	70.43	72.85	69.47	65.25	66.54
Jarul	56.66	52.28	50.37	68.56	60.65	70.56

1.9 Achievement (s) : Biodiversity of the community reserve has enriched and awareness has created among the local people for biodiversity conservation.

1.10 Financial Statement

1.10.1 Total cost : 5,00000.00

1.10.2 Cost of the year : 75,250.00

1.10.3 Expenditure of the year: 75,000.00

1.10.4 Source of fund : GOB

1.11 Beneficiaries : FD, Universities, NGOs and development agencies.

2. **Study** : On-going
- 2.1 Program Area : Biodiversity and Conservation
- 2.2 Title of the study : **Buddha-Bihar (Kiyang) based tree biodiversity conservation in Rangamati Hill District**
- 2.3 Justification : The tree biodiversity in Chittagong Hill Tracts (CHT) is decreasing in an alarming rate due to number of causes. Buddha-Bihar (*Kiyang*) is the religious institution for the followers of Buddha. Most of the Buddha-Bihar (*Kiyang*) of Rangamati Hill District is situated at the top of the hills. During establishment they cut the natural vegetation of the area. After establishing the Buddha-Bihar the religion leaders and local people do not cut any tree species from Bihar areas and they considered these trees as sacred tree. At present the Buddha-Bihar is considered as important place for tree biodiversity conservation in CHT. Therefore, this study has taken to awareness development for tree biodiversity conservation and enrichment plantation around the Bihar area.
- 2.4 **Objectives** :
- 2.4.1 To conserve biodiversity by involving local religious leaders.
- 2.4.2 To enrich biodiversity in Buddha-Bihar (*Kiyang*) areas by participatory effort.
- 2.4.3 To develop a religious institution based biodiversity conservation model.
- 2.5 Expected output :
- a) Religious leaders and local people will be motivated for indigenous tree plantation and conserve tree biodiversity in Buddha-Bihar (*Kiyang*) areas.
- b) Biodiversity of hill forest will be conserved and enriched for future research work.
- c) Awareness will create among religious leaders and local people for tree biodiversity conservation at local level.
- 2.6 **Study period** :
- 2.6.1 Starting year : 2008– 09
- 2.6.2 Completion year : 2012 – 13
- 2.7. Personnel(s) :
- 2.7.1 Study leader : M. Mohiuddin, D.O.
- 2.7.2 Associates : Asim Kumar Paul, R.O. ; A.H.M Jahangir Alam, R.O.
- 2.8 **Progress** :
- 2.8.1 Previous year : Four-consultation meetings were carried out with the religion leaders (*Bantheyas*) to focus about the importance of tree biodiversity conservation in Bihar area.

PRA and group discussion meetings were carried out with the religion leaders (*Bantheyas*) and local people to list up the suitable species for Bihar areas. A participatory map of the Bihar was made by the local people and religious leaders for enrichment plantation. A listed 27 priority species suitable for plantation around the Buddha-Bihar (*Kiyang*) area was prepared by the Bantheyas and local people. The priority species were neem, champa, mahagony, garjan, arjun, bahera, jarul, kainjal bhadi, civit, kadam and sil-koroi. Five thousand seedlings of 27 indigenous species were distributed to three Bihar namely Bodhipur Bonobihar, Khamarpara Adarsha Bonobihar, Nirbanpur Bonobihar of Manikchari area. These species were planted around the Bihar areas.

2.8.2 This year:

Activities of the study	Progress
a. Six awareness or sensitizing group meetings with the religions leaders and community people at Bodhipur, Nirbanpur and Khamarpara Buddha-Bihar towards the plantation around the Buddha-Bihar (<i>Kiyang</i>) areas.	a. Six awareness or sensitizing group meetings were conducted with the religion leaders (<i>Bantheya</i>) and local community people for biodiversity conservation. They draw a PRA map for selecting new plantation sites for this year plantation. Local people and religion leaders mentioned 25 priority species suitable for plantation around the Buddha-Bihar (<i>Kiyang</i>) area. The main suitable species were garjan, jarul, uriam, bandarhola, kainjal bhadi, champaful, goda, deshi neem, chapalish, arjun, kadam, horitaki, uriam, and pitraj.
b. Motivation to the religions leaders and local people for wild seedlings collection from the natural forest for enrichment plantation around the Bihar areas.	b. A series of motivation meeting were conducted with local people and religion leaders for wild seedlings collection. They were agreed to collect wild seedlings from the nature. The seedling height an survival percentage have been given in table 2.
c. Motivate the religion leaders and local people for maintenance and conservation of planted seedlings of tree species	c. After the awareness meeting the religion leaders were convinced about the importance of tree biodiversity conservation. They maintain and look after the planted seedlings around the Bihar area. They also agreed to convey the message to the local people during monthly religious meetings.
d. Reporting (Draft report).	g. A draft report is in progress.

Table 2: Average survival and height growth of the species (age 03 years) at three Buddha-Bihar's of Rangamati.

Species	Species Height (Average) cm			Survival (%)		
	Nirbanpur	Bodhipur	Khamar para	Nirbanpur	Bodhipur	Khamar para
Champa	102.00	97.00	92.65	87.75	80.21	83.25
Garjan	83.46	90.26	80.54	82.65	71.52	80.35
Arjun	76.78	71.58	69.76	88.33	82.65	80.75
Chapalish	78.00	81.35	75.43	72.84	61.25	65.23
Menda	83.69	76.00	82.37	67.32	65.36	59.35

Rain tree	103.35	100.25	102.56	77.42	67.45	70.45
Kainjalbhadi	95.65	88.62	91.57	62.34	60.25	67.45
Bohera	72.36	70.24	68.76	83.62	70.48	72.56
Chickrassy	58.63	62.35	55.34	72.14	67.53	65.35
Neem	86.83	82.35	84.30	81.55	72.45	73.89
Nagesswar	52.00	60.62	55.28	49.00	51.32	52.36
Mahogany	98.00	83.16	86.63	76.21	72.65	73.00
Telsur	88.54	67.45	71.56	68.4.2	61.45	64.26
Bakul	63.25	58.35	56.32	79.76	73.85	63.25
Dhakijam	76.67	77.24	63.54	74.15	70.25	67.45
Lohakat	43.86	45.26	46.54	46.57	49.35	59.75
Civit	59.72	61.35	66.56	70.52	65.72	68.65
Palas	68.57	65.22	52.36	67.00	60.25	63.54
Uriam	51.33	61.00	57.65	62.35	62.25	64.57
Mohua	75.32	58.56	63.47	58.24	63.48	61.84
Khayer	60.25	-----	-----	52.00	-----	-----
Amloki	42.35	48.43	46.85	75.47	77.25	73.54
Haritaki	51.66	45.28	46.37	71.23	66.65	70.65
Kadam	91.58	86.85	86.45	72.57	68.45	70.25
Jalpai	52.26	56.24	50.76	65.75	63.78	64.38
Ghoranim	89.50	86.69	87.26	73.27	72.15	71.45
Jarul	67.25	65.24	60.38	66.42	65.82	64.64

2.9 Achievement(s) : Awareness has created among the religious leaders and local people for biodiversity conservation in the Bihar.

2.10 **Financial Statement** :

2.10.1 Total cost : 4,00000.00

2.10.2 Cost of the year : 80,045.00

2.10.3 Expenditure of the year : 80,000.00

2.10.4 Source of fund : GOB

2.11 **Beneficiaries** : Government Departments, Academic Institutes, NGOs, and local communities

3. **Study** : **On-going**

3.1 Program Area : Post Harvest Utilization- Physical Processing

3.2 Title of the Study : **Anatomical variation of three timber species toon (*Toona ciliata*), sil-koroi (*Albizia procera*), rain-tree (*Samanea saman*) in relation to their four ecological regions of Bangladesh**

3.3 Justification : The anatomical properties of wood vary depending on the different factors. Wood properties also vary with growing habitat of the species. The detail anatomical properties of these species were studied without considering the habitat. The

present study is taken to determine the impact of habitat on the wood properties of these species.

3.4 Objectives :

3.4.1 To determine the detail gross and minute anatomical features of three species of occurring in different regions of Bangladesh.

3.4.2 To determine the anatomical variation of three species in relation to difference regions.

3.5 Expected output :

a) Anatomical variation in relation to their ecological variation of three species will be known.

b) BFRI xylarium will be enriched with the document.

3.6 Study period :

3.6.1 Staring year : 2009 – 10

3.6.2 Completion year : 2012 - 13

3.7 Personnel (s) :

3.7.1 Study leader : Asim Kumar Paul, R.O.

3.7.2 Associates : A.H.M.Jahangir Alam, R.O.

3.8 Progress :

3.8.1 Previous years : Wood samples of toon (*Toona ciliata*), rain-tree (*Samanea saman*) and sil-koroi (*Albizia procera*) were collected from Bogra and Sylhet District. Their local names and local uses were documented. Nine wood blocks of toon (*Toona ciliata*), rain-tree (*Samanea saman*) and sil- koroi (*Albizia procera*) were prepared. The prepared blocks were boiled in hot water for softening and microtome sectioning. 60 maceration slides of toon (*Toona ciliata*), rain-tree (*Samanea saman*) and sil-koroi (*Albizia procera*) were prepared. Vessel and fiber lengths of toon (*Toona ciliata*), rain-tree (*Samanea saman*) and sil- koroi (*Albizia procera*) at near pith, heartwood and sapwood were measured under the microscope.

3.8.2 This year:

Activities of the study	Progress
a. Microtome sections cutting of 24 wood blocks of three species for permanent slides.	a. Twentyfour wood blocks of toon (<i>Toona ciliata</i>), rain-tree (<i>Samanea saman</i>) and sil- koroi (<i>Albizia procera</i>) were prepared. The prepared blocks were boiled in hot water for softening and microtome sectioning.
b. Study of minute anatomical properties from permanent	b. Sixty maceration slides of toon (<i>Toona ciliata</i>), rain-tree (<i>Samanea saman</i>) and sil-koroi (<i>Albizia procera</i>) were prepared. Vessel and fiber lengths of toon (<i>Toona ciliata</i>),

slides.	rain-tree (<i>Samanea saman</i>) and sil-koroi (<i>Albizia procera</i>) at near pith, heartwood and sapwood were measured under the microscope. Among the species the highest vessel length was observed in sapwood (257 μm), followed by heartwood (291 μm) and near pith (256 μm). On the other hand highest fiber lengths was observed in sapwood (469 μm), followed by heartwood (334 μm) and near pith (205 μm).
c. Reporting (Draft report).	e) Preparation of draft of scientific report.

- 3.9 Achievement(s) :
- 3.10 Financial Statement :
- 3.10.1 Total cost : 1,20,000.00
- 3.10.2 Cost of the year : 24,400.00
- 3.10.3 Expenditure of the year: 24,000.00
- 3.10.4 Source of fund : GOB
- 3.11 Beneficiaries : FD, Universities, NGOs and development agencies.

4. Study : New

- 4.1 Program Area : Post Harvest Utilization- Physical Processing.
- 4.2 Title of the Study : **Anatomical properties of Lambu (*Khaya* sp.) tree grown in Bangladesh.**
- 4.3 Justification : *Khaya* (*Khaya*) species belongs to family Meliaceae. It is an exotic tree species. This species has been introduced to southern part of Bangladesh from India. It is very fast growing species. Generally, Lambu is long and straight having clear bole with light branching species. This species is suitable for making furniture, pole, constructional purposes and other household articles. There is not detailed information about anatomical properties of Lambu (*Khaya*) timber species with special reference to Bangladesh. So, this study has taken to develop database on anatomical properties of the species for determining better utilization
- 4.4 Objectives :
- 4.4.1 To determine the detail gross and minute anatomical features of the species grown in Bangladesh.
- 4.4.2 To develop a database on anatomical properties of this species for determining better utilization.
- 4.5 Expected output :a) Data base on anatomical properties of Lambu (*Khaya* sp.) woods will be developed.

b) BFRI Xylarium will be enriched with wood collections and permanent slides.

4.6 Study period :

4.6.1 Starting year : 2011 – 12

4.6.2 Completion year : 2012 - 13

4.7 Personnel(s) :

4.7.1 Project leader : Asim Kumar Paul, R.O

4.7.2 Associates : A.H.M.Jahangir Alam, R.O ; Mohammed Mohiuddin, D.O

4.8 Progress :

4.8.1 Previous year : N/A

4.8.2 This year:

Activities of the study	Progress
a. Preparation of work plan.	a. Work plan has been prepared consulting the pertinent literature.
b. Collection of wood samples from the different areas of Bangladesh.	b. Wood samples were collected from Jessore District.
c. Study of gross anatomical properties from pith to bark of the samples.	c. Gross anatomical features namely colour, texture, grain, parenchyma and ray type have been studied and recorded.
d. Reporting (Draft report).	d. Preparation of draft of scientific report is under process.

4.9 Achievement(s) :

4.10 Financial Statement :

4.10.1 Total cost : 1,20,000.00

4.10.2 Cost of the year : 40,000.00

4.10.3 Expenditure of the year: 40,000.00

4.10.4 Source of fund : GOB

4.11 Beneficiaries : FD, BFIDC, Academic Institutes, NGOs and Wood Traders, Farmers .

5. **Study** : **New**

5.1 Program Area : Biodiversity and Conservation

5.2 Title of the Study : **Regeneration status of tree species in plantation and natural forest of Paithong areas of Bandarban Hill District.**

5.3 **Justification** : Paithong forest area covers 320 hectors of hilly land under Paithong Mauja in Lama Thana under Bandarban Hill District. It is controlled by the Aziznagar range Forest Department. This study area consists of medium and small hills with gentle slopes. Both bangali and tribal people are living in this area. There are some protected forest and private land. Tree species are naturally growing for long time in this area. Also knows that, regeneration sapling survive both the natural and plantation. There is not detailed information about regeneration status of planted and natural grown species. The study will help us evaluate the sustainability of the natural resources and private plantation. The information on plant resources is getting importance for restoration of ecology, sustainable land use and local label biodiversity management of Bandarban Hill District. So, this study has taken to analyze the regeneration of phytosociological data with database both of plantation and natural forest.

5.4 **Objectives** :

5.4.1 To determine regeneration status of tree species in different habitats (planted and natural forest) in Paithong forest areas.

5.4.2 To determine the vegetation dynamics of plantation and natural forest patches.

5.5 **Expected output** :

a. Data base on regeneration status and phyto-sociological information in planted and natural habitats of Paithong forest area will be developed.

b. BFRI herbarium will be enriched with botanical specimens of the study area.

5.6 **Study period** :

5.6.1 Staring year : 2011 – 12

5.6.2 Completion year : 2012 – 13

5.7 **Personnel(s)** :

5.7.1 Study leader : M. Mohiuddin, D.O.

5.7.2 Associates : Syedul Alam, RA-1

5.8 **Progress** :

5.8.1 Previous year : N/A

5.8.2 This year:

Activities of the study	Progress
a. Preparation of work plan	a. Work plan has been prepared consulting the pertinent literature.

consulting pertinent literatures.	
b. Site selection and lying out of temporary sample plots.	b. Visited Paithong forest area and site selection has done. Forty permanent sample plots were lay out representing various slopes (hill top and hill base) in natural and planted areas of Paithong forest area.
c. Data collection on tree seedlings regeneration and phyto-sociological data in natural and planted forest.	c. Listing of natural and planted regeneration tree seedlings of each plot was done. Natural regeneration of tree seedlings of 32 species was found in natural forest and seedlings of 30 tree species were found in the planted sample plots. Seedlings of Kurchi (<i>Holarrhena antidysenterica</i>), kachua (<i>Aporusa dioica</i>), dharmara (<i>Stereospermum personatum</i>), kannyari (<i>Gardenia coronaria</i>), putijam (<i>Syzygium fruticosum</i>), gurja batna (<i>Lithocarpus pachyphylla</i>), goda (<i>Vitex peduncularis</i>), menda (<i>Litsea glutinosa</i>), lana assar (<i>Pterospermum semisagittatum</i>), assar (<i>Grewia nervosa</i>) and muli bans (<i>Melocanna baccifera</i>) were the most occurrence in the both the sample plots.
d. Botanical specimen collections and processing of the samples	d. Thirty-two seedlings and botanical samples were collected and processed for preservation in the herbarium.
e. Identification of species and data analysis	e. Identification of the collected samples were made consulting literature and voucher specimens.
e. Compilation of reports.	e. Preparation of draft of scientific report is under process.

5.9 Achievement(s) :

5.10 Financial Statement :

5.10.1 Total cost : 1, 00,000.00

5.10.2 Cost of the year : 41,000.00

5.10.3 Expenditure of the year: 41,000.00

5.10.4 Source of Fund : GOB

5.11 Beneficiaries : GOs, Academic Institutes, NGOs, Taxonomist & Wild life biologists.

FOREST INVENTORY DIVISION

1 Study : On going

1.1 Programme Area : Forest Inventory, Growth and Yield.

1.2 Title Of the study: Growth and yield assessment of akashmoni (*Acacia auriculiformis*) and mahogany (*Swietenia macrophylla*) through establishment of permanent sample plots(PSPs).

1.3 Justification : Continuous Forest Inventory (CFI) is very much important for forest management. This study will be carried out as a part of CFI. Provisional site indices curves and yield tables for akashmoni and mahogany have been determined. These curves and tables need improvements. Again, information on changes of the growth rates at different stages of ages is required.

1.4 Objectives :

1.4.1. To generate information on growth and yield of the akashmoni and mahogany tree species in plantations forests of Bangladesh.

1.4.2 Setting physical rotation of these species.

1.5 Expected output:

1.5.1 Site indices curves for these species grown in the plantation forests will be available.

1.5.2 Growth and yield of these species at different plantation sites will be available.

1.5.3 Physical rotation of these species will be available.

1.6 Study period:

1.6.1 Starting year : 2010-11

1.6.2 Completion year : 2020 –21

1.7 Personnel:

1.7.1 Project Leader : S. M. Zahirul Islam, RO

1.7.2 Associates : M .A. H. Shah Jalal, DO (C.C)

1.7.3 : Mofizul Islam Khan. FI

1.8 Progress:

1.8.1 Previous years, if any:Re-measurements of the trees in 71 PSPs from eestablished 44 PSPs for mahogany at Jesshore & Faridpur Forest Division and 27 PSPs for akashmoni at Chitagong (15) & Cox’s Bazar,(12) Forest Division.

1.8.2. This year:

Action plan as per annual research programme	Progress
a. Establish new PSPs of akashmoni and mahogany in existing plantation at Chitagong, Jasshore and Faridpur District and Re-measurement of trees in established PSPs	Yearly re-measurement from 15 PSPs of akashmoni laid out in Cox's Bazar Forest Division. Other activities not done due to TA fund shortage.
b. Summarization of collected data.	The summarized data shown in table -1

Table-1: Data summary of akashmoni collected from Ukia and Ramu under Cox's Bazar forest division

Location	Year of Plantation	No. of Plots	Age in year	Average			Increment	
				No. of tree	GBH(cm)	Ht(m)	GBH(cm)	Ht(m)
Ukhia and Ramu Cox's Bazar	2004	3	7.8	34	38.3	12.5	4.9	1.8
	2006	3	5.8	45	26.7	10.5	4.6	1.8
	2005	3	6.8	37	29.5	11.5	4.3	1.7
	2003	3	8.8	46	31.8	12.7	3.6	1.4
	2007	3	4.8	28	23.6	7.8	4.9	1.6

1.9 Achievement(s), if any :

1.9.1 Prepared growth and yield tables for the species gamar, moluccana, eucalyptus, young garjan, mangium, minjiri, akashmoni and pine in the plantations.

1.9.2 Prepared growth and yield tables for sissou, mahogany koroi, eucalyptus and bokain planted on the crop land.

1.10. Estimated Cost :

1.10.1 Total cost : Tk. 5,00,000.00

1.10.2 Cost of the year : Tk: 31,000.00

1.10.3. Expenditure of the year : Tk. 11,400.00

1.10.4 Source of fund : GOB

1.11 Beneficiaries:

Forest Department, development policy maker, researchers, forestry teachers, students, trainees and trainers, BFIDC, timber traders, universities and NGOs

- 2 Study : On going**
- 2.1 Programme Area :** Forest Inventory, Growth and Yield.
- 2.2 Title Of the Study :** Growth and yield assessment of keora (*Sonneratia apetala*) and baen (*Avicennia* sp.) in the coastal plantations of Bangladesh.
- 2.3 Justification :** Provisional site indices curves and yield tables for keora and baen have been prepared in 1989. These curves and tables need to be improved including the new plantations raised on newly accreted lands.
- 2.4 Objectives :**
- 2.4.1** To generate information on growth and yield of the keora and baen in the coastal plantations of Bangladesh
- 2.4.2** Setting physical rotation of these species
- 2.5 Expected output:**
- 2.5.1** Site indices curves will be prepared for keore and baen grown in the coastal plantations of Bangladesh.
- 2.5.2** Growth and yield of the keore and baen at different sites will be available.
- 2.6 Study period:**
- 2.6.1 Starting year :** 1988-89
- 2.6.2 Completion year :** 2010 –11
- 2.7 Personnel:**
- 2.7.1 Project Leader :** S. M. Zahirul Islam, RO
- 2.7.2 Associates :** M. A. H. Shah Jalal, DO (C.C)
- 2.7.3 :** Mofizul Islam Khan. FI
- 2.8 Progress:**
- 2.8.1 Previous years, if any:** Re-measurements of eighty seven (87) permanent sample plots(PSPs) of keora and baen laid out at Salimpur of Chittagong, Moheshkhali of Cox’s Bazar under Chittagong Coastal Forest Division and Patharghata of Barguna, Rangabali of Galachipa under Patuahkali Coastal Forest Division have been taken.

2.8.2. This year:

Action plan as per annual research programme	Progress
a. Yearly re-measurement of the trees in the established PSPs at Chittagong and Cox’s Bazer Coastal Areas.	Works as per programme not done due to TA fund shortage.
b. Summarization of collected data.	Nil

2.9 Achievement(s), if any :

- Prepared site indices curves and growth and yield tables for the species keora.
- Fixation of physical and financial rotation of keora was determined. Considering the different factors of raising the coastal plantations, a rotation age is 12 years for site indices 15 and 18 meters dominant height and 15 years for site indices of 6, 9 and 12 meters dominant height at the same reference age.

2.10. Estimated Cost

2.10.1 Total cost : Tk. 46,190.00

2.10.2 Cost of the year : Tk: 25,080.00

2.10.3. Expenditure of the year : Nil

2.10.4 Source of fund : GOB

2.11 Beneficiaries:

Forest Department, development policy maker, researchers, forestry teachers, students, trainees and trainers, BFIDC, timber traders, universities and NGOs

3 Study : **On going**

3.1 Programme Area : Forest Inventory, Growth and Yield

3.2 Title of the study : Growth and yield assessment of major mangrove species in the Sundarban.

3.3 Justification : Diameter increment rates of the six important species in the Sundarbans have been estimated with data collected from only 12 permanent sample plots (PSPs). These need refinement with data collected from wide range of sample plots covering whole of Sundarbans.

3.4 Objectives :

3.4.1 To generate information on diameter/girth increment rates of major mangroves species of Sundarban at different degrees of salinity.

3.5 Expected output: Diameter/girth increment rates of the major mangrove species in the Sundarbans at different degrees of salinity will be estimated.

3.6 Study period:

3.6.1 Starting year : 1977-78

3.6.2 Completion year : 2014 –15

3.7 Personnel:

3.7.1 Project Leader : S. M. Zahirul Islam, RO

3.7.2 Associates : M. A. H. Shah Jalal, DO (C.C)

3.7.3 : Mofizul Islam Khan FI

3.8 Progress:

3.8.1 Previous years, if any:

- Re-measurements of 27 PSPs lay out in natural mangrove forests of Sundarbans Forest Division in Khulna have been taken.
- DBH increment rates on important mangrove species at different levels of salinity in the Sundarbans have been estimated. Rates of new recruitment and growth retardation due to sundri top dying have also been estimated.

3.8.2 This year:

Action plan as per annual research programme	Progress
a. Yearly re-measurement of the trees in the established 27 PSPs at Sunderbans.	Works as per programme not done due to TA fund shortage..
b. Summarization of collected data.	Nil

3.9 Achievement(s), if any :

Diameter increment rates of the six important species in the Sundarbans have been estimated using collected data from 12 PSPs and published in Bangladesh Journal of Forest Science.

3.10. Estimated Cost :

3.10.1 Total cost : Tk. 135,000.00

3.10.2 Cost of the year : Tk: 15,600.00

3.10.3. Expenditure of the year : Nil

3.10.4 Source of fund : GOB

3.11 Beneficiaries:

Forest Department, development policy maker, researchers, forestry teachers, students, trainees and trainers, BFIDC, timber traders, universities and NGOs

4 Study : On going

4.1 Programme Area : Assessment and statistics of Forest resources.

4.2 Title of the study :An Inventory of Village Bamboo Resources of Tagorgoan and Panchgahor District.

4.3 Justification: Bamboos are important non-timber resources that contribute a vital role in economy and poverty alleviation of rural people. Bamboo planting programme and extraction are creating rural employment meeting the day-to-day needs of rural people. Inventory of bamboo aims to collect information and estimation of the total bamboo resources availability in the homestead in study areas on national basis. It is needed also to gain information of the compositions of bamboo product for management planning or policy development.

4.4 Objectives (s) of the study:

To make an inventory of bamboo resources in respect of stocking, species composition and biomass estimation from Tagorgoan and Panchgahor District

4.5 Expected output:

4.5.1 Stand and stocks tables of bamboos grown in villages of Tagorgoan and Panchgahor will be known.

4.5.2 Bamboo species composition in Tagorgoan and Panchgahor will be identified.

4.5.3 Bamboo inventory methodology will be developed.

4.6 Study period:

4.6.1 Starting year: 2008-09

4.6.2 Completion year: 2011 –12

4.7 Personnel:

4.7.1 Project Leader : S. M. Zahirul Islam, RO

4.7.2 Associates : M.A. H. Shah Jalal, DO (C.C)

4.7.3 : Mofizul Islam Khan.

4.8 Progress:

4.8.1 Previous years, if any: Bamboo inventory data were collected from 10 sample villages of 10 upzilla at Tangail, 10 sample villages of 10 upzilla at Dinajpur, 6 sample villages of 6 upzilla at Nilfamari, 6 sample villages of 6 upzilla at Rangpur and 6 sample villages of 6 upzilla at Gaibandha to evaluate the species composition, biomass and stocking of bamboo resources of home garden.

4.8.2 This year:

Action plan as per annual research programme	Progress
a. Determination sample villages and collection of data.	Data from three sample villages of three upzilla of Tagorgoan and three sample villages of three upzilla of Panchgahor were

	collected to evaluate the species composition, biomass and stocking of bamboo resources of home garden.
b. Data analysis.	The collected data entered in computer and summarized shown in table 5 and 6. Data analysis is going on.

Table-5: The Summarized data from Tagorgoan.

Location	No, of Plots (Household)	Total No of clumps	Surveyed Clumps	Species	Total culmps
Ranisangkail	28	155	38	3	2890
Pirgong	29	175	46	4	2568
Baliadangi	34	189	45	4	2778

Table-6: The summarized data from Panchgahor

Location	No, of Plots (Household)	Total No of clumps	Surveyed Clumps	Species	Total culmps
Atuari	32	210	42	3	2886
Tatulia	21	83	21	4	1575
Dabigonj	25	217	25	4	1675

4.9 Achievement(s), if any :

Inventory of 27 pilot villages of Bangladesh, Cox's Bazar & Chittagong hill forest, Raikong & Mathamohari reserve forests and southern Sylhet forests were inventoried to estimate bamboo resources.

- 4.10. Estimated Cost** :
- 4.10.1 Total cost** : Tk. 400,000.00
- 4.10.2 Cost of the year** : Tk: 56,580.00
- 4.10.3. Expenditure of the year** : Tk: 56,580.00
- 4.10.4 Source of fund** : GOB

4.11 Beneficiaries:

Forest Department, development policy maker, researchers, forestry teachers, students, trainees and trainers, BFIDC, timber traders, universities and NGOs

5 Study : New

5.1 Programme Area : Forest Inventory, Growth and Yield

5.2 Title of the study : Preparation of volume tables of Jhau(*Casuarina equisetifolia* L)

5.3 Justification: A good number of jhau tree species planted along the coastal belt has become mature for harvesting both in private and public land. But, volume tables for

jhau planted in the coastal belt of Bangladesh are not available. The volume tables of trees are necessary for economic evaluation, future management, utilization, research purposes and to estimate the quantity of wood during harvest of the tree species. The aims of this study is to determine the method and equations for volume estimation and stand volume tables preparation for jhau. This information is required for proper management of the trees in the coastal belt

5.4 Objectives (s) of the study:

To prepare volume tables of Jhau.

5.5 Expected output: Volume equation and stand of volume table of Jhau will be prepared for ready use.

5.6 Study period:

5.6.1 Starting year : 2011-12

5.6.2 Completion year : 2011 –12

5.7 Personnel:

5.7.1 Project Leader :M. A. H. Shah Jalal, DO (C.C)

5.7.2 Associates : S. M. Zahirul Islam, RO

5.7.3 : Mofizul Islam Khan FI

5.8 Progress:

5.8.1 Previous years, if any: Nil

5.8.2 This year:

Action plan as per annual research programme	Progress
a. Data collection of Jhau for preparation of volume table from existing plantation.	Data were collected more than 110 standing trees of Jhau from Taknuf, Cox's Bazar, 195 from Cox's Bazar and 157 from Kouakhata Patuakhali for volume table preparation. The stand table of collected volume table data shown in table-2, 3 and 4.
b. Data analysis and selection of best-suited volume equation and model.	Progress going on

Table-2: Stand table of collected volume table data of Jhau from Taknuf, Cox's Bazar.

	Height in meter						Total
		9	14	19	24	29	
Girth at breastat height in cetimeter	40		12	2			14
	60		23	23			46
	80			18	12		30
	100			6	8		14
	120			1	5		6
	Total	0	35	50	25	0	110

Table-3: Stand table of collected volume table data of Jhau from Cox's Bazar.

Diameter class (cm)	Height Class (m)					
	4-9	9-14	14-19	19-24	24-29	Total
20-40	02	12	07			21
40-60		15	27	21	01	64
60-80			15	30	16	61
80-100			04	05	07	16
100-120			05	07	07	19
120-140			01	07	04	12
140-160				01	01	02
Total	02	27	59	71	36	195

Table-4: Stand table of collected volume table data of Jhau from Kuakata, Patuakhali.

Diameter class (cm)	Height Class (m)					
	4-9	9-14	14-19	19-24	24-29	Total
20-40		20	2			22
40-60		15	42	3		60
60-80			9	19	10	38
80-100				14	14	28
100-120				5	4	9
Total		35	53	41	28	157

5.9 Achievement(s), if any :

- Volume tables for 11 important species (am, badi, jam, kanthal, koroi, mahogany, neem, pitraj, rain tree, shimul and kadam) grown in the home gardens were prepared.
- Mathematical Volume Equations and Tables for *Albizia richardiana* (Rajkoroi/ Chambole) Planted on Road Sides in The Southern Parts of Bangladesh
- Volume Equations and Tables for rubber tree of Bangladesh have been prepared for published.

5.10. Estimated Cost :

5.10.1 Total cost : Tk. 70,620.00

5.10.2 Cost of the year : Tk: 28,560.00

5.10.3. Expenditure of the year : Tk. 28,560.00

5.10.4 Source of fund : GOB

5.11 Beneficiaries:

Forest Department, development policy maker, researchers, forestry teachers, students, trainees and trainers, BFIDC, timber traders, universities and NGOs

Forest Economics Division

- 1. **Study** : **New**
- 1.1 Programme Area : Forest Inventory and Economics
- 1.2 Title of the Study : Impact analysis of bamboo plantations raised by branch cutting and bamboo groves management technique.
- 1.3 Justification : Bamboo plays a vital role in rural life and used extensively for agricultural and housing materials. It is also an important raw material for pulp and paper and rayon industries. Bamboo plantations of conventional method through offset and rhizomes are costly and poorly increased in its field. Pressure on bamboo resource are being increased day to day due to its' multipurpose uses. So, bamboo branch cutting technique is found to be suitable for large scale bamboo plantations and scientific management of bamboo grove can be ensured to reduce the gap between demand and supply in this sector. The present study is, therefore undertaken to evaluate the economic impact assessment of the plantations raised by bamboo branch cutting and scientifically managing bamboo groves of bamboo growers.
- 1.4 **Objectives** :
- 1.4.1 To evaluate economic benefit of bamboo plantations using branch cutting technique.
- 1.4.2 To assess the bamboo grower's interest of bamboo plantations using branch cutting technique.
- 1.4.3 To determine the economic impact of bamboo groves management technique.
- 1.5 Expected output : Economic gain of the bamboo plantations using branch cutting and bamboo groves management technique on economy of rural people will be determined
- 1.6 **Study period** : 2011-12 to 2013-14
- 1.6.1 Starting year : 2011-12
- 1.6.2 Completion year : 2013-14
- 1.7 Personnel (s) :
- 1.7.1 Study leader : M.A Taher Hossain; RO.
- 1.7.2 Associates : Hasina Mariam; DO, Md. Melon; FI, Forzana Yasmin; RA-1.

- 1.8 **Progress** :
- 1.8.1 Previous years, if any (.....year) : N.A
- 1.8.2 This year :

Activities of the study	Progress
a. Survey at Faithong of Cox's bazaar and Birampur of Dinajpur District.	a. Group discussion meeting were been conducted with the bamboo growers that had been received training on technique of bamboo plantation through bamboo branch cutting and bamboo grove management. Among the participant, 25 bamboo growers from each location were been selected randomly for interview.
b. Collection of data through pre designed questionnaire from the selected bamboo plantations.	b. Desired information was able to collect only from the plantations of private bamboo grower at Faithong of Cox's bazaar and bamboo plantations of Social Forest Division (SFD), Dinajpur. Data on bamboo plantations establishment cost, yield of bamboo culms, market price of bamboo culms , bamboo plantation area raised by the technique of bamboo branch cutting and rhizomes as well as the attitude of bamboo grower for bamboo propagation by using bamboo branch cutting were recorded.
c. Compilation and analysis of data.	c. A comparison of bamboo plantation cost, bamboo resource yield and its' financial return in both type of plantation were made. Impact assessment of bamboo plantations were made for the period of 16 years. Compilation of basic data and results of economic analysis are in table 1 & 2.

Tab.1 Basic information on bamboo plantation.

Variable	Locations	
	Faithong of Cox's bazar	SFD of Dinajpur
1. Total bamboo planted area (ha)	-	433.5
2. Average bamboo planted area (ha)	0.41	-
3. Plantation through bamboo branch cutting (%)	60	95
4. Price of bamboo branch cutting (Tk./ unit)	6	15
5. Price of rhizome (Tk./unit)	100	100
6. Collection of average rhizome cost (Tk/unit)	30	30
7. Bamboo branch cutting/ Rhizome planted (nos/ha)	494	494
8. Existing clumps (%) of bamboo branch cutting	50	80
9. Existing clumps (%) of rhizome	45	75
10. Average price of a bamboo culm (Tk./unit)	120	110
11. ARR	10%	

Tab. 2 Economic assessment of bamboo branch (B.B) cutting and rhizome based bamboo plantation at Faithong of Cox's bazaar and Social Forest Division (SFD) of Dinajpur.

Economic Indicator	SFD of Dinajpur		Faithong	
	B.B cutting	Rhizome	B.B cutting	Rhizome
IRR (Internal Rate of Return in %)	50	35	43	30
NPW (Net Present Worth Tk/ha. in'000')	803.48	716.82	533.98	443.60
B-C ratio (Benefit- Cost ratio)	6.57	4.68	5.76	3.90
Le (Land Expectation Value ,Tk/ha in '000')	223.50	199.39	148.54	123.40
EAEnpv (Equal Annual Equivalent, Tk./ha '000')	102.70	91.62	68.25	56.70

1.9 Achievement (s), if any : Economic gain of the bamboo plantation by using branch cutting technique at Faithong of Cox's bazaar and SFD of Dinajpur have been determined.

1.10 **Financial Statement** :

1.10.1 Total cost : Tk. 3,20,000.00

1.10.2 Cost of the year : Tk. 62,000.00

1.10.3 Expenditure of the year : Tk. 62,000.00

1.10.4 Source of fund : GOB.

1.11 **Beneficiaries** : FD ,Bamboo grower, Private Entrepreneurs, NGOs.

2. Study : **New**

2.1 Programme Area : Forest Inventory and Economics

2.2 Title of the Study : Determination of financial rotation of babla (*Acacia nilotica*) plantations in Bangladesh.

2.3 Justification : Babla plantations have so far been raised largely in coastal area by Forest Department (FD) and NGOs. The plantations have been raised in embankment and road side in short and long term rotations. The planters are used to face the problems in determining the harvesting age (rotation), the actual timber volume as well as prices of standing trees of their plantations. So, the study has been undertaken to determine the financial rotation to ensure optimum profitable management of the plantations

2.4 **Objective** :

2.4.1 To determine the financial rotation of babla (*Acacia nilotica*) based on its the existing utilization.

2.5 Expected output : Optimum rotation of babla (*Acacia nilotica*) will be determined.

2.6 **Study period** : 2011-12 to 2013-14

2.6.1 Starting year : 2011-12

2.6.2 Completion year : 2013-14

2.7 **Personnel (s)** :

2.7.1 Study leader : M.A Taher Hossain; RO.

2.7.2 Associates : Hasina Mariam; DO, Md. Melon; FI, Forzana Yasmin; RA-1.

2.8 **Progress** :

2.8.1 Previous years, if any (...year) : N.A

2.8.2 This year :

Activities of the study	Progress
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a. Conduct the DFO office of Bagerhat and Noakhali to collect the detail information on babla plantation.	a. Year wise information on the background of existing babla plantation were collected for respective areas of Bagerhat Social Forest Division and Noakhali C/A Division.
b. Data collection and analysis.	b. Data were collected from the sample plots (Size 0.01 ha) of mixed and mono plantations of babla species raised within 1990-91 to 2005-06 and 1996-97 to 2205-06 under Social Forest Division of Bagerhat and Coastal Afforestation Division of Noakhali respectively. The information were height, girth, total number of trees/plot, number of babla trees/plot, price of babla seed, plantation management cost, market price of babla timber and babla fire wood. Basic information and analysis are in table 1, 2 & 3.

Tab 1. Basic information on babla species plantation.

Items	Unit
1. Babla tree seed (Tk/kg)	12
2. Babla seed (Kg/ha)	20
3. Average fuel wood price (Tk/40 kg)	80
4. Average babla tree round log size in 1-6 to 2 ft (Tk/ft.)	170
5. Average babla tree round log size in 2 to 2-6ft.(Tk/ft.)	270

Tab 2. Financial analysis of babla species plantation in Bagerhat C/A Division

Plantation year	Age (year)	GBH (cm/tree)	NPV (Tk./ha)	IRR (%)	B/C ratio	Le (Tk/ha)	EAEnpv (Tk/ha)
1990-91	21	69.4	94368	21	2.15	14744	10911
1992-93	19	59.7	50214	19	1.83	9815	6003
1993-94	18	42.0	12282	14	1.31	2694	1498
1994-95	17	60.3	33121	18	1.65	8169	4129
1995-96	16	38.4	-406	9.8	0.99	-113	-52
1996-97	15	54.9	64810	22	1.90	20398	8521
1997-98	14	48.9	52680	21	1.72	18831	7151
1998-99	13	38.0	12969	15	1.32	5289	1826
1999-00	12	36.4	16670	17	1.39	7796	2447
2001-02	10	52.2	96392	35	2.12	60481	15687
2002-03	9	31.9	973	11	1.03	717	169
2003-04	7	33.0	5740	14	1.15	5020	1076
2005-06	6	30.3	9564	19	1.24	12396	2196

Tab. 3 : Financial analysis of babla species plantation in Noakhali C/A Division

Plantation year	Age (year)	GBH (cm/tree)	NPV (Tk/ha)	IRR (%)	B/C ratio	Le (Tk/la)	EAEnpv (Tk/ha)
1996-97	15	57.8	383589	24	2.57	120730	50432
1997-98	14	53.5	452889	27	2.60	161891	61478
1999-00	12	52.8	375010	29	2.48	175367	55038
2005-06	6	36.1	69091	32	1.89	89547	15864

- 2.9 Achievement (s), if any : N.A.
- 2.10 **Financial Statement** :
- 2.10.1 Total cost : Tk. 3,10,000.00
- 2.10.2 Cost of the year : Tk. 73,000.00
- 2.10.3 Expenditure of the year : Tk. 73,000.00
- 2.10.4 Source of fund : GOB.
- 2.11 **Beneficiaries** : FD, Private Planters. NGOs etc.

SOIL SCIENCE DIVISION

1. **Study** : **Ongoing**
- 1.1 Programme Area : Plantation technique and forest management
- 1.2 Title of the Study : Effect of integrated soil fertility management in rubber
planataion
at Dantmara Rubber Estate, Fatikchari, Chittagong
- 1.3 Justification : Integrated soil fertility management (ISFM) in rubber
plantation can be very productive both from latex yield and economic viewpoint.
Development of ISFM in the rubber plantation is a holistic approach that includes two
way options of chemical and biological fertilizers management throughout the life cycle
of the plant. Integration of nitrogen shrubs/cover crops will be the important components
of the ISFM system which will be combined with other components from plantation
establishment to harvesting of rubber wood. Very few investigations have so far been
done on the potential use of intercropping by introducing different nitrogen fixing
shrubs/cover crops like gliricidia, indigofera, calopogonium, stylosenthes, arhar, lemon,
zinger, turmeric, pineapple, cassava, banana, medicinal plants, etc. for improving soil
fertility in rubber plantation. Encouraging results on the growth and yield of rubber
plantation was obtained from banana, cassava, zinger and cultivation of other crops in
some rubber growing countries. Improved soil and water conservation practices through
intercropping of leguminous cover crops, organic manuring, mulching, etc. in the rubber
plantation may contribute to increase soil organic carbon by about 30-50% (Yogaratnam,
2007). Rubber plantation can reduce air pollution and help to maintain ecological
balance. While the world is facing the affects of climate change, rubber trees can protect
us from its bad effect. Properly managed plantations are self-suitable ecosystems and
could maintain a fair degree of biodiversity. In view of developing suitable models of
ISFM in combination with appropriate selection of intercrops for increasing latex yield
and income in the rubber plantation the present research work has been initiated.
- 1.4 **Objectives** :
- 1.4.1 To utilize litter fall of rubber trees as organic compost
- 1.4.2 To assess the effect of compost on growth and latex production in new and mature rubber
plantation
- 1.4.3 To evaluate the role of different nitrogen fixing crops in new rubber plantation
- 1.5 Expected output : Increasing soil fertility and latex production of rubber
plantation

- 1.6 **Study period** :
- 1.6.1 Starting year : 2010-11
- 1.6.2 completion year : 2014-15
- 1.7 **Personnels** :
- 1.7.1 Study leader : M. Zahirul Alam, Assistant Soil Scientist
- 1.7.2 Associates : Md. Jahangir Alam, Divisional Officer
: Md. Motiar Rahman, Assistant Soil Scientist
- 1.8 **Progress** :
- 1.8.1 Previous years (2010-11) : Litter falls were collected from 1994-95 rubber plantation and average air & oven dry weight of litter falls were recorded (6.71 & 5.81 kg/tree respectively). An experiment was set up through making ten heaps for composting of litter falls under the treatments of T₀ (Litter fall & weeds), T₁ (litter fall & weeds + cowdung), T₂ (litter fall & weeds + PKS fertilizers) and T₃ (litter fall & weeds + rubber effluents) and it is maintaining.
- 1.8.2 This year :
- | Activities of the study | Progress |
|---|---|
| a. Prepared heap will be maintained and new heap will be made for composting of litter falls | a. Prepared heaps were maintained for five times and completed. Ten new heaps were made for composting of litter falls |
| b. Compost samples from heap will be collected for storage and nutrient analysis | b. Ten compost samples were collected and analyzed (Table 1) |
| c. Mature rubber plantation (15-20 years) will be selected for applying compost | c. One hundred eighty mature rubber trees were selected for applying compost and NPK fertilizers dose in six treatments. |
| d. Compost will be applied in 0.50 acre new rubber plantation | d. Different compost and NPK fertilizers dose were applied in 0.50 acre new rubber plantation in five treatments |
| e. Six soil samples from new and mature rubber plantation will be collected for nutrient analysis | e. Composite soil samples from new and mature rubber plantation were collected and analyzed (Table 2) |
| f. Field management by three times weeding of 1.50 acre established plantation, repairing of fence, land preparation for intercropping and pruning | f. Field management were done through weeding and land preparation as per schedule. |
| g. Cover crops (<i>pueraria-Pueraria phaseoloides</i> and thai lazzabati- <i>Mimosa invisa</i>) will be broadcast and shrubby crop (<i>arhar-Cajanus cajan</i>) seed sown as intercrop in new established rubber plantation | g. Cover crops (<i>pueraria-Pueraria phaseoloides</i> and thai lazzabati- <i>Mimosa invisa</i>) were broadcast and shrubby crop (<i>arhar-Cajanus cajan</i>) seed sown as intercrop in new established rubber plantation. |
| h. Data analysis and report writing | h. Data were analyzed and compiled |

Table 1: Nutrient status of compost and rubber effluent

Sl. No.	Parameters	Unit	Compost				Rubber effluent
			T ₀	T ₁	T ₂	T ₃	
01	pH		5.75	5.65	5.50	5.40	5.12
02	Organic carbon (OC)		-	-	-	-	-
03	Nitrogen (N)	%	-	-	-	-	0.18
04	Potassium (K)		1.64	1.58	4.09	1.66	3.07

05	Calcium (Ca)	meq/100gm	6.74	7.48	10.48	7.23	0.0155
06	Magnesium (Mg)		4.52	2.88	3.70	2.88	2.88
07	Phosphorus (P)		640	1400	3350	650	1100
08	Sulphur (S)		1350	1500	1450	1300	300
09	Manganese (Mn)		155	220	200	145	0.1168
10	Iron (Fe)	µg/gm	450	550	450	350	1.5838
11	Boron (B)		410	450	500	450	0.62
12	Copper (Cu)		6.0	4.0	7.5	4.5	2.0
13	Zinc (Zn)		35	65	40	30	0.5960

T₀ = Litter fall & weeds (110 kg per pit)

T₁ = Litter fall & weeds + cowdung (110 kg + 30 kg per pit)

T₂ = Litter fall & weeds + PKS fertilizers (110 kg + 9.5 kg per pit)

T₃ = Litter fall & weeds + rubber effluent (110 kg + 50 litre per pit)

Table 2: Initial soil nutrient status of the experimental sites at Dantmara Rubber Estate, Fatikchari, Chittagong

Soil depth (cm)	pH	OC %	N	K meq/100gm	Ca	Mg	P	S	Mn µg/gm	Zn	B	Cu	Fe
0-15	4.5	1.47	0.10	0.12	1.78	0.16	3.75	7.10	2.1	0.6	0.3	0.8	14.5
15-30	4.4	1.12	0.08	0.09	0.67	0.06	3.0	5.75	0.9	0.9	0.4	2.0	23.4
30-50	4.5	0.86	0.05	0.08	0.54	0.06	5.35	4.45	0.1	0.5	0.5	0.1	10.6

1.9 Achievement : Established 1.5 acre experimental rubber plantation at Dantmara Rubber Estate, Fatikchari, Chittagong.

1.10 **Financial Statement** :

1.10.1 Total cost : Tk. 5,00,000.00

1.10.2 Cost of the year : Tk. 1,27,970.00

1.10.3 Expenditure of the year : Tk. 1,27,970.00

1.10.4 Source of fund : GOB

1.11 **Beneficiaries** : BFIDC and private rubber planters

2. **Study** : **Ongoing**

2.1 Programme Area : Soil consevation and watershed management

2.2 Title of the Study : Minimization of soil erosion in teak through trails by mixed

planataions at Faitong, Lama, Bandarban Hill District

2.3 Justification : Teak (*Tectona grandis*), an important timber plant is cultivated as monoculture in Bangladesh since long time (*Brandis, 1879*). It has long been a general belief that monoculture of teak cultivation deteriorates the soil health. Moreover, in teak plantation there occurs destruction of organic matter due to clear felling and burning of native vegetation, exposure of the surface to insulation, relative absence of ground flora, increased erosion and laterization (Singh, 1962). It is often

noticed that the teak plantations of Chittagong, Chittagong Hill Tracts and Sylhet area are devoid of undergrowth vegetation and there occurs severe soil erosion that eventually causes land degradation. Researchers and forest managers agreed to combat that. Its mitigation is urgent. In this regard no notable work could be cited. BFRI researcher's findings supported to infer that under planting in teak was unable to stop soil erosion even the introduced species did not survive (Emdad, 2000). An attempt could be made to check soil erosion through biological manipulation. To address the problem in teak plantations, mixed plantation with teak may be approached. Some silvicultural practices have been suggested to guard against erosion in teak plantations. These include strict fire protection (Bloch, 1951), encouraging undergrowth (Vevekananda, 1931), mulching (Copestone, 1919), mixed cropping (White, 1991), planting teak in strips separated by unplanted strips (Bell, 1973) and under planting with legumes (Alphen de Veer, 1957). Among these approaches mixed planting of teak with different species may be suitable. So, it is necessary to find out the compatible tree species in teak plantation.

- 2.4 **Objectives** :
- 2.4.1 To compare soil loss in mono and mixed plantations of teak
- 2.4.2 To determine appropriate species for mixed plantations of teak
- 2.5 Expected output : Appropriate tree combination with teak to reduce soil erosion
- 2.6 **Study period** :
- 2.6.1 Starting year : 2007-08
- 2.6.2 completion year : 2014-15
- 2.7 **Personnels** :
- 2.7.1 Study leader : M. Zahirul Alam, Assistant Soil Scientist
- 2.7.2 Associates : Md. Jahangir Alam, Divisional Officer
: Md. Motiar Rahman, Assistant Soil Scientist
- 2.8 **Progress** :
- 2.8.1 Previous years (2007-11) : Average survival percentage of hybrid acacia was maximum (81.33%) compare to *T. grandis* (75.80%), *E. camaldulensis* (71.30%) and *D. turbinatus* (59.0%) among five treatments. Maximum height and girth were also attained by hybrid acacia (6.60 m and 29.16 cm). Soil erosion was quantified by scaling method.
- 2.8.2 This year :

Activities of the study	Progress
a. One hectare established plantation will be maintained by two times weeding and one time pruning	a. One hectare established plantation was maintained by two times weeding and one time pruning.
b. Data on height, girth and survival percentage will be collected from established plantation	b. Data on height, girth and survival percentage were collected from established plantation and recorded (Table 1).
c. Soil loss will be assessed by scaling method	c. Soil loss was assessed by scaling method (Fig. 1).
d. Data analysis and report writing	d. Data were analyzed and compiled.

Table 1: Height, girth and survival percentage of fourth year mixed plantations in different treatments

Treatment	Species	Height (m)	Girth (cm)	Survival (%)
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T ₀	<i>Tectona grandis</i>	2.54	10.43	79.84
	<i>Tectona grandis</i>	2.54	9.86	76.85
T ₁	<i>Swietenia macrophylla</i>	3.03	11.21	54.07
	<i>Tectona grandis</i>	1.21	8.65	39.82
T ₂	Hybrid acacia	7.97	38.21	67.74
	<i>Tectona grandis</i>	2.32	8.69	68.52
T ₃	<i>Eucalyptus camaldulensis</i>	8.39	25.18	64.45
	<i>Tectona grandis</i>	2.56	9.77	65.74
T ₄	<i>Dipterocarpus turbinatus</i>	2.63	10.95	57.78

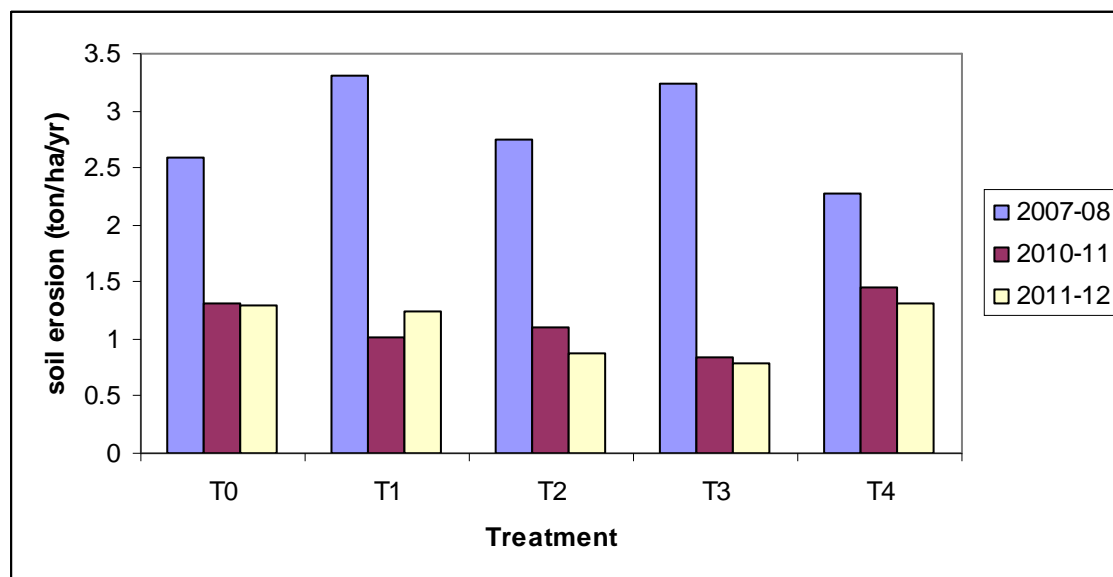


Fig. 1: Soil erosion (t/ha/yr) under different treatments in mixed plantation at Faitong, Lama, Bandarban

2.9 Achievement : Established 1.0 hectare mixed plantation at Faitong, Lama, Bandarban Hill District

2.10 **Financial Statement** :

2.10.1 Total cost : Tk. 2,00,000.00

2.10.2 Cost of the year : Tk. 25,200.00

2.10.3 Expenditure of the year : Tk. 25,200.00

2.10.4 Source of fund : GOB

2.11 **Beneficiaries** : FD and private planters

3. **Study** : **Ongoing**

3.1 Programme Area : Soil conservation and watershed management

3.2 Title of the Study : Effect of arhar (*Cajanus cajan*) as a mixed crop on soil erosion

minimization in zinger cultivation in the hills of CHTs

3.3 Justification : Thousands of hectares of slope land in the Chittagong Hill Tracts (CHTs) are covered by zinger cultivation every year irrespective of slope gradient.

Simultaneously, it is thought that traditional zinger cultivation system is largely involved with increased soil erosion in the sloping uplands. Cultivation of zinger in this region starts from March-May through loosening the soil by a spade and planting rhizome in the furrow of up and down direction of the hills. Harvesting of crop is done in December-February in every year (Islam and Majumder, 2008). During this cultivation period, particularly in the months of June-August, monsoon downpour removes loose soil. Depending on the slope gradient, slope position, cycle of fallow period, management operations different rate of erosion occurs. In a study, it was found that higher soil erosion rate (9-113 t/ha) was estimated during rainy season and lower (9-67 t/ha) during post harvest phase (Anon. 1997). Zinger is mostly used as spices, but it is also popular for its medicinal values worldwide (Brady, 1992). Along with removal of top soil, traditional zinger cultivation simultaneously disrupts soil nutrient pool by carrying away soil organic matter (SOM), nitrogenous elements, phosphorus and other essential plant nutrients. This also results in increased bulk density, poor water holding capacity and low microbial activities of the soil. Thus, the fertile zinger cultivation site turns into a degraded land (Farhad, 2006).

Introduction of arhar (*Cajanus cajan*), a leguminous crop may effectively contribute to the adverse impacts of traditional zinger cultivation system through its proper management. Arhar, a multipurpose cash crop is capable of growing on a wide range of soil. As a leguminous crop it supplies additional nitrogen to the soil and used for green manure. Spatial and temporal arrangement of arhar plant through hedgerow formation in the zinger cultivation system is useful to reduce soil erosion. Moreover, this crop yields up to 2.25 t/ha which can be used as pulse and poultry feeds. It gives 47.63 t/ha biomass and 2.95 t/ha stem/liter production (Gowda, 1982). In general, improved management of arhar is necessary to develop for the purpose of sustainable slope land productivity in zinger cultivation. Aiming at this present research activity was undertaken.

- 3.4 **Objectives** :
- 3.4.1 To quantify soil and nutrients loss in zinger cultivation in hilly area
- 3.4.2 To assess the effect of arhar planting in zinger fields in hill slope on soil conservation
- 3.5 Expected output : Minimization of soil erosion for sustaining soil fertility and zinger

production in hill slopes

- 3.6 **Study period** :
- 3.6.1 Starting year : 2009-10
- 3.6.2 completion year : 2012-13
- 3.7 **Personnels** :
- 3.7.1 Study leader : Md. Motiar Rahman, Assistant Soil Scientist
- 3.7.2 Associates : Md. Jahangir Alam, Divisional Officer
: M. Zahirul Alam, Assistant Soil Scientist

- 3.8 **Progress** :
- 3.8.1 Previous years (2009-11) : Fifteen decimal hilly lands were cultivated for zinger and arhar production. Analyzed data showed that soil erosion was higher (148.52 ton/ha/yr) in the traditional system (T_0) than that of T_1 (zinger and arhar cultivation along the slope-129.45 ton/ha/yr) and T_2 (zinger and arhar cultivation across the slope-91.74 ton/ha/yr). Soil nutrients loss were also higher in the traditional system. Yield of zinger was found 12.84, 15.07 and 15.81 ton/ha/yr in the T_0 , T_1 and T_2 experimental plots respectively.

- 3.8.2 This year :
- | Activities of the study | Progress |
|--|--|
| a. Fifteen decimal established experimental plots will be maintained | a. Fifteen decimal established experimental plots were maintained through furrowing. |
| b. Zinger rhizom and arhar seed will be | b. Zinger rhizome and arhar seed were sown as per |

- | | |
|--|---|
| sown as per farmer choice | farmer choice |
| c. Six soil samples will be collected for analysis of soil nutrients | c. Six soil samples were collected and soil nutrients analyzed (Table 1) |
| d. Yield data of zinger and arhar will be collected | d. Yield data of zinger and arhar were collected and recorded |
| e. Soil erosion and existing nutrient status will be assessed | e. Soil erosion and existing nutrient status was assessed (Fig. 1 and Table 2)) |
| f. Data analysis and report writing | f. Data were analyzed and compiled |

Table 1: Initial soil status of the experimental plots at wagga, Kaptai, Rangamati Hill tracts

Plot No.	Soil depth (cm)	pH	SOM (%)	Total-N (%)	P		S		K		Ca		Mg	
					μg/g soil		μg/g soil		Meq/100g soil		Meq/100g soil			
T ₀	0-15	5.4	3.12	0.28	3.0	13.0	0.36	2.23	1.51					
	15-30	4.8	2.20	0.24	3.0	12.0	0.36	2.20	1.50					
	30-50	4.9	1.89	0.20	2.5	12.0	0.35	2.15	1.45					
T ₁	0-15	5.2	3.01	0.27	2.0	10.0	0.28	1.27	1.00					
	15-30	5.0	2.38	0.24	2.0	9.0	0.27	1.25	1.01					
	30-50	4.9	2.41	0.17	2.0	9.0	0.27	1.20	0.98					
T ₂	0-15	5.1	2.84	0.17	2.0	8.0	0.27	0.86	0.53					
	15-30	4.9	2.10	0.16	2.0	8.0	0.26	0.82	0.55					
	30-50	4.6	1.46	0.17	1.8	8.0	0.25	0.80	0.50					

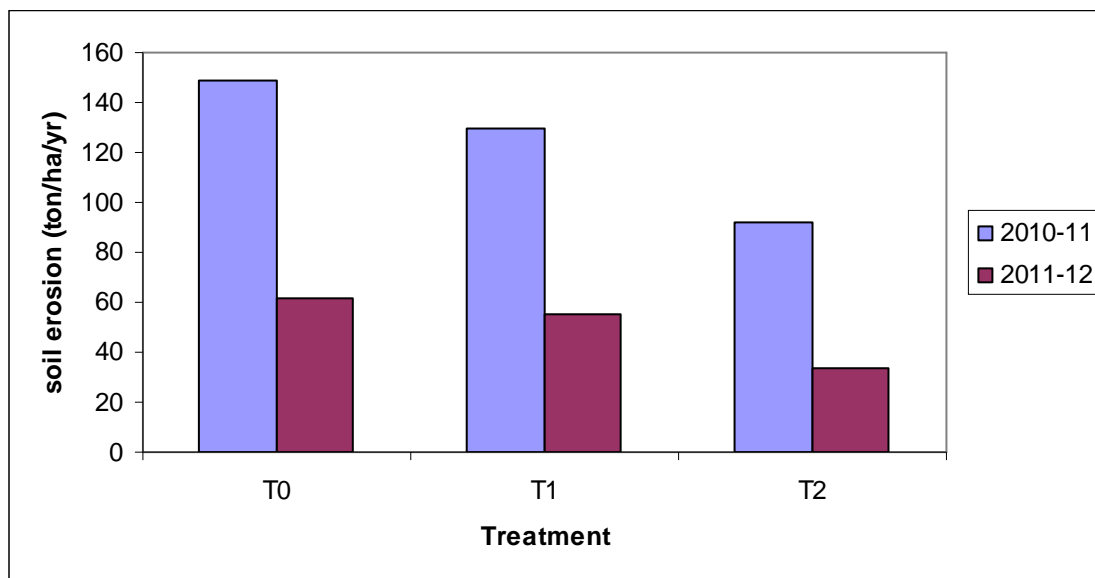


Fig. 1: Soil erosion (ton/ha/yr) of the experimental plots at Wagga, Kaptai, Rangamati Hill District

Table 2: Estimation of soil nutrient loss (kg/ha/yr) in the experimental plots at 35% slope

Soil nutrients	2010-11			2011-12		
	T ₀	T ₁	T ₂	T ₀	T ₁	T ₂
Organic matter	3950.63	2640.78	2577.89	1630.58	1125.06	955.40
Nitrogen	207.92	181.23	146.78	85.82	77.21	54.40
Phosphorus	0.79	0.65	0.42	0.32	0.27	0.16
Potassium	27.77	18.64	16.42	11.46	7.94	6.09
Sulfur	2.30	1.27	0.73	0.95	0.54	0.27
Calcium	99.35	67.18	42.57	41.01	28.62	15.78
Magnesium	24.65	12.56	16.60	10.17	5.35	6.15

3.9 Achievement : Established fifteen decimal experimental plots at Wagga, Kaptai, Rangamati Hill District.

3.10 **Financial Statement** :

3.10.1 Total cost : Tk. 3,00,000.00

3.10.2 Cost of the year : Tk. 56,070.00

3.10.3 Expenditure of the year : Tk. 56,070.00

3.10.4 Source of fund : GOB

3.11 **Beneficiaries** : Zinger cultivators, hill farmers and private planters

4. **Study** : **Ongoing**

4.1 Programme Area : Soil conservation and watershed management

4.2 Title of the Study : **Assessment of carbon storage trends in the soil-plant system in different forest areas**

4.3 Justification : The forest plays a critical role in global carbon cycle and offer significant potential to capture and hold carbon, thus forming an important climate change mitigation option. Although, deforestation contributes to about 1.6 Gt C per year, thus provides a large mitigation opportunity to stabilize green house gases (GHG) concentration (2 to 4 Gt C annually) in the atmosphere (Scholes and Noble, 2001) along with significant benefits. As tree grow and their biomass increases, they absorb carbon from the atmosphere and store it the plant tissues (Mathews et. al., 2000) resulting in growth of different parts. Active absorption of CO₂ from the atmosphere in photosynthetic process and its subsequent storage in the biomass of growing trees or plants is the carbon storage (Baes et. al., 1977). In terms of atmospheric carbon reduction, trees in urban areas offer the double benefit of direct carbon storage and stability of natural ecosystem with increased recycling of nutrient along with maintenance of climatic conditions by the biogeochemical processes.

Soil carbon level is expected to decrease due to increased net primary production. The quality of soil organic matter may also shift where more inert components of the carbon pool prevail. An increased risk of soil erosion and nutrient loss due to reduced vegetation cover in combination with episodic rainfall and greater wind intensities is expected. A shift in land suitability for farming due to greater significance of soil texture on plant / soil-water dynamics and plant available water is likely. Transient salinity may be increased. Soil biology and microbial population are expected to change under conditions of elevated carbon dioxide and changed moisture and temperatures regimes (Nuttall, 2007).

Assessment of aboveground carbon content in different forests is essential to evaluate soil carbon status to prepare useful database and its change over time. This will contribute to improved forest management as well as appropriate land use in the changing environment. In view of this the present research work was undertaken.

- 4.4 **Objectives** :
- 4.4.1 To determine carbon storage of different forest tree species and adjacent soil
- 4.4.2 To assess the correlation between soil and plant system on carbon storage trends
- 4.5 Expected output : Prepared data bank on carbon storage trends from different forest tree species and soil
- 4.6 **Study period** :
- 4.6.1 Starting year : 2010-11
- 4.6.2 completion year : 2014-15
- 4.7 **Personnels** :
- 4.7.1 Study leader : Md. Motiar Rahman, Assistant Soil Scientist
- 4.7.2 Associates : Md. Jahangir Alam, Divisional Officer
: M. Zahirul Alam, Assistant Soil Scientist
- 4.8 **Progress** :
- 4.8.1 Previous years (2010-11) : Carbon content of fifteen plant species (12 mangrove and 3 forest tree species) were analyzed and compiled. Soil organic carbon content at adjacent selected tree species was also analyzed.
- 4.8.2 This year :

Activities of the study	Progress
a. Root, stem, branch, twig and leaf samples from 5 forest species and 5 bamboo species will be collected at different forest areas for determination of carbon content	a. Root, stem, branch, twig and leaf samples of 5 forest tree species (<i>A. auriculiformis</i> , <i>E. camaldulensis</i> , Hybrid acacia, <i>S. saman</i> and <i>T. grandis</i>) were collected and analyzed for carbon content (Table 1). Carbon content of different parts of 5 bamboo species (<i>B. vulgaris</i> , <i>D. giganteus</i> , <i>B. tulda</i> , <i>M. baccifera</i> and <i>B. vulgaris</i> var <i>straita</i>) were also determined (Table 2).
b. Soil profile will be excavated and soil samples will be collected from adjacent selected trees	b. Soil profile was excavated and composite soil samples under 0-15 and 15-30 soil depth at each selected tree & bamboo species were collected and analyzed (Table 3).
c. Soil and plant samples will be analyzed	c. Soil and plant samples were analyzed and completed.
d. Data analysis and report writing	d. Data were analyzed and compiled.

Table 1: Carbon content (%) of five forest species at different age class

Sl. No.	Species	Age group (years)		
		1-5	6-10	11-15
01	Akasmoni (<i>Acacia auriculiformis</i>)	51.25	52.95	56.04
02	Eucalyptus (<i>Eucalyptus camaldulensis</i>)	55.66	56.18	56.14
03	Hybrid acacia	56.22	55.69	55.89

04	Rain tree (<i>Samanea saman</i>)	55.27	53.63	50.02
05	Teak (<i>Tectona grandis</i>)	53.11	54.91	54.89

Table 2: Carbon content (%) of five bamboo species at mature and immature stages

Sl. No.	Species	Mature	Immature
01	Baizza (<i>Bambusa vulgaris</i>)	51.94	51.48
02	Budum (<i>Dendrocalamus giganteus</i>)	53.62	52.54
03	Mitingga (<i>Bambusa tulda</i>)	51.80	55.28
04	Muli (<i>Melocanna baccifera</i>)	43.42	42.76
05	Sorna (<i>B. vulgaris var striata</i>)	52.75	53.29

Table 3: Soil organic carbon content (%) at adjacent selected tree species under 0-15 and 15-30 cm soil depth

Sl. No.	Species	Soil depth (cm)	
		0-15	15-30
01	Akasmoni (<i>Acacia auriculiformis</i>)	1.18	0.75
02	Eucalyptus (<i>Eucalyptus camaldulensis</i>)	1.13	0.90
03	Hybrid acacia	0.99	0.94
04	Rain tree (<i>Samanea saman</i>)	0.93	0.83
05	Teak (<i>Tectona grandis</i>)	1.04	0.73
06	Baizza (<i>Bambusa vulgaris</i>)	0.47	0.57
07	Budum (<i>Dendrocalamus giganteus</i>)	0.82	1.06
08	Mitingga (<i>Bambusa tulda</i>)	1.03	1.0
09	Muli (<i>Melocanna baccifera</i>)	1.10	0.79
10	Sorna (<i>B. Vulgaris var striata</i>)	0.25	0.60

4.9 Achievement : Carbon content of twenty five forest tree species were assessed for preparation of data bank.

- 4.10 **Financial Statement** :
- 4.10.1 Total cost : Tk. 6,00,000.00
- 4.10.2 Cost of the year : Tk. 58,730.00
- 4.10.3 Expenditure of the year : Tk. 58,730.00
- 4.10.4 Source of fund : GOB
- 4.11 **Beneficiaries** : FD, NGO and academician

MINOR FOREST PRODUCTS DIVISION

1. Study : On-going

1.1. Programme Area : Bamboo and Non-timber Economic Crops.

1.2. Title of the Study : **Nursery, plantation and management techniques, and conservation of ten rattan species available in Bangladesh.**

1.3 Justification : Rattan is one of the important natural resources in Bangladesh. Besides ecological importance, this natural resource has been used as raw materials in cottage industries and has potential economic value. Once the country was rich in rattan population. But due to improper management and over exploitation, this valuable natural resource is now at the verge of disappearance. Realizing its importance as natural resources, Forest Department took initiative to rehabilitate rattan species primarily in natural habitats. As part of this initiative to provide technical support, it is necessary to develop nursery raising and plantation management techniques and conservation strategy of rattan species.

1.4. Objective(s) :

1.4.1 To develop suitable techniques for production of quality planting materials of ten rattan species.

1.4.2 To develop appropriate plantation techniques and site suitability of ten rattan species.

1.4.3 To determine the optimum harvesting age and sound management system for maintaining sustainable production of different rattan species.

1.5. Expected output : Appropriate technique will be available for production of quality planting materials for plantation raising and management of different rattan species will be available. Conservation and centralization of all rattan species available in Bangladesh will be possible. Permanent seed source of different rattan species will be created.

1.6 Study period :

1.6.1 Starting year : 2002-2003

1.6.1 Completion year : 2014-2015

1.7. Personnel(s) :

1.7.1 Study Leader: : Md. Sah Alam, RO

1.7.2 Associates : Rafiqul Haider, DO

1.7.3 : S.R. Merry, SRO

1.8. Progress :

a) Previous years, if any :

Fruit maturing time, weight of seed per kg. for ten rattan species were studied. Seed germination period and germination percentage, root-shoot ratio of seedlings and seedling-growth in the nursery of four species like, ail (*Calamus tenuis*), kerak (*C. viminalis*), golla (*Daemonorops jenkinsiana*) and udum (*C. longisetus*) were completed.

5.0 ha experimental plantations and conservation plots of ail (*Calamus tenuis*), kerak (*C. viminalis*) golla (*Daemonorops jenkinsiana*) udum (*C. longisetus*) and sundi (*Calamus guruba*) at BFRI Headquarter and Hinguli Research Station were established.

c) This year

Action plan as per annual research programme	Progress
a) Seed collection of different rattan species from different locations (Sylhet, Bandarban, Kaptai, Gazipur, Tangail, Teknaf, etc.).	a) Collected 35 kg rattan seeds (ail, kerak, golla and sita) from different locations (Sylhet, Bandarban, Teknaf, Salna, Sitakundu and Chittagong University) .
b) Nursery trial for bhudum (<i>C. latifolius</i>), sundi (<i>C. guruba</i>), and sita (<i>Calamus erectus</i>) rattan species	b) Germination (%) of sita bet: - Clean seed with 24 hours cold water treatment (30%) - Clean seed with 48 hours cold water treatment - nil - Clean seed normal (26%)
c) Raising 20,000 seedlings of different rattan species for trial plantation, establishment of conservation plots and remaining seedlings for distribution on payment basis.	c) Raised 20,000 seedlings of ail, kerak and golla bet in the nursery
d) Maintenance of seedlings in the nursery through weeding, watering, manuring, etc	d) Seedlings were maintained in the nursery through weeding, watering, manuring, etc
e) Raising trial plantations over an area of 1.0 ha. at BFRI Headquarter and Hinguli Research Station.	e) Raised 1.0 ha. trial plantation with three species (kerak, jali and golla) at Hinguli Research Station (0.5ha) and BFRI campus (0.5 ha).
f) Maintenance of 5.0 hectare old trial plantation and conservation plots at BFRI Headquarter and Hinguli Research Station through vacancy filling, weeding and other tending operations	f) Maintained 5.0 hectare old plantation at BFRI Headquarter and Hinguli Research Station through weeding, vacancy filling, etc.
g) Data collection and report writing	g) Data collected and compilation is under way.

- 1.9. Achievement(s), if any : Nursery and plantation techniques of jali, kerak and golla have been developed.
- 1.10. Financial Statement :
- 1.10.1 Total cost : Tk. 8, 00,000.00
- 1.10.2 Cost of the year : Tk. 1, 36,980.00
- 1.10.3 Expenditure of the year : Tk. 1, 36,980.00
- 1.10.4 Source of fund : GOB
- 1.11. Beneficiaries : FD, NGO's, Private planters, Farmers, Educational Institute, Rattan industries and BSCIC.

2. Study : On-going

- 2.1. Programme Area : Bamboo and Non-timber Economic Crops.
- 2.2. Title of the Study : **Nursery and plantation techniques of selected medicinal plants.**
- 2.3 Justification : Once Bangladesh was rich in medicinal plants. The natural and the homestead forests have been support various species of medicinal plants. Unfortunately, due to lack of proper attention and management practices, this valuable resource has greatly declined. It is necessary to cultivate medicinal plants considering

the increasing importance of herbal drug. For this it is necessary to know the technical know-how on plantation and management techniques of medicinal plant.

- 2.4. Objective(s) :
- 2.4.1 To develop nursery techniques for production of planting materials.
- 2.4.2 To develop plantation and sound management techniques for sustained yield.
- 2.5. Expected output : Improved and easy nursery raising, plantation and management technique of valuable medicinal plant.
- 2.6. Study period
- 2.6.1 Starting year : 2002-2003
- 2.6.2 Completion year : 2012-2013
- 2.7. Personnel(S) :
- 2.7.1 Project Leader : S.R. Merry, SRO
- 2.7.2 Associates : Rafiqul Haider, DO
- 2.7.3 : Md. Sah Alam, RO
- 2.8. Progress :

a) Previous years, if any :

Nursery and plantation technique of different medicinal plants such as aswagandha, basak, satamuli, simul, sarpagandha, arjun, ulatkambal, datura, mehedi, bach, bel, bahera, raktakambal, shinduri, sonalu, sajna, haritaki, akand, kantikari, have been developed.

b) This year

Action plan as per annual research programme	Progress
Collection of propagating materials and raising 1500 seedlings (300 for each species) of five medicinal plants such as, chalmugra (<i>Hydnocarpus kurzii</i>), ritha (<i>Sapindus mukorossi</i>), kuchila (<i>Strychnos nux-vomica</i>), apang (<i>Achyranthes aspera</i>), bish katali (<i>Polygonum hydropiper</i>).	<p>a) Selected medicinal plants seeds like ritha, kuchila), apang, bishkatali were collected. However, seeds of chalmugra could not collect due to unavailability.</p> <p>According to the plan, experiments were conducted and data were recorded on germination period, germination percentage and growth.</p> <p><u>Ritha:</u></p> <p>Generally germination starts after 60 days of sowing and completed within 4 months. However, in case of cold water treatment for 12 and 36 hours, germination starts at 21 days and completed within 116 days. Average height of seedlings was found 19.5 cm. at age of five months</p> <p>Soaking seeds in luke warm water for 10 second showed the highest germination (50%), followed by 15 seconds (47%) and five seconds (37%)</p> <p>Scratching of seed by rubbing in the floor showed (47%). control (45%), cold water treatment for 12 and 36 hours showed the germination (33%) and 24 hours only 09%.</p> <p><u>Kuchila</u></p> <p>Experiment was conducted according to ritha, but no seed germination was found.</p> <p><u>Bakful</u></p> <p>Germination starts 3-4 days and completed within 8 days.</p> <p>Germination %</p> <p>Cold water treatment for 24 hours showed highest germination (85%), followed by cold water treatment for 12 hours (76%), for control (73%)</p>

	<p>and 36 hours showed 43%..</p> <p>Average seedling height was recorded 11 cm. at age of one month with 4 leaves.</p> <p><u>Apang</u></p> <p>Germination starts 3-4 days and completed within 9-10 days.</p> <p>Germination percentage was recorded highest for cold water treatment with 36 hours showed highest germination (95%), followed by cold water treatment for 12 hours (83%), (81%) for 24 hours and control (72%) .</p> <p><u>Bishkatali:</u></p> <p>Germination starts after three days of sowing and completed within seven days.</p> <p>Cold water treatment for 24 hours showed highest germination (80%), followed by (69 %) for 36 hours, (56%) for 12 hours and (43%) for control.</p>
Establishment of 0.25 hectare experimental plantations with five selected medicinal plants Hinguli Research Station	b) Activities of experimental plantation of 0.25 hectares with five selected species like ritha, neem, ulatkumbal, shorpagandha, basak is going on at Hinguli Research Station.
Maintenance of 1.0 hectare trial plantations at BFRI Headquarter and Hinguli Research Station.	c) Maintained old experimental plantation at Hinguli Research Station and MFPD Head Quarter through weeding and other tending operations.
d) Collection of data on survival, growth and biomass from raised plots of BFRI Headquarter and Hinguli Research Station.	d) Survival and growth data of chalmugra, mandha, shimul, agar, neem, sonalu, bahera, bansonalu, chalta, jolpai, polash, basak, chagolboti, kanchon were collected from Hinguli Research Station
e) Report writing and printing	e). Compilation of data is under process and two folder on tulsi and kalomegh were submitted to TTC for publication.

2.9. Achievement(s), if any :

Five folders and five bulletins on flowering and fruiting, nursery and plantation techniques of different medicinal plants available in Bangladesh were published (in Bengali and English).

2.10 Financial statement. :

- 2.10.1 Total cost : Tk. 3, 50,000.00
2.10.2 Cost of the year : Tk 55,250.00
2.10.3 Expenditure of the year : Tk. 55,250.00
2.10.4 Source of fund : GOB

2.11. Beneficiaries : FD, NGO's, Private planters, Farmers,' Educational Institutions, Rattan industries and BSCIC.

3. Study : On-going

3.1. Programme Area : Bamboo and Non-timber Economic Crops.

3.2 Title of the Study : **Germplasm conservation and management practices of different medicinal plants**

3.3 Justification : Once Bangladesh was rich in floral diversity. It is estimated that about 5,700 angiosperm found in Bangladesh. Out which species 747 species reported have medicinal value which has

tremendous impact on the treatment of disease of specially people dwelling in the forests areas or near by forest. There is a huge demand of medicinal plants in Ayurvedic and Unani pharmaceutical company. This resource is becoming scarce day by day due to habitat loss, anthropogenic pressure and indiscriminate exploitation. To revamp/regain the depleting medicinal plant resources, it is necessary to conserve them either in-situ or ex-situ condition. That will serve as germplasm centre or gene pool and that will be utilized for future propagation and improvement program.

- 3.4. Objective(s) :
- 3.4.1 To authenticate correct identification of medicinal plants.
- 3.4.2 To conserve medicinal plants for scientific study and demonstration.
- 3.4.3 To develop a gene pool of medicinal plants species for propagation purposes.
- 3.4.4 To popularize the cultivation and use of medicinal plants.
- 3.4.5 To determine management techniques for maximum yield of medicinal plants.
- 3.5. Expected output : To conserve the valuable medicinal resource for easy identification, use of herbal, drug processing companies, primary health care and as well as environmental improvement.

3.6. Study period

- 3.6.1 Starting year : 2002-2003
- 3.6.2 Completion year : 2009-2010

3.7. Personnel (s) :

- 3.7.1 Project Leader : S.R. Merry, SRO
- 3.7.2 Associates : Rafiqul Haider, DO
- 3.7.3 : Md. Sah Alam, RO

3.8. Progress :

a) Previous years, if any :

Germplasm of 100 annual and perennial medicinal plants namely; neem, amloki, haritaki, bahera, ashok, nishinda, arjun, shinduri, deb-kanchan, akand, basak, shatchandan, agar, bel, naglingam, chalmugra, rakta-kambal, jalpai, kuchila, ritha, tejpata, kao-phal, karpur, daiphall, supari, baramasala, bashpata, kajubadam, mahua, dadmardan, tejbahal, maillum, belimbi, and so on, have been conserved in the BFRI headquarter nursery and Hinguli Research Station..

b) This year

Action plan as per annual research programme	Progress
a) Collection of propagating materials for 25 annual and five perennial medicinal plants from Bogra, Dinajpur, Natore, Bandarban and Khagrachari districts of Bangladesh.	Seed/propagating materials of 7 annual (berala, kukursungha, pathorchur, bontulshi, tulshi (India), alkhusi, saladpata, and 2 perennial species (bakful, lotkon) were collected from different locations of Bangladesh.

c) Raising 4,000 seedlings of different medicinal plants for establishing conservation plots and left over seedling for distribution.	4,000 seedlings of tulsi, mohabingaraj, ban-dharosh, apang, boch, stevia, satamuli, kalomagh, aswagundha, pathorkuchi, noyontra, pipul, satodran, thankuni, brammi, pudina, basak, ulotkumbal, jatropa, passonfruit, misridana, dadmordon, himsagar, kuch, kalkesuti, bhuikumra, were raised.
d) Maintenance of seedlings in the nursery.	Seedlings were maintained at MFPD head quarter nursery.

e) Re-establishment of conservation plots for 40 annual and five perennial medicinal plants at Headquarter MFP nursery.	Re-established 66 annual and newly established 7 annual and 2 perennial medicinal plants at MFPD Headquarter nursery.
f) Establishment of conservation plots of ten perennial plants at Hinguli Research Station.	Establishment of conservation plots for ten perennial medicinal plants like neem, nisinda, bakful, udal, arjun, jolpai shajna, bahera, basak, lotkon and bel is going-on at Hinguli Research Station.
g) Maintenance of old and new conservation plots at BFRI campus and Hinguli Research Station.	0.5 hectare old conservation plots of both annual and perennial plants were maintained at Hinguli Research Station and MFPD headquarter nursery.
h) Development of medicinal plant museum.	A gallery system steel rack (4' X 4') was arranged in the museum for putting specimen jar.

3.9. Achievement(s), if any : Conservation plots of 100 medicinal plants are established at MFPD nursery and BFRI campus as permanent sources of propagating materials.

3.10 Financial Statement . :
 3.10.1 Total cost : Tk. 6,80,000.00
 3.10.2 Cost of the year : Tk. 91,035.00
 3.10.3 Expenditure of the year : Tk. 91,035.00
 3.10.4 Source of fund : GOB

3.11. Beneficiaries : FD, NGO's, Private planters, Farmers' Educational Institute, Rattan industries and BSCIC.

4. Study : on-going

4.1. Programme Area : Bamboo and Non-timber Economic Crops.

4.2. Title of the Study : **Standardizing the nursery and plantation technique of khair (*Acacia catechu*)**

4.3 Justification : Khair is a comically important tree species. Extract of its wood is used with pan (betel-leaf) and in medicine. It is also used in dyeing of cotton, silk and calico-printing. Rajshahi region was the particular area for khair cultivation in Bangladesh and was abundant a few years back. However, now it becomes scarce in the area. Khair based cottage industries in the area are at stake due to shortage of khair wood. According to the famous media personality Hanif Sonket and

local people, low germination rate of khair is the primary cause of people's unwillingness for cultivation of khair. BFRI's previous studies also indicate the similar notion. Considering the fact the study is under taken to develop appropriate nursery raising techniques and their growth behavior.

4.4. Objective(s) :

- a) To observe the seed germination percentage with different treatments.
- b) To observe the seed germination period, seedlings growth, etc. under different treatments.
- c) To find out survival and growth performance of seedlings with different spacing.

4.5 Expected output : Improved nursery and plantation technique of khair will be known.

4.6 Study period :

4.6.1 Starting year : 2010-2011

4.6.2 Completion year : 2013-2014

4.7. Personnel(s) :

4.7.1 Project Leader : Rafiqul Haider, DO

4.7.2 Associates : S.R. Merry, SRO

4.7.3 Md. Sah Alam, RO

4.8. Progress :

a) Previous years, if any : Germination percentage, germination period of seeds and root-shoot ratio of khair seedlings were studied. Raised experimental plantations of 0.5 hectare at Hinguli Research Station.

b) This year

Action plan as per annual research programme	Progress
a) Seed collection, placing of seeds with different treatments (soaking seeds in hot water for 30 seconds, in cold water for one and two days) in nursery bed.	a) Seeds were collected from Birampur, Dinajpur and sowing in the nursery bed.
b) Observing seed germination percentage, germination period, seedlings growth, etc in the nursery.	<div style="border: 1px solid black; padding: 5px;"> b) Germination period normally 5 to 15 days - cold water treatment 5 to 7 days - hot water treatment 7 to 20 days Data on germination percentage - Cold water treatment, 48 hours - (75%) - Cold water treatment, 24 (80%) - Hot water for 30 seconds (56%) - Control - (75%) </div>
c) Raising 500 seedlings for experimental plantations at MFP headquarter and Hinguli Research Station.	c) Raised 500 seedlings and maintained at MFPD headquarter nursery.
d) Out planting of seedlings with	d) Established 0.5 hectare trial plantation of khair with three

three treatments (spacing- 1.5mx1.5m, 2mx2m, 2.5mx2.5m) and three replications and 36 seedlings in each plot. spacing (1.5mx1.5m, 2mx2m, 2.5mx2.5m) and three replication at Hinguli Research Station according to plan.

e) Maintenance of last year's 0.5 hectare experimental plantation in Hinguli Research Station. e) Maintained 0.5 hectare last year khair plantation at Hinguli Research Station through weeding, vacancy filling, etc.

f) Data collection and report writing. f) Growth performance and survival data have been recorded from the experimental plantation.

4.9. Achievement(s), if any :

4.10. Financial statement :

4.10.1 Total cost : Tk. 5,00,000.00

4.10.2 Cost of the year : Tk. 29,105.00

4.10.3 Expenditure of the year : Tk. 29,105.00

4.10.4 Source of fund : GOB

4.11. Beneficiaries : FD, NGOs, Private planters, Farmers, Educational Institutes, Herbal drug producers, etc.

5. Study : New

5.1 Programme Area : Bamboo and Non-timber Economic Crops.

5.2 Title of the Study : **Study on nursery and plantation technique of dhup (*Canarium resiniferum*).**

5.3 Justification : Dhup (*Canarium resiniferum*) is a medium to big sized evergreen tree. It is used to prevent the water infiltration in boat and launch, it is also used in preparing varnish and of medical purpose for plastering. Its wood may be used as veneer and ply woods. Its blackish to brown color gum (oleoresin) used as dhup in dry condition. It is also used for the treatment of indolent ulcer as ointment and treatment of swelling due to rheumatic fever. Traditionally, dhup powder is used as mosquito repellent in the village area of Bangladesh, creating smoke during the sunset. The Hindu community people used dhup for their religious purposes. It is very important species in terms of medicinal and religious value. The species is naturally grown in the forest of Chittagong, Cox's bazaar and Sylhet. However, now the species is becoming rare. It may be due to physiological stress condition to regenerate. So, it is needed to conserve the species. With a view to this, it is necessary to develop its nursery and planting techniques. Considering the facts the study has been under taken. To fulfill the following objectives

5.4 Objective(s) :

5.4.1 To observe the phenological character of dhup

5.4.2 To standardize nursery techniques of dhup.

5.4.3 To developed plantation techniques of dhup.

- 5.5 Expected output : Improved nursery and plantation technique of dhup
5.6 Study period :
5.6.1 Starting year : 2011-2012
5.6.2 Completion year : 2015-2016
5.7 Personnel (s) :
5.7.1 Study Leader : Rafiqul Haider, DO
5.7.2 Associate : S. R. Merry, SRO
5.7.3 : Md. Sah Alam, RO
5.8 Previous progress if any : Not applicable

b) This year

Action plan as per annual research programme	Progress
a) Collection of background information on present situation of dhup in Bangladesh.	a) Phenological information: Flowering: July-August Fruit maturing: September.-October
b) Collection of seed and nursery trial with different treatments (soaking seeds in hot water for 30 seconds, soaking in cold water for 24 hours and 48 hours) at BFRI headquarter	b) Collected dhup seeds (17 kgs) from Adampur, Moulavibazar. Seeds are sown in the nursery bed according to the plan.
c) Observation of seed germination percentage, germination period, seedlings growth, etc.	c) Germination: Germination start after one month of sowing Germination percentage- -- - large – 12 to 16 cm 28.66% - medium – 10 to 12 cm- nil - small - 5 to 10 cm - nil Medium size seed: - 48 hours cold water treatment – nil - 24 hours cold water treatment- nil
d) Raising of 300 seedlings at BFRI headquarter nursery.	d) Raised 60 seedlings and maintained at MFPD headquarter nursery.
e) Site selection and site preparation (jungle cutting, debris clearing, etc.) for raising experimental plantation.	e) Sites were selected and prepared by jungle cutting, debris clearing, etc. for raising experimental plantation.
f) Raising 0.025 hectare plantation (64 seedlings in each plot, 3 replication) with 2mx2m spacing	f) Raised 0.025 hectare plantation as per plan.

- 5.9. Achievement (s) if any :
 5.10 Financial statement :
 5.10.1 Total cost : Tk. 5, 00,000.00
 5.10.2 Cost of the years : Tk. 37,300.00
 4.10.3 Expenditure of the year : Tk. 37,300.00
 5.10.4 Source of fund : GOB
 5.11 Beneficiaries : FD, NGOs, Private planters, Farmers, Educational Institutes, Herbal drug producers, etc.

Mangrove Silviculture Division

- 1. Study** : **On-going**
1.1 Programme Area : Breeding and tree improvement
1.2 Title of the Study : **Vegetation dynamics and regeneration pattern in relation to salinity and siltation of the Sundarban.**
1.3 Justification :

The Sundarbans, like other mangrove ecosystems, is dynamic and complex. Changes in this ecosystem are occurring continuously. To ascertain these changes, regular collection of relevant data from the forests on a long-term basis is a prerequisite. Continuous forest inventory through Permanent Sample Plots (PSPs) are useful to record changes in the various parameters associated with the stand density, species composition, structure and species shifts. The Sundarban forest is dependent on natural regeneration in order to be managed under a sustainable yield basis. The main problem of the forest is inadequacy of natural regeneration. So, the present study will help to record past and present regeneration and vegetation status of the forest that could improve the management system of the Sundarban.

- 1.4 Objectives** :
1.4.1 To determine the species composition.
1.4.2 To determine the natural regeneration status of major mangrove species.
1.4.3 To understand the vegetation dynamics in the Sundarban over time.
1.4.4 To assess the impact of salinity and siltation on the change of vegetation.
1.5 Expected output : Species composition, vegetation dynamics and regeneration status of major mangrove species in the Sundarbans.
1.6 Study period : 2007-2016
1.6.1 Starting year : 2007-08
1.6.2 Completion year : 2015-16
1.7 Personnel (s) :
1.7.1 Study leader : Dr. M. M. Rahman, DO
1.7.2 Associate : S. M. M. Hasnin, SRO

1.7.3 Associate : A. S. M. Helal Siddiqui, RO

1.8 Progress :

1.8.1 Previous years, if any(..year) :

Thirty Permanent Sample Plots (PSPs) were maintained. Data on species composition, number of trees of different species, height, DBH, regeneration of the seedlings recruitment of mangrove species were recorded from 30 PSPs. Seedlings recruitment of major mangrove species were recorded from the PSPs. Average seedlings recruitment in the year 2010 was found 33,133/ha/year. Among them, *Heritiera fomes* constituted 43.16%, *Excoecaria agallocha* 31.89%, *Ceriops decandra* 10.76%, *Bruguiera sexangula* 3.52%, *Avicennia officinalis* 1.01%, *Aegiceras corniculatum* 3.92%, *Xylocarpus mekongensis* 0.91%, *Sonneratia apetala* 0.20%, *Amoora cuculata* 2.41%, *Cynometra ramiflora* 1.21%, *Nypa fruticans* 0.10%, *Phoenix paludosa* 0.20%, *Rhizophora mucronata* 0.31%, *Acanthus illicifolius* 0.10% and *Brownlowia tersa* 0.30%. Height and DBH class of Sundri and Gewa were analysed. Highest number of sundri trees (51%) was found under DBH class $>5 \leq 10$ cm and only 3.5% Sundri trees was found above 30cm DBH. Highest number of gewa trees (74%) was found under DBH class $>5 \leq 10$ cm and only 1.5% gewa trees was found above 20cm DBH. Highest number of sundri trees (41%) was found under height class $>5 \leq 10$ m and only 2.3% sundri trees was found above 15m height. Highest number of gewa trees (47%) was found under height class $>5 \leq 10$ m and only 14% gewa trees was found above 10m height.

1.8.2 This year :

Activities of the study

Progress

- | | |
|---|--|
| a) Maintenance (Demarcation of plots, replacement of damaged signboards, number-plates, jungle cutting etc.) of 30 PSPs in different salinity zones throughout the Sundarban. | a) Thirty PSPs in different salinity zones (10 PSPs in each saline zone) of the Sundarban were maintained (Table-1). |
| b) Collection of data on species composition, dia-class, height class, regeneration data, growth data, salinity and siltation data from the PSPs. | b) Data on species composition, dia-class, height class, regeneration data, growth data, salinity and siltation data from the PSPs were collected. |
| c) Compilation and analysis of data. | c) Thirty Permanent Sample Plots(PSPs) were maintained. Data on species composition, number of trees of different species, height, DBH, regeneration of the seedlings recruitment of mangrove species were recorded from 30 PSPs. Seedlings recruitment of major mangrove species were recorded from the PSPs. Average seedlings recruitment in the year 2011 was found 35,317/ha/year. Among them, <i>Heritiera fomes</i> constituted 26.75%, <i>Excoecaria agallocha</i> |

24.96%, *Ceriops decandra* 23.55%, *Bruguiera sexangula* 11.46%, *Avicennia officinalis* 7.02%, *Aegiceras corniculatum* 0.76%, *Xylocarpus mekongensis* 2.27%, *Amoora cuculata* 2.41%, *Cynometra ramiflora* 0.48%, *Phoenix paludosa* 0.07% and *Rhizophora mucronata* 0.03%. Height and DBH class of Sundri and Gewa were analysed and shown in Fig.1,2,3,and 4.

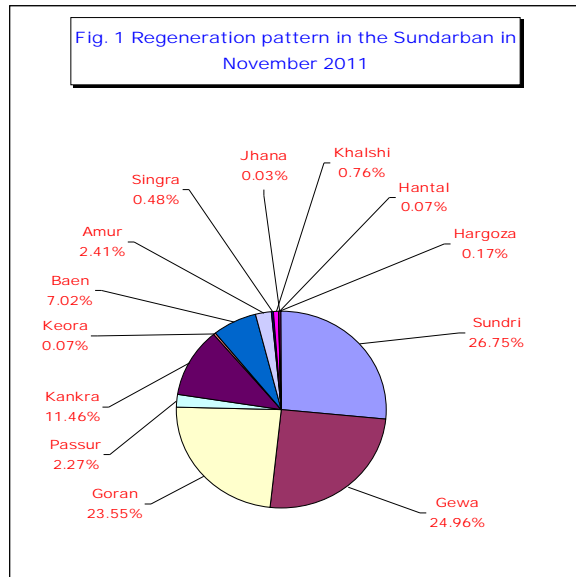
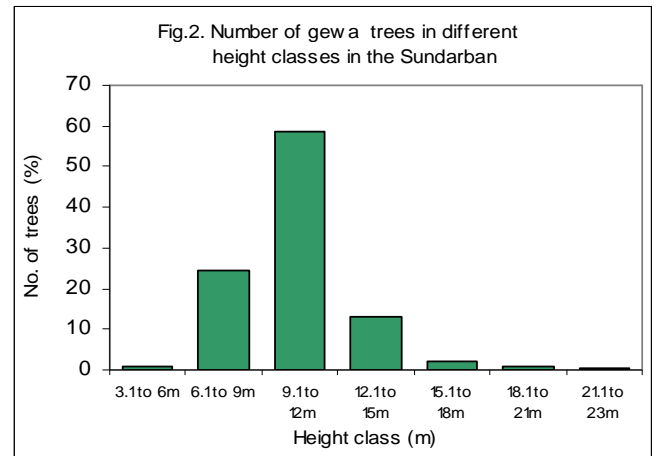
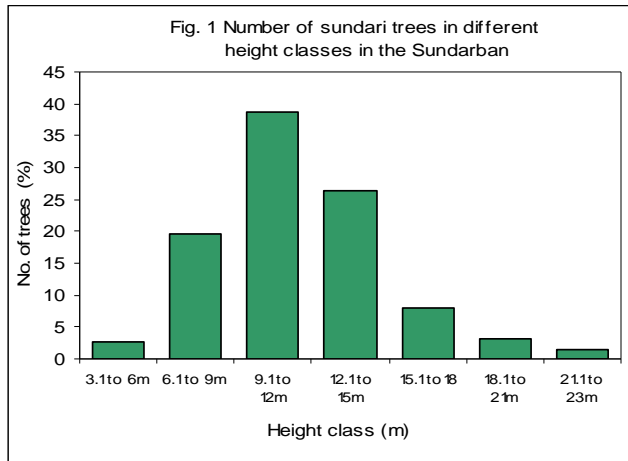


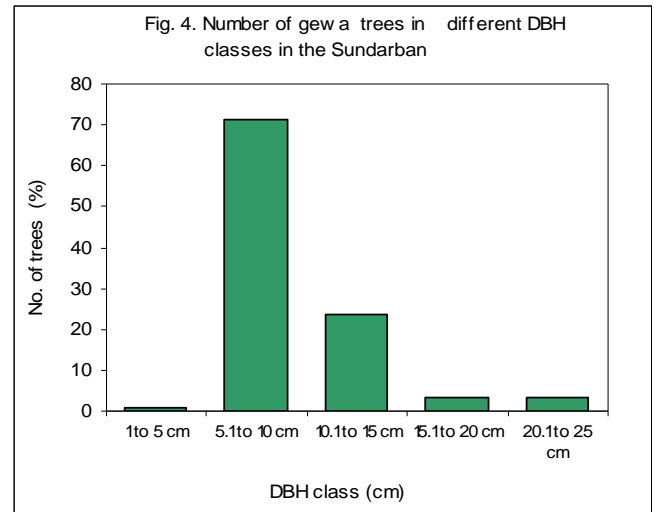
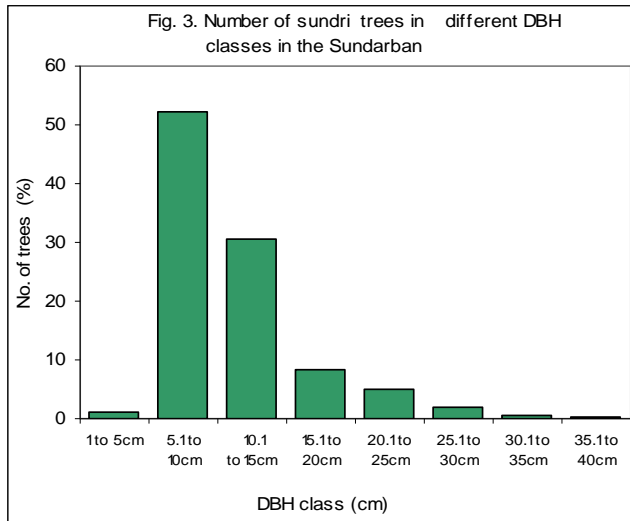
Table 1. Salinity basis PSPs in the Sundarban

Salinity Zone	Sl no.	Location	No. PSP's	No. of Compt.
Less Saline Zone	1.	Nandabala	1	26
	2.	Jongra	3	30
	3.	Supoti(East)	4	3
	4.	Supoti(West)	5	5
	5.	Sarankhola	26	24
	6.	Mirgamari	25	28
	7.	Bagi	6	1
	8.	Dhangmari	13	31
	9.	Koramjol	14	31
	10.	Mora bhola	28	2
Moderate Saline Zone	11.	Charaputia	2	15
	12.	Baniakhali	7	35
	13.	Kashiabad	8	36

Strong Saline
Zone

14.	Alkidives(East)	15	17
15.	Alkidives(West)	16	17
16.	Bosboja(East)	22	37
17.	Bosboja(West)	23	37
18.	Kalabogi	24	32
19.	Katka	27	7
20.	Bhadra	29	29
21.	Gewakhali(W)	11	38
22.	Sonamukhi khal	12	41
23.	Ball River	17	41
24.	Kadamtala	18	46
25.	Chunkuri(East)	19	47
26.	Chunkuri(West)	20	47
27.	Kateshor	21	46
28.	Koikhali	30	47
29.	Burigoalini	9	46
30.	Gewakhali(E)	10	20





- 1.9 Achievement(s), if any** : Thirty Permanent Sample Plots (PSPs) were established in different salinity zones throughout the Sundarban
- 1.10 Financial Statement** :
- 1.10.1 Total cost** : Tk. 10,00,000/=
- 1.10.2 Cost of the year** : Tk. 1,20,000/=
- 1.10.3 Expenditure of the year** : Tk. 1,20,000/=
- 1.10.4 Source of fund** : GOB
- 1.11 Beneficiaries** : FD

- 2. Study** : **On-going**
- 2.1 Programme Area** : Biodiversity and conservation
- 2.2 Title of the Study** : **Centralization and conservation of mangrove vegetation in three salinity zones of the Sundarban.**
- 2.3 Justification** :

Establishment and maintenance of mangrove arboretum is very much essential for conservation of genetic resources and to study taxonomy, ecology, silviculture, genetic diversity etc. of all mangrove species available in the Sundarban.

- 2.4 Objectives** :
- 2.4.1** To conserve mangrove species in their natural habitat.
- 2.4.2** To centralize threatened mangrove species.
- 2.4.3** To observe the flora-fauna interaction over time.
- 2.4.4** To demonstrate flora and fauna in natural habitat in the Sundarban.

- 2.5 Expected output** : Conservation of mangrove species and improvement of biodiversity in the Sundarban.
- 2.6 Study period** : 2006-2016
- 2.6.1 Starting year** : 2006-07
- 2.6.2 Completion year** : 2015-16
- 2.7 Personnel (s)** :
- 2.7.1 Study leader** : A. S. M. Helal Siddiqui, RO
- 2.7.2 Associate** : Dr.M. M. Rahman, DO
- 2.7.3 Associate** : S. M. M. Hasnin, SRO
- 2.8 Progress** :
- 2.8.1 Previous years, if any(.,year) :**

Three conservation plots covering an area of sixty hectares were established at Dhangmari (Com. No. 31), Bogi (Com. No. 24) and Munshiganj (Com. No. 46) in three salinity zones of the Sundarban. Initially it was recorded that there are thirty seven species at Bogi in the less saline zone, thirty one species at Dhangmari in the moderate saline zone and twenty two species at Munshiganj in the strong saline zone of the conservation plots. Dhundul (1.5 ha), kirpa (1.8 ha), passur (0.9 ha), jhana (0.6 ha), khalshi (0.9 ha), Bakul Kankra (0.9 ha), shingra (0.9 ha) and Maricha Baen (0.9 ha) species were centralized in three conservation plots in different saline zones. Growth and survival of those planted species in the conservation plots in different years have been recorded and maintained.

2.8.2 This year :

Action plan as per annual research programme	Progress
a) Demarcation of boundary lines of three plots by clearing jungle and painting of trees.	a) Boundary lines of three plots by clearing jungle and painting of trees were demarcated.
b) Planting of previously raised 7,200 seedlings seedlings of 3 mangrove species namely Bhatkathi (<i>Rhizophora apiculata</i>), Kankra (<i>Bruguiera gymnorhiza</i>) and Dhundul (<i>Xylocarpus granatum</i>).	b) Previously raised 7,200 seedlings seedlings of 3 mangrove species namely Bhatkathi (<i>Rhizophora apiculata</i>), Kankra (<i>Bruguiera gymnorhiza</i>) and Dhundul (<i>Xylocarpus granatum</i>) were planted in the Sundarban.
c) Raising of 7,200 seedlings of 4 mangrove species namely Goran (<i>Ceriops decandra</i>), Khalshi(<i>Aegiceras corniculatum</i>), Amur (<i>Amoora cuculata</i>) and Hantal(<i>Phoenix paludosa</i>) for next year plantation.	c) A total of 7,200 seedlings of 4 mangrove species namely Goran, Khalshi, Amur and Hantal have been raised for next year plantation.
d) Maintenance of previously raised experimental plantations of kirpa (1.8 ha), passur (0.9 ha), jhana (0.6 ha), khalshi (0.9 ha), amur (0.9 ha) bakul kankra(0.9 ha), amdhekur(0.9ha) and Marichabaen(0.9 ha).	d) Previously raised experimental plantations of kirpa (1.8 ha), passur (0.9 ha), jhana (0.6 ha), khalshi (0.9 ha), amur (0.9 ha) bakul kankra(0.9 ha), amdhekur(0.9ha) and Marichabaen(0.9 ha) were

	maintained.
e) Collection of survival and growth data from the experimental plantations twice a year.	e) Survival and growth data from the experimental plantations have been collected twice a year.
f) Compilation and analysis of data.	f) Growth performances of different mangrove species planted in different years in the Sundarbans are shown in Table-1, 2 and 3.

Table-1. Growth performance of kirpa at two locations in the Sundarbans

Name of Location	Year of plantation	Spacing	Av. Height (m)	Av. Dbh (cm)	Av. Survival (%)
Munshigonj	2004	(1x1) m.	2.15	-	97.33
		(1.5x1.5) m	2.13	-	98.67
		(2x2) m	2.85	-	92.00
	2006	(1x1) m.	2.53	-	92.00
		(1.5x1.5) m	3.58	-	98.67
		(2x2) m	3.08	-	92.00
Dhangmari	2004	(1x1) m.	3.20	5.46	89.33
		(1.5x1.5) m	4.67	5.45	100.00
		(2x2) m	4.46	4.93	93.33

Table-2 Growth performance of different mangrove species planted in 2008 in the Sundarbans

Name of Location	Name of species					
	Passur		Khalshi		Jhana	
	Av. ht. (m)	Av. Surv %	Av. ht. (m)	Av. Surv %	Av. ht. (m)	Av. Surv %
Dhangmari	0.52	88	0.74	92	2.56	71
Munshiganj					1.25	15
Bogi	0.38	8	0.50	12	1.02	1

Table-3 Growth performance of different mangrove species planted in 2009 in the Sundarbans

Name of Location	Name of species					
	Baen		Singra		Amur	
	Av. ht. (m)	Av. Surv. %	Av. ht. (m)	Av. Surv. %	Av. ht. (m)	Av. Surv. %
Dhangmari	1.40	25	-	-	0.76	95
Munshigonj	-	-	-	-	0.90	31
Bogi	-	-	0.72	39	0.85	54

2.9 Achievement(s), if any :

Three conservation plots (Twenty hectares at each saline zone) were established at Dhangmari (Com. No. 31), Bogi (Com. No. 24) and Munshiganj (Com. No. 46) in the Sundarban. Five mangrove species were centralized in the three conservation plots of the Sundarban.

- 2.10 Financial Statement** :
- 2.10.1 Total cost** : Tk.14,00,000/=
- 2.10.2 Cost of the year** : Tk. 2,10,000/=
- 2.10.3 Expenditure of the year** : Tk. 2,10,000/=
- 2.10.4 Source of fund** : GOB
- 2.11 Beneficiaries** : FD, Universities, NGOs, Researchers, Visitors, Students.
- 3. Study** : **On-going**
- 3.1 Programme Area** : Plantation Technique and Forest Management
- 3.2 Title of the Study** : **Growth performance of mangrove and non-mangrove experimental plantations in the Sundarban.**
- 3.3 Justification** :
- There are poorly stocked less productive areas in the Sundarban. The Mangrove Silviculture Division studied the growth performance of mangrove and non-mangrove species in poorly stocked less productive areas of the Sundarbans since 1988. Those are all preliminary results of planted mangrove and non-mangrove species. So, monitoring or continuous investigation up to several years are to be needed to find out the actual performance of mangrove species with a view to study the survival, establishment and growth of these mangrove species.
- 3.4 Objectives** :
- 3.4.1.** To determine the growth performance of mangrove and non-mangrove experimental plantations in the Sundarban
- 3.5 Expected output** :
- Determination of growth and yield of the planted mangrove species over poorly stocked areas and non mangrove species on the raised lands of the Sundarban and to increase the productivity of the mangrove forest.
- 3.6 Study period** : 2006-2016
- 3.6.1 Starting year** : 2006-07
- 3.6.2 Completion year** : 2015-16
- 3.7 Personnel (s)** :
- 3.7.1 Study leader** : A. S. M. Helal Siddiqui, RO
- 3.7.2 Associate** : Dr.M. M. Rahman, DO
- 3.7.3 Associate** : S. M. M. Hasnin, SRO
- 3.8 Progress** :
- 3.8.1 Previous years, if any(..year)** :

A total of 3.5 ha mangrove and 3.5 ha non-mangrove species plantations were maintained. Growth data of one non-mangrove (Jarul- *Legerstroemia speciosa*) and eight mangrove species (Sundri- *Heritiera fomes*, gewa- *Excoecaria agallocha*, goran- *Ceriops decandr*, kirpa- *Lumnitzera racemosa*, passur (*Xylocarpus mekongensis*), kankra (*Bruguiera gymnorrhiza*), amur (*Amoora cucullata*), khalshi (*Aegiceras corniculatum*) were recorded and analyzed. Growth performance of Jarul is very promising in the raised land of the Sundarban. Average survival percentage of jarul was 83 and average height was 6.9m & average DBH 12.2cm at the age of 15 years at Khatakhali in the less saline zone of the Sundarban. The average of survival of sundri, gewa and kirpa were 21%, 70% and 63% as well as average height of those species were 1.8m, 5.0m and 5.5m respectively at the age of 14 years at Burigoalini in the strong saline zone. The average of survival of jhana and gewa were 26% and 86% as well as average height of those species were 5.6m and 3.2m respectively at the age of 11 years at Khashitana in the strong saline zone of the Sundarban. The average of survival of gewa and goran were 61% and 55% as well as average height of those species were 2.1m and 1.6m respectively at the age of 10 years at Andermanik in the strong saline zone of the Sundarban

3.8.2 This year

:

Action plan as per annual research programme	Progress
a) Maintenance of 3.5 ha mangrove and 3.5 ha non-mangrove experimental plantations.	a) A total of 3.5 ha mangrove and 3.5 ha non-mangrove species plantations were maintained
b) Collection of growth data (Survivability, height, dbh, bole height, etc.) from the experimental plantations.	b) Survival and growth data (Survivability, height, dbh, bole height, etc.) have been recorded from the experimental plantations.
a) Compilation and analysis of data.	c) Growth performances of different mangrove and non-mangrove species planted in different years in the Sundarbans are shown in Table-1, 2 and 3.

Table-1. Growth performance of Jarul planted at Katakhal and Bogi

Research Station	Year of plantation	Spacing	Height (m)	DBH (cm)
Dhangmari	1996	1.5mx 1.5m	6.98	14.39
		1.75m x 1.75m	6.19	15.93
		2.0m x 2.0m	6.50	14.05
Bogi	1993	1.5mx 1.5m	9.83	13.20
		1.75m x 1.75m	8.88	11.80
		2.0m x 2.0m	8.10	12.00

Table-2. Growth performance of different mangrove species at Burigoalini in different years of the Sundarbans.

Name of Location	Year of plantation	Name of species	Av. ht. (m)	Av. dbh (cm)	Av. Surv. (%)
Burigoalini	1995	Sundri	2.73	-	14
		Gewa	5.43	4.78	52
		Kirpa	4.61	4.30	63
	1999	Gewa	2.29	-	66
		Goran	2.25	-	74

		Kankra	4.67	5.16	23
		Khalshi	2.56	-	82
		Jhana	8.20	12	2

Table-3. Growth performance of mangrove species at different locations in the Sundarbans.

Name of Location	Year of plantation	Name of species	Av. height (m)	Av.dbh (cm)	Av.Survival (%)
Khashitana	1997	Gewa	4.59	5.41	76
		Goran	2.29	-	51
		Jhana	6.44	7.57	26
	1998	Gewa	2.58	-	67
	1999	Sundri	1.51	-	42
Andermanik	1999	Goran	1.73	-	60
		Gewa	2.97	4.49	61
Kadamtala	2000	Sundri	1.25	-	42
		Gewa	3.26	-	84
		Amur	0.85	-	5

3.9 Achievement(s), if any : Plantations of 3.5 ha mangrove and 3.5 ha non-mangrove species were established in the Sundarban.

3.10 Financial Statement :

3.10.1 Total cost : Tk.9,00,000/=

3.10.2 Cost of the year : Tk. 80,000/=

3.10.3 Expenditure of the year : Tk. 80,000/=

3.10.4 Source of fund : GOB

3.11 Beneficiaries : FD, NGOs.

4. Study : **On-going**

4.1 Programme Area : Biodiversity and conservation

4.2 Title of the Study : **Development of a mangrove museum.**

4.3 Justification :

Establishment of a mangrove museum is very much essential for preservation and demonstration of the flora and faunal specimens of the Sundarban to the students, researchers and general people of the country which will create awareness and will help protect and preserve the Sundarban ecosystem.

4.4 Objectives :

4.4.1 To collect and preserve the representative specimens of flora and fauna from the Sundarban.

4.4.1 To demonstrate the specimens of flora and fauna to the students, teachers, researchers and visitors.

4.5 Expected output : Establishment of a mangrove museum housing representative flora and fauna of the Sundarban.

4.6 Study period : 2008-2016

4.6.1 Starting year : 2008-09

4.6.2 Completion year : 2015-16

- 4.7 Personnel (s)** :
- 4.7.1 Study leader** : S M. M. Hasnin, SRO
- 4.7.2 Associate** : Dr. M. M. Rahman, DO
- 2.7.3 Associate** : A. S. M. Helal Siddiqui, RO.
- 4.8 Progress** :
- 4.8.1 Previous years, if any(..year)** :

Museum room was renovated. One digital camera, two iron racks, one multipurpose almirah, 2 display board, two wooden plant press, 20 glass containers, 5 gallons formaldehyde and 15 camera films were purchased. Twelve wood samples of mangrove tree species were prepared. Thirty floral specimens (propagules, fruits) and 20 fish specimens were collected and preserved in the museum. Fifteen herbarium specimens of mangrove species have been prepared. One documentary film of Sundarban was prepared and 100 still pictures were printed.

4.8.2 This year :

Action plan as per annual research programme	Progress
a) Collection and preservation of fleshy fruits, plant parts and available faunal specimens from the Sundarbans.	a) Fleshy fruits and plant parts of major mangrove species' specimens and fifteen fish specimens have been collected from the Sundarbans and preserved in the museum.
b) Maintenance of previously collected flora and faunal specimens in the museum.	b) Previously collected flora and faunal specimens from the Sundarban in the museum were maintained.
c) Preparation of videos, still pictures, digital pictures and lamination of still pictures.	c) 100 nos of still pictures of different sizes were printed and laminated.
d) Collection and reprocessing of hides of tiger, deer, crocodile, snake, etc.	d) One number of tiger hide, two pieces of deer hide and one piece of lizard skin have been collected and demonstrated in the Mangrove museum.

- 4.9 Achievement(s), if any** :
- A museum has been established at the Divisional Head Quarter of Mangrove Silviculture Division, Khulna in 2002 having 55 flora and 50 faunal specimens and twelve wood samples of mangrove tree species.
- 4.10 Financial Statement** :
- 4.10.1 Total cost** : Tk.10,00,000/=
- 4.10.2 Cost of the year** : Tk.75,000/=
- 4.10.3 Expenditure of the year** : Tk. 75,000/=
- 4.10.4 Source of fund** : GOB
- 4.11 Beneficiaries** :

- 5. Study : On-going**
- 5.1 Programme Area : Biodiversity and conservation**
- 5.2 Title of the Study : Heart rot disease of Pasur (*Xylocarpus mekongensis*) trees in the Sundarban.**
- 5.3 Justification :**

The major mangrove tree species are being affected by different disorders and diseases. Many valuable forest resources have been lost over last few decades and years. There are many climate vulnerable species are going to be threatened and endangered and some are being extinct in the Sundarbans. Poor and insignificant natural regeneration of the mangrove species with both timber and non timber are decreasing due to global warming and increasing water salinity, sedimentation, insufficient up stream water flow. Implementation of the illicit cutting and application of management policies and other environmental causes some mangrove species are to be depleted, some are being rare and some are being endangered and extinct. Pasur, a commercially valuable deciduous multipurpose tree species is affected by heart rot problem. As a result the condition is characterized by a gradual loss of tree vigor which can lead to tree death and dieback or decline. The species is affected by heart rot diseases. Heart rot is generally regarded as a condition locally known as "dhor". It is characterized by the gradual death of the crown starting first with small twigs and then gradually larger branches die and lignin portion of the stem becomes useless. The fruit body, gall and cankers are developed on the different portion of the standing trees. Some environmental factors i.e. water salinity, soil contents, water turbidity, sedimentation and successional changes are also responsible for the heart rot problem". This is a great loss to the forest ecosystem and the country. Considering the disorders of the economic important species it needs integrated research to overcome and to detect infestations of the problems heart rot disease of pasur in the Sundarbans. The purposes of this study is to know the vegetation status and heart rot disease status of pasur. To determine the infection condition with causal factors (pathogen) for heart rot of pasur and to high light its important uses.

5.4 Objectives :

- 5.4.1** To determine the infestation status of pasur in the Sundarban.
- 5.4.2** To determine the environmental factors responsible for heart rot disease of pasur.
- 5.4.3** To identify the causal organism of heart rot disease.
- 5.4.4** To develop management plan for pasur.

5.5 Expected output :

The study will help to develop management strategy of the threatened and climate vulnerable major mangrove species of the Sundarbans. Standardized experimental nursery will be raised. Trial plantation will be raised poorly regenerated area, in the newly accreted char land area of the Sundarbans and its buffer zone. The low lying swampy area and catchments areas of the Sundarbans will be designated by the healthy seedlings of the threatened species as well as other associated species.

5.6 Study period : 2009-12

5.6.1 Starting year : 2009-10

- 5.6.2 Completion year** : 2011-12
- 5.7 Personnel (s)** :
- 5.7.1 Study leader** : A. S. M. Helal Siddiqui, RO.
- 5.7.2 Associate** : Dr. M. M. Rahman, DO
- 5.7.3 Associate** : S M. M. Hasnin, SRO
- 5.8 Pogress** :
- 5.8.1 Previous years, if any(..year) :**

The infestation status of heart rot disease of pasur vary in different locations of the Sundarbans. The analyzed result shows that it is heavily infested in Kalbogi (69%). Then followed by Baniakhali (65%), Kasiabad (55%) and Dhangmari only (5%). The results also show that total regeneration including seedlings, saplings and trees per hectare of these locations are 67,334 at Kalabogi, 75,998 at Baniakhali, 52,666 at Kashiabad and 1,20,330 at Dhangmari. The real constitution of passur trees per hectare areas are 109 nos. at Baniakhali, 106 nos. at Kalabogi, 105 nos. at Kashiabad and 20 nos. at Dhangmari. The decay wood samples have been tested at the Pathological laboratory of Forestry and Wood technology Discipline, Khulna University. The pathogens are identified locally and internationally. The Isolets of pure culture of fungal pathogen were sent to the International Mycological Institute, U.K. for confirmation of identification. The Institute very cordially identified two pathogens among the sent samples. The Institute reported that *B 398422 Phanerochaetaceae sp.* top match of 100% to an unpublished *Phanerochaete subglobosa*; top published choice >98% to *Ceriporiopsis*. Both these taxa belong to Phanerochaetaceae, a family of white-rot or wood inhabiting saprobes; the basidioma range from polyporoid to resupinate. Report from Dr P.M. Kirk. The other reports followed as-*C 398423 Schizophyllum commune Fr. 1815*. A very common and globally distributed species which is saprobic on many types of woody substrata. Report from Dr P.M. Kirk. and *D 398424 Schizophyllum commune Fr. 1815*. Results from an analysis of molecular data showed a very close match (>99%) to this species, which is of global distribution and is considered a saprobe of many tree species in addition to other plants; Report from Dr P.M. Kirk.

5.8.2 This year :

Action plan as per annual research programme	Progress
a) Four more sites will be selected for collecting the infestation status of heart rot disease of passur.	a) The Sundarbans were visited for collecting the infestation status of heart rot disease of pasur and four sites were selected.
b) Collection of soil and plant samples (pneumatophore, stem, fruit body, leaf, twig and little branches) from the selected sites of the Sundarban for experimental analysis.	b) Soil and plant samples (pneumatophore, stem, fruit body, leaf, twig and little branches) from the selected sites of the Sundarban were collected for experimental analysis.
c) Collection of data on regeneration status,	c) Data on infestation status, water salinity, soil pH, inundation and siltation from affected and unaffected areas were recorded.

infestation, water salinity, soil pH, inundation and siltation from affected and unaffected areas.	
d) Raising plantation with the previously raised seedlings.	d) Experimental plantations were raised at three locations of the Sundarban.
e) Compilation of data.	e) Soil data have been analyzed. Analyzed soil samples vary place to place. The results also vary in different depths. The soil samples were collected 15cm, 30cm and 45cm depths in all the 4 locations eg. Kalabogi (compartment-32), Baniakhali (Compartment-35), Kashiabad (Compartment-36) and Dhangmari (Compartment-31).

Fig-1. Regeneration status of pasur in different locations of the Sundarban per ha.

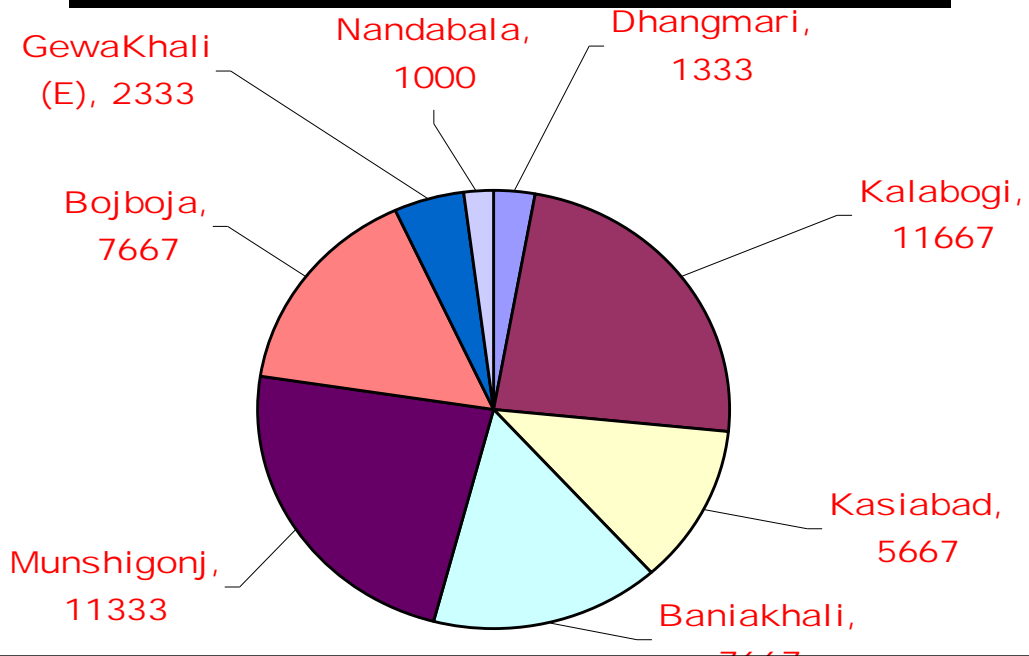
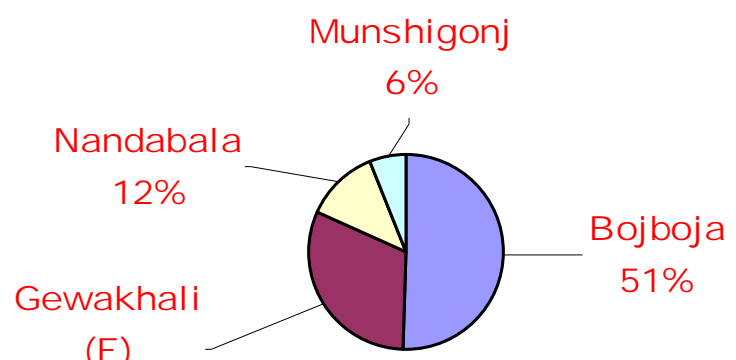


Fig-2. Heart Rot affected passur trees in different locations in the Sundarban (%)



5.9 Achievement(s), if any :

The causal organism of heart rot disease of passur trees are identified locally and internationally. The Isolets of pure culture of fungal pathogen were sent to the International Mycological Institute, U.K. for confirmation of identification. The Institute very cordially identified two pathogens among the sent samples. The identified two fungal pathogens are *Phanerochaete subglobosa* and *Schizophyllum commune*. Based on this results a Ph. D thesis has been submitted at the Department of Botany, Jahangirnagar University.

5.10 Financial Statement :

5.10.1 Total cost : Tk.4,50,000/=

5.10.2 Cost of the year : Tk.1,00,000/=

5.10.3 Expenditure of the year : Tk.1,00,000/=

5.10.4 Source of fund : GOB

5.11 Beneficiaries :

6. Study : **On-going**

6.1 Programme Area : Biodiversity and conservation

6.2 Title of the Study : **Development of nursery and plantation techniques of khalshi (*Aegiceras corniculatum*) in the coastal zone of Bangladesh.**

6.3 Justification :

Khalshi (*Aegiceras corniculatum*) is an important honey producing mangrove species in the Sundarban. Nursery and plantation techniques of this species are most essential for conservation of the species in the Sundarban because the natural population of the species has declined in a large scale.

6.4 Objectives :

6.4.1 To develop nursery and plantation techniques of Khalshi.

6.4.2 To conserve and extension of the species.

6.5 Expected output :

Development of nursery and plantation techniques of Khalshi. Extension and conservation of the species, honey production, employment and income generation.

6.6 Study period : 2010-2015

6.6.1 Starting year : 2010-11

6.6.2 Completion year : 2014-15

6.7 Personnel (s) :

6.7.1 Study leader : Dr. M. M. Rahman, DO

6.2 Associates : S. M. M. Hasnin, SRO

6.7.3 : A. S. M. Helal Siddiqui, RO

6.8 Progress :

6.8.1 Previous years, if any(..year):

A total number of 15,000 propagules (seeds) of khalshi were collected from the Sundarban and 9,000 seedlings were raised for experimental plantations in three salinity zones of the Sundarban. Data on soil pH, water salinity, light intensity, inundation and siltation in the selected sites were recorded. Germination of the seeds, survival and growth performance of the seedlings in the nursery were recorded.

6.8.2 This year :

Action plan as per annual research programme	Progress
a) Raising plantation with the previously raised seedlings.	a) Experimental plantations were raised at three locations of the Sundarban.
b) Collection of propagules (seeds) from the Sundarban and nursery raising.	b) Propagules (seeds) of khalshi were collected from the Sundarban and 9,000 seedlings were raised for next year experimental plantation.
c) Collection of data on soil pH, water salinity, light intensity, inundation and siltation in the selected sites.	c) Data on soil pH, water salinity, light intensity, inundation and siltation in the selected sites were recorded.
d) Observation on germination of the seeds, survival and growth performance of the seedlings in the nursery.	d) Germination of the seeds, survival and growth performance of the seedlings in the nursery were recorded.
e) Maintenance of nursery.	e) Nurseries were properly maintained.
f) Data collection and analysis.	f) Data were collected and analyzed.

6.9 Achievement(s), if any :

Three experimental plantations of Khalshi (*Aegiceras corniculatum*) were raised at three locations of the Sundarban.

6.10 Financial Statement :

6.10.1 Total cost : Tk.12,00,000/=

6.10.2 Cost of the year : Tk. 1,90,000/=

6.10.3 Expenditure of the year : Tk. 1,90,000/=

6.10.4 Source of fund : GOB

6.11 Beneficiaries :

- 7. Study : On-going**
- 7.1 Programme Area : Social forestry
- 7.2 Title of the Study : **Development of homestead forest and environment to support the rural people living adjacent to the Sundarban.**

7.3 Justification :

Bangladesh is experiencing deforestation, degradation of existing forest, biomass shortage and decline in livelihood status of people living adjacent to the forest. According to different scenarios, the carbon dioxide concentration in the atmosphere has been increasing dramatically. The deterioration of world's single largest mangrove forest has also led to decline in environmental service functions at local, national and global level. This is associated with human pressure, illegal felling, fuel wood collection, sudden onslaught of top dying in major species, etc. causing deterioration of major mangrove ecosystem which ultimately declines hundreds of hectares carbon sinks. With this view, the feasibility study will be conducted in the surrounding villages of the Sundarban. It is expected that the study will provide empirical evidence on carbon leakage, the rate of carbon sequestration, carbon storage/carbon stock through empowering/encouraging mangrove dwellers to restore their homesteads for sustainable livelihood as well as for enhancing carbon sinks.

7.4 Objectives :

- 7.4.1 To explore present livelihood status of local mangrove dwellers.
- 7.4.2 To assess homestead vegetation of the mangrove dwellers.
- 7.4.3 To develop homestead forest of the mangrove dwellers for decreasing pressure on the resources of the Sundarban and to improve the environment as well.

7.5 Expected output :

Development of socio-economic status by increasing homestead forest of the adjacent people of the Sundarban which will ultimately decrease pressure on the Sundarban.

7.6 Study period :

7.6.1 Starting year :

7.6.2 Completion year :

7.7 Personnel (s) :

7.7.1 Study leader : S. M. M. Hasnin, SRO

7.7.2 Associate : Dr.M. M. Rahman, DO

7.7.3 Associate : A. S. M. Helalsiddique, RO

7.8 Progress :

7.8.1 Previous years, if any(..year):

Three villages adjacent to the Sundarban have been selected for conducting this study. Among these three villages, one is Central Kalinagar at Shamnagar in Satkhira and the other two are Rayenda and Tafalbari at Sarankhola in Bagherhat. Ninety farmers have been selected in those three villages adjacent to the Sundarban for evaluating long term livelihood security analysis in different stages. A number of 12,000 seedlings have been distributed among the selected farmers and other people living adjacent to the Sundarban.

7.8.2 This year :

Action plan as per annual research programme	Progress
a) Selection of 3 new villages of the Sundarban for conducting this study.	a) Three new villages adjacent to the Sundarban have been selected for conducting this study. Among these three villages, one is Chila Bazar at Mongla in Khulna and the other two are Kadamtala at Shamnagar in Satkhira and Bogi at Sharankhola in Bagherhat.
b) Arrangement of 3 meetings for awareness development and collection of information about livelihood status of local people adjacent to the Sundarban.	b) Three meetings have been conducted at the three selected villages for awareness development and collection of information about livelihood status. Socio-economic status of the people, living adjacent to the Sundarban has been studied. Ninety farmers have been selected in those three villages adjacent to the Sundarban for evaluating long term livelihood security analysis in different stages through questionnaires. Land wise category of people with their homestead area has been shown in fig 1, 2 and 3.
c) Raising people demanding seedlings.	c) A number of 9,000 seedlings of raintree, akashmoni, neem, koroï and mehogany have been raised according to stakeholders' demands.
d) Distribution of seedlings among the mangrove dwellers.	d) Raised 9,000 seedlings of raintree, akashmoni, neem, koroï and mehogany have been distributed among the selected farmers.
e) Collection of growth and survival data from the experimental areas.	e) Growth and survival data have been collected from the experimental areas.

Fig. 1. Landwise category of people of Cillabazar, Mongla with their average homestead

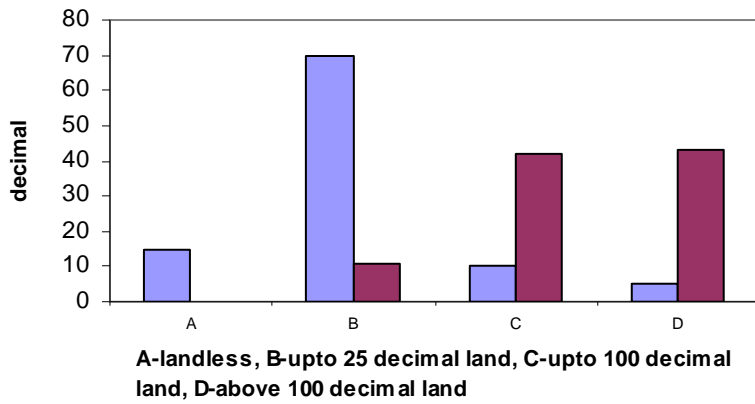


Fig. 1. Landwise category of people of Kadamtola, Munshiganj with their average homestead

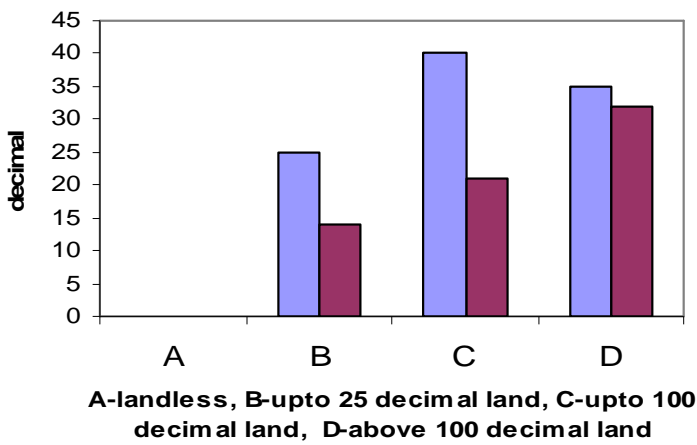
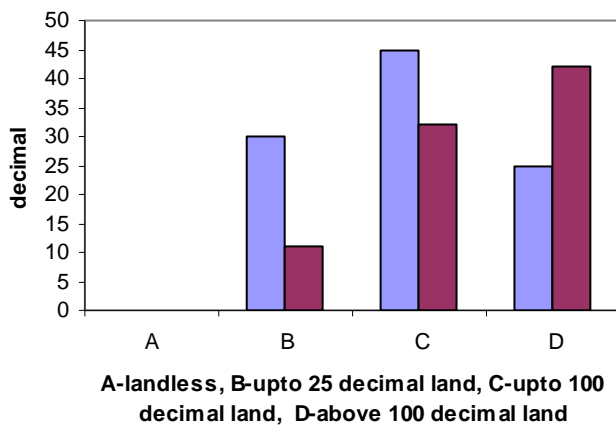


Fig. 1. Landwise category of people of Bogi with their average homestead



7.9 Achievement(s), if any :
Farmers level stakeholders have been selected in three villages adjacent to the Sundarban for evaluating long term livelihood security analysis in different stages.

7.10 **Financial Statement** :

7.10.1 Total cost : Tk.3,50,000/=

7.10.2 Cost of the year : Tk. 75,000/=

7.10.3 Expenditure of the year : Tk. 75,000/=

7.10.4 Source of fund : GOB

7.11 **Beneficiaries** :

8. **Study** : **On-going**

8.1 Programme Area : Breeding and Tree Improvement

8.2 Title of the Study : **Selection and development of the top dying tolerant sundri (*Heritiera fomes*) trees in the Sundarban.**

8.3 Justification :

A lot of sundari trees have been dying due to a disorder known as top dying. Studies have been conducted but actual cause for the disorder has not yet been ascertained. So, a study for improvement of the species is necessary.

8.4 **Objectives** :

8.4.1. To develop a pure line of top dying tolerant sundri trees.

8.5 Expected output :

Selection and development of top dying resistant sundri trees in the Sundarban.

8.6 **Study period** : 2008-2016

8.6.1 **Starting year** : 2008-2009

8.6.2 **Completion year** : 2015-16

8.7 Personnel (s) :

8.7.1 **Study leader** : Dr. M. M. Rahman, DO

8.7.2 **Associate** : S. M. M. Hasnin, SRO

8.7.3 **Associate** : A. S. M. Helal Siddiqui, RO

8.8 **Progress** :

8.8.1 Previous years, if any(..year):

Forty numbers (10 nos. in each location) of healthy (disease free) sundari trees have been selected for development of pure line in the Sundarban. The average height, bole height and DBH of the selected healthy (disease free) sundari trees were 10.8m, 7.5m and 16.2cm

respectively at Bholarpar (compt. No. 24) in the less saline zone. The average height, bole height and DBH of the selected healthy (disease free) sundari trees were 10.6m, 6.3m and 16.6cm respectively at Bojbaja (compt. No. 37) in the moderate saline zone. The average height, bole height and DBH of the selected healthy (disease free) sundari trees were 10.1m, 4.9m and 17.8cm respectively at Kalabogi (compt. No. 33) in the moderate saline zone. The average height, bole height and DBH of the selected healthy (disease free) sundari trees were 15.8m, 8.3m and 22.7cm respectively at Kalabogi Khal (compt. No. 32) in the moderate saline zone. Average DBH and height of selected sundri trees at different locations of the Sundarban are shown in Fig. 1. The water salinity of Bholarpar (compt. No. 24), Bojbaja (compt. No. 37), Kalabogi (compt. No. 33) and Kalabogi Khal (compt. No. 32) were recorded 2ppt, 21ppt, 19ppt and 20ppt respectively in May, 2009. The soil pH of Bholarpar (compt. No. 24), Bojbaja (compt. No. 37), Kalabogi (compt. No. 33) and Kalabogi Khal (compt. No. 32) were 4.2, 5.4, 6.0 and 6.2 respectively. Inundation was regular in all the experimental sites. Siltation / erosion gauge have been placed in each location.

8.8.2 This year :

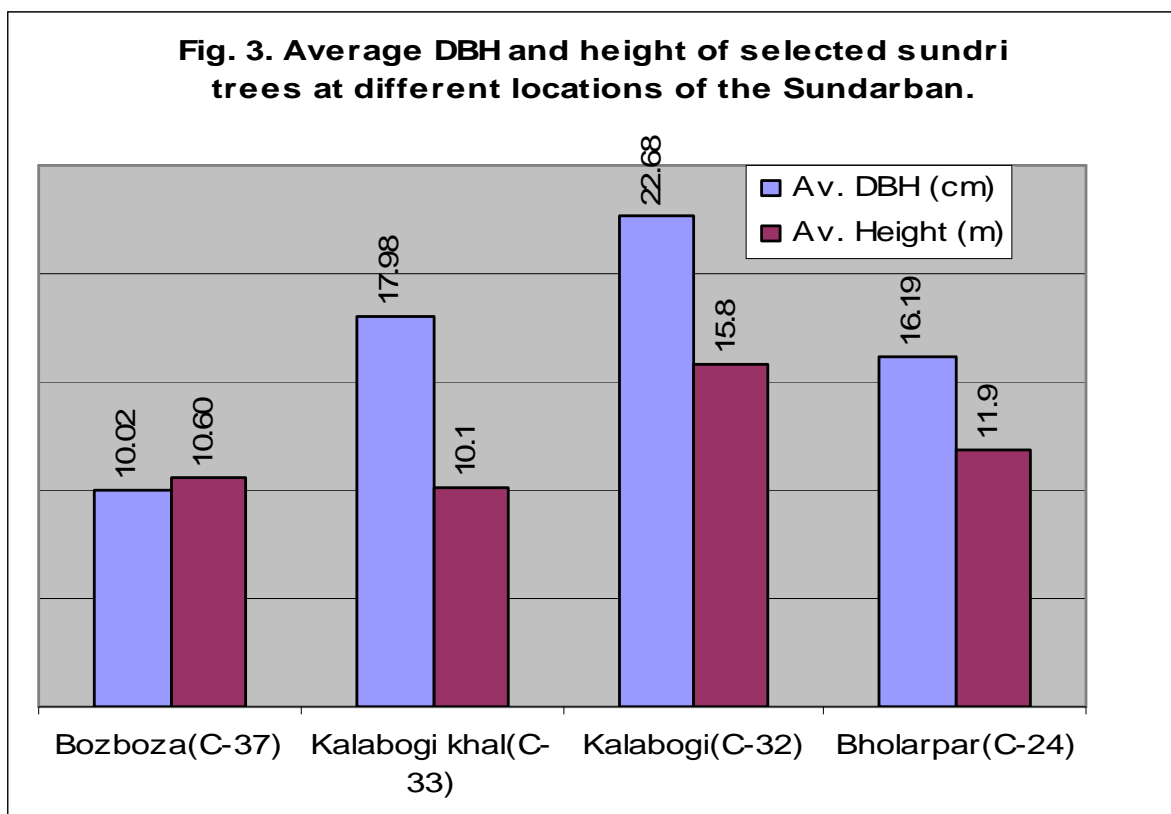
Action plan as per annual research programme	Progress
a) Planting of previously raised seedlings of selected sundari trees at three locations of the Sundarban.	a) Raised seedlings of selected sundari trees at three locations of the Sundarban have been planted.
b) Observation of flowering and fruiting behaviors in the selected trees.	b) Flowering and fruiting behaviors of the selected trees have been observed and recorded.
c) Collection of data on soil pH, water salinity, light intensity, inundation and siltation in the selected sites.	c) Data on soil pH, water salinity, light intensity, inundation and siltation in the selected sites have been collected.
d) Collection of seeds from the selected trees.	d) Eight thousand seeds from the selected sundari trees have been collected.
e) Raising seedlings at H/Q, Bogi and Dhangmari Research Stations for next year plantations.	e) Six thousand seedlings have been raised at Bogi and Dhangmari Research Stations for next year plantations.
f) Observation on germination of the seeds, survival and growth performance of the seedlings in the nursery.	f) Germination of the seeds, survival and growth performance of the seedlings in the nursery have been recorded.
g) Data compilation	g) Germination success, average height before planting and growth performance of sundari in different locations of the Sundarban at the age of one year are shown in Table – 1,2. Average DBH and height of selected sundri trees at different locations of the Sundarbans is shown in figure-3.

Table-1. Raising nursery with sundari seeds collected from different locations of the Sundarban in 2010.

Sl. No.	Location	Compt. No.	No. of seeds sown	Initiation of germination (days)	Completion of germination (days)	Germination Success (%)	Average height at the age of 10 months (cm)
1.	Kalabogi	32	2000	9	55	85	30
2.	Kalabogi Khal	33	2000	6	44	76	27
3.	Bojbaja	37	2000	11	51	71	26
4.	Bhola Nadir Par, Sarankhola	24	2000	7	48	87	34

Table-2. Growth performance of sundari in different locations of the Sundarban at the age of one year.

Sl. No.	Location	Compt. No.	Survival percentage (%)	Average height (cm)
1.	Kalabogi	32	98	43
2.	Kalabogi Khal	33	92	47
3.	Bojbaja	37	95	39
4.	Bhola Nadir Par, Sarankhola	24	89	50



8.9 Achievement(s), if any :
Forty numbers (10 nos. in each location) of healthy (disease free) sundari trees have been selected for development of pure line in the Sundarban.

8.10 **Financial Statement** :

8.10.1 Total cost : Tk. 16,40,000/=

8.10.2 Cost of the year : Tk. 90,000/=

8.10.3 Expenditure of the year : Tk. 90,000/=

8.10.4 Source of fund : GOB

8.11 **Beneficiaries** :

9. **Study** : **New**

9.1 Programme Area : Post harvest utilization-Chemical processing

9.2 Title of the Study : **Investigation on the unused part of harvested golpata (*Nypa fruticans*) from the Sundarban.**

9.3 Justification :

Golpata (*Nypa fruticans*) is an economically important mangrove species in the Sundarbans. A huge amount of golpata leaves are harvested annually. At the time of harvesting the unused part of leaves are left in the Sundarbans. That is why the better utilization and management with the unused part of harvested golpata are to be determined.

9.4 **Objectives** :

9.4.1. To explore the remaining part of harvested golpata for better utilization and management.

9.5 Expected output :

Determination of better utilization and management with the remaining part of harvested golpata.

9.6 **Study period** : 2011-2013

9.6.1 Starting year : 2011-2012

9.6.2 Completion year : 2012-13

9.7 Personnel (s) :

9.7.1 **Study leader** : Dr. M. M. Rahman, DO

9.7.2 **Associate** : S. M. M. Hasnin, SRO

9.7.3 **Associate** : A. S. M. Helal Siddiqui, RO

9.8 **Progress** :

9.8.1 Previous years, if any(..year): Not applicable

9.8.2 This year :

Action plan as per annual research programme	Progress
a) Field visit and survey of golpata extraction areas in the Sundarban.	a) Golpata extraction areas of the Sundarban were visited.
b) Collection of materials (remaining part of harvested golpata) for lab analysis.	b) Materials (remaining part of harvested golpata) were collected for lab analysis.
c) Data compilation and reporting.	c) Data have been collected and colated.

9.9 Achievement(s), if any : Not applicable

9.10 **Financial Statement** :

9.10.1 Total cost : Tk.2,50,000/=

9.10.2 Cost of the year : Tk. 60,000/=

9.10.3 Expenditure of the year : Tk. 60,000/=

9.10.4 Source of fund : GOB

9.11 **Beneficiaries** :

FOREST PROTECTION DIVISION

1. **Study** : **On-going**

1. Programme Area: Forest Pests and Diseases

1.2 Title of the Study : **Development of improved techniques of initiation for agar in agar trees (*Aquilaria malaccensis* Lam.)**

1.3 Objectives : **1.3.1 To develop improved techniques of artificial initiation of agar in agar trees.
1.3.2 To train agar entrepreneurs with advanced knowledge on agar production and extraction.**

1.4 Expected output : **Increased production of agar will be ensured**

1.5 **Study period** :

1.5.1 Starting year : 2005-2006

1.5.2 Completion year : 2012-2013

- 1.6 Personnel :
- 1.6.1 Study Leader : Md. Rafiqul Islam, D.O.
- 1.6.2 Associates : Md. Zillur Rahman (RA-1)
Kazi Asad-uz-zaman (F. I)
Shameema Nasreen (F.I)

1.7 **Progress**

1.7.1 Previous year, if any(2010-2011)

Selected agar trees(30) in agar plantations of Fasiakhali (Cox’s Bazar north), Baroduara (Chittagong south), Baghyhut (Chittagong south) (Moulvibazar) were treated with different nailing densities (1-5cm) in March and April. Agar enriched wood core samples and drilled agar trees. Following fungi were identified; *Mucor* sp., *Penicillium* sp. and four unidentified for nailing and three unidentified for drilling and *Alternaria solani*, *Aspergillus niger*, *Cochliobolus lunatus*, *Mucor* sp., *Yeast* sp., *Fusarium* sp., *Alternaria* sp., *Sclerotinia fructicola* and five unidentified for air-spora Forty participants were trained at BFRI auditorium, Chittagong.

1.7.2 This year

Action plan as per annual research programme	Progress
a. Nailing of selected agar trees	About 50 selected agar trees in agar plantations of Fashiakhali (Cox’s Bazar North), Baroduara (Chittagong South), Korerhut (Chittagong north), Baghyhat (Chittagong Hill Tracts North), Lathitila (Moulvibazar) and Baghmara (Moulvibazar) were treated with different nailing densities (1-5 cm) in September , November, May and June.
b. Field trials of CA kit technique at Govt. and private agar plantation	Could not be done.
c. Collection & identification of fungi	Agar-enriched wood core samples were collected from previously nailed and drilled agar trees. Following fungi were identified; <i>Mucor</i> sp., <i>Penicillium</i> sp. and four unidentified for nailing and three types of fungus like <i>Aspergillus</i> sp., <i>Curvularia</i> sp. and <i>Botryodiplodia</i> sp. are identified from air spora.
d. Harvesting & assessment of samples	Samples were collected from selected site of Agar plantation viz. Fasiakhali (Cox’s Bazar), Baroduara (Chittagong south), Baghyhat (Chittagong Hill Tracts North), Lathitila (Moulvibazar) and Baghmara & Lawachara (Moulvibazar). Primary result suggested that the site of Moulazvibazar showed better for agar formation than another site.
e. Visit to new agar plantation	
f. Training to the entrepreneurs	Forty participant of Agar cultivators, extractors and traders were trained at BFRI auditorium, Chittagong.

1.8 Achievement(s), if any : Nailing distance of 4cm shows best performance for agar formation. Primary result suggested that the site of Moulazvibazar showed better for agar formation than another site

1.9 **Financial Statement** :

1.9.1 Total cost : Tk. 15,00,000/- (approx.)

1.9.2 Cost of the year : Tk. 76,000/- (approx.)

1.9.3 Expenditure of the year : Tk. 67,000/- (approx.)

1.9.4 Source of fund : GOB

1.10 **Beneficiaries** : Forest Department, agar industry owners, agar planters, NGOs and general public.

2. **Study** : **On-going**

2.1 Programme Area : Forest Pests and Diseases

2.2 Title of the Study : **Major pests and diseases of commercially important medicinal plants and their management**

2.3 **Objective(s)** :

1.3.1 : To identify pests and pathogens of commercially important medicinal plants

2.3.2 : To determine the nature and extent of damage by each pest and pathogen

2.3.3 : To know the biology and ecology of key pests and pathogens

2.3.4 : To develop/adapt suitable management techniques for key pests/pathogens

2.4 Expected output : Increased production of commercially important medicinal plants will be ensured

2.5 **Study period**

2.5.1 Starting year : 2005-2006

2.5.2 completion year : 2012-2013

2.6 Personnel(s) :

2.6.1 Study Leader : Md. Rafiqul Islam, D.O.

2.6.2 Associates : Md. Zillur Rahman (RA-1)

Kazi Asad-uz-zaman (F. I)

Shameema Nasreen (F.I)

2.7 **Progress** :

2.7.1 Previous years, if any(2010-2011)

Different kinds of insects like, scale insect, mealy bug, leaf beetle, shoot borer (Micro-Lepidopteran) defoliator on basak were recorded from Bogra, Natore, Gaibandha, Rangpur, Sirajgong, Tangail, Naogaon, FPD and MFPD nursery of BFRI campus. A Epilachna beetle was collected from Sirajgong first time. Tulsi was seriously infested by a sapsucker which was identified as spittle bug.

Causal agent of root rot and leaf blight of ashwagandha, identified as *Fusarium solani*, and *Alternaria citri*. Root rot of kalomegh caused by *Curvularia sp.* Powdery mildew disease of tulsi first time recorded from FPD nursery .Die-back of basok (95%), powdery mildew of tulsi (60-

90%), root rot of tulsi (50%), root rot of kalomegh (80%), root rot of ashwagandha (80%) leaf blight of ashwagandha (90%) recorded respectively.

Sarpaganda and shotomoly seedling have been planted for natural pest/disease infestation /infection. Scale insect, shoot borer, lepidopteran moth, jassid, aphid, mealybug, psyllid, leaf roller, termite and beetle were successfully controlled by Neem oil. Black aphid, spittle bug, leaf roller and minor defoliator were controlled by chilly powder & Garlic significantly. Root rot & leaf blight of ashwagandha, Powdery mildew of tulsi, leaf spot of gritakumari, die-back of basok were controlled by Bordeaux mixture successfully.

2.7.2 This year

Action plan as per annual research programme	Progress
a. Laboratory and field trial	Neem oil is sprayed to control scale insect of sarpogandha , spittle bug of tulsi and akanda. Initially result found effective(95%). Five kinds of fungicide(Bordeaux mixture, Cupravit, Theovit, Dithane M- 45 and Amcozim) are sprayed to control the powdery mildew of tulsi in five plots. Primary result showed that Bordeaux mixture successfully controled the disease(90%) .
b. Collection of pest and disease sample	Insects and diseases samples were collected from medicinal plants from Bogra, Natore, Gaibandha, Rangpur, Sirajgong, Tangail, Bandarban& Khakrachari under SPGR project, FPD and MFPD nursery of BFRI campus . Root rot of ashwagandha, kalomegh, tulsi are recorded. Collar rot of gritakumari,die-back of basak and powdery mildew of tulsi are also collected from nurseries & field visit. Scale insect is recorded from basak and sarpogandha. Spittle bug infestation is recorded from tulsi and akanda. Aphid is also collected from sarpogandha and tulsi.A mole cricket was collected from ashwagandha, kalomegh and shotomoly from Bandarban first time.
c. Record of nature & extent of damage	Tulsi (Black and white) leaves are infested by Spittle bug (35%) and powdery mildew (90%). Basak is infested by sooty mould fungus (60 %),scale insect(60%) and die-back (60%) . Basak leaf spot are noticed about 5 % . Sarpogandha leaves are infested by aphid and scale insect (20%). Gritakumari collar rot is noticed and recorded (60%).
d Rearing/culture and identification.	Root rot of Ashwagandha caused by <i>Fusarium solani</i> , Root rot of Kalomegh caused by <i>Curvularia sp.</i> Powdery mildew of tulsi, die- back of basak and collar rot of gritakumari are cultured in media in the laboratory. A leaf defoliator (<i>Danus chysippus</i>) of akanda is identified, ecology is studied. Nature of injury was recorded 55%.
e. Development of nursery	For nursery development and management weeding, fertilization (Organic), watering , regular observation, data collection, sample collection and management practices are going on.

2.8 Achievement(s), if any : Powdery mildew of tulsi was controlled by Bordeaux mixture. Root rot and Leaf blight of Ashwagandha were controlled by Dithane M-45 & Bordeaux mixture respectively. Sapsucker of Tulsi is control by Chilli powder and Garlic

juice @ 2ml./L of water. Aphid, jassid, mealybug and scale insect of Ashwagandha were controlled by Neem oil @ 2ml./L of water.

- 2.9 **Financial Statement** :
- 2.9.1 Total cost : Tk. 10,00,000/- (approx.)
- 2.9.2 Cost of the year : Tk. 1,79,000/- (approx.)
- 2.9.3 Expenditure of the year : Tk.1,65,000/- (approx.)
- 2.9.4 Source of fund : GOB
- 2.10 **Beneficiaries** : Forest Department, NGOs and general public

3. **Study** : **On-going**
- 3.1 Programme Area : Forest Pests and Diseases
- 3.2 Title of the Study : **Major pests and diseases of forest seeds and their management**
- 3.3 **Objective(s)** :
- 3.3.1 : To identify pests and pathogens of forest seeds in the field and storage condition
- 3.3.2 : To determine the nature and extent of damage by each pest and pathogen
- 3.3.3 : To develop suitable management techniques of key pests and pathogens
- 3.4 Expected output : Pest and disease-free seeds will be made available that leads to better germination and production of healthy and sound seedlings .
- 3.5 **Study period**
- 3.5.1 Starting year : 2007-08
- 3.5.2 completion year : 2012-2013
- 3.6 **Personnel(s)** :
- 3.6.1 Study Leader : Md. Rafiqul Islam, D.O.
- 3.6.2 Associates : Md. Zillur Rahman (RA-1)
Kazi Asad-uz-zaman (F. I)
Shameema Nasreen (F.I)
- 3.7 **Progress** :
- 3.7.1 Previous years, if any(2010-2011)

Bruchid beetle, *Bruchus sp* were reared up from kalo koroi, sil koroi and ipil-ipil. A borer was recorded from teak. A *lepidopteran* moth and a coleoprteran weevil reared up from passure and kankra seeds respectively. *Mucor sp.* , *Aspengilles sp.*, *Penicillunis sp.* and *Fusarium sp.* were isolated from infected of koroi and ipil-ipil. Among the mangroves seeds, average infestation were recorded 45% in kankra and 80% in passur.

3.7.2 This year:

Action plan as per annual research programme	Progress
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a. Setting up laboratory experiments for seed pest / disease management	Initially seeds(sil koroi, ipil ipil, Jarul, akasmoni, acacia hybrid, teak, mahogany) are dried and kept with Neem oil mixture, Svin powder, Classic, Malathion and Bavistin for observation. No infestation is observed up june 05, 2012.
b Collection of pest/disease samples and recording .	Seeds of sil koroi, fulkoroi, ipil ipil, raintree, akasmoni, acacia hybrid, minzeri, teak, mahogany, sissoo, arjun , kankra ,passur and sundri were collected and kept in laboratory for observation and experiment. The rate of infestation were recorded 6.60% in teak, 4.33% in acacia, 6.40% in ipil-ipil, 3.84% in silkoroi, 5.02% kalo koroi, 13-38% in sal. Among mangrove seeds, average infestation were recored 45% in karkra and 80% in passur.
c. Nature and extent of damage	Nature and extend of damage are recorded from collected seeds.
d.Rearing/culture and identification	Some diseased seeds Jarul, Mahogani , Kankra are cultured in media and some fungus identified they are as <i>Aspergillus sp.</i> , <i>Penicillium sp.</i> and <i>Mucor sp.</i>

3.9 Achievement(s), if any : Bruchids, scolytids and a moths were recorded from ipil-ipil, teak, koroi, kankra, sundry and passur seeds. Some fungi were identified from ipil ipil , koroi and rain tree seeds.

3.10 Financial Statement :

3.10.1 Total cost : Tk. 15,00,000/- (approx.)

3.10.2 Cost of the year : Tk. 1,35,000/-(approx.)

3.10.3 Expenditure of the year : Tk. 1,27,000/-(approx.)

3.10.4 Source of fund : GOB

3.11 **Beneficiaries** : FD, BFRI, NGOs, nursery owners, private planters and general public

PLANTATION TRIAL UNIT DIVISION

1. Study : On-going

1.1 Programme Area : Plantation technique and forest management

1.2 Title of the study : **Growth performance of different mangrove and non-mangrove species in the coastal areas of Bangladesh**

- 1.3 Justification : The Forest Department started mangrove afforestation in the coastal belt of Bangladesh from 1966. About 1,72,000 ha of coastal plantations have been raised in Bangladesh till to date. Among them keora and baen occupying more than 90% area of the coastal forest. These plantations encountered a number of problems. Morphological changes, species succession and insect infestation threatening the sustainability of coastal forest. No regeneration appeared under keora plantations due to rising of forest floor, compactness of soil and non-availability of seed source of other mangrove species. Therefore, after harvesting of matured keora trees, there will be no second rotation crops for sustainability of this forest. In order to maintained a continuous forest cover in the coastal belt, trial plantations of some major mangrove species under keora plantations and some non-mangrove species in the raised lands were undertaken in different coastal islands. The present study is aimed to preserve and maintained these trial plots for the development of coastal forest management strategy.
- 1.4 Objective(s)** :
- 1.4.1 : To select site-suitable mangrove and mainland species for coastal areas of Bangladesh.
- 1.5. Expected output : Sustainable coastal forest management strategy is expected to be developed depending on the growth performance of mangrove and non-mangrove species.
- 1.6 Study Period** :
- 1.6.1 Starting year : 2007-08
- 1.6.2 Completion year : 2011-12
- 1.7 Personnel (s) :
- 1.7.1 Study Leader : S. A. Islam, DO
- 1.7.1 Associates : 1. M.G. Moula, RO
2. M.A. Habib, FI
3. M. G. Rasul, FI
4. M.A.Q. Miah, FI
- 1.8. Progress** :
- 1.8.1 Previous years, if any : A total of 14.33 ha of older trials of mangrove (9.5 ha), non-mangrove (4.0 ha) and palm (0.83 ha) species were maintained by weeding, cleaning, climber cutting, fence repairing etc. Growth and survival data of mangroves species such as sundari, gewa, passur, goran, khalshi, hantal, kankra, shingra and golpata; non-mangrove species such as rain tree, jhao, payra, sada koroï and kalo koroï; and palm species such as palmyra palm, coconut, date palm and betel nut were recorded from the experimental plantations raised in different

islands under Rangabali and Char Kukri-Mukri Research Stations. Growth data were compiled and analyzed.

1.8.1 This years :

Activities of the study	Progress
a. Maintenance of 14.33 ha of older trials of mangrove (9.5 ha), non-mangrove (4.0 ha) and palm (0.83 ha) species by weeding, cleaning, climber cutting, fence repairing etc. in different sites of Rangabali and Char Kukri-Mukri Research Stations.	A total of 14.33 ha of older trials of mangrove (9.5 ha), non-mangrove (4.0 ha) and palm (0.83 ha) species have been maintained by weeding, cleaning, climber cutting, barbed wire fence repairing, etc. at different islands under Rangabali and Char Kukri-Mukri Research Stations.
b. Collection of survival and growth data from the experimental plantations once a year.	Growth data have been collected from the experimental plantations.
c. Compilation and analysis of data.	Data have been compiled and analyzed.
d. Preparation of final report.	Report/paper writing is in progress.

Table 1. Growth performance of mesophytic species planted at Char Rawshan in 1994.

Species	Jylarkhal (Char Kukri-Mukri)			Char Rawshon (Char Kukri-Mukri)		
	Survival %	Height (m)	DBH (cm)	Survival %	Height (m)	DBH (cm)
<i>Samanea saman</i> (Rain tree)	30	12.66	16.56	-	-	-
<i>Acacia nilotica</i> (Babla)	16	11.62	12.30	41	12.41	15.12
<i>Albizia lebbek</i> (Kala koro)	8	10.75	10.67	-	-	-
<i>Pithecellobium dulce</i> (Payra)	-	-	-	39	14.16	25.51
<i>Pongamia pinnata</i> (Karanja)	-	-	-	30	19.85	31.29

Table 2. Growth performance of mesophytic species planted at Char kashem in 1998.

Species	Survival %	Height (m)	DBH (cm)
<i>Samanea saman</i> (Rain tree)	83	9.15	21.17
<i>Thespesia populnea</i> (Sanboloi)	41	5.57	13.26
<i>Pithecellobium dulce</i> (Payra)	41	6.65	11.41
<i>Casuarina equisetifolia</i> (Jhao)	64	12.09	17.76
<i>Acacia nilotica</i> (Babla)	38	6.18	11.16
<i>Albizia procera</i> (Sada koro)	33	8.40	17.75
<i>Albizia lebbek</i> (Kala koro)	46	10.47	15.43

1.9. Achievement(s), if any

: A total of 14.33 ha experimental plantations of mangrove (9.5 ha), non-mangrove (4.0 ha) and palm (0.83 ha) species have been established at different islands under Rangabali and Char Kukri-Mukri Research Stations. Some major mangrove species for differently inundated coastal habitats viz. sundri, gewa, passur, hantal, khalshi, kirpa, kankra and shingra have been found promising to enrich and sustain coastal forest in Bangladesh. Similarly, in the raised lands of coastal areas, promising performance among non-mangrove species has been recorded for jhao, sada koro, kala koro, raintree and

payra. Among the palm species palmyra palm, coconut, date palm and betel nut have been found promising in the foreshore area of the coastal habitat. Some scientific papers have published in the renowned journals.

- 1.10 Financial Statement** :
- 1.10.1 Total cost : Tk. 16,00,000.00
- 1.10.2 Cost of the year : Tk. 1,40,000.00
- 1.10.3 Expenditure of the year : Tk. 1,40,000.00
- 1.10.4 Source of fund : GOB
- 1.11. Beneficiaries** : FD; Local Farmers and NGO.
- 2. Study** : **On-going**
- 2.1 Programme Area : Production of quality planting materials
- 2.2 Title of the study : **Establishment of Seed Production Areas and Demonstration plots for priority planting mangrove species**
- 2.3 Justification : The main goal of any plantation is to produce maximum yield per unit area. It can be done by using improved seed sources from selected seed stands and from Plus Trees. Considering the urgent need of quality seeds for coastal afforestation programmes, it is imperative that Seed Production Areas (SPA) for priority mangrove species should be established as a source of improved seeds and propagules. This study have been undertaken with a view to provide improved seed sources by selecting superior phenotypes from nature-made stressed conditions and to established demonstration plots with seeds of SPA and PTs for getting maximum yield from major mangrove species.
- 2.4 Objective(s)** :
- 2.4.1 : To develop interim source of improved quality seeds of mangrove species.
- 2.4.2 : To establish demonstration plots with PT/SPA seeds.
- 2.5. Expected output : Establishment of better quality seed sources of major mangrove species in the coastal areas of Bangladesh.
- 2.6 Study Period** :
- 2.6.1 Starting year : 1997-98
- 2.6.2 Completion year : 2011-12
- 2.7 Personnel (s) :
- 2.7.1 Study Leader : M.G. Moula, RO
- 2.7.1 Associates : 1. S. A. Islam, DO
2. M.A. Habib, FI

- 3. M. G. Rasul, FI
- 4. M.A.Q. Miah, FI

2.8. Progress

2.8.1 Previous years, if any : Seeds of baen were collected from selected PTs and 6000 seedlings were raised in polybags at Char Kukri-Mukri, Rangabali and Char Osman Research Stations. Three demonstration plots (1.2 ha) with baen were established at Char Kukri-Mukri, Rangabali and Char Osman Research Stations. Previously raised 3.2 ha demonstration plots of keora were maintained by weeding and fence repairing. Growth and survival data were recorded from the keora demonstration plots.

2.8.1 This years :

Activities of the study	Progress
a. Collection of seeds from selected baen PTs and raising of 8,000 seedlings in the nursery.	a. Seeds of baen were collected from selected baen PTs. Eight thousand seedlings of baen have been raised in the nursery at Rangabali, Char Kukri-Mukri, Sitakundu and Char Osman Research Stations.
b. Establishment of demonstration plots (1.6 ha) with baen seedlings at Char Kukri-Mukri, Rangabali, Sitakundu and Char Osman Research Stations.	b. Four demonstration plots (1.6 ha) with baen have been established at Char Kukri-Mukri, Rangabali, Sitakundu and Char Osman Research Stations.
c. Maintenance of previously raised 4.4 ha demonstration plots of keora, sundari and baen at Char Kukri-Mukri, Rangabali and Char Osman Research Stations.	c. Previously raised 4.4 ha demonstration plots of keora, sundari and baen have been maintained at Char Kukri-Mukri, Rangabali and Char Osman Research Stations
d. Collection of survival and growth data from the experimental plots.	d. Growth and survival data have been recorded from the demonstration plots.
e. Compilation and analysis of data.	e. Data have been compiled and analyzed.

2.9. Achievement(s), if any : Four hectares of SPA for keora have been established at Char Taposhi of Patuakhali Forest Division and 1.6 hectares demonstration plots of keora have been successfully raised at Rangabali and Char Kukri-Mukri Forest Research Stations.

2.10 Financial Statement

- 2.10.1 Total cost : Tk. 9,50,000.00
- 2.10.2 Cost of the year : Tk. 1,20,000.00
- 2.10.3 Expenditure of the year : Tk. 1,20,000.00
- 2.10.4 Source of fund : GOB

2.11. Beneficiaries

: Forest Department, Coastal Farmers.

- 3. Study : On-going**
- 3.1 Programme Area : Social Forestry
- 3.2 Title of the study : **Study on the improvement of coastal homesteads through resource generation.**
- 3.3 Justification : The coastal region of Bangladesh covers an area of about 47,201 km² (710 km long) extending along the Bay of Bengal. Bangladesh is one of the most densely populated countries in the world. The coastal zone constitutes 20% of the area and 28% of the population of the country. Homesteads represent a land use system involving deliberate management of multipurpose trees and shrubs in limited association with seasonal vegetables. It play a vital role in providing timber, fuelwood, fodder, fruits and vegetables. A higher percentage of the population living below the absolute poverty line in the coastal zone compared to the country as a whole. Moreover, the people of the coastal islands are very poor and their livelihood mostly depends on daily labour and fishing. Their homegarden can be a source of livelihood for many poor farmers. Therefore, this study have been undertaken to improve their livelihood status and to develop vegetation cover in the coastal homesteads through supplementing some resources for the poor farmers.
- 3.4 Objective(s) :**
- 3.4.1 : To improve livelihood status of coastal rural farmers through resource generation in coastal homesteads.
- 3.4.2 : To assess and prepare database on existing and recreating numbers and areas of different resources.
- 3.5. Expected output : Improvement of livelihood status of coastal rural farmers through resource generations in the homesteads as well as enrich existing pattern of coastal vegetation.
- 3.6 Study Period :**
- 3.6.1 Starting year : 2006-07
- 3.6.2 Completion year : 2011-12
- 3.7 Personnel (s) :
- 3.7.1 Study Leader : S. A. Islam, DO
- 3.7.1 Associates : 1. M.G. Moula, RO
2. M.A. Habib, FI
3. M. G. Rasul, FI
4. M.A.Q. Miah, FI
- 3.8. Progress :**
- 3.8.1 Previous year, if any : A total of 2000 seedlings rain tree, akashmoni, neem, and jarul (500 seedlings for each species), 1000 seedlings of fruit tree species such as kalojam, kathal, kamranga, tentul and amra (200 seedlings for each species) were raised at

Rangabali and Char Kukri-Mukri Research Stations. Eight types of different vegetable seeds and 200 seedlings of mango (improved variety) were purchased. A total of 1736 seedlings of rain tree, akashmoni, neem, and jarul; and 1116 seedlings of kalojam, kathal, kamranga, tentul, amra and mango; 8 types of different vegetable seeds have been distributed to the selected 62 farmers for resource generation.

3.8.1 This years :

Activities of the study	Progress
a. Raising of 2500 seedlings of timber tree species such as rain tree, sil koro, akashmoni, neem, and mehogni (500 seedlings for each species) at Rangabali and Char Kukri-Mukri Research Stations.	a. A total of 1250 seedlings of timber tree species such as rain tree, sil koro, akashmoni, neem, and mehogni (250 seedlings for each species) were raised at Char Kukri-Mukri Research Stations .
b. Raising of 1200 seedlings of fruit tree species such as kalojam, kathal, amloki, tentul, amra and supari (200 seedlings for each species) at Rangabali and Char Kukri-Mukri Research Stations.	b. A total of 1200 seedlings of fruit tree species such as kalojam, kathal, amloki, tentul, amra and supari (100 seedlings for each species) were raised at Char Kukri-Mukri Research Stations.
c. Procurement of different seasonal vegetable seeds.	c. Eight different types of vegetable seeds/ seedlings were procured and distributed to 62 selected farmers.
d. Supply of seedlings and vegetable seeds to the selected 62 farmers to enrich vegetation in the farmer's homesteads.	d. A total of 1178 seedlings of rain tree, sil koro, akashmoni, and mehogni and 992 seedlings of kalojam, kathal, amloki, tentul, amra and supari; 8 types of different vegetable seeds have been distributed to the selected farmers for developing their resources.
e. Collection and analysis of data.	e. Data have been collected and compiled.

Table 1. Income generation of selected farmers through vegetable cultivation at Rangabali and Kukri-Mukri Island.

Farmers Group	Location	No. of family	Vegetable prod. (kg)	Vegetable's price	Family use (kg)	Sale (kg)	Sale (Tk.)
Group-A	Char Nazir	16	6518	66511.35	3042	3476	35470.00
Group-B	Char Nazir	16	6453	73889.85	2799	3654	41840.00
Group-C	Aminpur	15	4644	64188.64	2236	2408	33283.00
Group-D	Babuganj	15	6259	56751.92	3438	2821	25376.00
Total		62	23874	261341.76	11515	12359	135969.00
Average			385.06	4215.19	185.73	199.34	2193.05

3.9 Achievement(s), if any : Till today, a total of 62 farmers have been selected at Char Nazir and Char Kasem under Rangabali Research Station; and Char Aminpur, Shahabajpur and Babuganj under Char Kukri-Mukri Research Station. Seedlings of different salt

tolerant timber and fruit species have been planted in their homesteads. Vegetation of coconut, guava apelkul, sundari and golpata, have already been developed in their homesteads.

- 3.10 Financial Statement** :
- 3.10.1 Total cost : Tk. 8,30,000.00
- 3.10.2 Cost of the year : Tk. 1,40,000.00
- 3.10.3 Expenditure of the year : Tk. 1,40,000.00
- 3.10.4 Source of fund : GOB
- 3.11. Beneficiaries** : Coastal rural farmers and NGOs.

4. Study : **On-going**

4.1 Programme Area : Plantation technique and forest management

4.2 Title of the study : **Introduction of bamboo, rattan and golpata in the coastal homesteads of Bangladesh.**

4.3 Justification : The homegardens of Bangladesh are small and scattered. These are extremely productive and regarded as a more reliable place for tree farming being adjacent to living quarters. Over 76% of the population lives in rural areas and they are heavily dependent on homegardens for their livelihood. Their aggregate area constitutes only about 0.25 million ha, representing 10% of the country's forests. An estimated 88% of all wood supplies are drawn from the homegardens. Bamboo and rattan intensely related to traditional life of Bangladeshi, especially to rural people and nature lovers, being used in various household articles. About 15-17 bamboo species are cultivated in the village groves. At present, village bamboos constitute 80% of the total national supply. But in the coastal areas bamboo and rattan population are very poor. On the other hand, golpata is a very valuable mangrove plant species in the natural Sundarban. Golpata leaves are widely used for thatching roofs and walls of dwelling in south-western region of the country. This species can be cultivated in the low land adjacent to homesteads in the coastal belts for increasing its productivity. Therefore, this study is undertaken to introduce site-suitable bamboo and rattan species in the coastal homesteads as well as to develop golpata cultivation to the farmer's level.

- 4.4 Objective(s)** :
- 4.4.1 : To investigate the possibility for introduction of bamboo rattan and golpata in coastal homesteads of Bangladesh.
- 4.4.2 : To select site suitability of bamboo, rattan and golpata in the coastal areas.
- 4.4.3 : To increase the productivity of bamboo, rattan and golpata in the coastal areas.
- 4.5. Expected output : Production of bamboo, rattan and golpata in the coastal areas will be increased.
- 4.6 Study Period** :
- 4.6.1 Starting year : 2009-10
- 4.6.2 Completion year : 2012-13
- 4.7 Personnel (s) :
- 4.7.1 Study Leader : S. A. Islam, DO
- 4.7.1 Associates : 1. M.G. Moula, RO
2. M.A. Habib, FI
3. M. G. Rasul, FI
4. M.A.Q. Miah, FI
- 4.8. Progress** :
- 4.8.1 Previous years, if any : Four meeting cum training programs were organized at Rangabali, Char Kukri-Mukri, Char Osman and Cox's Bazar Research Stations with coastal rural people for the awareness development and to learn nursery and plantation techniques for bamboo, rattan and golpata in the coastal homesteads. A total of 8000 seedlings of rattan, 4000 seedlings of bamboo (branch cutting) and 4000 seedling of golpata were raised in the nursery at 4 research stations. Seedlings of bamboo (2900 nos.), rattan (4700 nos.) and golpata (3650 nos.) have been distributed to the 300 coastal homesteads.
- 4.8.1 This years :

Activities of the study	Progress
a. Organizing four awareness meetings with coastal rural people for cultivating bamboo, rattan and golpata in the coastal homesteads at Rangabali, Char Kukri-Mukri, Char Osman and Sitakundu Research Stations.	a. Two awareness meeting were organized with coastal rural people for cultivating bamboo, rattan and golpata in the coastal homesteads at Char Kukri-Mukri and Char Osman Research Stations.
b. Collection of seeds of rattan and golpata for raising 8000 seedlings of rattan and 2000 seedlings of golpata.	b. Seeds of rattan (jali bet) and golpata were collected for raising 8000 seedlings of rattan and 2000 seedlings of golpata in poybags.
c. Raising 8000 seedlings of rattan species, 4000 seedlings (branch cutting) of bamboos (<i>Bambusa balcooa</i> / <i>B. vulgaris</i>) and 2000 seedlings of golpata.	c. A total of 8000 seedlings of rattan, 4000 seedlings of bamboo and 2000 seedling of golpata were raised in the nursery at 4 research stations.

d. Supplying of seedlings to the selected coastal farmers.	d. Seedlings of bamboo (2950 nos.), rattan (3000 nos.) and golpata (1100 nos.) have been distributed to the coastal farmers.
e. Maintenance and supervision of seedlings planted in previous year.	e. Seedlings of bamboo, rattan and golpata planted in 2010 and 2011 have been maintained.
f. Collection and analysis of data.	f. Data on survivability and growth have been recorded and compiled.

Table 1. Seedlings of bamboo, rattan and golpata distributed to the coastal farmers in 2012.

Name of Station	No. of seedlings distributed		
	Bamboo	Rattan	Golpata
Rangabali	800	700	300
Char Kukri-Mukri	850	1000	400
Sitakundu	800	1000	400
Char-Osman	500	300	-
Total	2950	3000	1100

4.9. Achievement(s), if any : Total 480 coastal homesteads were selected till 2011 for introducing bamboo, rattan and golpata. A total of 8,750 seedlings of bamboo, 13,800 seedlings of rattan and 7,395 seedlings of golpata have been distributed to the coastal farmers.

4.10 Financial Statement :
4.10.1 Total cost : Tk. 8,00,000.00
4.10.2 Cost of the year : Tk. 1,50,000.00
4.10.3 Expenditure of the year : Tk. 1,50,000.00
4.10.4 Source of fund : GOB

4.11. Beneficiaries : Forest Department and adjacent coastal dwellers.

5. Study : On-going

5.1 Programme Area : Plantation technique and forest management

5.2 Title of the study : **Introduction of major bee foraging mangrove plant species in the coastal belts of Bangladesh.**

5.3 Justification : The floristic composition of the natural Sundarban is rich compared to many other mangroves of the world. Chaffey and Sandom (1985) presented a list of 66 species in the Bangladesh Sundarban. There are some important nectar and pollen yielding mangrove flora in this forest. These are khalshi, baen, goran, gewa, keora, choyla, hantal, passur, dhundul etc. The Sundarban is the major natural habitat of the wild indigenous giant honeybee, *Apis dossata*.

Honeybees are well known for their highly preferential selection of the plant species for collection of nectar and pollen. The important bee foraging mangrove plant species can be planted in the coastal belt of Bangladesh to enrich the coastal vegetation. This could be the source of nectar and pollen yielding mangrove plants which can provide support in natural and artificial apiculture. Therefore, this study has been undertaken for developing plantation techniques of major bee foraging mangrove plant species.

- 5.4 Objective(s)** :
- 5.4.1 : To develop better silvicultural techniques for plantations for each bee foraging mangrove plant species.
- 5.4.2 : To provide the sources of honey plants.
- 5.5. Expected output : Knowledge on the proper methods and suitable sites for plantations for different bee foraging mangrove species in the coastal belts; and providing sources of honey. There will be a scope for introducing apiculture with bees.
- 5.6 Study Period** :
- 5.6.1 Starting year : 2010-11
- 5.6.2 Completion year : 2013-14
- 5.7 Personnel (s) :
- 5.7.1 Study Leader : M.G. Moula, RO
- 5.7.1 Associates : 1. S. A. Islam, DO
2. M.A. Habib, FI
3. M. G. Rasul, FI
4. M.A.Q. Miah, FI
- 5.8. Progress** :
- 5.8.1 Previous years, if any : Seeds of khalshi, gewa and goran were collected from the Sundarban. A total of 6000 seedlings of khalshi, 2000 seedlings of gewa and 4000 seedlings of goran were raised at Rangabali, Char kukri-Mukri and Char Osman Research Stations. A total of 2.4 ha experimental mixed plantations of khalshi, gewa and goran were raised at the above mentioned research stations.
- 5.8.1 This years :

Activities of the study	Progress
a. Collection of seeds of khalshi (<i>Aegiceras corniculatum</i>) gewa (<i>Excoecaria agallocha</i>), goran (<i>Ceriops decandra</i>), passur (<i>Xylocarpus mekongensis</i>) and baen (<i>Avicennia officinalis</i>) from the Sundarban.	a. Seeds of khalshi, gewa, goran, passur and baen were collected from the Sundarban.
b. Raising seedlings of khalshi (7,200 nos.) gewa (2400 nos), goran (4,800 nos), passur (4,800 nos.) and baen (2400 nos.) at Rangabali, Char kukri-Mukri, Stakundu and Char Osman Research Stations.	b. A total of 7,200 seedlings of khalshi, 2500 of gewa, 4,800 of goran, 4800 of passur and 2,400 of baen were raised at Rangabali, Char kukri-Mukri, Stakundu and Char Osman Research Stations.

c. Raising of 4.0 ha experimental mixed plantations of khalshi, gewa, goran, passur and baen at 3:1:2:2:1 ratio with 3 replications.	c. A total of 4.0 ha mixed plantations khalshi, gewa, goran, passur and baen at 3:1:2:2:1 ratio with 3 replications have been raised at 4 Research Stations.
d. Maintenance of 2.4 ha experimental plantations raised in previous year.	d. Previously raised 2.4 ha experimental plantations were maintained.
e. Collection and analysis of data.	e. Data have been collected and compiled.

5.9 Achievement(s), if any : A total of 6.4 ha Experimental mixed plantations of some bee foraging mangrove plant species have been raised at Rangabali, Char kukri-Mukri, Sitakundu and Char Osman Research Stations.

5.10 Financial Statement :

5.10.1 Total cost : Tk. 8,00,000.00

5.10.2 Cost of the year : Tk. 1,75,000.00

5.10.3 Expenditure of the year : Tk. 1,75,000.00

5.10.4 Source of fund : GOB

5.11. Beneficiaries : Forest Department and adjacent coastal dwellers.

6. Study : On-going

6.1 Programme Area : Plantation technique and forest management

6.2 Title of the study : **Development of model vegetation to protect soil erosion, salt spray and other climatic changes in the coastal belt of Bangladesh.**

6.3 Justification : The coastal belt of Bangladesh is 710 km long extending along the Bay of Bengal. It lies within the tropical zone between 21⁰ - 23⁰ N latitude and 89⁰ – 93⁰ E longitudes. Out of 64 districts of Bangladesh, the coastal zone now covers 19 coastal districts facing, or in proximity to, the Bay of Bengal. The coastal zone of Bangladesh is prone to multiple threats such as cyclones, storm surges, floods, soil erosion, salt spray as well as earthquakes, tsunamis, and all other climatic hazards. Mangrove forests are vegetated inter-tidal wetlands that provide goods and environmental services. Recently, mangroves and other types of coastal forest and vegetation have been considered as protection against cyclones, wind, salt spray, tsunamis and coastal erosion as green shelterbelts. The coastal forests can reduce wind and storm wave impact as well as current velocities. Choosing the types of trees and plantation model to be used for shelterbelts is very important for getting maximum environmental benefit. Therefore, this study has been undertaken to develop a better model plantation of suitable

mangrove and non-mangrove species against climatic hazards in the coastal belt of Bangladesh.

- 6.4 Objective(s)** :
- 6.4.1 : To develop a better model plantation of suitable species against major climatic changes in the coastal belt of Bangladesh.
- 6.4.2 : To select mangrove species that can tolerate cyclonic and salt hazard.
- 6.4.3 : To increase the coastal forest product.
- 6.5. Expected output : Model vegetation in the coastal belt will be developed against all climatic hazards.
- 6.6 Study Period** :
- 6.6.1 Starting year : 2010-11
- 6.6.2 Completion year : 2014-15
- 6.7 Personnel (s) :
- 6.7.1 Study Leader : S. A. Islam, DO
- 6.7.1 Associates : 1. M.G. Moula, RO
2. M.A. Habib, FI
3. M. G. Rasul, FI
4. M.A.Q. Miah, FI

- 6.8. Progress** :
- 6.8.1 Previous years, if any : Seeds of keora, baen and golpata were collected for raising experimental plantations for newly accreted lands; and sundari, kankra, gewa, goran and khalshi for moderately established lands. A total of 12,000 seedlings of these species were raised at Rangabali and Char kukri-Mukri Research Stations. A total of 2.72 ha experimental model plantations in different length and size were raised using keora, baen and golpata for newly accreted lands; and sundari, kankra, gewa, goran and khalshi for moderately established lands

6.8.1 This years :

Activities of the study	Progress
a. Collection of seeds of keora, baen and golpata for newly accreted lands; sundari, kankra, passur, gewa and khalshi for moderately established lands; and karanja, payra, jhao and babla for raised lands for raising model plantations.	a) Seeds of keora, baen and golpata for newly accreted lands; sundari, kankra, passur, gewa and khalshi for moderately established lands; and karanja, payra, jhao and babla were collected for raised lands for raising model plantations.
b. Raising 35 thousands seedlings of theses species at Rangabali, Char kukri-Mukri, Char Osman and Sitakundu Research Stations.	b) A total of 27 thousands seedlings of theses mangrove and non-mangrove species have been raised at Rangabali, Char kukri-Mukri, Char Osman and Sitakundu Research Stations.

c. Procurement of Refract meter and Wind meter for measuring water/soil salinity and wind velocity.	-
d. Raising of 7.0 ha experimental model plantations of these species at 4 Research Stations.	A total of 7.0 ha experimental model plantations in different length and size have been raised.
e. Establishment of 36 siltation gauge in the experimental plantations for measuring siltation/soil erosion.	-
f. Collection of data on different climatic parameters and from experimental plantations.	Data have been collected from previously raised experimental plots.

6.9. Achievement(s), if any : N/A

6.10 Financial Statement :

6.10.1 Total cost : Tk. 20,00,000.00

6.10.2 Cost of the year : Tk. 2,00,000.00

6.10.3 Expenditure of the year : Tk. 2,00,000.00

6.10.4 Source of fund : GOB

6.11. Beneficiaries : Forest Department and adjacent coastal dwellers.

7. Study : On-going

7.1 Programme Area : Plantation technique and forest management

7.2 Title of the study : **Establishment of pilot plots of six mangrove species as under planting in keora plantations**

7.3 Justification : Coastal man-made forest in Bangladesh faces serious threats of erosion due to rapid geomorphological changes, inadequate regeneration of exiting mangrove species, high frequency of inundation and intense human pressure for land. The Plantation Trial Unit Division of BFRI generated plantation techniques of some major mangrove species as underplanting in the differently inundated coastal habitats. It is now needed to raise plantations in pilot scale of these mangrove species to confirm and modernized this technology.

7.4 Objective(s) :

7.4.1 : To establish pilot plots of site-suitable mangrove species in differently inundated coastal habitats.

7.5. Expected output : Coastal vegetation is expected to be enriched and sustained.

7.6 Study Period :

7.6.1 Starting year : 2008-09

7.6.2 Completion year : 2011-12

- 7.7 Personnel (s) :
 7.7.1 Study Leader : S. A. Islam, DO
 7.7.1 Associates : 1. M.G. Moula, RO
 2. M.A. Habib, FI
 3. M. G. Rasul, FI
 4. M.A.Q. Miah, FI

- 7.8. Progress** :
 7.8.1 Previous years, if any : A total of 14,000 seedlings of six mangrove species (sundari, passur, kankra, khalshi, gewa, and hantal) were raised in polybags in the nursery at Rangabali and Kukri-Mukri Research Stations. Three hectares experimental plantations were raised with these six mangrove species at Kukri-Mukri and Madarbunia Research Stations. Previously raised 3.0 ha experimental plots of six mangrove species were maintained by weeding and cleaning. Data have been collected and compiled.
 7.8.1 This years :

Activities of the study	Progress
a) Collection seeds of sundari, passur, gewa, khalshi, kankra and hantal for raising of 10,000 seedlings.	Seeds of 6 mangrove species such as sundari, passur, kankra, khalshi, gewa, and hantal were collected for raising of 10,000 seedlings.
b) Raising of 10,000 seedlings of these 6 mangrove species in the nursery.	A total of 10,000 seedlings of these six mangrove species were raised in polybags at Rangabali and Kukri-Mukri Research Stations.
c) Selection and preparation of sites for the establishment of 2.0 ha pilot plots of six mangrove species.	-
d) Establishment of 2.0 ha pilot plots for 6 mangrove species.	-
e) Maintenance of previously raised 9.0 ha experimental plots.	Previously raised 9.0 ha experimental plots have been maintained by weeding and cleaning.
f) Collection and compilation of data.	Data have been collected and compiled.

- 7.9. Achievement(s), if any : Nine hectares experimental plantations of six mangrove species (sundari, passur, kankra, khalshi, gewa, and hantal) have been established at Char Kukri-Mukri and Rangabali Research Stations.

- 7.10 Financial Statement** :
 7.10.1 Total cost : Tk. 5,00,000.00
 7.10.2 Cost of the year : Tk. 75,000.00
 7.10.3 Expenditure of the year : Tk. 75,000.00
 7.10.4 Source of fund : GOB

- 7.11. Beneficiaries** : Forest Department and adjacent coastal dwellers.

- 8. Study : On-going**
- 8.1 Programme Area : Plantation technique and forest management
- 8.2 Title of the study : **Community based adaptation to climate change through coastal afforestation in Bangladesh (CBACC-CF).**
- 8.3 Justification : “Community based adaptation to climate change through coastal afforestation (CBACC-CF) in Bangladesh” is a full placed project funded by the Leased Developed Countries Fund (LDCF), executed by the Ministry of Environment and Forest with other 6 implementing partners. This project is going-on to reduce the vulnerability of coastal communities to the impacts of climate change. Bangladesh is one of the most vulnerable countries to climate change impacts. The observed and projected impacts of climate change and vulnerability in the coastal areas include sea level rise, increasing salinity trends, growing drainage congestions, increasing frequency and intensity of tropical cyclones and storm surges, erosion of coastal embankment and extreme weather events. As the poor lives in the coastal belts, they are the most vulnerable and the prime victims of the detrimental effects of climate change. Coastal afforestation has been deemed the green shield to save the lives and livelihoods of the coastal people. The Forest Department has been increasing coastal forest resources over the last three decade and till to date 0.19 million hectares of newly accreted land have been afforested mainly with keora (*Sonneratia apetala*). The Plantation Trial Unit Division of BFRI successfully generated plantation technique of major mangrove species inside the keora plantations and thus selected 10 commercially important disaster resistant mangrove species for differently inundated (3, 6, 9, and 12 Months) coastal habitat to cope with different scenarios of sea level rise. The use of this research finding will help to stabilize the newly accreted char lands, to maintain a continuous sustainable forest cover, and conserve the coastal ecosystems for long time. The aim of this study is to raise model demonstration plantations with the selected mangrove species inside keora plantations, and to observe the performance and geomorphological changes in the plantations.
- 8.4 Objective(s) :**
- 8.4.1 : To reduce vulnerability of coastal communities to the impacts of climate change-induced risks in four upazilas in the coastal districts of Borguna and Patuakhali (Western region), Bhola (Central region), Noakhali (Central region), and Chittagong (Eastern region).

8.5. Expected output : Promotion of climate-resilience development in the coastal areas of Bangladesh.

8.6 Study Period :

8.6.1 Starting year : 2009-10

8.6.2 Completion year : 2011-12

8.7 Personnel (s) :

8.7.1 Study Leader : S. A. Islam, DO/DPD

8.7.1 Associates : 1. M.G. Moula, RO

2. M.A. Habib, FI

3. M. G. Rasul, FI

4. M.A.Q. Miah, FI

8.8. Progress :

8.8.1 Previous years, if any : A total of 90 thousands seedlings of different mangrove species such as sundari, passur, kankra, khalshi, gewa, shingra, baen, and golpata were raised in the nursery at Char Kukri-Mukri and Hatia with the participation of contractual farmers. A total of 30 ha model demonstration plantations were established at different locations of Char Kukri-Mukri and Hatia islands. Initial information on livelihood status of these farmers was recorded.

8.8.1 This years :

Activities of the study	Progress
a) Collection of seeds of mangrove species such as sundari, passur, kankra, khalshi, gewa, shingra and baen from the Sundarban for raising 120,000 seedlings.	Seeds of different mangrove species such as sundari, passur, kankra, khalshi, gewa, shingra and baen were collected from the Sundarban for raising 120 thousand seedlings.
b) Raising of 1,20,000 seedlings of these species in polybags with the participation of contractual farmers at Char kukri-Mukri Research Stations and Hatia.	A total of 120 thousand seedlings of these species were raised in polybags with the participation of contractual farmers at Char kukri-Mukri and Hatia.
c) Selection and preparation of sites for the establishment of 40 ha model demonstration plantations at Char kukri-Mukri and Hatia islands.	Planting sites were selected for the establishment of 40 ha model demonstration plantations at Char kukri-Mukri and Hatia islands.
d) Raising of 40 ha model demonstration plantations of these species at Char kukri-Mukri and Hatia islands.	Fourty ha model demonstration plantations have been established with these species at Char kukri-Mukri and Hatia islands.
e) Maintenance of previously raised 55 ha model plantations.	Previously raised 55 ha model plantations planted in 2009 and 2010 have been maintained by weeding and watching.
g) Collection of survival and growth data from the model demonstration plantations twice a year.	Data on growth and survivability have been recorded.
f) Collection of information on livelihood status of the selected contractual farmers.	Initial information on livelihood status of the contractual farmers has been recorded.

8.9 Achievement(s), if any : A total of 95 ha model demonstration plantations have been established under keora plantations at different locations of Char Kukri-Mukri and Hatia islands.

8.10 Financial Statement :

8.10.1 Total cost : Tk. 30,00,000.00

8.10.2 Cost of the year : Tk. 8,00,000.00

8.10.3 Expenditure of the year : Tk. 8,00,000.00

8.10.4 Source of fund : GOB

8.11. Beneficiaries : Forest Department and adjacent coastal dwellers.

Wildlife Section

1. **Study** : **On-going**

1.1 Programme Area : Biodiversity and conservation.

1.2 Title of the Study : **Wildlife diversity in the Protected Areas (PAs) of Bangladesh**

1.3 Justification :

1.4 **Objectives** :

1.4.1 : To determine the present status and habitat categories of wildlife species for sustainable conservation in the PAs

1.4.2 : To rehabilitate of major avian/threatened wildlife species by their feeding, nesting and breeding facilities

1.5 Expected output : Development of management plan for sustainable conservation of wildlife species in the PAs of Bangladesh

1.6 **Study Period** :

1.6.1 Starting year : 2007-2008

1.6.2 Completion year : 2011 - 2012

1.7 Personnels :

1.7.1 Study Leader : M.A. Rahman, R.O

1.7.2 Associates : M. K. Islam, RA (Gr-1)

1.7.3 : S.M. Mainuddin, (FI)

1.8 **Progress** :

1.8.1 Previous year : A total of 128 Wildlife species were recorded in Rema Kalenga Wildlife Sanctuary including 08 species of Amphibia, 15 Reptilia, 74 species of Aves and 31 Species of Mammalia.

1.8.2 This year :

Activities of the study	Progress
a. Assessment of wildlife diversity in Rema Kalenga Wildlife Sanctuary(W.S), Hobigonj	a. Rema Kalenga Wildlife Sanctuary was visited and a total of 172 wildlife species were recorded (figure-1).

	Amphibia : 09 spp. Reptilia : 19 spp. Aves : 112 spp. Mammalia : 32 spp.
b. Documentation of ecological behavior (habitat types, feeding, resting, nesting, breeding and movement) of the observed wildlife species in the PAs	b. Habitat types, feeding and resting behavior of 5 (five) wildlife species were also noted in the Rema -Kalenga WS (table-1).
c. Report writing and printing	c. Data analysis and report writing is going on.

1.9. Achievement : NA

1.10 Financial Statement:

- 1.10.1 Total cost : 5, 00,000/-
- 1.10.2 Cost of the year : 1,55,000/-
- 1.10.3 Expenditure of the year: 1, 55, 000/-
- 1.10.4 Source of fund : GOB

1.11. **Beneficiaries** : Researchers, Students and Teachers of different Educational Institutions and Forest Department / NGOs

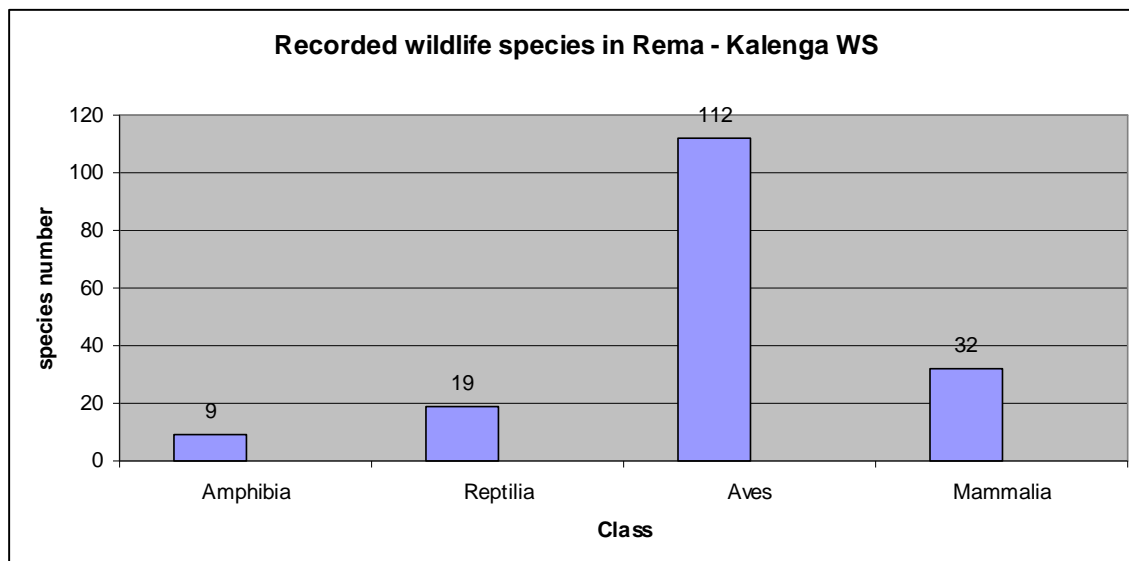


Figure 1: Recorded wildlife species in Rema-Kalenga WS

Table -1 Habitat type, feeding, breeding and resting of observed wildlife species in Rema-kalenga WS

Sl. No.	Name of the species	Feeding	Breeding	Nesting	Movement	Resting
01.	Skipper Frog (<i>Ephlyctis cyanophlyctis</i>)	Insects, small fishes and mosquito larvae	April-August	It does not make nest spawns on water	Diurnal and nocturnal	take rest in undisturbed grass land

02.	Bronze grass Skink (<i>Mabuya carinata</i>)	Insect specially mite	April-June	It does not make nest but lay eggs in the save place of forest floor	Diurnal	take rest in undisturbed grass land
03	Hill Myna <i>Gracula religiosa</i>	Insect, ripe fruits specially figs, berry	March-August	Tree holes	Diurnal	take rest on the tree branches and in breeding season into the nest
04..	Greater Racket- Tail Drongo <i>Dicrurusparadiseus</i>	Insects,	March-August	on the top branches of tree with small dried sticks, grass and leaves	Diurnal and crepuscular	take rest on the tree branches
05.	Black Giant Squirrel <i>Ratufa bicolor</i>	Fruits, seeds, leaves and barks	March-September	Make huge roughly rounded nest on the top branches of tree by aggregating leaves with small dried sticks nest has a inner chamber with entry in one side	Diurnal and arboreal	take rest on the tree branches

2. **Study** : **On-going**
- 2.1 Programme Area : Biodiversity and conservation.
- 2.2 Title of the Study : **Development and maintenance of wildlife museum**
- 2.3 Justification :
- 2.4 **Objectives** :
- 2.4.1 : To collect wildlife species and displaying objects having scientific value
- 2.4.2 : To preserve wildlife specimens for future demonstration and research
- 2.5 Expected output : Enrichment of information on the morphological, taxonomical and ecological aspects of the wildlife resources
- 2.6 **Study Period** :
- 2.6.1 Starting year : 2004-2005
- 2.6.2 Completion year : 2011 - 2012
- 2.8 Personnels :
- 2.7.1 Study Leader : M.A. Rahman, R.O
- 2.7.2 Associates : M. K. Islam, RA (Gr-1)
- 2.7.3 : S. M. Mainuddin, (FI)
- 2.8 **Progress** :
- 2.8.1 Previous year : A total of 02 (two) wildlife specimens including I.

Reptilia: Olive Reedley Sea Turtle (*Lepidochelys olivacea*); and ii) Aves: Eggs of Red Jungle Fowl (*Gallus gallus*) were collected and preserved in the wildlife museum.

2.8.2 This year :

Activities of the study	Progress
a) Collection of wildlife specimens and preservation	a) A total of 4 (four) specimen were collected and preserved in the wildlife museum. List of collection is given in table-2.
b) Preparation of videos, posters, still pictures of collected wildlife specimen.	b) Routine cure has been done.
c. Report writing and printing	c) Report writing is going on.

2.9. Achievement : NA

2.10 Financial Statement :

2.10.1 Total cost : 5, 00,000/-

2.10.2 Cost of the year : 45,000/-

2.10.3 Expenditure of the year : 45,000/-

2.10.4 Source of fund : GOB

2.11. **Beneficiaries** : Researchers, Students and Teachers of different educational Institutions and Forest Department / NGOs

Table-2. Collected specimens for wildlife museum

Class	Name of specimen	Number
Mammalia	Bengal Porcupine (<i>Hystrix indica</i>)	01
Reptilia	Binocellate Cobra (<i>Naja naja</i>)	01
	Snake(Unidentified)	01
	Checkered keel back (<i>Xenochrophis piscator</i>)	01
Total		04

TECHNOLOGY TRANSFER UNIT

- 1. Study : On going**
- 1.1. Programme area : Training and Technology Transfer
- 1.2. Title of the study : Training for BFRI Staff Members and stakeholders
- 1.3. Justification : To increase the efficiency of human resource there is no alternative to training. Training makes a govt. servant enable to manage his works efficiently. Training disseminate the technology and makes a technology familiar to the mass people.

1.4. **Objectives** :

- 1.4.1. To develop capacity of BFRI staff members
- 1.4.2. To enhance capacity of stakeholders in their respective area
- 1.4.3. To disseminate BFRI technology to the stakeholders

1.5. Expected output : Knowledge and skills of BFRI resource persons and stakeholders will be enhanced. Capacity of individual level will be developed.

1.6. **Study period**

- 1.6.1 Starting year : 2006-2007
- 1.6.2 Expected completion Year : 2015-2016

1.7 Personnel :

- 1.7.1 Study leader : Kabir Uddin Ahmed
- 1.7.2 Associates : Md. Akter Hossain

1.8 **Progress:** :

1.8.1 Previous years : Thirty-Two training programmes were organized during 2010- 2011 and 946 persons were participated in the training programme.

1.8.2	This year	
	Activities of the study	Progress
	1. Training on how to write ACR 2. Training on Preservative treatment 3. Bamboo branch cutting technique 4. Cultivation technique of medicinal plant 5. Bamboo grove management 6. Mother tree selection technique 7. Apiculture in hilly area 8. Nursery development and Mixed plantation technique	17 Training programme were arranged on 8 technologies

1.9 Achievements : Farmers and nursery owners are using BFRI technologies in the field.

1.10 **Financial statement**

- 1.10.1 Total cost :
- 1.10.2 Cost of the year :Tk. 600000.00
- 1.10.3 Expenditure of the year :Tk. 500000.00
- 1.10.4 Source of the fund :GOB
- 1.11 **Beneficiaries** : BFRI's staff member and the stakeholders

2. **Study** :**On going**

- 2.1 Programme area :Training and Technology Transfer
- 2.2 Title of the study :Workshops and Seminars
- 2.3 Justification : **Stakeholders** are not familiar with BFRI technologies. Introduction of BFRI technologies by workshop and seminar will be promulgated throughout Bangladesh.

2.4 **Objectives** :

- 2.4.1 To disseminate BFRI technologies to the stakeholders.
- 2.4.2 To share knowledge and experiences among scientists and stakeholders.
- 2.4.3 To nurture scientific culture and enhance linkage among the scientists and stakeholders.

2.5 Expected output :BFRI technologies will be disseminated to the stakeholders. Sharing of knowledge and experiences will benefit both BFRI scientists and stakeholders.

2.6 Study period :

2.6.1 Starting year :2006-2007

2.6.2 Expected completion Year :2014-2015

2.7 Personnel :

2.7.1 Study leader :Kabir Uddin Ahmed

2.7.2 Associates : Md. Akter Hossain

2.8 Progress :

2.8.1 Previous years : During 2010-11 three workshop were organized, at upazilla level it was in Satkania of Chittagong and two in district level at Cox's Bazar and Moulvibazar. 390 persons were participated on those programme

2.8.2	This year	
	Activities of the study	
	Progress	
	1. Dissemination of BFRI technologies at 5 (2+3) districts and upazillas (to be decided) with the help of district administrative.	BFRI technologies were disseminated at Bhola District.
	2. Workshop on Annual Research Progress for 2010-11 and Research Programme for 2011-12	Workshop on Annual Research Progress for 2010-11 and Research Programme for 2011-12 were arranged and workshop on Half Yearly Research Progress were arranged.
	3. Seminar: Monthly seminars on topics of recent interest (title to be decided)	-
	p.	

2.9 Achievements :Dissemination of BFRI technologies and information through workshop and seminar

2.10 Financial Statement :

2.10.1 Total cost :

2.10.2 Cost of the year : Tk. 200000.00

2.10.3 Expenditure of the year : Tk. 200000.00

2.10.4 Source of the fund : GOB

2.11 Beneficiaries : Nursery owners, private entrepreneurs, Forest Department, Bangladesh Forest Industries and Development Corporation (BFIDC) and other forest or forest produce related stakeholders

3. Study : On going

3.1 Programme area : Training and Technology Transfer

3.2 Title of the study : Publicity and Advertisement

3.3 Justification : Peoples and stakeholders will be familiar with BFRI technologies and activities

3.4 Objectives

3.4.1 To create awareness about BFRI technologies to the stakeholders and mass people

3.4.2 To disseminate BFRI technologies to the end users

3.5 Expected output : People will be made aware about BFRI technologies. BFRI Technologies will reach to the people.

- 3.6 **Study period**
- 3.6.1 Starting year : 2006-2007
- 3.6.2 Expected completion Year : 2015-2016
- 3.7 Personnel :
- 3.7.1 Project leader : Kabir Uddin Ahmed
- 3.7.2 Associates : Md. Akter Hossain
- 3.8 **Progress** :
- 3.8.1 Previous years : Participated in tree fair at Dhaka, Chittagong, Environment Fair and furniture mela.

3.8.2	This year	
	Activities of the study	Progress
	<p>Participation: Tree Fair, Environment Fair.</p> <p>Advertisement in print media on:</p> <ul style="list-style-type: none"> • BFRI information • Bamboo branch cutting • Preservative treatment • Plus tree selection • Nursery raising and development • Nursery pest and disease management • Use of treated bamboo sticks at <i>Pan boroj</i> 	<p>Participated in national tree fair-2012, Environment fair-2012, Ctg. City Corporation tree fair-2011, Ctg. Forest Division tree fair-2011, Moulavibazar tree fair-2011</p> <p>Thousands of people visited BFRI stalls and more than 1500 peoples put their comments in the visitor's book. More than 30,000 printed materials were distributed among the visitor</p> <p>In 14 national and local dailies, in weekly Bangla Barta, in monthly Ekushey patrika, 7 advertisement were circulated in 31 spots.</p>

3.9 Achievements : Awareness has been created among the mass people through demonstration of BFRI technologies in the fairs.

- 3.10 Financial Statement :
- 3.10.1 Total cost :
- 3.10.2 Cost of the year : Tk. 950000.00
- 3.10.3 Expenditure of the year : Tk. 950000.00
- 3.10.4 Source of the fund : GOB
- 3.11 Beneficiaries : People at all levels

- 4. Study : On going**
- 4.1 Programme area : Training and Technology Transfer
- 4.2 Title of the study : Audio-video documentation
- 4.3 Justification : BFRI technologies will be communicated to the mass people

4.4 Objectives

4.4.1 To document BFRI technologies in audiovisual form.

4.4.2 To disseminate BFRI technologies among the mass people and stakeholders

4.5 Expected output : Awareness will be created among the mass people about BFRI technologies. BFRI technologies will be disseminated to the mass people.

4.6 Study period :

4.6.1 Starting year : 2005-2006

4.6.2 Expected completion Year : 2015-2016

4.7 Personnel :

4.7.1 Study leader : Kabir Uddin Ahmed

4.7.2 Associate : Md. Akter Hossain

4.8 Progress :

4.8.1 Previous Years: : Documentaries 11 technologies and Introduction of BFRI were prepared.

4.8.3 This year

Activities of the year	Progress
Update of audio-visual documentation on BFRI introduction (translation in English).	

4.9 Achievements : Peoples are adopting BFRI technologies.

4.10 Financial Statement

4.10.1 Total cost :

4.10.2 Cost of the year : 75,000.00

4.10.3 Expenditure of the year : 75,000.00

4.10.4 Source of the fund : GOB

4.11 Beneficiaries : People at all levels

5. Study : On going

5.1 Programme area : Training and Technology Transfer

5.2 Title of the study : Printing Materials and Publicity

5.3 Justification : Peoples and stakeholders will be familiar with BFRI technologies and activities

5.4 Objectives :

5.4.1 To document BFRI technologies in printed form

5.4.2 To disseminate BFRI technologies

5.4.3 To

5.5 Expected output :

5.6 Study period

5.6.1 Starting year : 2005-2006

5.6.2 Expected completion Year : 2013-2014

5.7 Personnel (s) :

5.7.1 Study leader : Kabir Uddin Ahmed

5.7.2 Associate : Md. Akter Hossain

5.8 Progress

5.8.1 Previous years : Leaflets, booklets, posters and folders were printed

5.8.2 This year

Activities of the year	Progress
Leaflet	
<ol style="list-style-type: none"> 1. <i>KuA Kjg cxiZtZ eukPvl</i> 2. <i>euki Sio e'e'icbv</i> 3. <i>euki goK `gb e'e'icbv</i> 4. <i>cib eitR e'euZ euki kjv, Lyl, Kibg I Qtbi e'enuiK Avqyuj euk</i> 5. <i>imvqubK msi qYx c0q4M Aumeve I ibgP KtR e'euZ KtVi Avqyuj euk</i> 6. <i>eY PviitvcY I cuiPhP</i> 7. <i>NlytcuKvi AvugY I Zvi ibqSy</i> 8. <i>bunniZ DBitcuKvi AvugY I Zvi ibqSy</i> 9. <i>bunniZ Pvivi Xtj covtiM</i> 10. <i>eYi eR msi qY I `vgRvZKiY</i> 11. <i>KtqKuW i "ZcY eYi eqm ufiEK Drcv b, eaBnvi I AveZB Kij -</i> 12. <i>mRbvi KuU id` KvixtcuKvi AvugY I ZvibqSy</i> 13. <i>tKv_vq uK MQ j Mteb</i> 	28000 leaflet of 13 types were printed
<ol style="list-style-type: none"> 1. <i>euki thwRZ cY (Kt:uuRU tclM:m)</i> 2. <i>tgnMbi Wlv id` KvixtcuKvi AvugY I Zvi ibqSy</i> 3. <i>teZi PviDrcv b, Pvl I e'envi</i> 4. <i>%AubK cxiZtZ Kw mbv³KiY</i> 5. <i>KuLi Rngi AvBtj tvcY thM eY-</i> 6. <i>ARyMtQi cvZvi Mj tcvKvi AvugY I Zvi ibqSy</i> 7. <i>MpibgP mglMmte mitgU etUW cuUqKj teM</i> 8. <i>eb eRZjvi ufbatiM I Zvi cZKvi</i> 9. <i>euki tUKmB Ni</i> 10. <i>Aumeve I Mq mgP mglMz ivevi KtVi e'envi</i> 	14000 folders of 10 types were printed

5.9 Achievement : BFRI technologies were disseminated and awareness developed to all sector people through these printing materials.

5.10 Financial Statement

- 5.10.1 Total cost :
- 5.10.2 Cost of the year : 600000.00
- 5.10.3 Expenditure of the year : 600000.00
- 5.10.4 Source of fund : GOB
- 5.11 Beneficiaries : People at all levels

Research Progress Product Wing

2011-12

VENEER AND COMPOSITE WOOD PRODUCTS DIVISION

1. **Study:** On-going
 - 1.1 Programme area: Post Harvest Utilization -Physical Processing
 - 1.2 Title of the study: **Design and fabrication of furniture using bamboo composites.**
 - 1.3 Justification :
 - 1.4 **Objectives:**
 - 1.4.1 To assess the potential of bamboo composites for making quality furniture.
 - 1.4.2 To assess economic feasibility of commercially valuable furniture made of bamboo composites.
 - 1.5 Expected output:
- 1.6. **Study period** 2005-15
 - 1.6.1 Starting year: 2005-06
 - 1.6.2 Completion year: 2014-15
- 1.7 Personnel(s):
 - 1.7.1 Study Leader: K. Akhter, DO
 - 1.7.2. Associates: M. M. Rahaman, RO
- 1.8 **Progress:**
 - 1.8.1 Previous Years:

Different types of composite products such as, bamboo mat wood veneer board, bamboo ply and flattened bamboo ply were made using muli (*Melocanna baccifera*) bamboo. One chair, one shelf and one table were prepared and kept for service test. Bamboo mat overlaid particleboard and bamboo ply were made using bhyjja (*Bambusa vulgaris*) bamboo. Twelve molded chair and two tables were made and distributed for popularizing the technology. Four molded chairs were made using bamboo mat wood veneer board and bamboo ply and kept for service test. Twelve molded chairs and three tables were fabricated by composite products of borak (*Bambusa balcooa*) bamboo and kept in Director's office, CRO's office, BFRI show rooms, Dhaka and Chittagong, for exhibit and dissemination of the technology. Two shelves, one dining Table and four chairs were fabricated and kept for service test in VCWP Division. Four armed chairs and one almirah were fabricated using bamboo particleboard and bamboo Ply. Two single sofa and one three seated sofa, two book shelves and one computer table were prepared using bamboo ply and bamboo strips overlaid particle board. The bamboo composite furniture are kept in VCWP division for service test.

1.8.2 This year:

Activities of the study	Progress
a) Visit to bamboo plantation area and furniture shops and industries (Dhaka and Nilfamari)	Bamboo plantation area in Nilfamari was visited. End-users were encouraged and advised to visit BFRI and seek for the technology in the related field.
b) Design improvement of furniture component	Different bamboo composite products were selected for making furniture. One dressing table, one reading table, four molded chair and two tea tables were designed.
c) Procurement of bamboo culms (<i>Bambusa vulgaris/Bambusa balcooa</i>)	Borak (<i>Bambusa balcooa</i>) bamboos were collected from Bashkhali, Chittagong.
d) Preparation and processing of strips and mats	Strips were prepared and treated with borax-boric acid solution. Bamboo mats were prepared using Mitinga (<i>Bambusa tulda</i>) bamboo. Mats were treated with borax-boric acid solution.
e) Manufacturing of furniture components	Different types of composite products such as bamboo ply, bamboo particleboard, bamboo strips over laying particle board were made using borak (<i>B. balcooa</i>) bamboo. -Bamboo particleboard was made using bamboo strips and urea formaldehyde glue. -Bamboo particleboard was made by using planner shaving. Borax - boric acid was added with UF glue. -Bamboo strips over laying particleboard were made using bamboo strips and planner shavings.
f) Fabrication of one show case, four moulded chair and one alna.	One show case one alna and one tea table were prepared using bamboo ply board. Four molded chairs were prepared using bamboo mat overlaid veneer board. The bamboo composites furniture are kept in VCWP Division for service test.
g) Financial analysis and reporting	Price of the raw materials and manufacturing cost were calculated (Table-1).

Table: 1 Different bamboo furniture made from composite products

Furniture	Size	Bamboo species	Composite products	Material Cost (Taka)	Manufacturing cost (Taka)
Show case	5 ft. x4 ft.	<i>B. balcooa</i>	Bamboo ply board	7,500/-	6,000/-
Alna	4 ft. x1ft	<i>B. balcooa</i>	Bamboo ply board	1500/-	1000/-
Moulded chair		<i>B. balcooa</i>	Bamboo ply board and bamboo mat veneerboard	900/-	800/-
Tea table	2ft.x 2ft.	<i>B. balcooa</i>	Bamboo ply board	1200/-	800/-

1.9.1 Achievement(s): Bamboo composites can be used as furniture materials which can be promoted to exportable commodity.

1.10 **Financial statement** :

1.10.1 Total cost : Tk10,50,500.00

1.10.2. Cumulative cost : Tk. 94,700.00

1.10.3 Cost of the year : Tk1,00,500.00

1.10.4 Source of fund : GOB

1.11 Beneficiaries: Furniture industries, plywood and particleboard industries, farmers/bamboo growers, general people, village women, NGOs.

2. **Study: On-going**

2.1 Programme Area: Post Harvest Utilization -Physical Processing

2.2 Title of the study: **Determination of the durability and gluing characteristics of plywood made from treated non-durable wood.**

2.3 Justification (For new study):

2.4 **Objectives:**

2.4.1 To determine the treating efficiency of non-durable wood in making plywood

2.5 Expected output:

2.6. **Study period** : 2005-12

2.6.1 Starting year : 2005-06

2.6.2 Completion year : 2011-12

2.7 Personnel(s):

2.7.1 Project Leader: K. Akhter, DO

2.7.2. Associates: M. M. Rahaman, RO

2.8 **Progress**

2.8 .1 Previous progress

- a. Veneers of simul (*Bombax ceiba*) wood were treated with borax-boric acid and neem leaves solution of different concentrations. Three-ply and eleven-ply plywood were prepared at three different pressures at hot press. Shear test and delimitation test were performed to determine the gluing characteristics of the ply wood.
- b. Veneers of rubber wood were treated with borax-boric acid solution of different concentrations. Three-ply and eleven-ply plywood were prepared at three different pressures at hot press. Shear test and delimitation test were performed to determine the gluing characteristics of the ply wood.
- c. Veneers of kadam wood were treated with borax-boric acid solution of different concentrations. Three-ply and eleven-ply plywood were prepared at three different pressures at hot press. Shear test and delimitation test were performed to determine the gluing characteristics of the ply wood.
- d. Durability of the treated simul wood and rubber wood samples was investigated in pathology laboratory of BFRI by agar block test using white rot fungi. Samples for agar block test were prepared from eleven-ply plywood and sterilized with gamma radiation at Bangladesh Atomic Energy Research Institute, Savar, Dhaka.
- e. Two Scientific papers i) Effect of borax-boric acid treatment of simul (*Bombax ceiba*) veneers on Glue-Bond Quality of plywood and

- ii) Preservative treatment of simul (*Bombax ceiba*) veneers with Hot and Cold water solution of borax-boric acid by soaking process, were published in the proceedings of IRG 28th Annual Meeting, Biarritz, France, 9-13 may 2010.

2.8.2 This year:

Activities of the study	Progress
a) Peeling of am (<i>Mangifera indica</i>) log and drying of veneer	The logs of am wood were peeled to veneers and veneers were dried to required moisture contents (10%).
b) Treatment of the veneers with preservative.	Am veneer were treated with 2.5% and 5% Borax-boric acid solution
c) Manufacturing of three ply plywood using urea formaldehyde glue.	Three ply Plywood were made at 200 psi specific pressures by using hot press.
d) Determination gluablity of plywood	Dry and wet shear test of the three ply plywood samples were performed to investigate the glue bond quality (Table. 1 and Table. 2).
e) Visit to plywood factories	It is not possible to visit the plywood factories due to fund constraint.

Table:1 Strength properties of plywood made from am (*Mangifera indica*) wood.
(Dry shear Test)

Concentration (ratio)	Load at failure (kg/cm ²)	Wood failure (%)
Control	25.75	94
1:39 (2.5%)	24.77	93
1: 19 (5%)	22.85	92

Table:2 Strength properties of plywood made from am (*Mangifera indica*) wood.
(Wet shear Test)

Concentration (ratio)	Load at failure (kg/cm ²)	Wood failure (%)
Control	17.65	42
1:39 (2.5%)	16.75	40
1: 19 (5%)	15.55	38

2.8.1 Achievement(s): Veneer of non-durable Am wood can be used for making plywood after preservative treatment.

2.10 **Financial statement** :

2.10.1 Total cost of the study: Tk. 7,36,450.00

2.10.2. Cumulative cost : Tk 71,200.00

2.10.3 Cost of the year : Tk. 86,450.00

2.10.4 Source of fund : GOB

2.11 Beneficiaries: Wood merchants, plywood industries, villagers/farmers, BFIDC & NGOs

3. **Study : On-going**
 3.1 Programme area: Post Harvest Utilization -Physical Processing
 3.2 Title of the study: **Characterization of Lambu (*Khya spp.*) wood-studies on peeling, drying, gluing and particleboard making.**
 3.3 Justification (For new study):

3.4 **Objectives:**

3.4.1 To determine the suitability of Lambu (*Khya spp.*) wood for plywood and particleboard making.

3.5 Expected output:

3.6. **Study period** : 2009-12

3.6.1 Starting year : 2009-10

3.6.2 Completion year : 2011-12

3.7 Personnel(s):

3.7.1 Study Leader: M. M. Rahaman, RO

3.7.2. Associates: K. Akhter, DO

3.8 Progress :

3.8.1 Previous year :

Logs of lambu were collected. The logs were cross cut to bolts of 1.2 meter and preserved in log ponds of Veneer and Composite Wood Products Division. The logs of lambu wood were peeled to veneers and veneers were dried to required moisture contents (8%). Three ply Plywood were made at three specific pressures (150psi, 200psi, 250psi) by using hot press. Dry shear, wet shear and delimitation test of the three ply plywood samples were performed to investigate the glue bond quality.

3.8.2 **This year:**

Activities of the study	Progress
a) Preparation of lambu chips	Chips of lambu wood were prepared and dried to required moisture contents.(6-8%)
b) Manufacture of particle board	Particleboard were made at 200 psi specific pressures by using hot press
c) Preparation of test samples of particleboard	Test samples of particleboard were prepared to determine the quality of particleboard. (Table 1).
d) Determination of physical and mechanical properties of particleboard.	Physical and mechanical properties of particleboard were determined (Table 1).
e) Visit to plywood industry, kustia and furniture shop sylhet.	Furniture shop of sylhet were visited and End-users were advised to visit BFRI to collect information about the technology in the related field.

Table 1. Strength properties of particleboard made from Lambu (*Khaya sp.*) wood.

MOR (kg/cm ²)	Internal bond strength (kg/cm ²)	Thickness swelling (%)		Water absorption (%)	
		1 hr	24 hrs	1 hr	24 hrs
115.00	6.00	10.09	17.87	34.6	45.00

- 3.9.1 Achievement(s) :
- 3.10 **Financial statement** :
- 3.10.1 Total cost of the study: Tk.3,10,300.00
- 3.10.2. Cumulative cost : Tk. 70,100.00
- 3.10.3 Cost of the year : Tk. 83,080.00
- 3.10.4 Source of fund : GOB
- 3.11 Beneficiaries: Wood merchants, plywood industries, villagers/farmers, BFIDC & NGOs

PULP AND PAPER DIVISION

1. Study : On-going

1.1 Programme area : Post Harvest Utilization – Chemical Processing

1.2 Title of the study : **Influence of age on kraft pulping of kadam (*Anthocephalus chinensis*).**

1.3 Justification : Pulp and paper industry of Bangladesh uses both wood and non wood material for producing pulp. The per capita consumption of paper is increasing day by day with the increase of human population. But forest resources are decreasing at an alarming rate resulting acute crisis in raw material supply to the industry. To fulfill the need, both government and non-government organizations have been working in different aspects to increase the forest productivity. One of the approaches is the utilization of short rotation species for pulp production.

Pine is regarded as good raw material for pulping all over the world. Its rotation cycle is seven years. On the other hand Kadam (*Anthocephalus chinensis*) wood is widely used either alone or in mixture with bamboo for pulp production in Karnaphulli Paper Mills. But no definite cutting age is maintained at the time of harvesting. In 2001-2002, the mill has raised kadam plantation in their own land. It is expected that the nine years kadam species could be a suitable raw material for pulping. With this aim in view, pulp making characteristics of kadam of three age groups would be studied. The inter-relationship of age of wood species with pulp yield and quality would help to determine the optimum harvesting cycle of the species

1.4 Objective (s):

1.4.1 To determine the optimum harvesting time of the species with respect to yield and quality pulp

1.5. Expected output : Supplementation of the raw material would be enhanced.

1.6. Study period :

1.6.1 Starting year : 2009-10

1.6.2 Completion year : 2011-12.

1.7 Personnel (s):

1.7.1 Study Leader: Daisy Biswas, DO (in-charge)

1.7.2 Associates : Md. Misbahuddin, FI. and Urbashi Roy, FI

1.8 Progress:

1.8.1 Previous years, if any: Chemical constituents likely cold water solubles, hot water solubles, alcohol-toluene solubles, 1% caustic soda solubles, holocellulose and alpha-cellulose of kadam wood of three different age groups were determined. Pulps were made by varying alkali doses likely, 14, 16 and 18%. Kappa number and pulp yield were determined.

1.8.2 This year:

Activities of the study	Progress
a. Preparation of hand sheets of kraft pulp made from chips of kadam of three different age groups	Hand sheets of kraft pulp in three different freeness levels were made from chips of kadam.
b. Evaluation of physical strength properties.	The sheets were conditioned maintaining 21°C temp. and 50±2% RH. Test samples were prepared and then tear, tensile and burst strength were determined.
c. Reporting.	Report writing is in progress

1.9 Achievement(s), if any:

1.10 Financial Statement

1.10.1 Total cost: Tk. .2,00,000

1.10.2 Cost of the year: Tk. 66,000

1.10.3 Expenditure of the year: Tk.

1.10.4 Source of fund: GOB

1.11 Beneficiaries: Pulp and Paper Industries.

2. **Study** : **On-going**

2.1 Programme Area : Post Harvest Utilization – Chemical Processing

2.2 Title of the study : **Production of high yield pulp from bagasse, wastes of sugar mill of Bangladesh**

2.3 Justification : The demand of forest resources increases gradually with the continuous increase of population. However, the incremental rates of our demand and supply of the natural resources are not same. As a result the forest resources are becoming scarce everyday. On the otherhand, the consumption of paper, board and newsprint has been growing at a robust rate of 20% annually in the last five years. But the paper mill could not reach their targeted levels of daily paper production due to the scarcity of raw material supply. Therefore immediate action is necessary to find out new source of raw materials for pulp and paper mills to cope up with the future demand for attaining self sufficiency in paper production.

Bagasse, a fibrous residue, obtains after extraction of sugar from sugarcane and is available in the sugar mills of Bangladesh. Previously, bagasse was found suitable for the production of kraft and soda pulp. However, there is no study on the production of CTMP to improve the pulp yield. With this aim in view this study has been undertaken.

2.4 **Objective (s):**

2.4.1. Pulping process improvement for the production of high yield pulp

2.5. Expected output : Supplementation of the raw material would be enhanced

2.6. **Study period** :

2.6.1. Starting year : 2010-11

2.6.2. Completion year : 2013-14

2.7 **Personnel(s)**

2.7.1 Study Leader : Daisy Biswas, DO (in-charge)

2.7.2 Associates : Md. Misbahuddin, FI and Urboshi Roy, FI.

2.8 Progress:

2.8.1 Previous years, if any:

2.8.2 This year:

Activities of the study	Progress
a. Collection and processing of raw material	Related information has been collected
b. Pretreatment of bagasse by sulphite and alkaline peroxide	Will be done in the next years
c. Preparation of chemithermomechanical(CTMP) pulp by varying pulping time	-Do-
d. Refinement of treated material in sprout waldron refiner in three different freeness level.	-Do-
e. Measurement of the energy required for the production of pulp.	-Do-
f. Determination of kappa number and yield	-Do-

2.9.1 Achievements, if any : Nil

2.10 **Financial statement** :

2.10.1 Total cost : Tk. 2,00,000

2.10.2 Cost of the year : Tk. 66,000

2.10.3 Expenditure of the year : Tk.

2.10.4 Source of fund : GOB

2.11 Beneficiaries: Pulp and Paper Industries

3. **Study** : **On-going**

3.1 Programme area : Post Harvest Utilization – Chemical processing

3.2 Title of the study : **Oxygen delignification of kraft pulp of stem and branches of rubber tree (*Hevea brasiliensis*)**

3.3 Justification :

Bangladesh Forest Industries Development Corporation (BFIDC), Chittagong Hill Tract Development Board (CHTD) and other private organizations have planted rubber trees (*Hevea brasiliensis*) in a large scale for latex production. The stem and branches of harvested rubber tree was found suitable for pulp production. In order to determine the end use of the pulp, bleaching response need to be observed. Recently, oxygen delignification of pulp is regarded as the environment friendly bleaching process. In this study the kraft pulp of stem and branches of rubber tree (*Hevea brasiliensis*) would be bleached with the supply of oxygen gas at various pressures.

3.4 **Objective(s)** :

3.4.1 To investigate the bleaching response of rubber pulp for using as high quality paper.

3.5 Expected output: High quality pulp for making printing and writing paper.

3.6. **Study period** :

3.6.1. Starting year : 2011-12

3.6.2. Completion year : 2013-14

3.7 **Personnel(s)**

3.7.1 Study Leader : Daisy Biswas, DO (in-charge)

3.7.2 Associates : Md. Misbahuddin, FI and Urboshi Roy, FI.

3.8 Progress:

3.8.1 Previous years, if any:

3.8.2 This year:

Activities of the study	Progress
a. Processing of stem and branches of rubber tree.	Stem and branches of rubber tree were collected from Dantmara rubber state. These were converted into planks of size 3" ×3"×length of the bolt.. and preserved in the division for air drying.
b. Preparation of kraft pulp with 18% active alkali by maintaining 150 min. cooking time to suit 20-25 kappa number	-Do-
c.. Bleaching of the prepared pulp with oxygen at various pressure	-Do-
d Determination of kappa number and yield	-Do-

3.9. Achievements, if any : Nil

3.10 **Financial statement** :

3.10.1 Total cost : Tk. 2,00,000

3.10.2 Cost of the year : Tk. 45,000

3.10.3 Expenditure of the year : Tk.

3.10.4 Source of fund : GOB

3.11 Beneficiaries: Pulp and Paper Industries

4. Study : **New**

4.1 Programme area : Post Harvest Utilization – Chemical processing

4.2 Title of the study : **Pulp making characteristics of baizzya (*Bambusa vulgaris*) in a mixture with hardwood species.**

4.3 Justification (For new study) : In the past, Karnaphuli paper mill used entirely muli bamboo (*Melocanna baccifera*) for pulp production. Later on, wood is used widely along with village bamboos likely *Bambusa vulgaris* for smooth pulp production but there is no information regarding the optimum use of bamboo with wood in producing chemical pulp.

There is an anatomical and chemical variation exists between wood and bamboo. The pulp quality might differ with the variation of wood: bamboo ratio. In this study optimum ratio of bamboo and wood would be ascertained with respect of both yield and quality of pulp

4.4 **Objective (s):**

4.4.1. Determination of the optimum ratio of bamboo and wood with respect to yield and quality pulp

4.5. Expected output : Rational utilization of the raw material would be enhanced.

4.6. **Study period** :

4.6.1. Starting year : 2011-12

4.6.2. Completion year : 2013-14

4.7 **Personnel(s)**

4.7.1 Study Leader : Daisy Biswas, DO(in-charge)

4.7.2 Associates : Md. Misbahuddin, FI.; Urboshi Roy, FI. and M. S. Rahman , RO.

4.8 Progress:

4.8.1 Previous years, if any:

4.8.2 This year:

Activities of the study	Progress
a. Collection and processing of raw material.	<i>Bambusa vulgaris</i> and <i>Albizia richardiana</i> were collected from KPM and Boalkhali, a village of Chittagong respectively. The dry matter content of the material was measured.
b. Preparation of kraft pulp by varying alkali dose and pulping time with the chips of bamboo and wood	Kraft pulps were prepared with 16, 18 and 20 % active alkali by maintaining 150 min cooking time and 170°C. Yield of the pulp was determined (Table 1)

4.9. Achievements, if any : Nil

4.10 **Financial statement** :

4.10.1 Total cost : Tk. 4,50,000

4.10.2 Cost of the year : Tk. 43,000

4.10.3 Expenditure of the year : Tk.

4.10.4 Source of fund : GOB

4.11 **Beneficiaries:** Pulp and Paper Industries

Table 1: Pulping studies of baizzya (*Bambusa vulgaris*) in mixture with hard wood

Chips composition (%)		Active Alkali(%)	Chemical Consumption	Screen yield(%)	Reject(%)
<i>B. vulgaris</i>	<i>A. richardiana</i>				
100	00	16	15.67	47.0	3.41
		18	17.54	46.3	2.10
		20	19.45	44.7	1.52
70	30	16	15.58	46.5	4.00
		18	17.60	45.1	2.00
		20	19.41	42.3	1.70
50	50	16	15.61	48.9	4.08
		18	17.53	47.5	3.28
		20	19.48	46.6	1.25
30	70	16	15.58	48.9	1.32
		18	17.6	48.8	1.30
		20	19.38	47.7	0.44
00	100	12	12.50	48.2	0.04
		14	13.21	46.8	0.20
		16	13.50	44.6	Nil

WOOD PRESERVATION DIVISION

1. **Study** : **On-going**
- 1.1 Programme Area : Post Harvest Utilization –Chemical Processing
- 1.2 Title of the Study : **Extension of preservation treatment technology. to the end- users**
- 1.3 Justification : NA
- 1.4. **Objectives** :
- 1.4.1 : To motivate people through training, workshop, group discussions, personal contacts etc.
- 1.4.2 : To provide technical support to the business initiators for development of entrepreneurship in preservative treatment
- 1.5 Expected output : Use of preservative treatment technology by common people and development of local entrepreneurship.
- 1.6 **Study period** : 2007 –2013
- 1.6.1 Starting year : 2007 – 2008
- 1.6.2 completion year : 2012 – 2013

- 1.7 **Personnels** :
- 1.7.1 Study Leader : Abdus Salam, RO.
- 1.7.2 Associates : Mozammel Hoque Chy,RO.; Dr. Khurshid Akhter,DO.

1.8 **Progress** :

- 1.8.1 Previous years :
- Four training programmes were organized on preservative treatment of wood, bamboo, sungrass and other house building materials at Zaldi, Banigram, Banshkhali and Baripara of Chittagong; Moheshkali, Cox's Bazar district and treated bamboo sticks were distributed to the betel leaf farmers.
 - A treated bamboo house was constructed at Sonapur, Feni Sadar for disseminating the treatment technology.
 - Technical support was provided in developing and modifying the treatment plant at Feni Sadar, Charbata, Noakhali and Moheshkali under the guidance of BFRI scientists for disseminating the technology.

1.8.2 **This year :**

Activities of the study	Progress
a. Procurement of raw materials, chemicals and other inputs.	a. Chemicals, hardware, glass ware, laboratory goods etc. and Equipments such as Buchary machine were procured.
b. Treatment of demonstration materials for training and motivation programme.	b. Wood, bamboo, sungrass etc. demonstration materials were treated for training and motivation programme. About 800 interested people from different areas took part in the training and motivation programme. Treatment process was demonstrated and necessary advices were given to them.
c. Bamboo demonstration model house will be repaired at Fythong, Bandarban.	c. Bamboo demonstration model house was repaired at Fythong, Bandarban. Preservative treatment technology was disseminate to about 200 local people of Fythong, Bandarban . Theoretical and practical training on preservation technology were provided to the end-user.
d. Arrangement of training and motivational activities in Rajshahi, Kushtia, Barisal and Jessore	d. Theoretical and practical training on preservation technology were given to 1000 nos. of Emam of Bangladesh Emam Prosikhan Center, Chittagong 200 nos. of betel leaf & vegetable farmers were motivated and trained on the treatment of bamboo sticks and thatching materials at Barishal & Jessore.
e. Monitoring of service life of previously established experiments in betel leaf & vegetable farms in Moheshkhali, Barisal and Jessore	e. Evaluation was made on the service life of betel leaf sticks supplied in 2010 at Barishal and Jessore. It was observed that the treated sticks were in good condition where as the untreated ones were fully damaged.

f. 2500 nos. treated bamboo sticks will be Distributed at Rajshahi, Panchanagor, Kushtia, Barisal and Jessore betel leaf & vegetable farmers.	f. 2500 bamboo sticks were treated with 10%, CCB solution by soaking method and will be supplied at Barishal, Jessore betel leaf and vegetable farmers. Technical support was given to the business initiator at Jessore.
g) Analysis and reporting	g) Analysis and reporting are in progress.

1.9 Achievement(s), if any

1.10 : NA

1.11 **Financial statement** :

1.10.1 Total cost : Tk. 9,63,000 /-

1.10.2 Cost of the year : Tk.1,95,000/-

1.10.3 Expenditure of the year : Tk.

1.10.4 Source of fund : GOB

1.11 **Beneficiaries** : NGOs and general public, particularly the users of wood, bamboo, sun grass and other materials

2 **Study** : **On-going**

2.1 Programme Area : Post Harvest Utilization –Chemical Processing

2.2 Title of the Study : **Evaluation of CCB preservative and Treatability & durability of wood and bamboo species.**

2.3 Justification : NA

2.4 **Objectives** :

2.4.1 : To develop treating schedule for preservative treatment.

2.4.2 : To determine outdoor service life of wood and bamboo species treated with CCB.

2.4.3 : To disseminate the information to the end-users.

2.5 **Expected output** :

2.6 : Treatment schedule and service life of wood and bamboo species.

2.6 **Study period** : 2007-2014

2.6.1 Starting year : 2007-2008

2.6.1 Completion year : 2013-2014

2.7 **Personnels** :

2.7.1 Study Leader : Mozammel Hoque Chy, R O.

2.7.2 Associates : Abdus Salam, R O.; Dr. Khurshid Akhter, D O.

2.8 **progress** :

2.8.1. Previous progress, if any :

- Bijya (*Bambusa vulgaris*) bamboo, Rubber(*Hevea brasiliensis*) wood, Rajkoroï
- (*Albizia richardiana*) wood were treated by soaking method using CCB solution. The treated samples were installed in the stake- yard for service test.
- Underground portion of the untreated samples of Bijya (*B. vulgaris*) were destroyed completely after 9 months and treated samples are still remain in sound condition.

- Underground portion of the untreated samples of rubber (*Heavea brasiliensis*) wood were destroyed completely after 9 months and treated samples are still remain in good condition.
- Underground portion of the untreated samples of Raj koroï (*Albizia richardiana*) were destroyed completely after 6 months and treated samples are still in good condition.

2.8.2. This year :

Activities of the study	Progress
a. Procurement of CCB preservative, Lambu (<i>Khaya</i> Sp.) wood, Rajkoroï (<i>Albizia richardiana</i>) wood, Rubber (<i>H. brasiliensis</i>) wood and Baijja (<i>B. vulgaris</i>) bamboo, Muli (<i>Melocanna baccifera</i>) bamboo, Borak (<i>B. balcooa</i>) bamboo.	a. Wood and bamboo Procured from different areas and different market.
b. Processing of timber & bamboo and preparation of samples	b. For preservative treatment 140 nos of samples of wood and bamboo were prepared as follows : Wood : 50.80 cm í 5.0 8 cm í 2.54cm 20.32 cm í 10.16 cm í10.16cm 20.32 cm í 7.62 cm í10.16cm Bamboo: 91.44 cm í dia 8 cm
c. Treatment of samples with 10% CCB solution by soaking and Lowry Empty cell pressure process for target retention of 8-16 kg/m ³ following standard schedule.	c. 81 numbers of samples wood and bamboo have been treated with 10% CCB solution using Lowry Empty cell pressure process (Table – 01)
d. Installation of treated and untreated samples in stake yards at BFRI campus & Barisal PTU campus for service test	d. Treatability group was determined and class as below :Wood: Rajkorai-Highly treatable Lambu-Moderately treatable
e. Collection of data from BFRI & Barisal stake yard.	e. Treated samples were installed at BFRI campus, ctg and Plantation Trial Unit (PTU) in Barisal stake-yard investigating service life.
f. Analysis of data and determination of treatability group.	f. Data are being collected from stake-yard after every 04 months
g. Reporting.	g.

2.9 Achievement(s),if : NA

2.10 **Financial statement** :

2.10.1 Total cost : Tk. 3,08,833/-

2.10.2 Cost of the year : Tk. 98,920/-

2.10.3 Expenditure of the year : Tk.35,000/-

2.10.4 Source of fund : GOB

2.11 **Beneficiaries** : NGOs , general public, particularly the users of wood and bamboo.

Table- 1. Retention of preservatives through rajkoroi (*Albizia richardiana*) treated by pressure process.

Sample (nos)	Size (cm)	Average moisture content (%)	Pressure (kg/cm ²)	Average absorption (gm)	Average Retention (kg/m ³)
50	50.8x5.08x2.54	28	8.81	111.3	16.98

FOREST CHEMISTRY DIVISION

1. **Study** : **On-going**
- 1.1 Programme Area : Post Harvest Utilization-Chemical Processing.
- 1.2 Title of the Study : **Improvement of the existing extraction techniques of agar (*Aquilaria malaccensis* Lam.) oil.**
- 1.3 Justification : Forest Department has raised plantations of agar trees in Moulavibazar and at some other districts. After several years when a plentiful quantity of agar wood is formed, they should be utilized properly for extraction of agar oil. The local people of greater Sylhet district extract agar oil by crude methods and hence get lower yield and poor quality of the oil. So a study was taken to improve the existing extraction techniques with an aim to increase the yield and quality of agar oil. It is expected that the agar entrepreneurs will get better yield and quality of agar oil by adaptation the improved extraction technique.
- 1.4 **objectives** :
- 1.4.1 To improve the existing extraction techniques of oil from agar wood to obtain it's maximum yield and better quality.
- 1.4.2 To assess the oil content in agar fruit.
- 1.5 Expected output : Improved extraction technique and increase yield and quality of agar oil.
- 1.6 **Study period** :
- 1.6.1 **Starting year** : **2005-2006**
- 1.6.2 **Completion year** : **2011-2012**
- 1.7. **Personnel's** :
- 1.7.1 Study leader : S. Akhter, DO
- 1.7.2 Associates : M. S. Rahman, RO
: S. C. Nath, RA (Gr.-1)
- 1.8. **Progress** :
- 1.8.1 Previous progress : One prototype distillation apparatus was fabricated and oil was extracted in water distillation method. Yield of oil was found to vary from 0.001 to 0.09% from artificial and natural grades of agar wood. Extraction with Clevenger apparatus yielded 0.89% oil from natural grade of agar wood. Improvement was made on separation and purification technique of the oil. Oil was extracted from agar fruits by steam distillation method, though it could not be separated from water. However, when Soxhlet apparatus was used, the fruits yielded 17.96% vegetable oil.

Agar oil was analyzed through GC-MS chromatograph at BCSIR, Chittagong and major chemical constituents were Octacosane, Caryophyllene oxide, Cadinene, Di-isooctyl ester, Cyclohexane carboxyldehyde, Ledene alcohol.

Four training programmes on agar production, extraction and utilization were conducted for agar traders at Barolekha, Moulavibazar and BFRI headquarter. In all, one hundred and sixty distillation plant owners and traders were trained. One Bangla bulletin on agar cultivation and agar cottage industry in Bangladesh was published. One model of pilot scale distillation apparatus was fabricated.

1.8.2 This year :

Activities for the study	Progress
a. Collection of agar wood from artificially inoculated and experimental agar trees from Borolekha, Moulavibazar.	Artificial grades of agar chips were collected from Moulavibazar district.
b. Extraction of oil from agar wood in laboratory and pilot scale distillation apparatus.	Five charges were made to extract oil in laboratory scale distillation apparatus. Oil percentages were found to vary from 0.03% to 0.04%. In pilot scale distillation apparatus oil found 0.59%.
c. Improvement of present extraction technique.	Improvement was made on water circulation system and separation of oil in extraction technique. One pilot scale apparatus was designed and installed at Barolekha, Moulavibazar to compare with traditional technique. In improvement method 0.59 % oil was obtained whereas in the traditional method 0.41% oil was extracted. The observations and results are given in Table 1.
d. Arrangement of training programme to the agar producers and traders.	One training programme on agar production, extraction and utilization was conducted for agar distillation plant owners and traders at Borolekha, Moulavibazar.

1.9 Achievement : The traditional extraction technique of agar oil was improved. Improvement was made on better percentage of oil, circulation system of distillate and separation of oil in extraction technique. One prototype and one pilot scale distillation apparatus was designed and fabricated. One Bangla bulletin on agar cultivation and agar cottage industry in Bangladesh was published.

1.10 **Financial Statement** :

1.10.1 Total cost :Tk, 12,62,000/-(IncludingTk.4,00,000 for training programme)

1.10.2 Cost of the year :Tk. 3,40,000/-(Including Tk. 1,00,000 for training programme)

1.10.3 Expenditure of the year :Tk. 3,35,000/- (Including Tk. 1,00,000 for training programme)

1.10.4 Source of fund : BFRI (GOB), FD (GOB).

1.11 **Beneficiaries** : FD, Agar producers and traders.

Table 1. Extraction of agar oil in traditional and improved method

Sl. No.	Parameter	Traditional method	Improved method
1.	Extraction time (days)	15 - 30	7-10
2.	Yield oil (%)	0.41	0.59
3.	Oil separation technique	Manual	Separatory funnel is used
4.	Water circulation technique	Manual	Auto No labour is needed
5.	Drying of oil	Sun drying. This may cause degradation of oil	Dried over anhydrous sodium sulphate.

2. **Study** : **New**
- 2.1 Programme Area : Post Harvest Utilization-Chemical Processing.
- 2.2 Title of the Study : **Chemical characterization of rubber (*Hevea brasiliensis*) seed oil for industrial utilization.**
- 2.3 Justification : The rubber tree (*Hevea brasiliensis*) is exploited in Bangladesh mainly for latex in view of its economic importance. The secondary products namely, wood and the seeds are mostly neglected. Of these two products, the seeds have the greatest potential and are in abundance in the country. About 7000 metric ton of rubber seeds is produce in per annum in the country. The seeds are rich in oil content. It's content in the dried kernel is found up to 47%. Although huge potentialities, the seeds are not exploited for its utilization. The present study has taken to chemical characterize of the oil for industrial utilization.
- 2.4 **Objectives** :
- 2.4.1 To assess the suitability of rubber seed oil (RSO) for various industrial application.
- 2.5 Expected output : Utilization of rubber seed oil as industrial raw materials.
- 2.6 **Study period** :
- 2.6.1 **Starting year** : **2011-2012**
- 2.6.2 **Completion year** : **2011-2012**
- 2.7. **Personnel's** :
- 2.7.1 Study leader : M. S. Rahman, RO
- 2.7.2 Associates : S. Akhter, DO
: S. C. Nath, RA (Gr.-1)
- 2.8. **Progress** :
- 2.8.1 Previous progress : N/A
- 2.8.2 This year :

Activities for the study	Progress
a. Collection of rubber seeds and preparation of sample	Rubber seeds were collected from Dantmara Rubber Estate, Hiyanko. Seeds were screened and dried over sun. Samples were prepared.
b. Design and establish of mechanical oil expeller.	Purchasing of mechanical oil expeller machine is on going
c. Extraction of oil from seed by chemical and mechanical process.	Oil was extracted in solvent extraction method. About 47% oil was obtained from rubber seed kernel. About 17.4 2% crude oil was obtained from whole rubber seed by mechanical process.

d. Physical and chemical characterisation of oil.	Physical and chemical properties of oil were determined. (Table-2,3)
e. Esterification of oil for bio diesel production.	Product (Biodiesel) was analyzed for its confirmation (Table-4). For using in commercial sector it needs more experiment according to biodiesel ASTM, WWFC and EAS-ERIA standard.

2.9 Achievement : Physical, chemical properties and fatty acid composition of rubber seed oil were determined. Biodiesel from rubber seed was analyzed for its confirmation.

2.10 **Financial statement** :

2.10.1 Total cost : Tk. 1,20,000/-

2.10.2 Cost of the year : Tk. 1,20,000/-

2.10.3 Expenditure of the year : Tk. 1,20,000/-

2.10.4 Source of fund : GOB

2.11 **Beneficiaries** : Rubber garden owners, BFIDC, FD, Oil Industries.

Table-1: Fatty acid composition of rubber seed oil using GLC:

Fatty acid	(%)
Palmitic	14.071
Stearic	0.019
Oleic	9.838
Linoleic	36.920
Linolenic	29.064
Behenic	8.700

Table-2: Physical and chemical properties of rubber seed oil

Sl. No.	Test Parameter	Result
01	Refractive Index (30 ⁰ C)	1.472
02	Specific Gravity (30 ⁰ C)	0.928
03	Viscosity (mp) (30 ⁰ C)	520 mp
04	Acid Value	10.0
05	Iodine Value	40.32
06	Saponification Value	194.66
07	Peroxide value (millimoles/1000g)	2.5
08	Titre value (⁰ C)	29 ⁰ C-32 ⁰ C
09	Unsaponification matter (%)	1.14%
10	Free Fatty Acid (as Oleic) (%)	8.55

Table 3: Properties of biodiesel from rubber seed oil (Source from BCSIR, Dhaka)

Name of the analysis		Method	RSO
Color		ASTM & DIN 51900	4.5
Density at 15 ⁰ C(g/cc)		IP-160/57	0.9319
Kinematic viscosity(cst)	40 ⁰ C	ASTM-D 445-65	44.7912
	100 ⁰ C	ASTM-D 445-65	9.5192
Pour point, ⁰ C		ASTM-D 97-57	4.5
Flash point, ⁰ C		ASTM-D 93-62	60
Fire point, ⁰ C		ASTM-D 93-62	66
Acid value, mg KOH/g		IP-1/58	5.49
Sulfur content, g/g		ASTM-D 129-64	0.02719
Cetane no.		ASTM-D 613-86	38.5
Water content, %		IP-74/57	Trace
Carbon residue, %		ASTM-D 189-65	
Ash content, %		ASTM-D 482-63	0.05163
Calorific value(Kcal/kg)		-	9956.1534
LCV in KJ/Kg			

* RSO = Crude rubber seed oil

SEASONING AND TIMBER PHYSICS DIVISION

1. **Study** : **On-going**
- 1.1 Programme area : Post harvesting utilization- Physical processing
- 1.2 Title of the study : **Studies on physical and mechanical properties of katbadam (*Terminalia catappa*) wood.**
- 1.3 Justification : Till now, physical and mechanical properties of about 92 forest and homestead timber species were determined. Basic information on physical and mechanical properties is needed prior to using wood species for making furniture and other uses. As per demand of end users the species has been selected for finding their physical and mechanical properties.
- 1.4 **Objectives** : To assess the suitability of katbadam wood for making furniture and construction materials.
- 1.5 Expected output : Determination of physical and mechanical properties of katbadam (*Terminalia catappa*) wood for appropriate use.
- 1.6 **Study period** :
- 1.6.1 Starting year : 2006-07
- 1.6.2 Completion year : 2012-13
- 1.7. Personnel (s) :
- 1.7.1 Study leader : U. K. Rokeya, RO
- 1.7.2 Associates : M. Jahangir Alam, DO and M. Rowson Ali, RO

1.8. **Progress** :

1.8.1 Previous years, if any : Physical and mechanical properties of about 92 local timber species (commercially important/commercially less important) were evaluated.

1.8.2 This year
:

Activities of the study	Progress
a. Collection of three sample trees of katbadam amounting 40 cft. from Chittagong hill tracts/Satkhira.	a. 40 cft katbadam round wood were collected from Chasra, Jessore.
b. Preparation of 270 samples for testing physical and mechanical properties in green condition.	b. 270 samples were prepared for testing physical and mechanical properties in green condition.
c. Preparation of 250 samples for testing physical and mechanical properties in air-dry condition.	c. Preparation of 250 samples for testing physical and mechanical properties in air-dry condition is going on.
d. Determination of physical and mechanical properties of katbadam both in green and air-dry condition.	d. Physical and mechanical properties of katbadam were determined in green condition.
e) Data analysis and reporting.	e. Data on physical and mechanical properties of katbadam was compiled and analyzed in green condition (Table-1).

Table-1: Data on physical and mechanical properties of katbadam in green condition

S1 no.	Properties	Values
01.	Moisture content (MC %)	51.0
02.	Specific gravity	0.54
03.	Volumetric shrinkage (Green to OD)	11.2%
04.	Static bending (kg/cm ²)	
	Stress at proportional limit	280
	Modulus of rupture	503
	Modulus of elasticity	54
05.	Compression parallel to grain (kg/cm ²)	
	Stress at proportional limit	172
	Maximum crushing strength	261
06.	Compression perpendicular to grain	
	Stress at proportional limit (kg/cm ²)	76
07.	Shear parallel to grain(kg/cm ²)	
	Radial	111
	Tangential	113
08	Cleavage (kg/cm)	
	Radial	30
	Tangential	31

09	Tension perpendicular to grain (kg/cm ²)	
	Radial	31
	Tangential	32
10.	Hardness (kg)	
	Side	353
	End	461
11.	Nail withdrawal (kg)	
	Side	79
	End	44
12.	Toughness (cm-kg)	
	Radial	209.8
	Tangential	213.4

1.9 Achievement (s), if any : NA

1.10 **Financial Statement** :

1.10.1 Total :

1.10.2 Cost of the year : Tk. 74,800.00

1.10.3 Expenditure of the year : Tk. 74,800.00

1.10.4 Source of fund : GOB

1.11. **Beneficiaries** : BFIDC, FD, Wood Industries, University students, BFRI and others

2. **Study** : **New**

2.1 Programme area : Post harvesting utilization- Physical processing.

2.2 Title of the study : **Studies on modified solar kiln augmented with residue burner for efficient seasoning of different thickness of wood.**

2.3 Justification : Seasoning properties of about 20 wood species were determined using 2.54 cm thickness of wood sample. But little information's are available on seasoning properties for 4.0 cm and 5.0 cm thicknesses of wood sample. As per demand of end users, the study has been undertaken using different thicknesses of wood samples.

2.4 Objective (s) of the study :

2.4.1 To enhance the efficiency of wood seasoning process through modified solar kiln augmented with residue burner

2.4.2 To determine the seasoning characteristics of different thicknesses of wood.

2.5 Expected output : Application of improved solar kiln for effective seasoning of different thicknesses of wood.

2.6 **Study Period** :

2.6.1 Starting year : 2011-12

2.6.2 Completion year : 2011-12

2.7. Personnel (s) :

2.7.1 Study leader : Md. Rowson Ali, RO

2.7.2 Associates : M. Jahangir Alam, DO and U. K. Rokeya, RO

2.8. **Progress** :

2.8.1 Previous years, if any :

Table: Seasoning schedule of different timber species in 3 conditions

Species	Seasoning schedule / seasoning conditions		
	Air dry (From dry to rainy season), in days	Solar kiln (From dry to rainy season), in days	Solar kiln with additional heat for 3-5 hours, in days
Mahogany- <i>Swietenia macrophylla</i>	45-60	15-22	5-6
Rubber- <i>Hevea brasiliensis</i>	40-65	15-25	5-8
Rajkoroi- <i>Albizia richardiana</i>	35-50	20-27	8-10
Raintree- <i>Samanea saman</i>	38-90	17-28	6-7
lambu- <i>Khaya sp.</i>	25-45	16-20	6-8
Arjun- <i>Terminalia arjuna</i>	27-45	20-22	8-10
Jalpai- <i>Elaeocarpus floribundus</i>	28-36	20-24	9-11

2.8.2 This year :

Activities of the study	Progress
a. Collection of 50 cft. rain tree (<i>Samanea saman</i>) and ghora-neem (<i>Melia azadarach</i>) round wood for preparation of 122-183 cm x 2.54-4.0 cm x 2.54-4.0-5.08 cm size planks.	a. 25 cft rain tree and 25 cft ghora-neem round wood were collected from Satmile, Jessore and 122-183 cm x 2.54-4.0 cm x 2.54-4.0-5.08 cm of planks size were prepared.
b. Testing of rain tree and ghora-neem sample planks for determination of seasoning efficiency in three seasoning conditions (air drying, solar kiln and solar kiln with burner).	b. Seasoning properties of rain tree and ghora-neem sample planks were determined in air dry, solar kiln and solar kiln with burner.
c. Maintenance of solar kilns.	c. Existing solar kilns of BFRI have been maintained by repairing and painting.
d. Data analysis and report writing.	d. Data on seasoning properties of rain tree and ghora-neem were analyzed (Fig: 1, 2, 3, 4, 5 and 6)

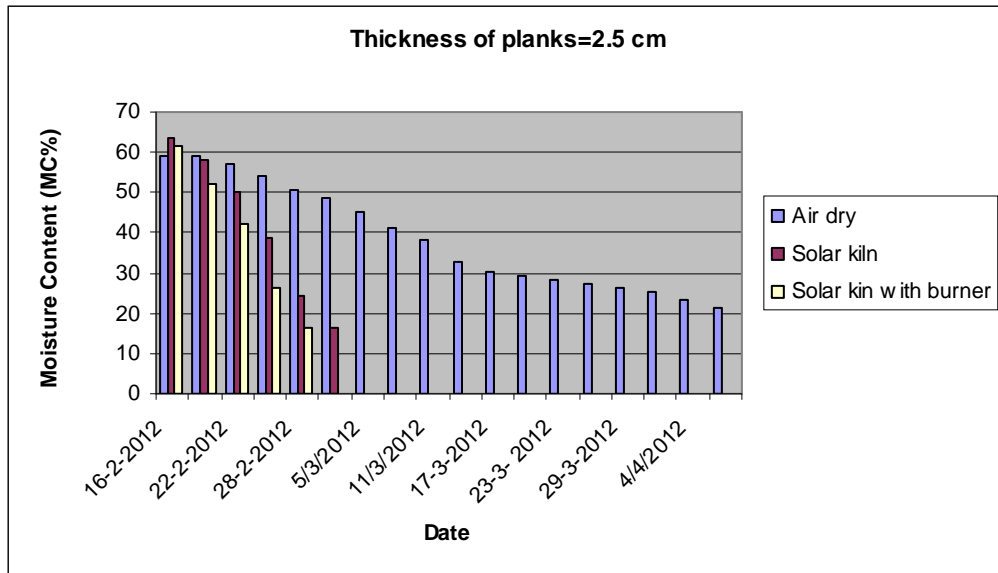


Fig.1: Variation in Moisture content (%) of rain tree (*S. saman*) wood with time

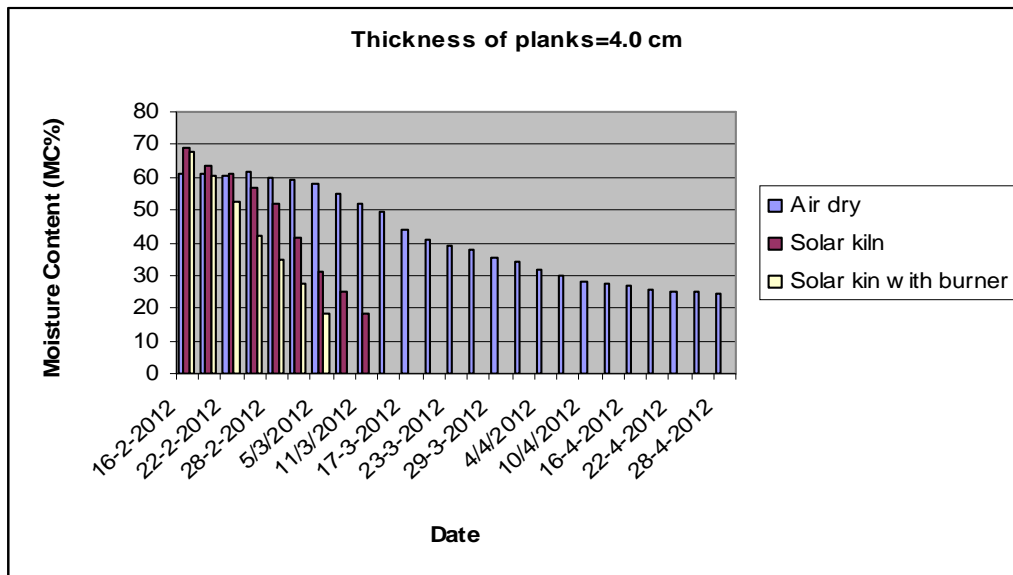


Fig.2: Variation in Moisture content (%) of rain tree (*S. saman*) wood with time

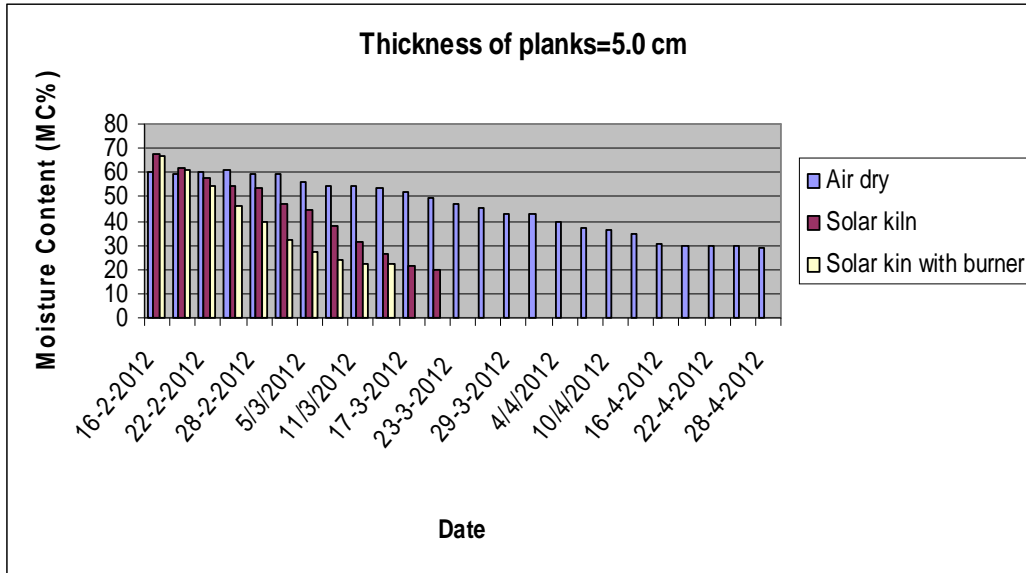


Fig.3: Variation in Moisture content (%) of rain tree (*S. saman*) wood with time

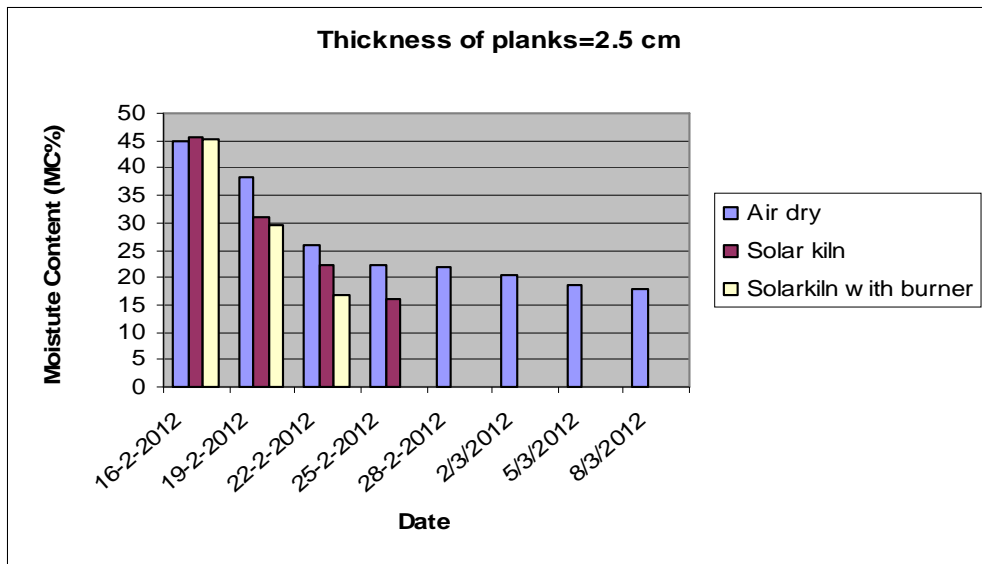


Fig.4: Variation in Moisture content (%) of ghora-neem (*M. azadarach*) wood with time

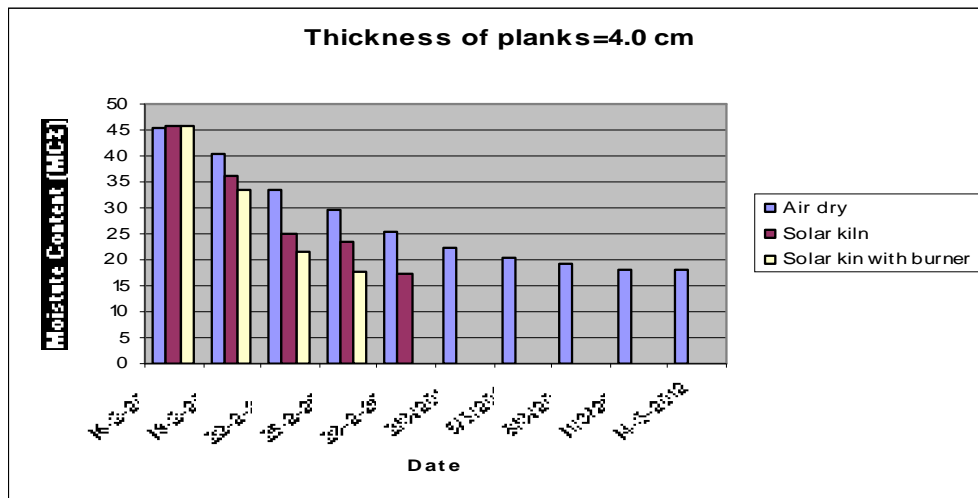


Fig.5: Variation in Moisture content (%) of ghora-neem (*M. azadarach*) wood with time

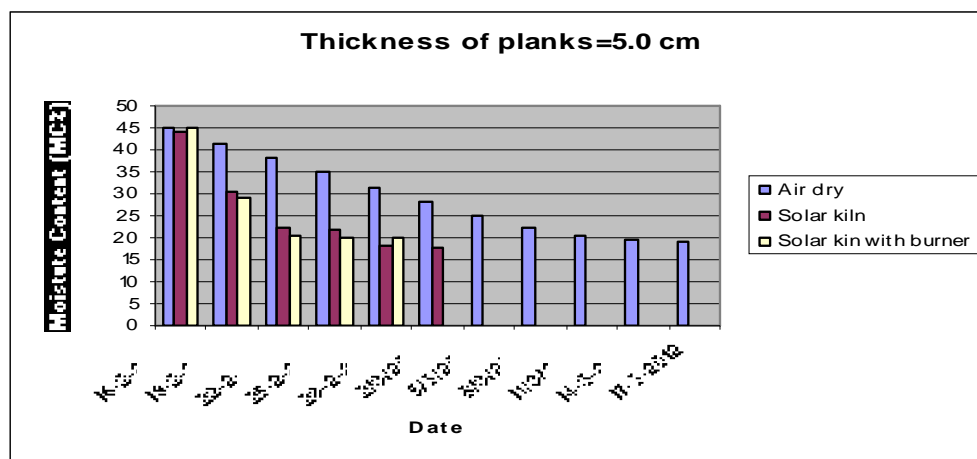


Fig.6: Variation in Moisture content (%) of ghora-neem (*M. azadarach*) wood with time

- 2.9 Achievement (s), if any : NA
- 2.10 **Financial Statement** :
- 2.10.1 Total cost :
- 2.10.2 Cost of the year : Tk. 1, 14,550.00
- 2.10.3 Expenditure of the year : Tk. 1, 14,550.00
- 2.10.4 Source of fund : GOB
- 2.11 **Beneficiaries** : BFIDC, FD, Wood Industries, University students, BFRI and others.

3. **Study** : **New**
- 3.1 Programme area : Training and technology transfer
- 3.2 Title of the study : **Dissemination of solar kiln technology to the stakeholders for efficient seasoning of wood**
- 3.3 Justification : Seasoning and Timber Physics Division has developed a technology on solar kiln for drying of different timber species. It is important to disseminate the benefits of using solar kiln technology, proper seasoning schedule, installation cost of solar kiln and its merits and demerits. In this regards and as per demand of stake holders, the study “dissemination of solar kiln technology for efficient seasoning of wood” has undertaken. This will help to aware this technology to the end-user through training programme for better utilization of wood.
- 3.4 Objectives :
- 3.4.1 To disseminate solar kiln technology to the wood traders, furniture makers and wood based cottage industries.
- 3.5 Expected output : Capacity building and developed knowledge in solar kiln technology for drying of wood.
- 3.6 **Study Period** :
- 3.6.1 Starting year : 2011-12
- 3.6.2 Completion year : 2013-14
- 3.7. Personnel (s) :
- 3.7.1 Study leader : M. Jahangir Alam DO
- 3.7.2 Associates : Md. Rowson Ali, RO and
U. K. Rokeya RO
- 3.8. **Progress** :
- 3.8.1 Previous years, if :
:
- 3.8.2 This year :

Activities of the study	Progress
a. Selection of stakeholders/trainee in different areas of Bangladesh (Chittagong, Sylhet, Rajshahi)	a. Thirty stakeholders (wood traders, saw mill owners and furniture makers) were selected.
b. Preparation of training materials	b. Training materials were prepared
c. Arrangement of training programme	c. Two training programme were conducted at Kaligonj Upazilla, Satkhira and Salgaria, Pabna Sadar
d. Collection of information and sharing of knowledge with stakeholders	d. Information and sharing knowledge were collected from stakeholders.
e. Report writing	e. Report were summarized

- 3.9 Achievement (s), if any : NA
- 3.10 **Financial Statement** :
- 3.10.1 Total cost :
- 3.10.2 Cost of the year : Tk. 60,650.00
- 3.10.3 Expenditure of the year : Tk. 58,450.00
- 3.10.4 Source of fund : GOB
- 3.11 **Beneficiaries** : BFIDC, FD, Wood Industries, University students, I and others.

WOOD WORKING AND TIMBER ENGINEERING DIVISION

1. **Study** : **On going**
- 1.1 Programme Area : Post Harvest Utilization- Physical Processing.
- 1.2 Title of the Study : **Characterization of lambu (*Khaya sp.*), jhau (*Casuarina equisetifolia*) and arjun (*Terminalia arjuna*) wood for working and finishing properties.**
- 1.3 Justification :
- 1.4 **Objectives** :
- 1.4.1 : To assess the suitability of lambu, jhau and arjun wood for making furniture and construction materials.
- 1.4.2 :
- 1.5 Expected output :
- 1.6 **Study period** :
- 1.6.1 Starting year :
- 1.6.2 Completion year :
- 1.7 Personnel (s) :
- 1.7.1 Study leader : M Ramiz Uddin, DO
- 1.7.2 Associates : M N A Mridha, RO T K Dey, RA-I
- 1.8 **Progress** :
- 1.8.1 Previous years : Working properties of lambu and jhau wood such as planning, shaping, boring and mortising by machine and hand tools have been completed. Sawing qualities of lambu and jhau wood was determined.
- 1.8.2 This year :

Activities of the year	Progress
a) Collection of research input.	a. Research input have been collected from Service & Engineering Division.
b)Determination of working properties such as planning, shaping, boring, mortising, turning by machine and hand tools of arjun wood.	b. Working properties of arjun wood was completed. Results are shown in Table-1.
c) Evaluation of finishing properties.	c. Finishing properties of lambu, jhau and arjun was completed. Results are shown in Table-1.
d) Report writing.	d. Report writing is in progress.

- 1.0 Achievement : Jhau wood may be used as furniture and construction materials.
- 1.10 **Financial statement** :
- 1.10.1 Total cost : Tk. 3,82,310.00
- 1.10.2 Cost of the year : Tk. 1,65,000.00
- 1.10.3 Expenditure of the year : Tk. 68,000.00
- 1.10.4 Source of fund : GOB
- 1.11 **Beneficiaries** : BFIDC, FD, NGOs, Wood based industries, Common people.

Table 1: Working properties of arjun wood and finishing properties of lambu, jhau and arjun wood.

Name of the species	Sawing Qualities	% of defect free samples (Machining)					% of defect free samples (Hand tools)				Finishing Qualities
		Planning	Shaping	Boring	Mortising	Turning	Planning	Shaping	Boring	Mortising	
Jhau											Excellent.
Lambu											Fair
Arjun	Easy	80	60	100	100	100	70	80	100	80	Fair

2. **Study** : **On going**
- 2.1 Programme Area : Training and technology transfer.
- 2.2 Title of the Study : **Dissemination of furniture making technique of rajkoroi (*Albizia richardiana*) in the southern district of Bangladesh.**
- 2.3 Justification :
- 2.4 **Objectives** :
- 2.4.1 : To disseminate the furniture making techniques in the southern district of Bangladesh.
- 2.4.2 : To assess the durability of furniture made of treated rajkoroi wood.
- 2.5 Expected output :
- 2.6 **Study period** :
- 2.6.1 Starting year :
- 2.6.2 Completion year :
- 2.7 Personnel (s) :
- 2.7.1 Study leader : M Ramiz Uddin, DO
- 2.7. Associates : M N A Mridha, RO and T K Dey, RA-II
- 2.8 **Progress** :
- 2.8.1 Previous years :
- 2.8.2 This year :

Activities of the year	Progress
a) Distribution of one cot, five reading table, five chairs, twenty high bench and twenty low bench in the office of PTU division and 3 schools of Inderhat, Barisal for service test.	a. Distribution of one cot, five reading table, five chairs, twenty high bench and twenty low bench in the office of PTU division, Barisal, Jannatul Balet Cadet Madracha, Rupertoli, Barisal and Bongobesonager High School (Primary Section), Sholashahar, Chittagong for service test.
b) Collection of data from the selected location.	b. Service test data was collected from selected location.
c) Arrangement of a training programme on furniture making technique of rajkoroi at Barisal, for carpenter and timber merchants.	c. A training programme on furniture making technique of rajkoroi for carpenter and timber merchants was completed.
d) Report writing.	d. Report writing is in progress.

- 2.0 Achievement : Furniture making techniques of rajkoroi have been developed.
- 2.10 **Financial statement** :
- 2.10.1 Total cost : Tk. 3, 55,120.00
- 2.10.2 Cost of the year : Tk. 80,000.00
- 2.10.3 Expenditure of the year : Tk. 54,000.00
- 2.10.4 Source of fund : GOB
- 2.11 **Beneficiaries** : BFIDC, NGOs, Common people, Wood based Industries.

3. **Study** : **New**
- 3.1 Programme Area : Post Harvest Utilization- Physical Processing
- 3.2 Title of the Study : **Potential uses of treated round bamboo for making quality furniture.**
- 3.3 Justification :
- 3.4 **Objectives** :
- 3.4.1 : To establish round bamboo as a quality furniture materials after preservative treatment.
- 3.4.2 : To improve the design and quality of bamboo furniture.
- 3.4.3 : To increase the uses of bamboo for making furniture as an alternative of timber.
- 3.5 Expected output :
- 3.6 **Study period** :
- 3.6.1 Starting year :
- 3.6.2 Completion year :
- 3.7 Personnel (s) :
- 3.7.1 Study leader : M Ramiz Uddin, DO
- 3.7. Associates : M N A Mridha, RO and T K Dey, RA-1
- 3.8 **Progress** :
- 3.8.1 Previous years : N/A
- 3.8.2 This year :

Activities of the year	Progress
a. Review of literature.	a. Literatures were reviewed.
b. Collection of sample from Sylhet and Tangail for feasibility study.	b. Collection of sample was completed.
c. Processing of sample.	c. Processing of sample was completed.

- 3.0 Achievement : N/A
- 3.10 **Financial statement** :
- 3.10.1 Total cost :
- 3.10.2 Cost of the year : Tk. 55,000.00
- 3.10.3 Expenditure of the year : Tk. 55,000.00
- 3.10.4 Source of fund : GOB
- 3.11 **Beneficiaries** : Common people, Bamboo based Cottage Industries, NGOs.

DEVELOPMENT/OTHER FUNDED PROJECT

- 1. Study : On going**
- 1.1 Programme area : Breeding and Tree improvement:
- 1.2 Title of the study : **Selection of plus trees of important agroforestry and forest tree species**
- 1.3 Justification : **Plus trees form the base population of tree breeding programme and provides quality planting materials for immediate planting programme**
- 1.4 **Objectives :**
- 1.4.1 To establish sources of superior quality seeds from selected clones or progenies.
- 1.4.2 To obtain best possible gains from the breeding programmes by testing progenies/clones of the selected plus trees.
- 1.4.3 To popularize superior quality seeds produced in seed orchards
- 1.5 Expected output : An interim source of superior quality seeds and breeding materials will be available for the planters.
- 1.6 **Study period**
- Starting year : 1992-1993
- Expected completion Year: 2011-2012
- 1.7 Personnel :
- 1.7.1 Study leader : Kabir Uddin Ahmed, DO
- 1.7.2 Associates : Sukla Rani Bashak, SRO
Md. Arifur Rahaman, RO
Md. Mezan-Ul-Haque, RO
A.K.M Azad, RO
Md. Kamaluddin, RO
Md. Mukhlesur Rahman, FI
- 1.8 **Progress:** :

1.8.1 Previous years Nine hundred seventy plus trees were selected and seeds are being collected. 7613 kg seeds of 29 different forest tree species were collected and distributed to DNMSs. 246 DNMS members were trained on plus tree selection in 6 batches.

1.8.2 b. This year	
Activities of the study	Progress
b) Selection of 150 plus trees.	400 Plus tree selection manual printed
c) Collection of 1000 kg seeds from plus trees for distribution to District Nursery Malik Samitee (DNMS)	150 plus tree selected 910 kg seeds 15 species were distributed to DNMSs
d) Impart training on plus tree selection.	One plus tree selection training at Ramnagar, Jessore and one plus tree selection training at BFRI were arranged

- 1.9 Achievements : Better quality seed sources were created having broader genetic base.

1.10 Financial statement

- 1.10.1 Total cost :
1.10.2 Cost of the year :Tk.1,50,000.00
1.10.3 Expenditure of the year :Tk. 1,50,000.00
1.10.4 Source of the fund : HELVETAS Swiss Intercooperation
1.11 Beneficiaries : Forest Department (FD), Non Government Organizations(NGOs) and other tree planting agencies and Private Land Owners.

2. Study **On going**

- 2.1 Programme area : Breeding and Tree improvement
2.2 Title of the study : **Establishment and management of seed orchards**
2.3 Justification : Easy and accessible source of quality seeds is created.
Genetic worth of plus trees are identified

2.4 Objectives :

- 2.4.1 To establish and manage superior quality seed sources from selected clones or progenies.
2.4.2 To preserve better genetic stocks under ex situ condition from the natural stands and plantations for future breeding and tree improvement programme
2.4.3 To develop suitable techniques for mass production of clonal planting materials.
2.4.4 To screen best clones/progenies.
2.4.5 To supply quality seeds to FD, NGOs, DNMSs and planters.

- 2.5 Expected output: : Permanent source of quality seeds and improved planting materials will be available for the planters.

2.6 Study period :

- 2.6.1 Starting year : 2005-2006
2.6.2 Completion Year : 2011-2012

2.7 Personnel :

- 2.7.1 Study leader : Kabir Uddin Ahmed, DO
2.7.2 Associates : Sukla Rani Bashak, SRO
Md. Arifur Rahaman, RO
Md. Mezan-Ul-Haque, RO
A.K.M Azad, RO
Md. Kamaluddin, RO
Md. Mukhlesur Rahman, FI

2.8 Progress :

- 2.8.1 Previous years : 57.11 ha clonal seed orchard and seedling seed orchards were established at Salna, Dulahazara, Ichamati, Hyankoo SOCs and private planters land at Meherpur, Chuadanga, Rangpur and Takurgaon districts. Nursery facilities were increased.

2.8.2 b. This year

	Activities of the study	Progress
	a. Maintenance of existing 57.11 ha clonal seed orchard and seedling seed orchards at Salna, Dulahazara, Ichamati, Hyankoo SOCs. And at private farmers land at Takurgaon, Meherpur, Chuadanga and Faridpur	57.11 ha clonal seed orchard and seedling seed orchards at Salna, Dulahazara, Ichamati, Hyankoo SOCs. At private farmers land at Takurgaon, Meherpur were maintained.
	b. Collection of 300 kg teak seed and 250 kg gamar seed from Kaptai Seed Orchard Centre and 45 kg telsur seed from Ichamati Seed Orchard Centre.	Teak and gamar seeds were collected and send to DNMSs according to their Demand.
	c. Development of nursery and laboratory facilities.	Nursery facilities at Salna and Ichamati were increased by constructing 1500 sft cemented floor. In PPU of HQ nursery water supply facility increased.
	d. Events sharing workshop at BFRI	An workshop with stakeholders seed requirement were arranged.
	e. Development of IEC materials	One leaflet on vegetative propagation of hybrid acacia was printed

2.9 Achievements : One species named *Dalbergia latifolia* were introduced form Nepal also 42 families seed of *D. sissoo* were introduced.

2.10 Financial Statement

2.10.1 Total cost :

2.10.2 Cost of the year : 3,00,000.00

2.10.3 Expenditure of the year : 3,00,000.00

2.10.4 Source of the fund : HELVETAS Swiss Intercooperation

2.11 **Beneficiaries** : Forest Department (FD), Non Government Organizations (NGOs) , other tree planting agencies and private land owners .

4. **Study** : **On-going**

4.1 Programme Area : Biodiversity and conservation

4.2 Title of the Study : **Enrichment and Conservation of Mangrove Ecosystem.**

4.3 Justification :

The problems of the Sundarban are diversified due to its complex ecosystem and hence the proposed research agenda includes both bio-ecological and socio-economic investigations in order to improve and maintain sustained productivity as well as in reducing of natural disasters and to increase their adaptation to the long term effect of climate change.

4.4 Objectives :

- 4.4.1. To enrich mangrove ecosystem and determine better silvicultural techniques for major mangrove species.
- 4.4.2. To conserve a wider range of mangrove forest gene resources for future generations.
- 4.4.3. To develop the appropriate management strategies for sustainable yield and protective services from mangrove ecosystems.

4.5 Expected output :

The study will help to introduce the threatened mangrove species such as passur(*Xylocarpus mekongensis*), sundari(*Heritiera fomes*), dhundhul(*Xylocarpus granatum*), kirpa(*Lumnitzera racemosa*), jhana(*Rhizophora mucronata*), khilshi(*Aegiceras corniculatum*) and shingra(*Cynometra ramiflora*) in the newly accreted char land, poorly regenerated area, NCC(non commercial cover) area of the Sundarban. The swampy and low lying area adjacent to the Sundarban will also be covered by the mangrove species. As a result the productivity of the forest will be increased as well as the improvement of livelihood towards the mangrove dwellers. It will improve the natural ecosystems and biodiversity of the forest and provide positive impact on national poverty alleviation programs of the country. Thus environmental disaster as well as tsunami, cyclone, sidr will be decreased and forestry sector must be improved.

4.6 **Study period** : 2010-2014

4.6.1 **Starting year** : 2010-2011

4.6.2 **Completion year** : 2013-14

4.7 Personnel (s) :

4.7.1 **Study leader** : Dr. M. M. Rahman, DO

4.7.2 **Associate** : S. M. M. Hasnin, SRO

4.7.3 **Associate** : A. S. M. Helal Siddiqui, RO

4.8 Progress :

4.8.1 Previous years, if any(..year):

A total of 18,000 healthy seeds / propagules of khilshi, kirpa, sundari, passur, goran and kankra were collected from the Sundarban. The average of germination percentage of Sundri (*Heritiera fomes*), Pasur (*Xylocarpus mekongensis*), Baen (*Avicennia officinalis*), Kankra (*Bruguiera gymnorrhiza*), Singra (*Cynometra ramiflora*) and Kirpa (*Lumnitzera ramiflora*) were 70, 81, 75, 93, 55 and 29 respectively. Three experimental sites were selected for mangrove species trials in three salinity zones of the Sundarban. These were

barren and covered with grasses or non-commercial species like gila lata (*Derris trifoliata*), chanda lota (*Dalbergia candenatensis*), shun grass (*Saccharum spontaneum*), hargoja (*Acanthus ilicifolius*), hanthal (*Phoenix paludosa*), tiger fern (*Acrostichum aureum*), bhola (*Hibiscus tiliaceus*), nal khagra (*Phragmites karka*), hogla (*Typha elephantina*), kutum kata (*Caesalpinia crista*), dhanshi (*Myriostachya wightiana*) and kewa katta (*Pandanus foetidus*). The experiment was laid out in all the three salinity zones of the Sundarban. The seedlings were planted during September. The number of seedlings per species planted 567 at each location. Six mangrove species were planted at each site. The heights of the seedlings varied between 14cm and 81cm at the time of planting depending on the species. The average height before planting of Sundri (*Heritiera fomes*), Pasur (*Xylocarpus mekongensis*), Baen (*Avicennia officinalis*), Kankra (*Bruguiera gymnorrhiza*), Singra (*Cynometra ramiflora*) and Kirpa (*Lumnitzera ramiflora*) were 57cm, 78cm, 24cm, 40cm, 15cm and 20cm respectively. Planting was carried out over an area of 1.5ha in three experimental sites of the Sundarban.

4.8.2 This year :

Action plan as per annual research programme	Progress
a) Field visit to the Sundarban before collecting seeds/propagules.	a) The Sundarban have been visited before collecting seeds/propagules.
b) Seeds/propagules collection.	b) A total of 21,000 healthy seeds / propagules of khalshi (<i>Aegiceras corniculatum</i>), kirpa (<i>Lumnitzera ramiflora</i>), sundri (<i>Heritiera fomes</i>), passur (<i>Xylocarpus mekongensis</i>), goran (<i>Ceriops decandra</i>), kankra (<i>Bruguiera gymnorrhiza</i>) and dhundul (<i>Xylocarpus granatum</i>) were collected from the Sundarban.
c) Seeds/propagules sorting, treatment and storage.	c) Collected seeds/propagules sorting, treatment and storage have been done.
d) Nursery raising (soil collection and preparation, bag filling, bed preparation, shed preparation, fencing, seed sowing, mulching etc.) for next year plantation.	d) 14,000 seedlings of khalshi, kirpa, sundari, passur, goran, kankra and dhundul have been raised in three research stations of the Sundarban.
e) Raising plantations with the raised seedlings in the different locations of the Sundarban.	e) The experiment was laid out in Randomized Complete Block Design (RCBD) with seven replications in all three sites. Five mangrove species, viz., sundri (<i>Heritiera fomes</i>), pasur (<i>Xylocarpus mekongensis</i>), goran (<i>Ceriops decandra</i>), kankra (<i>Bruguiera gymnorrhiza</i>), khalshi (<i>Aegiceras corniculatum</i>) and dhundul (<i>Xylocarpus granatum</i>) were planted at each site.
f) Maintenance of nurseries and plantations.	f) Nurseries and plantations have been maintained.
g) Selection of promising seedlings at nursery stage for plantation.	g) Promising seedlings have been selected at nursery stage for plantation.
h) Data collection, collation and reporting.	h) A total of 21,000 healthy seeds / propagules of khalshi (<i>Aegiceras corniculatum</i>), kirpa (<i>Lumnitzera ramiflora</i>), sundri (<i>Heritiera fomes</i>), passur (<i>Xylocarpus mekongensis</i>), goran (<i>Ceriops decandra</i>),

	<p>kankra (<i>Bruguiera gymnorrhiza</i>) and dhundul (<i>Xylocarpus granatum</i>) were collected from the Sundarban and raised nurseries with those collected seeds/propagules. The average of germination percentage of khalshi, kirpa, sundari, passur, goran, kankra and dhundul were 76, 64, 84, 78, 82, 98 and 60 respectively and average height at the age of 7 month were 33cm, 19cm, 48cm, 76cm, 17cm, 29cm and 88cm respectively (Table-2). Nursery with seven different mangrove species has been maintained in different locations of the Sundarban. Three experimental sites were selected for mangrove species trials in three salinity zones of the Sundarban. The experiment was laid out in Randomized Complete Block Design (RCBD) with seven replications in all three sites. Five mangrove species, viz., sundri (<i>Heritiera fomes</i>), pasur (<i>Xylocarpus mekongensis</i>), goran (<i>Ceriops decandra</i>), kankra (<i>Bruguiera gymnorrhiza</i>), khalshi (<i>Aegiceras corniculatum</i>) and dhundul (<i>Xylocarpus granatum</i>) were planted at each site.</p>
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Table-1. List of mangrove species tried in the poorly regenerated lands of the Sundarban

Sl. No.	Vernacular name	Scientific name	Family
1.	Khalshi	<i>Aegiceras corniculatum</i>	Myrsinaceae
2.	Kirpa	<i>Lumnitzera ramiflora</i>	Combretaceae
3.	Sundri	<i>Heritiera fomes</i>	Sterculiaceae
4.	Passur	<i>Xylocarpus mekongensis</i>	Meliaceae
5.	Goran	<i>Ceriops decandra</i>	Rhizophoraceae
6.	Kankra	<i>Bruguiera gymnorrhiza</i>	Rhizophoraceae
7.	Dhundul	<i>Xylocarpus granatum</i>	Meliaceae

Table-2. Germination performance of different mangrove species at nursery of the Sundarban in 2011

Sl. No.	Name of species	No. of seeds / propagules sown	Initiation of germination (days)	Completion of germination (days)	Germination percentage (%)	Average height at the age of 7 month (cm)
1.	Khalshi	3,000	13	33	76	33
2.	Kirpa	3,000	30	75	64	19
3.	Sundri	3,000	6	25	84	48

4.	Passur	3,000	14	62	78	76
5.	Goran	3,000	7	22	82	17
6.	Kankra	3,000	8	12	98	29
7.	Dhundul	3,000	12	55	60	88

Table-3. Site descriptions and raising plantation at Dhangmari (Compartment No.-31) of the Sundarban in September, 2011

Sl. No.	Name of species	Average height at the time of plantation (cm)	Area of plantation (ha)	Spacing	Soil pH	Soil texture	Water salinity (ppt)	Inundation condition	Initial vegetation
1.	Sundri	52	0.5	1mx 1m	5.6	Silty - clay-loam	3.0	Inundation by all tides in monsoon	gila lata, chanda lota, shun grass, hargoja, tiger fern, dhanshi and kewa katta
2.	Pasur	84							
3.	Goran	19							
4.	Kankra	21							
5.	Khalshi	36							

Table-4. Site descriptions and raising plantation at Munshiganj (Compartment No.-46) of the Sundarban in September, 2011

Sl. No.	Name of species	Average height at the time of plantation (cm)	Area of plantation (ha)	Spacing	Soil pH	Soil texture	Water salinity (ppt)	Inundation condition	Initial vegetation
1.	Sundri	46	0.5	1mx1m	6.0	Silty-clay	15.0	Inundation by all tides in monsoon; seldom in non-monsoon	hargoja, tiger fern, hanthal, dhanshi and kewa katta
2.	Pasur	72							
3.	Goran	16							
4.	Kankra	18							
5.	Dhundul	86							

The seedlings were planted during September. The heights of the seedlings varied between 16cm and 86cm at the time of planting depending on the species. The seedlings were transferred from the nursery to the planting sites by country boat. The polybags were removed from the ball of soil and the seedlings were planted at 1m x 1m spacing. Staking was done to provide support to the newly planted seedlings.

Table-5. Site descriptions and raising plantation at Bogi (Compartment No.-1) of the Sundarban in September, 2011

Sl. No.	Name of species	Average height at the time of plantation (cm)	Area of plantation (ha)	Spacing	Soil pH	Soil texture	Water salinity (ppt)	Inundation condition	Initial vegetation
1.	Sundri	54	0.5	1mx1m	6.3	Silty-clay-loam	1.0	Inundation by all tides in monsoon	shun grass, bhola, nal khagra, hogla, kutum kata, dhanshi and kewa katta
2.	Pasur	91							
3.	Goran	21							
4.	Kankra	24							
5.	Khalshi	39							

Site descriptions and initial vegetations of experimental plots in different locations of the Sundarban are shown in table-3, 4 and 5. The average height before planting of Sundri (*Heritiera fomes*), Pasur (*Xylocarpus mekongensis*), Goran (*Ceriops decandra*), Kankra (*Bruguiera gymnorrhiza*) and Khalshi (*Aegiceras corniculatum*) were 54cm, 91cm, 21cm, 24cm and 39cm respectively (Table-5) and the average height of Dhundul (*Xylocarpus granatum*) is 86cm before planting (Table-4). Planting was carried out over an area of 1.5ha in three experimental sites of the Sundarban.

Table-6. Growth performance of different mangrove species at Dhangmari (Compartment No.-31) of the Sundarban

Name of Location	Year of plantation	Spacing	Name of species	Av. heit (cm)	Av. Survival (%)
Dhangmari	2010	1m X 1m	Sundri	71	96
			Pasur	99	91
			Baen	34	87
			Kankra	51	98
			Singra	22	78

Table-7. Growth performance of different mangrove species at Munshiganj (Compartment No.-46) of the Sundarban

Name of Location	Year of plantation	Spacing	Name of species	Av. height (m)	Av. Survival (%)
Munshiganj	2010	1m X 1m	Sundri	59	58
			Pasur	88	67
			Kirpa	24	78
			Kankra	45	54
			Singra	17	45

Table-8. Growth performance of different mangrove species at Bogi (Compartment No.-1) of the Sundarban

Name of Location	Year of plantation	Spacing	Name of species	Av. height (m)	Av. Survival (%)
Bogi	2010	1m X 1m	Sundri	69	98
			Pasur	98	89
			Baen	27	78
			Kankra	43	94
			Singra	18	74

The growth performance of six mangrove tree species i. e. Sundri (*Heritiera fomes*), Pasur (*Xylocarpus mekongensis*), Baen (*Avicennia officinalis*), Kankra (*Bruguiera gymnorrhiza*), Singra (*Cynometra ramiflora*) and Kirpa (*Lumnitzera ramiflora*) in three salinity zones of the Sundarban was shown in Table no. 6, 7 and 8. It is observed that the best growths were recorded in less saline zone and relatively lower growths were recorded in strong saline zone of the Sundarban.

4.9 Achievement(s), if any :

4.10 **Financial Statement** :

4.10.1 Total cost : Tk. 16,40,000/=

4.10.2 Cost of the year : Tk. 6,55,000/=

4.10.3 Expenditure of the year : Tk. 6,55,000/=

4.10.4 Source of fund : NATP-Phase-1(SPGR)BARC

4.11 **Beneficiaries** :

- Study** : **On-going**
- 3.1 Programme Area : Forest productivity enhancement.
- 3.2 Title of the Study : **Coordinated Project on Improvement of Agro-forestry Practices for Better Livelihood and Environment: BFRI (Forest) Component**
- 3.2.1 Sub title of the study: Collection, plantation, evaluation and conservation of herbal medicinal plants, and estimation of medicinal ingredients in the plants in hill eco-system through Agro-forestry.
- 3.3 Justification : NA
- 3.4 **Objectives** :
- 3.4.1 To collect, make plantation, evaluate and conserve herbal medicinal plants in hill eco-system through agro-forestry in CHT.
- 3.4.2 To develop pest and disease management technique.
- 3.4.3 To estimate active chemical ingredients
- 3.5 **Expected Output** : The study will help to introduce 5 commercially important medicinal plants species such as kalomegh (*Andrographis paniculata*), bashok (*Adhatoda vasica*), sarpaganda (*Rauwolfia serpentina*), aswagandha (*Withania somnifera*) and tulsi (*Ocimum tenuiflorum*) in the farmer's land of CHT. Proper marketing of these species will increase livelihood of the hilly people. It will increase natural eco systems and biodiversity of the forest and provide positive impact on national poverty allevation programme of the country.
- 3.6 **Study Period**
- 3.6.1 Starting year : 2011-2012
- 3.6.2 Completion year : 2012-2013
- 3.7 **Personnels**
- 3.7.1 Project Leader : Dr. Shaheen Akhter, CRO (P)
- 3.7.2 Associates : Syeeda Rayhana Merry, SRO, MFPD
Dr. Atiur Rahman, Assistant Professor, CU
- 3.8 **Progress**
- 1.8.1 Previous years

About 5000 healthy propagules of bashak (from Bogra), satomuli (from Natore), aswagandha (from Bogra) and seed of tulsi (from Natore) and kalomegh (from Sirajganj) were collected/raised for conservation. Three experimental sites were selected for cultivation of medicinal plant in three hill districts of Bangladesh. Data on survival and height of 45 days old plantation of 4 medicinal plants was recorded. At Bandarban site survival percentages of kalomegh, aswagandha, bashak, satomuli are found 70%, 75%, 90% and 50% respectively. Height of this four species was found to vary 30.48 to 50.8 cm. . Seedlings of aswagandha, tulsi and kalomegh were raised in the propagation chamber using BFRI developed technology. The experiment was conducted using fresh seed and treated seed (soaked in water for 24 hours). From this experiment we found that in case of fresh seed germination percentages of aswagandha, tulsi and kalomegh are found 50%, 70% and 55% respectively but in case of treated seed, germination percentages of aswagandha, tulsi and kalomegh were found 90%, 20% and 80% respectively. Better germination was found in treated seed of aswagandha and kalomegh, but in case of tulsi better germination was found

in fresh seed. The results are in corporate with previous findings. Conservation plot was selected at BFRI campus to conserve selected medicinal plant for demonstration and using a source of seed/propagules.

1.11.2 **This year :**

Activities of the study	Progress
a. Literature review.	a. Literature review has been done
b. Benchmark survey.	b. Benchmark survey has been done in three hill districts namely Khagrachari, Bandarban and Rangamati.
c. Field visit and personal communication before seed collection.	c. Before seed collection we have visited Natore, Bogra, Gaibandha and Sirajganj to identify the source of seed for nursery raising.
d. Seeds/ propagules collection.	d. Seeds are collected from Natore, Bogra and Sirajganj.
e. Seeds/ propagules stored.	e. Collected seeds are stored.
f. Establishment of trail plantation in farmers' field.	f. Quality planting materials were selected for nursery raising.
g. Establishment of conservation plots at BFRI campus.	g. Conservation plot was selected at BFRI campus to conserve selected medicinal plant for demonstration and as a source of seed/propagules.

3.9.1 **Achievement** : Three experimental sites were developed at Rangamati, Khagrachari and Banderban

3.10 **Financial statement** :

3.10.1 Total cost of the study : Tk. 1,16,40,000/-

3.10.2 Cost of the year : Tk. 78,88,100/-

3.10.3 Source of fund : BARC

3.11 **Beneficiaries** : Local farmers, NGO