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**RESOURCE ENHANCEMENT AND PROCESSING OF CANE
AND BAMBOO SPECIES SUITABLE FOR HANDICRAFTS**

**UNDP-GOI PROJECT ON CANE AND BAMBOO
SPONSORED BY MINISTRY OF TEXTILES**

**CUMULATIVE REPORT
MARCH 2000 TO JUNE 2001**



**KERALA FOREST RESEARCH INSTITUTE
PEECHI- 680653, THRISSUR, KERALA**

14-11-2001

**RESOURCE ENHANCEMENT AND PROCESSING OF CANE AND
BAMBOO SPECIES SUITABLE FOR HANDICRAFTS**

**UNDP- GOI Project on Cane and Bamboo
Sponsored by Ministry of Textiles**

**Cumulative Report
from March 2000 to June 2001**

Submitted by

**Kerala Forest Research Institute,
Peechi - 680 653, Thrissur, Kerala**

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SUMMARY

This is the cumulative report of the work done by Kerala Forest Research Institute, Peechi as a part of the UNDP-GOI project on Cane and Bamboo species suitable for handicrafts sponsored by Ministry of Textiles. The project consisted of the following sub projects.

1. Set up integrated gene pool banks
2. Undertake survey and documentation of cane and bamboo species used in handicrafts
3. Adopting techniques like macro-proliferation and tissue culture in addition to traditional rhizome planting
4. Develop packages for nursery and silviculture techniques
5. Establish germplasm banks for propagation and conservation techniques
6. Set up tissue culture and plant multiplication nurseries
7. Set up farms with NGOs/ farmers
8. Set up Oil-curing units
9. Conduct training
10. Publicity and awareness

The progress achieved in each component is given separately in the following pages

Activity 1.1. Survey and documentation of species used in handicrafts

Duration: 30 months

Objectives

1. Inventory of the species of bamboo/cane used in handicraft industry in Kerala and North East.
2. Assessment of the requirement of species of bamboo and canes used by the artisans for handicrafts.
3. Exploration of the feasibility of utilisation of other species of cane and bamboo, which are not currently in use, for handicrafts.

End out put: Documentation of the species of cane and bamboo used in handicrafts and exploration of species that are not currently used in handicrafts.

Work done during March - 2000

Physical targets: To initiate a survey among artisans to find out the bamboo and cane species used in handicrafts

Achievement: The project was formally approved on 15th of March 2000. There was a delay in starting the work.

Work done during April 2000 to March 2001

Physical targets

1. Preparation of a pro-forma for collection of information, discussion with collaborating institutes and finalization.
2. Meeting of artisans involved in cane and bamboo work in Kerala
3. Documentation of the species used in handicraft
4. Imparting training to the trainers from North East

Achievements

1. Prepared two proforma (one each on cane and bamboo) for collection of information from artisans, circulated to IRMDFR, Jorhat and SFRI, Itanagar and finalised after incorporating the suggestions given by them (Appendix. 1).

List of enclosures

- Appendix 1.** Proforma for collection of information on cane and bamboo
- Appendix 2.** List of Co-operative societies registered with Handicrafts and Marketing
- Appendix 3.** List of Cane and bamboo species used in Handicrafts in Kerala and North East
- Appendix 4.** Topics covered during the Training/Workshop on field identification, nursery techniques and management of bamboo and cane.

PROFORMA FOR COLLECTING INFORMATION ON USEFUL RATTAN SPECIES

Reporter:

Date :

Place :
Village :
District :
State :

1. Local name of the product :
2. Purpose of use : Household equipments
: Handicrafts
: Others
3. Particular use if any :
4. The product made by : Locals
: Tribals
: Small Scale Industrial Sector
5. If tribals, name of the tribe :
6. Details of the part of the plant used :
7. Source of raw material : Natural forest
: Plantations
: Homesteads
: Depots
8. Availability of the plant : Rare
: Occasional
: Common
9. Pre-treatment of the raw material if any :
10. Post-treatment of the product if any :

PROFORMA FOR COLLECTING INFORMATION ON USEFUL BAMBOO SPECIES

Reporter:
Date:
Place: District:
Village: State:
Block:

Product Information:

1) Name of the product: 2) Any other name:
3) Number of units produced: 4) Time spent on production of each unit:
(/day, /month, /year) (Hours, Days)
5) Cost of production of unit product: 6) Price of the product:
(In rupees) (at local market/any other market)
7) Durability of the product:
(In Days/Months/Years)
8) Post treatment of the product if any:

Raw Material:

9) Local name of plant material used: 10) Part of the plant used:
11) Source of raw material:
A-Natural Forests
B-Plantations
C-Homesteads
D-Govt. Depots
12) Requirement: (In numbers or Quintals/month or year)
13) Availability of the plant:
A-Rarely available
B-Falls short of demand
C-Plentifully available
14) Any particular technique used for processing:
15) Any pretreatment given to the raw material:
16) Tools Used:

Producer:

17) Product made by:

- A-Tribal
- B-Non Tribe
- C-Small scale cottage industry
- D-Individual/co-operative society

18) Name of tribe/caste, Specify:

19) Number of persons involved:

(/family, /community)

20) Hired laborers, if any:

Uses And User:

21) Uses:

- A-Household equipment
- B-Handicraft
- C-Other use)

22) Any Specific Use:

Marketing:

22) Marketing of the product:

- A-Sold directly by artisans in local Bazzars, Hatas, Melas etc
 - B-Sold to middleman Specify,
 - C-Marketed by society
 - D-Any other means ,specify
-

Appendix 2. List of cane and bamboo societies (from industries and from handicrafts).

CANE CRAFT

Sl. No.	Name and Address	Items Produced	No. of Artisans	Annual Production (in Lakhs)	Production Capacity (in Lakhs)
1	The Secretary, Eraviperor Harijan Handicrafts Industrial Co-op. Society, Eraviperor P.O., Thiruvalla (Via), Pathanamthitta Dist. 689 542	Different types of furniture and other fancy and utility items	20	8.86	10.00
2	M/s. Ummannoor Village Development Society, Nelikkunnam P.O., Kottarakkara, Quilon Dist. 691 623	“	40	18.50	25.00
3	Sri. M.B.Shibu, Kala Cane Industries, Pookkottumpadam P.O., Nilambur, Malappuram Dist. 679 332	“	5	3.76	4.25
4	Sri. P. Natarajan, Adiyakandiyoor, Thavalam P.O., Attappady, Palakkad Dist. 678 589	“	4	3.20	3.60
5	The Secretary, Varkala Rattan Vyavasaya Sahakarana Sangam, P.O. Palachira, Varkala, Thiruvananthapuram - 695 143	“	80	26.50	45
6	M/s. Thonnakkal Rattan Harijan Industrial Co-op. Society, Kadavoor P.O. Vengode, Thiruvananthapuram	“	15	5.76	6.50

**LIST OF CO-OPERATIVE SOCIETIES REGISTERED WITH
HANDICRAFTS AND MARKETING IN 7 SEC THRISSUR
MANUFACTURING CANE & BAMBOO ITEMS**

1. Deepthi Handicrafts Indl. Co-op. Society, Irinjalakuda North, Thrissur 680 175 (Bamboo mat & Bamboo mat painting only)
2. Pookottumpadam Karakonsal Vyavasaya Sahakarana Sangam, P.O. Pookothumpadam, Nilambur ((Via) Malappuram Dt. 679 332
3. Pinarayi Bamboo & Cane Workers Industrial Co-operative Society, Paiarayi P.O., Tellichery (Via), Cannanore 670 741
4. Nileswaram Cane & Bamboo Handicrafts Women's Indl. Co-op. Society, Nileswaram P.O. Kasargod 670 314
5. Vanitha Karakonsala Vyavasaya Sahakarana Sangam S. Ind. C. 157 Chovva P.O., Kannur 670 006
6. Seraphic Handicrafts Industrial Co-operative Society, Vellikulangara P.O. Thrissur District 680 693
7. M/s. Uravu, Waynad, Indigenous Science & Technology Study Centre, Thrikkaipetta P.O., Wayanad 673 577
8. M/s. Attapadi Girijan Karakoyisala Sahakarana Saya IND. C.P. 125, Bhootivazhy, Agali P.O., Palakkad 678 581

**LIST OF INDIVIDUAL CRAFTSPERSONS REGISTERED WITH HM7SEC
THRISSUR MANUFACTURING CANE & BAMBOO ITEMS**

- Kannur (Cane & Bamboo)
1. Sri.K.V. Jose
S/o Late K.V. Varghese
Koonamavu House (Bamboo
mat painting)
Annammanada P.O.
Thrissur Dist.
 2. Sri.A.R. Viswanathan
S/o Ramakrishnan
Little Edition
Athani P.O.
Thrissur Dist. 680 771
(Cane & Bamboo)
 3. Sri.K.A. Ajayghosh
S/o late K.V. Appu
Sona Handicrafts
Thanniseri P.O.
Irinjalakuda
Thrissur Dt. 680 701
(Bamboo mat painting)
 4. Sri.M.T. Davis
M/s. Anna Handicrafts Indl.
Co-op. Society
Melloor P.O. 680 311
Chalakydy (Via)
Thrissur Dt. (Bamboo mat
painting)
 5. Miss.P. Pushapalatha
D/o late P.P. Sreedharan,
Sree Sailam
Vattaparambil House
Mundayad P.O. 670 953
 6. Sri.C.M. Chakkan
S/o Makotha
Choondani
Melur P.O.
Chalakydy
Thrissur Dt.
Cane and Bamboo
 7. Mrs.P.K. Vasanthi
W/o M.C. Raghunathan
Mottaka House
Varam P.O.
Kannur (Cane and
Bamboo)
 8. Miss.M. Suvarna
D/o late Ramadas
"Yesyem" Nivas
Chovva P.O.
Kannur (Cane and Bamboo)
 9. Miss Suma, K.
D/o Late Kannan, K.
Kuhillath House
P.O. Chovva
Kannur Dist. 670 006
(Cane and Bamboo)
 10. Miss. Divya, T.
D/o Sadasivan
Chalil House
P.O. Chovva
Kannur-6
(Cane and Bamboo)

Information from office of DC(H) Thiruvananthapuram has received recently (Under compilation).

BAMBOO UTILITY AND FANCY ITEMS

Sl no.	Name & Address	Items produced	No. of Artisans	Annual production (in lakhs)	Production capacity (in lakhs)
1	The Secretary, Pookkottumpadam, Karakausala Vyavasaya Sahakarana Sangham P.O. Pookkottumpadam, (via) Nilambur, Malappuram Dt. 679 332	Lamp shades in different vanillier, curtain chains, fancy and utility items	15	3.78	4.00
2	The Secretary, Pinarayi Bamboo & Cane Works Industrial Co-op. Society, Pinarayi P.O., Thalassery (via), Kannur Dt. 670 741	"	8	2.63	3.00
3	Aishwarya Vanitha Handicrafts Industrial Co-op Society Ltd., No. B 426/ 95, Thuravamkarai P.O., Kanjoor, Ernakulam Dt. 683 575	"	10	3.25	3.75
4	Smt. Sukumaran David, Thodarikathu Valiyamala Veedu, Cherappally, Aryanadu P.O., Thiruvananthapuram Dt. 695 542	"	8	3.10	3.50
5	The Secretary, Vellamad Harijan Industrial Co-op. Society, Mithranikethan P.O., Vellamad, Thiruvananthapuram - 695 543	"	20	5.86	6.75
6	The Secretary, Eraviperoor Harijan Handicrafts Industrial Co-op Society, Eraviperoor P.O., Thiruvalla (via), Pathanamthitta Dt. 689 542	"	12	4.67	5.00
7	The Secretary, Nileswaream Cane and Bamboo Handicrafts Women's Industrial Co-op. Society, Nileswaream P.O., Kasargode Dt., 670 314	"	10	3.25	3.75

8	The Secretary, Malanadu Karakausala Vyavasaya Sahakarana Sangham, Kanjirappally P.O., Kottayam - 686 507	“	12	3.75	4.00
9	The Secretary, Angamaly Block Bamboo and Reeds Crafts Industrial Co-op. Society, Malayattoor Road, Kalady, Ernakulam Dt. 683 518	“	10	3.86	4.25
10	Thomas Yezakiel, Kochuveedu, Vembanoor, Vikas Nagar, Aruvikkara, Thiruvananthapuram Dt.	“	10	2.95	3.50
11	The Budhannor Women's Handicrafts Industrial Co-op. Society, Ltd. No. (A) 117, Budhannor P.O., Alappuzha Dt. 689 510	“	10	2.25	2.75

BAMBOO MAT AND PAINTING

Sl. No.	Name and Address	Items Produced	No. of Artisans	Annual Production (in Lakhs)	Production Capacity (in Lakhs)
1	Sri. K.A. Ajayghosh, Sona Handicrafts, Kunjhiikkathil House, P.O. Thannissery, Irinjalakuda, Thrissur Dt. - 680 701	Bamboo mats and Bamboo mat painting	8	3.65	4.50
2	Sri. M.T. Davis, M/s. Anna Handicrafts, Mellor P.O., Chalakudy (Via), 680 311	"	7	3.26	3.75
3	The Secretary, Deepthi Handicrafts Industrial Co-op. Society, Irinjalakuda North, Thrissur - 680 125	"	16	4.86	5.50
4	M/s. Sangam Industries, Block Jn. West Road, Vellangallor, Thrissur - 680 698	"	4	1.86	2.50
5	M/s. Kerala Bamboo Industries, Main Road, Chalakudy, Thrissur - 680 307	"	3	1.83	2.50

As per the information received from Government of Kerala

Appendix 3. Cane and bamboo species used in handicrafts in Kerala and North East

Table 1. List of cane species

Kerala		N.E. States	
Species	Local name	Species	Local name
<i>C. thwaitesii</i>	Thadiyan chooral Panni chooral	<i>C. gracilis</i>	Chulibeth
<i>C. hookerianus</i>	Velichural Kakkachooral	<i>C. leptospadix</i>	Lejai
<i>C. brandisii</i>	--	<i>C. tenuis</i>	Jati
<i>C. gamblei</i>	Paccha chooral	<i>C. arunachalensis</i>	Yoyee
<i>C. pseudotenuis</i>	--	<i>C. guruba</i>	Jolibeth
<i>C. rotang</i>	Cheruchural	<i>C. nambariensis</i>	Honka
<i>C. travancoricus</i>	Arichural	<i>C. flagellum</i>	--
<i>C. delessertianus</i>	Pachachural Ottamoodan	<i>C. floribundus</i>	--
		<i>C. erectus</i>	--

Table 2. List of bamboo species

Kerala		N. E. States	
Species	Local name	Species	Local name
<i>Bambusa bambos</i>	Illi, Mullu mula	<i>Bambusa balcooa</i>	Bholuka
<i>Dendrocalamus strictus</i>	Kallan mula, Kurathi mula	<i>Bambusa bambos</i>	Kotoba
<i>Pseudoxytenanthera bourdilloni</i>	Arayambu	<i>Bambusa pallida</i>	Bijuli
<i>Ochlandra travancorica</i>	Etta	<i>Bambusa nutans</i>	Mukulbah
<i>Ochlandra setigera</i>	Kara-etta	<i>Bambusa tulda</i>	Jathiba
<i>Ochlandra ebracteata</i>	Velleetta	<i>Dendrocalamus hamiltonii</i>	Kakobah
<i>Ochlandra scriptoria</i>	Ammei, Odal		
<i>Ochlandra wightii</i>	Era-kalli		

**TRAINING/WORKSHOP ON FIELD IDENTIFICATION, NURSERY
TECHNIQUES AND MANAGEMENT OF BAMBOO AND CANE**

Kerala Forest Research Institute, Peechi and Ministry of Textiles, Govt. of
India & UNDP

Venue : IRMDFR, Jorhat
Date : 18-19 April, 2000

Venue : SFRI, Itanagar
Date : 20-24 April, 2000

A team of Scientists involved in the UNDP cane and bamboo project visited the collaborating institutes in the North East and organized a workshop on field identification, nursery and plantation techniques for cane and bamboo.

During the Training programme the following topics were covered.

1. The data required for collecting the information on useful bamboo and rattan species (Appendix - 1).
2. How to prepare a Bamboo/Cane Herbarium (Appendix - 4)
3. Introductory note on the bamboo diversity
4. Taxonomical/morphological details of the cane and bamboo to be collected during the survey.

PREPARATION OF BAMBOO HERBARIUM

- Because of their specialized nature and infrequency of flowering (monocarpic plants) bamboos are seldom collected.
- The complexity of the plant itself account for the relatively poor representation of bamboo specimens in herbaria.
- Being monocarpic the life cycle is very long and a complete vegetative collection is often sufficient to allow identification to the genera, if not specific level.
- A complete bamboo herbarium needs all vegetative and floral characters for perfect identification.

How to collect Bamboos

A) Field requirements

- 1) Field book: A field book is a diary for recording data in field. It usually has 100 pages, each page dealing with one collection. The size of the field book varies from 10 x 15cm to 18 x 22cm. The number printed on the page of the field book is known as field number. Each page of the field book contain 6 tickets (having same field number). The tickets are removed from the field book and tied with the corresponding specimens before putting them in the collection bag. (It should cover, date, locality, elevation, habitat, common names and uses).
- 2) Secateurs, knife, khurpi, digger.
- 3) Pocket lens & Binoculars
- 4) Altimeter, measuring tape: Altimeter is taken for recording the altitude of the site. Measuring tape is helpful in recording measurements of the culm.
- 5) Polythene bags of different size.
- 6) Preservatives : Parts of the plant can be preserved in FAA in the field (Formalin 5 parts, Glacial Acetic acid 5 parts and 90 parts of 70 % Alcohol).
- 7) Camera with films, flash gun, close up lens, etc.

B) Parts of the bamboos need for herbarium preparation

1. Rhizomes : Before collecting rhizome following characters should be noted 1) Length between culms and diameter, 2) running over ground or under ground, 3) occurrence of buds on rhizome neck, 4) position of roots. For runner types collect a section of the rhizome ca. half a meter long. For clump forming types collect 2 several rhizomes and several culms ca. 15 cm above the ground.
2. New shoots : The new sprouting shoots are very essential for identification of bamboos by means of vegetative methods. Colour and surface characters can be recorded.
3. The culm : Before collecting the following characters should be noted : a) spacing - closely formed or widely separated; b) habit - erect, arching, vein like (climbing or hanging); c) height or length, diameter; d) colour of culm. Collect two nodes including internode. The fifth internode from the ground is considered to be the standard one for observing colour, form, texture and surface peculiarity.
4. Culm leaves or culm sheaths : Note the duration on culm (persistent or caducous), variability, colour pattern, texture and nature of the blade like reflexed, erect, horizontal and duration on sheath. Select the culm sheath from the culm where they are most represented in size and shape.
5. Branches : Collect the branches including node for finding the origin, number and arrangement and modification, if any.
6. Leafy twigs : Leafy twigs from young and old branches can be collected.
7. Inflorescence ; It can be found terminally leafy branches or occurring throughout a leafless plant. Collect flowering branches at all stages of development including fruits.

Bamboo preservation

1. Wet method of preservation

i) Wet method of preservation in the field

Formalin method

Methyl alcohol also used (*Methylated Spirit - denatured alcohol*)

The collections are spread out in ordinary old news papers and bundled up. Each bundle is then placed in a large polythene bag. 10% formalin is poured over the bundles, so that

the bundles just get soaked thoroughly, without however leaving excess of formalin in the bags. The bags are then tied air tight. No further change of folders is necessary till reaching the head quarters.

By this method it is possible to bring the collections made even over 3-4 months on reaching the head quarters, the bundles are opened out, the specimens are exposed to the atmosphere to drive away the excess of formalin fumes. Then the specimens are spread out for pressing and drying usual.

ii) Wet method of Preservation in the laboratory

Some parts of bamboos are large and fleshy and they can be collected and stored in liquid preservatives. The following are some chemical fixative suitable for liquid preservation

Liquid preservatives used for storing bamboo parts in Laboratory

1. Ethyl alcohol

70 percent ethyl alcohol is one of the best chemical for pressing fleshy parts of bamboos like new shoots, young culms, fleshy fruits, etc.

2. F.A.A. (Formalin Acetic acid Alcohol)

F.A.A. is prepared by mixing 90 part of 50% alcohol, 5 parts of glacial acetic acid and 5 parts of formalin.

3. Copenhagen mixture

10:1:8 mixture of IMS glycerol and water.

2. Dry method of preservation

1. Poisoning and preservation

Drying and poisoning of specimens is done for their permanent preservation. After 1-2 days of pressing the specimens are dipped in different kinds of preservatives, such as super-saturated solution of Mercuric chloride or Lauryl pentachloro phenate.

The solution is prepared in the following manner

Mercuric chloride is slowly added and dissolved in a litre of ethyl alcohol/ rectified spirit (usually methylated). It is added till the crystals of Mercuric chloride get dissolved, a point comes when crystals will fail to dissolve. This is the super saturated solution, best suited for poisoning of specimen.

2. Pressing and drying of bamboo specimen

Pressing is the process of placing specimens between the absorbents under heavy pressure.

All the plant parts such as young rhizomes, young culms, new shoots, leafy twigs including nodes, flowering twigs etc. are selected from the field collection and remove some projecting parts and spines without changing their morphology. (The large culms and old rhizome are can be collected as museum specimens and keep for air drying)

All parts such as leaves and flowers are spread out neatly. Some leaves are facing up and others down to show the characters on both surfaces. If the specimens are larger than the size of mounting sheet, that can be folded like V, N or comfortable manner.

The pressing can be done by sand witch method, ie, placing the specimen in between the blotting sheets, the specimens should be placed in such a way that there is almost uniform thickness of the bundle in the middle and on sides. This will provide uniform pressure in the press. Other wise there will be a bulge in the middle, which will get more pressure and the sides will not be properly pressed. To avoid this the specimens are evenly distributed in dryers, ie, some are placed in centre and some along the sides. The thick parts make the bundles uneven in pressing and it is managed by providing pads of paper.

The main object of pressing is to flatten and dry the specimens. This is done by keeping the straps tight and by changing the blotters every day for 6-10 days depending on weather. The plants gradually lose their moisture and finally become completely dry. The used and moist blotters are removed and dried and used over and over again.

Drying

The process of drying can be hastened by placing the press in sun or in drying chambers. The moist blotters are also dried in sun or artificial heat. During rainy weather, it is necessary to dry blotters over a stove or near an oven or chimney. It should be noted that the thinner the press, the quicker the process of drying.

3. Mounting

After the specimen is pressed, dried and poisoned, it is affixed (along with a label) on a mounting sheets. The mounting sheets are made from heavy long lasting white card sheet in uniform size 42 x 28cm (1cm). The aim of mounting is that the specimen should be neatly and uniformly spread and fixed on the sheet and all parts of the plants should be easily visible for study. For achieving this, before the plant is glued on sheet, it should be placed on the sheet in various positions so as to judge which position will be the best display.

Some important precautions in this regard are :

- a) Only one specimen is placed on one sheet.

- b) The new shoot, culms, culm sheath, branchlets, rhizome parts, leafy twig, flowering twig, etc. can be mount on separate sheet.
- c) There is some space left on the right hand bottom for label; if label is already printed on mounting sheet, no part of the plant should cover the label.
- d) The field number tagged with the plant is pasted in a proper straight position along with the thread.

4. Gluing the plant on the sheet and stitching

The plant specimen is commonly pasted to sheets with glue. The animal glue after proper treatment or synthetic gum can be used for glueing. There are two important methods of pasting by glue.

a. Glass plate method

In this method the glue part is uniformly spread over the surface of glass plate and the plant to be mounted is placed on the glass plate. Then the specimen along with its field label is lifted up with the aid of forceps and placed on the mounting sheet. The specimen is then firmly pressed by placing a blotting sheet on its top with a weighted hard board.

b. second method

In this method the specimen is laid on old newspaper, lower side facing up and applied part over it by the help of brush. The specimen is slowly lifted and placed on the mounting board. A blotter is placed on the specimen as in the previous method.

The mounting sheets with specimens glued on them are kept in press for one day for proper sticking and drying. Next day the bundle is spread and the intermediate blotters or newspapers removed.

The bamboos have some stiff parts and it can be stitched with the help of a strong needle and the thread should not be carried from one stitch to another on the lower side of the mounting sheet.

5. Herbarium Labels

Mounting of the specimens is followed by parting of herbarium labels. The size and design fo herbarium labels slightly vary accordingly to the need. Size is about 8 x 12 cm. In general, the labels should contain the following data.

1. Name of the family
2. Name of the genus and species
3. Locality of collection
4. Date of collection
5. Description/remarks/notes
6. Collectors name and number
7. Vernacular name and local uses

Herbarium label is fixed on the bottom right hand corner about 1 cm away from edges of the mounting sheet. After glueing the specimens and pasting the labels, the data on the labels should be entered clearly with some permanent ink or preferably typed before pasting.

6. Identification or determination of plants

Usually, identification is considered to be the process through with a specimen whose name is not known is recognised by its characters, to be similar to some known plant and accordingly given a name. For the purpose of identification, the scientific method is to first study the characters of the plant, check them with the flora of the region, work through the family, genus and species keys and compare with full description and illustration.

KERALA FOREST RESEARCH INSTITUTE

Peechi - 680 653, Trichur
HERBARIUM FIELD BOOK

No. 000001 Date

Locality District

Bot. Name

Family Local Name(s)

Habit Alt.

Habitat

Field Notes

Coll. Det.

..... cut along this line

(KFRI)	(KFRI)	(KFRI)	(KFRI)	(KFRI)	(KFRI)
000001	000001	000001	000001	000001	000001
○	○	○	○	○	○



KERALA FOREST RESEARCH INSTITUTE
Herbarium

Locality Date.

Coll. No. Acc. No.

Botanical Name

Family

Habit

Habitat

Distribution

Local Name(s)

Notes

.....

.....

.....

Coll. Det.

BAMBOO DIVERSITY

Bamboos comprise a large number of genera and species distributed in the tropical, subtropical and temperate regions of the world except Europe and Western Asia. They comprise a total of 75 genera and over 1250 species (Soderstrom 1985). However hardly 40 species of bamboos are considered important owing to their occurrence and to the economic potential. Bamboos occur in semi-evergreen, evergreen, as well as temperate forests though mostly are seen to occur in the tropical moist deciduous and tropical dry deciduous forests of India of all the commonly occurring genera *Bambusa* and *Dendrocalamus* are widely distributed. Ohnbugur and Goerrings (1990) compiled 10 genera under herbaceous bamboos, while, 920 species belonging to 85 genera as woody bamboos. However, most of the genera have been treated as congeneric by subsequent workers, thereby reducing the actual number of genera of species in the whole group. During the recent compilation (Seethalakshmi and Muktesh Kumar, 1997) it has been estimated that there are 128 species under 18 genera. It has been recorded that there are 32 species of bamboos under 10 genera occurring in the Western Ghats (Kumar, 1995) include 10 species which are introduced and cultivated in the region.

Bamboos (including reeds) play an important role in the economy of any country being important resource supporting a large number of industries both in the traditional and modern sector. The most important species is *Bambusa bambos*, which occur in the moist tracts and *Dendrocalamus strictus* are found in the dry regions. In the open evergreen forests Reeds (*Ochlandra spp.*) are found in pure patches. Apart from the forests, bamboos form an integral component of homestead tree cropping in Kerala.

Distribution & Ecology

Bamboos occur as an important associate in southern hill top, tropical evergreen forests, west coast tropical evergreen forests, wet bamboo breaks, west coast semi evergreen forests, moist teak bearing forests, dry bamboo breaks and reed breaks. *Bambusa bambos* occur in bulk on hills and plains in the moist deciduous forest having an average rainfall of 1200 mm - 2000 mm with a minimum temperature of 18°C and maximum 33°C. *Ochlandra travancorica* is the most important associate of the tropical evergreen and attains its best growth in very wet type of evergreen forests. In the evergreen types the most important association of *Ochlandra sp.* include *Hopea paviflora*, *Cullinia exarillata*, *Canarium strictus*, *Dipterocarpus indicus* etc. In the semi evergreen the association include both evergreen and deciduous species in the top canopy such as species of *Terminalia*, *Xylia*, *Sterculia* etc. *Bambusa* is a strong light demander but can withstand shade especially during young age. *Ochlandra* on the otherhand is of a shade tolerant type. It can grow well both in the open and under the close canopy of evergreen forests.

Endemism

The term endemic refers to the population or species with narrow ecological or other restriction which limit it to a special habitat or very restricted geographical range. Of the 31 species (29 species and 2 varieties) occurring in South India, there are 9 species coming

under the category of rare, endangered and 15 species endemic to South India. There are about 48% of bamboos that are endemic to South India. Endemic species with percentage of endemism in genus is shown in the table.

Endemic species with percentage of endemism in each genus.

Genus	Species	Percentage of Endemism	
		Total sp.	%
<i>Bambusa</i>	- <i>B. bambos</i> var. <i>gigantea</i>	7	14
<i>Ochlandra</i>	- <i>O. beddomei</i>		
	<i>O. ebracteata</i>		
	<i>O. scriptoria</i>		
	<i>O. setigera</i>		
	<i>O. sivagiriiana</i>	9	100
	<i>O. talboti</i>		
	<i>O. travancorica</i>		
	<i>O. travancorica</i> var. <i>hirsuta</i>		
	<i>O. wightii</i>		
<i>Pseudocyctenanthera</i>	- <i>P. bourdillonii</i>		
	<i>P. ritcheyi</i>	4	75
	<i>P. stocksii</i>		
<i>Schizostachyum</i>	- <i>S. beddomei</i>	1	100
<i>Sinarundinaria</i>	- <i>S. densifolia</i>	4	25

Flowering in bamboos is an interesting phenomenon and is considered significant from the point of regeneration and of sustained yield to industry. It flowers gregariously over large areas with an interval of 30 to 40 years. Almost all culms in all clumps die after flowering. The life span of *Bambusa bambos* is estimated to be 30-48 years (Nair, 1980). Sporadic flowering is also noticed in few instances. The flowering occurs from late November to early January and seedlings from March to June. In certain cases of sporadic flowering bamboo clumps produces flowers either in a few or all clumps which continue for a few years. *Ochlandra* sp. show gregarious flowering based on the locality factor. But, flowering may continue for 3 to 4 years. The flowering may remain in the clump for about two years.

Seed production is usually profuse and germination percentage is also satisfactory if the seeds escape damage from pests or other harmful agents. The newly sprouted seedling will resemble a grass in the first year and only in the subsequent year shoot and rhizome usually spread, a new culm develop. Factors like soils, climate, methods of working, biotic influence, overhead shade etc. influence the growth and development of new culms.

Natural regeneration is mostly from the large quantities of seeds produced. The gregarious flowering and death of clumps create congenial condition of light and space for successful regeneration. Germination starts with monsoon showers and results in thick matting of

seedlings. Further growth and development of seedlings depends on slope, soil, light intensity, wind, shade and fire. The seedlings can withstand gentle slopes and shade. During June - July the new clumps are reproduced along with the growth of rhizomes the clumps expand and develop.

Economic Importance

Bamboos (including reeds) are put to a variety of end uses and supports activities both in traditional and modern sectors. In the homesteads, bamboos are used as a structural material for house construction, fencing, support for crops etc. Mats and baskets are also widely used for several purposes, particularly for transport of vegetables, fruits and fish. Although mat weaving is a part time occupation, it is an important source of livelihood to the socially and economically backward sections in society. Women form the major work force in the mat weaving industry.

While the demand from both the traditional and modern sectors has increased, there has been a decline in the bamboo resource, widening the demand supply gap. No systematic effort has been made to augment the bamboo resources, and the emphasis continues to be on the extracting what is naturally available. Secondly there has been imbalance in the distribution also, the pulp and paper industries have been able to get a major portions of the annual yield. For instance, of the estimated annual yield of 3,00,000 tonnes of reeds in South and Central Kerala 2,75,000 tonnes have been allotted to the pulp and paper industries, whereas the State Bamboo Corporation, which organises supply of reeds to households and marketing of mats, gets only 25,000 tonnes annually.

In rural areas branches of thorny bamboos are widely used for fencing and the culms are used as water pipes. Thin diameter culms with thick walls are used as umbrella-handles, pluckers and fishing rods. Bamboo leaves are used for fodder and thatching. bamboo roots, leaves, sprouts and grains are used in Ayurvedic system of medicines for many diseases. the siliceous deposit 'Banslochan' found in the interior parts of the hollow culms is used for the treatment of asthma, cough, paralytic complaints and other debilitating diseases. Young bamboo shoots are edible. Goldsmiths prefer the charcoal made from bamboos. Different types of musical instruments, bow and arrows are made from bamboos. bamboo rhizomes are used for decorative handicraft items. Bamboo roots are considered poisonous due to the presence of cyanogenic glucosides, but the burnt roots are used for the treatment of ringworm, bleeding gums, peripheral joints and wounds.

Taxonomic Features

Bamboos are arborescent grasses belonging to the family Poaceae and are grouped under the subfamily Bambusoideae. They are perennial, herbaceous or woody, rhizomatous plants; leaves flat, petiolate, mostly with tessellate venation. Inflorescence of various types, spikelets or pseudospikelets, 1-many flowered; lodicules 3-6, rarely absent, usually large with different types of hairs, stamens 3-6, or many, flowers bisexual; leaves glabrous or hairy, awned or unawned; palea glabrous or hairy, styles usually 2-3, stigma mostly plumose, fruit usually - 1, a caryopsis as in *Bambusa*, *Gigantochloa*, *Phyllostachys*, *Thyrsostachys* etc. where the

pericarp is membranous, thin, soft and adhered to seed coat. The fruit has an apparent ventral suture which is nearly as long as the whole fruit, or (2) Glans : as in *Dendrocalamus*, *Schizostachyum* etc., where the pericarp is hard, smooth, cartaceous with no ventral suture, or (3) *Bacca* where pericarp is thick and fleshy and separated from seed-coat as in *Melocanna* and *Ochlandra*.

Three major growth form of bamboos are recognised in India. Tree forms contribute about 45% and generally found in deciduous forests, shrubs are about 36% and they are found in restricted habitats such as stream bands in the ecotones of evergreen forests and the rest are climbers which occur in the evergreen forests.

Specific Features

1. The vegetative parts of a bamboo plant consist of roots, rhizome, culm, culm-sheath, branches and leaves.
2. The basal portion of the culm which grows horizontally under soil surface with short internodes is the rhizome. The constricted portion of the rhizome is known as neck. Based on the structure of rhizome two types of bamboos are recognised.
 - a. Sympodial : These plants have mostly solid culms, and are clump forming
 - b. Monopodial - have the rhizomes continue then horizontal growth and they do not form any clump and have enough space between the culms.
3. Culms in the majority of bamboos are hollow and the wall thickening vary with the species. Culm may be erect or arching, semi scandant or scandant. In *Dinchoa* the culms are zig zag. In *Bambusa wamin* the internodes takes the shape of a pitcher.
4. The culm-sheaths are very prominent at the node which varies in shape, texture and size depending on the species. Each culm-sheath has imperfect blades, auricles and ligules.
5. When the culm attains maximum height the branches open out from the nodes of the culms and the pattern of branching is distinct.

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- Kumar, M. 1995 b. A reinvestigation on the Taxonomy of the genus *Ochlandra* Thw. (Poaceae - Bambusoideae) *Rheedea* 5(1): 35-46.
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- Seethalakshmi, K.K & Muktesh Kumar, M.S. 1997. Bamboos of India - A compendium. *BIC India, KFRI & INBAR*, New Delhi (in press)
- Soderstrom, T.R. 1985. Bamboo Systematics : Yesterday, Today and Tomorrow. *Journ. Amer. bamboo Soc.* 6(1-4): 4-16.

TAXONOMICAL DETAILS OF THE PLANT

1. **Locality** :
2. **Date** :
3. **Vernacular name** :
4. **Collection No.** :
5. **Botanical name** :
6. **Family** :
7. **Habitat** : Natural forests - Type of forest :
: Homesteads
8. **Habit** : Single stemmed
: Clump forming
9. **Diameter of the stem with sheath** :
- Diameter of the stem without sheath** :
10. **Length of a leaf** :
- Nature of leaf** : Cirrate
: Ceirrate
- Nature of leaflets** : Grouped
: Not grouped
- Shape of the leaf** :

11. Colour of the leaf sheath :

Nature of spines : Single spines
: Grouped

Nature of grouping : Horizontal
: Scattered
: Whorled
: Semi whorled

Colour of spines :

Knee : Present
: Absent

Ocrea : Present
: Absent

Flagellum : Present
: Absent
: Rudimentary

12. Petiole : Present
: Absent

13. Inflorescence : Axillary
: Terminal

14. Flowers : Dioecious : Inflorescence Included in prophyll
: Not included in prophyll
: Monoecious
: Hermaphrodite

15. Partial inflorescence :

Number :
Length :

16. Nature of primary sheath : Mouth lacerated
: Tightly sheathing
: Spiny
: Not spiny

17. Rachilla :
Length :

18. Bracts on rachilla : Distichous, overlapping, tubular
: Tubular
: Laminar

19. Fruits :
Size :
Shape :
Colour :

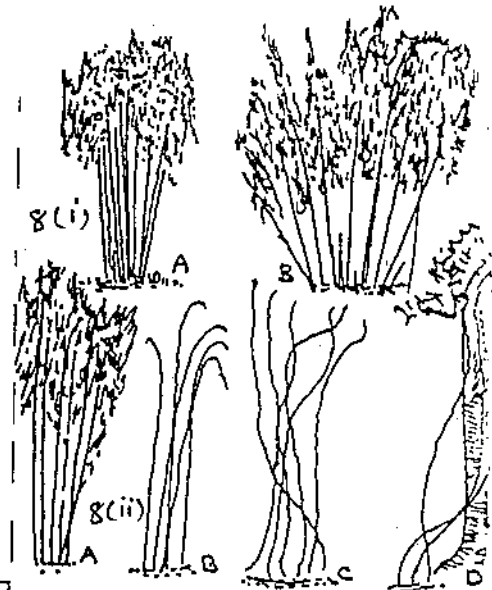
TAXONOMICAL DETAILS OF THE PLANT

1. Locality :-
2. Date :-
3. Collection No. :-
4. Vernacular Name :-
5. Botanical Name :-
6. Family :-

7. Occurrence :-A. Naturally Occurring
 :-B. Cultivated

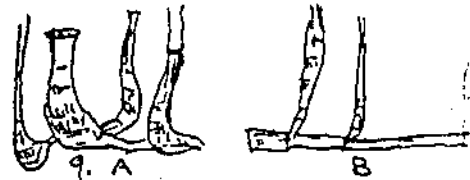
8. Clump Characteristics

- 8(i) Nature of the Clump :-A. Closely Packed
 :-B. Loosely Packed
- 8(ii) Habit of the Clump :-A. Erect Like Trees
 :-B. Erect With Pendulous Tip
 :-C. Straggling
 :-D. Climbing



- 8(iii) Height of the Clump :-
 (in metres)

9. Nature of Rhizome :-A. Pachymorph
 :-B. Leptmorph



10. Culm Characteristics

- 10(i) Colour of the Culm :-A. Dark Green
 :-B. Yellowish Green
 :-C. Grey Green
 :-D. Green with Colored Stripes
 :-E. Any Other Colour, specify

- 10(ii) Surface of the Culm :-A. glabrous
 :-B. Pubescent
 :-C. Glauous
 :-D. With Powdery Mass

- 10(iii) Size of the Culm :-A. Diameter(in mm) (mid point of 4th Internode)
 :-B. Internode Length(in cm) (length of 4th Internode)

10(iv) Thickness of the Culm

:A. Wall Thickness(in mm)

:B. Lumen Diameter(in mm)

:C. Amount of Pith(in mm)

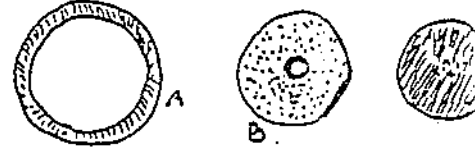
10(v) Hallowness of the Culm

:A. Hollow
(if culm diameter < two times lumen diameter)

:B. Semi-solid
(if culm diameter = two times lumen diameter)

:C. Solid
(if culm diameter > two times lumen diameter)

10(v)



10(vi) Shape in Cross Section

:A. Round

:B. Sulcate

:C. Plano-convex

10(vi)



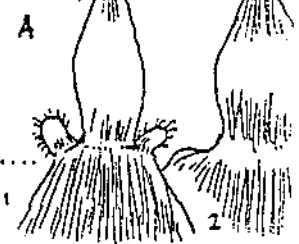
11 Culm-Sheath Characteristics

11(i) Colour of the Culm-Sheath :-

11(ii) Size of the Culm-Sheath :-Length

:-Breadth

11(ii)



11(iii) Appendages of Culm-Sheath

:A.1 Auricles Present

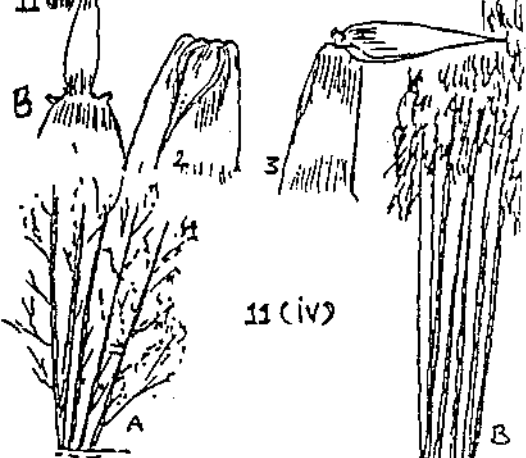
:A.2 Auricles Absent

:B.1 Blade Erect

:B.2 Blade Reflexed

:B.3 Blade Horizontal

11(iii)



11(iv) Duration of Culm-Sheath

:A. Persistent

:B. Cauducous

11(iv)

12 Occurrence of Branches:-A. From All Nodes

:B. From Upper Nodes

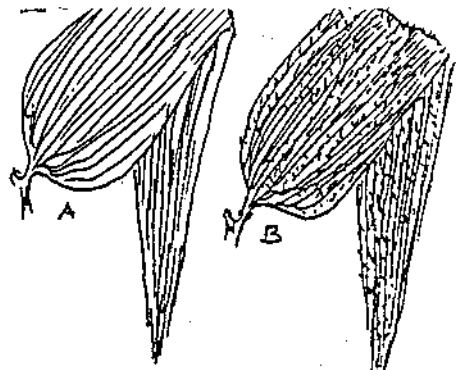
:C. From Lower & Upper Nodes



13 Leaf Characteristics

13(i) Size of the Leaf Lamina

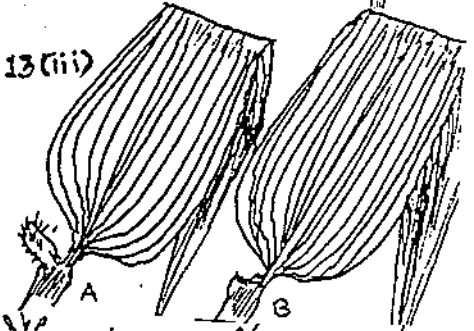
- :A. Length
- :B. Breadth



13(ii) Surface of the Leaf Lamina

- :A. Glabrous on Both Surface
- :B. Pubescent on Both Surface
- :C. Pubescent on Upper Surface Alone
- :D. Pubescent on Lower Surface Alone

13(ii)



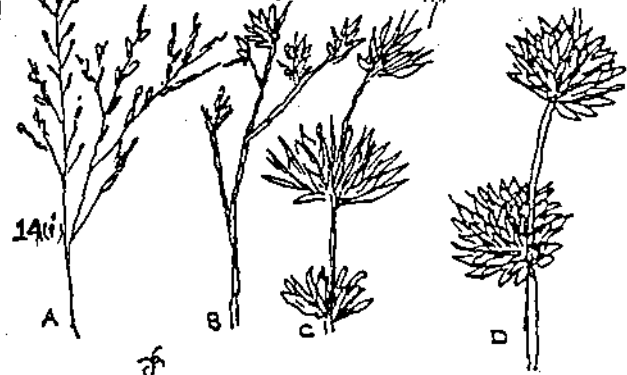
13(iii) Appendages of Leaf-Sheath

- :A. Auricles Present
- :B. Auricles Absent

14. Floral Characteristics

14(i) Inflorescence

- :A. Racemose
- :B. Spicate Panicle
- :C. Capitulate
- :D. Panicle of Semi-Verticillate Clusters

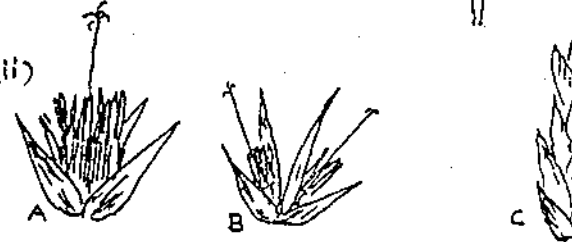


14(i)

14(ii) Spikelets

- :A. Single Flowered
- :B. Double Flowered
- :C. Many Flowered

14(ii)



14(iii) Floral Characters

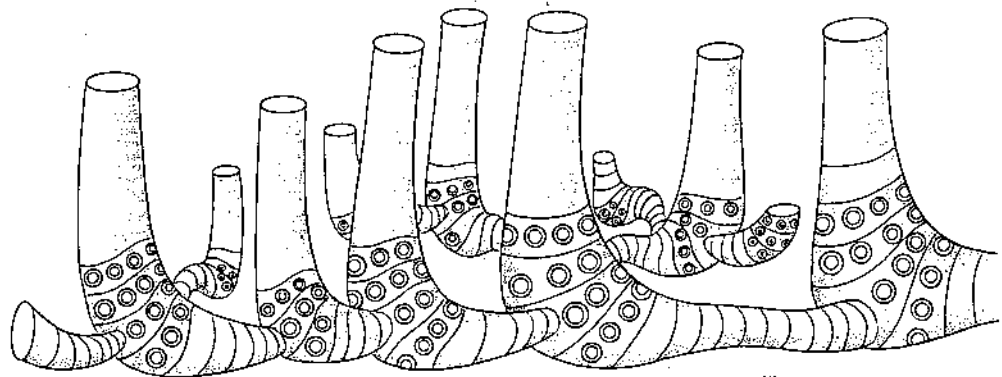
- | | | | |
|---------------|----------------------|-------------------|----------------------|
| :Empty Glumes | <input type="text"/> | :Flowering Glumes | <input type="text"/> |
| :Lemma | <input type="text"/> | :Palea | <input type="text"/> |
| :Lodicules | <input type="text"/> | :Stamens | <input type="text"/> |
| :Ovary | <input type="text"/> | :Style | <input type="text"/> |
| :Stigma | <input type="text"/> | | |

15. Fruit Characteristics

- :A. Caryopsis
- :B. Glans
- :C. Bacca

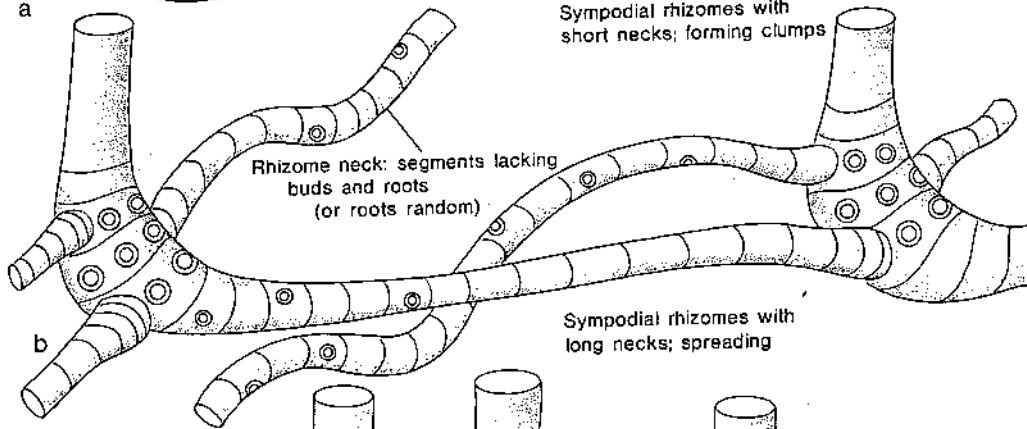
15.





a

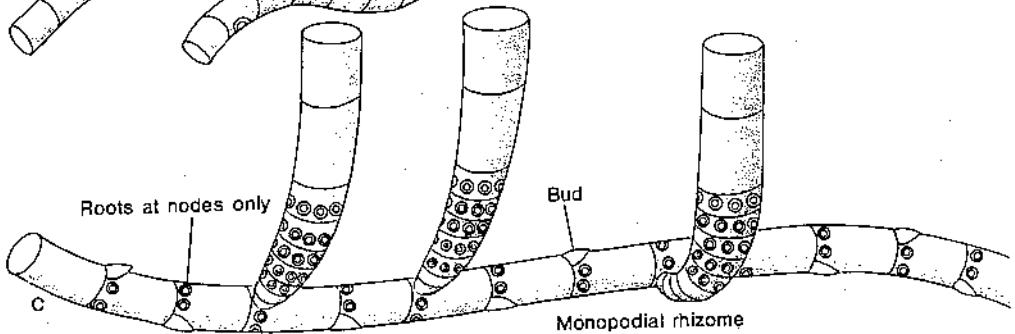
Sympodial rhizomes with short necks; forming clumps



Rhizome neck: segments lacking buds and roots (or roots random)

Sympodial rhizomes with long necks; spreading

b

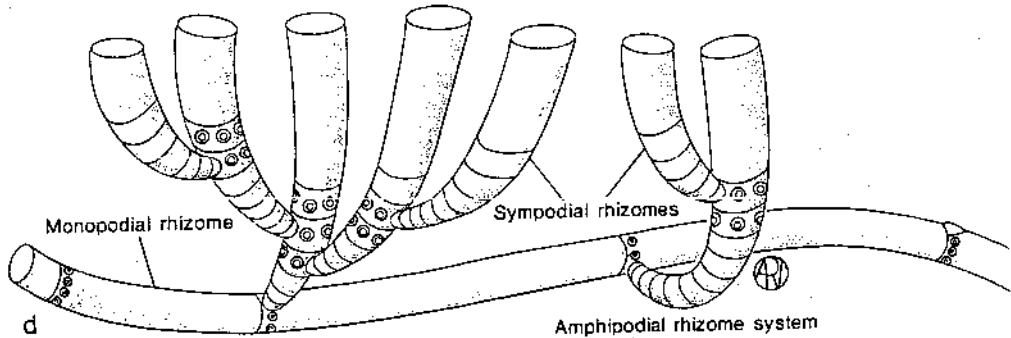


Roots at nodes only

Bud

Monopodial rhizome

c



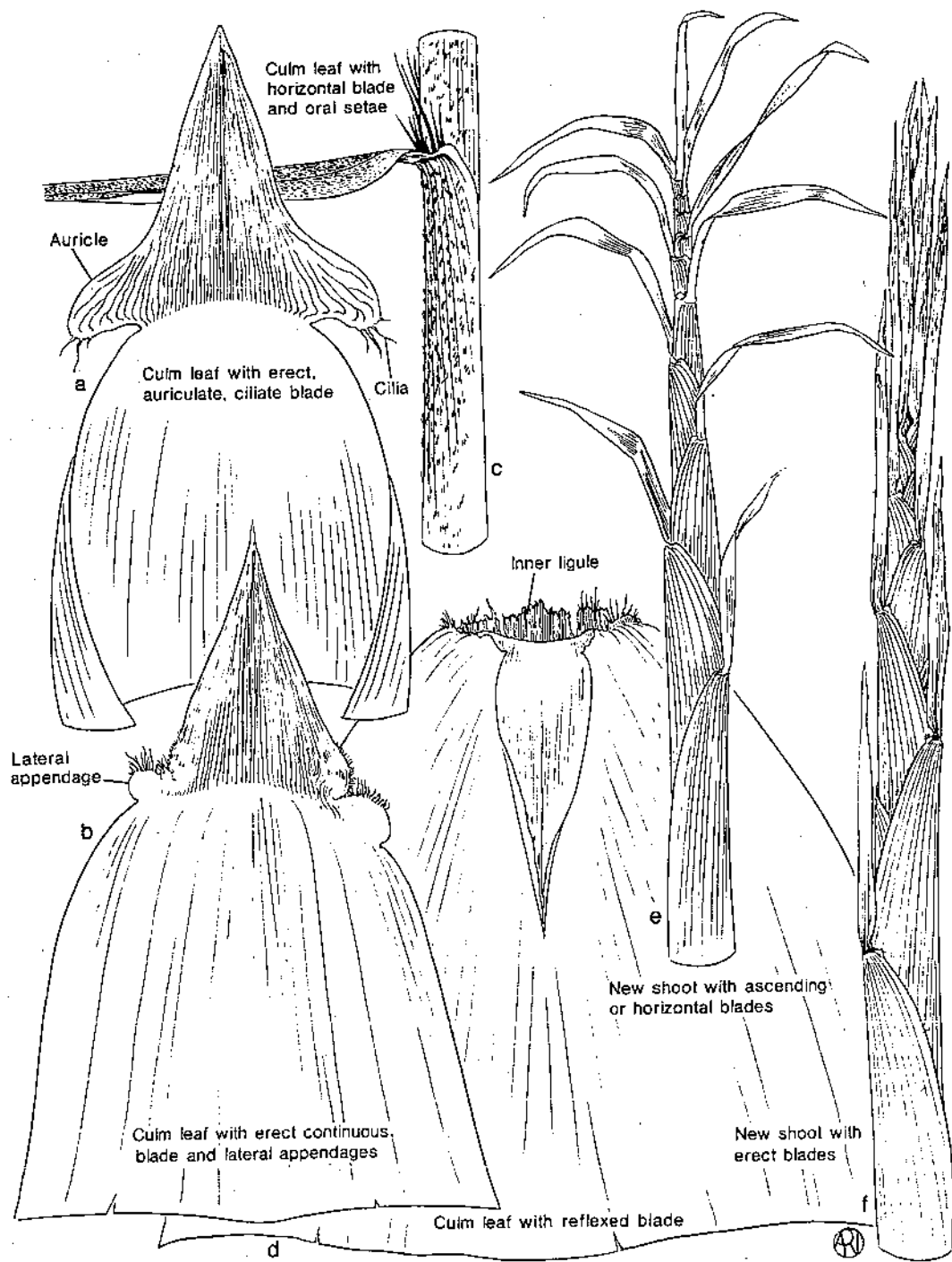
Monopodial rhizome

Sympodial rhizomes

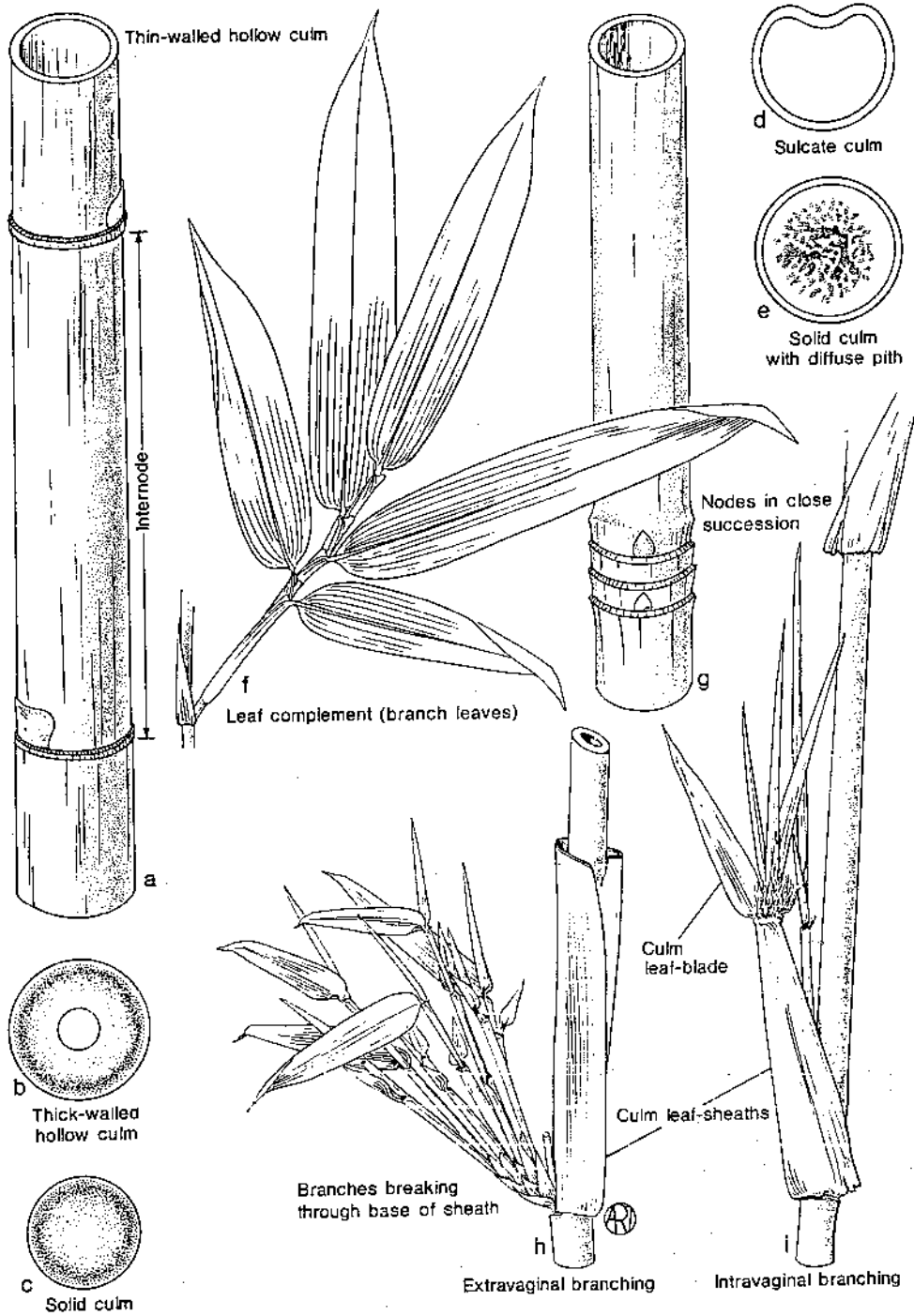
Amphipodial rhizome system

d

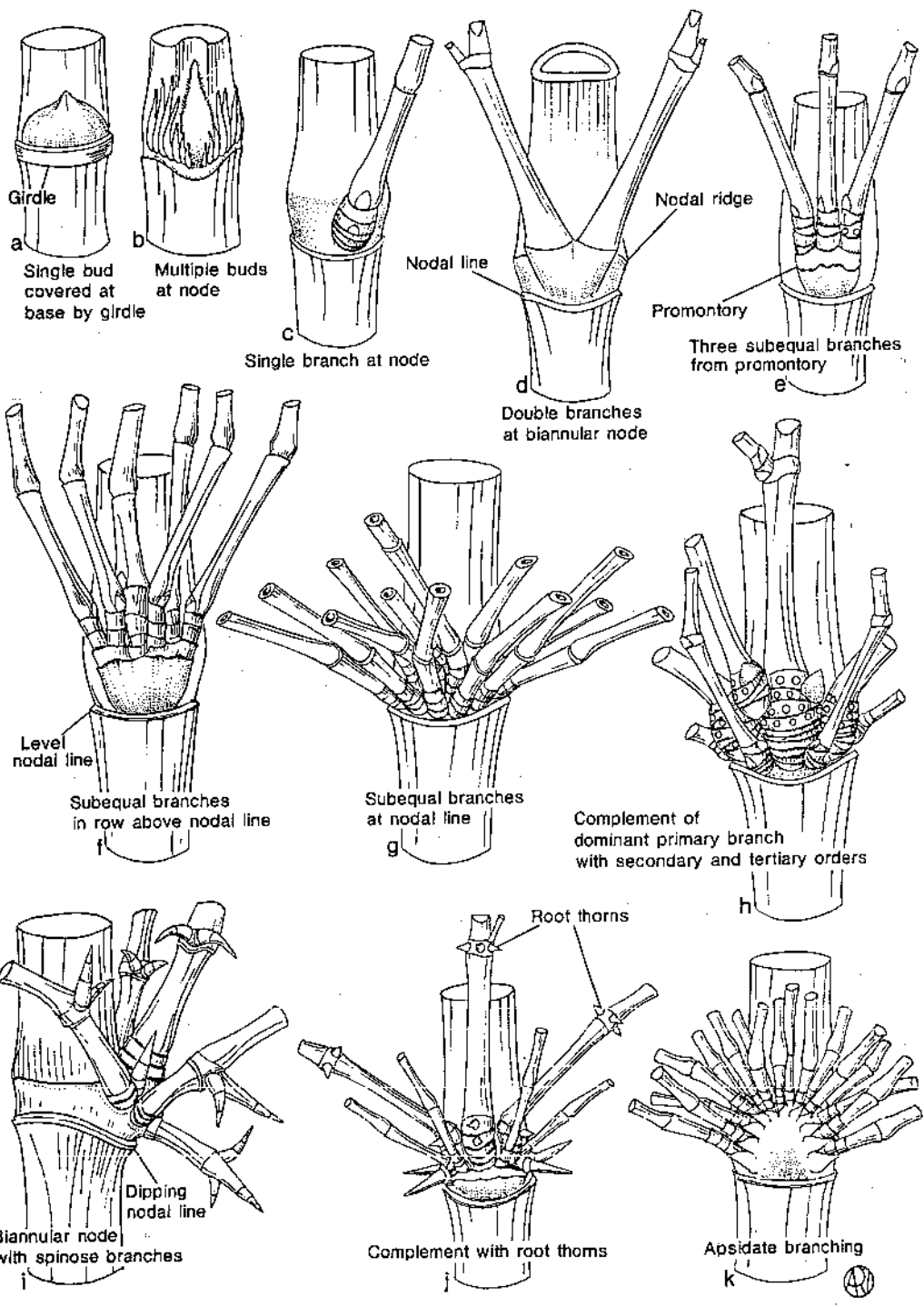
Rhizomes.



Culm leaves.



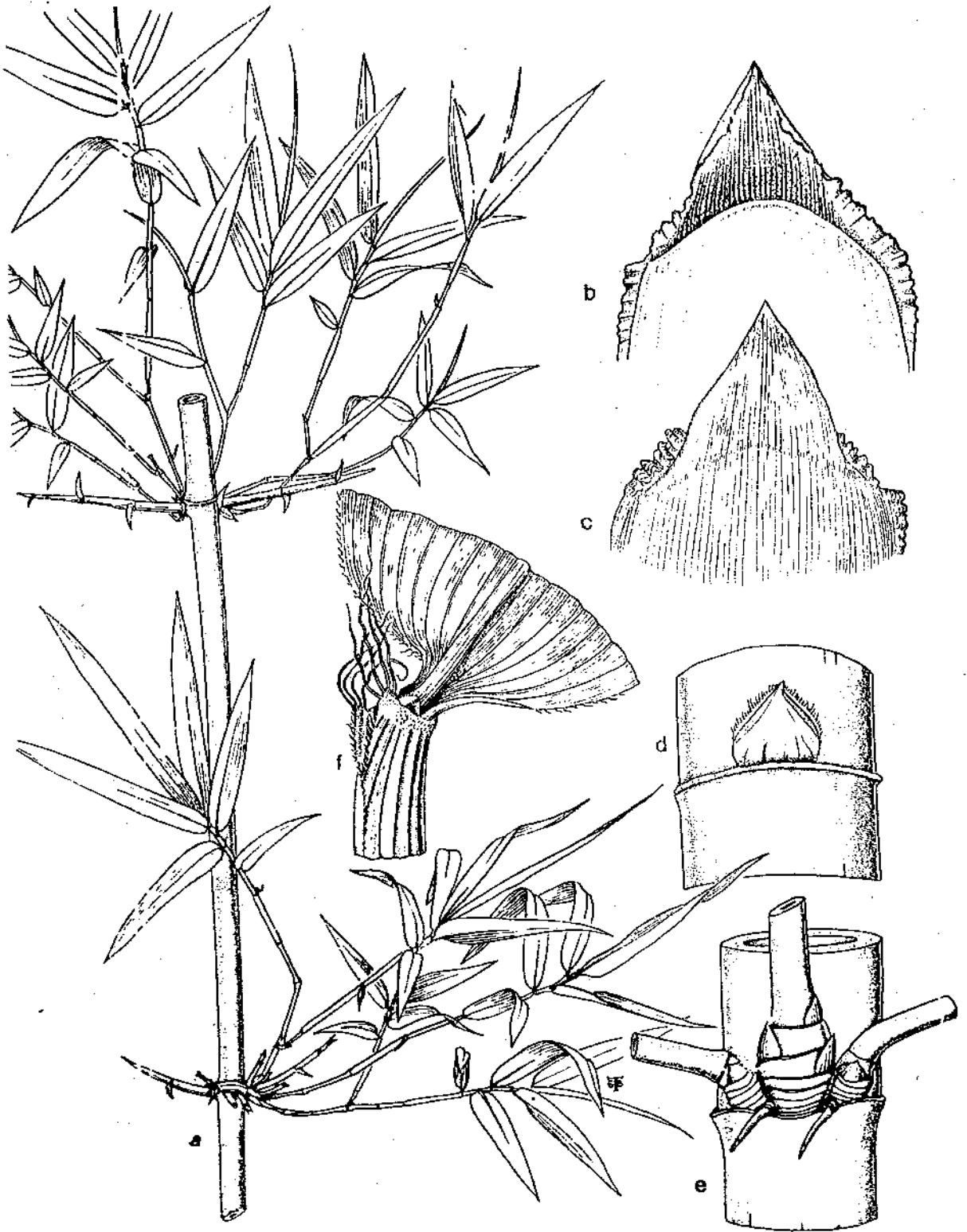
Culms, branching and branch leaves.



Nodes, buds, and branching.



Inflorescences.



Bambusa bambos

transplant rhizome. This method is expensive since extraction of rhizome is a labour intensive process. Further number of rhizomes available is limited. Extraction of rhizome will be injurious to the growth and survival of this rare species. An experiment was conducted to standardise a method for rooting of stem (culm) cuttings using root-promoting hormones. Factors like position of the cutting, age of the parent culm, different concentrations and types of root promoting substances were used for the experiment.

Propagation material: Cuttings from basal, middle and top parts of two and three year old selected culms from the clumps.

Root promoting substances: Naphthyl acetic acid (NAA) and Indole butyric acid (IBA) at three different concentrations (100, 250 and 500 PPM). A control without root promoting substances was maintained. The treatment was given by pouring the aqueous solution to the cavity.

Season of treatment: The experiments were conducted during April 2000.

Experimental design: Totally 63 combinations were planted in RBD in nursery beds.

Results: Good sprouting was observed but the rooting response was very poor. Generally this is the trend. Thin walled bamboo species are difficult to root. The experiment needs to be repeated with different rooting media root-promoting substances, types of parent materials and season.

Dendrocalamus giganteus

This is the giant bamboo, which is becoming rare. People prefer to cultivate it due its high price and high yield. Local people reports that it is less prone to insect attack when used for production of handicraft items. This species is the largest reported among Indian bamboos and the productivity is about 30tonnes/ha/annum. In China under well-managed conditions it is reported to produce 100 tonnes/ha/year. Seeding is very rare and conventional method of rhizome planting is very difficult. There was no information on vegetative propagation of this species using cuttings. Hence an experiment was conducted using stem and branch cuttings of this species.

Propagation material: Cuttings from basal, middle and top parts of two and three year old selected culms from the clumps growing in a homestead in Wyanad district in Kerala. It will be ideal if technology can be standardised for rooting of branch cuttings of the species and hence treatments were given to branch cuttings also.

Root promoting substances: Naphthyl acetic acid (NAA) and Indole butyric acid (IBA) at two different concentrations (100 and 200 PPM). A control without root promoting substances was maintained. The treatment was given by pouring the aqueous solution to the cavity for culm cuttings and by dipping the lower part in the solution for overnight for branches.

Season of treatment: The experiments were conducted during March 2001. Previous trials on other bamboo species by KFRI have revealed that in Kerala summer months are best for treatment of bamboos for root induction.

Experimental design: Totally 27 combinations for branch cuttings and 15 combinations of culm cuttings were treated and planted in RBD in nursery beds at Nilambur.

Results: About 100 percent sprouting were observed both in culm and branch cuttings.

B. Work done during April to June 2001

Physical targets

Conduct experiments for standardization of protocols for production of planting stock

Achievement

Observations on rooting of *D. giganteus* were recorded and it was found that 60 per cent of the stem cuttings have rooted. The best treatment with regard to age, position and growth regulating substance and concentration will be brought out after statistical analysis of the data and made available to DC (H) within next three months.

Present status since inception

Experiments were tried for two species. *Dendrocalamus giganteus* gave promising results and *Ochlandra beddomei* did not respond favourably. More number of species are required to be studied. Within the project period it is expected to complete the propagation of another three important species *D. brandisii*, *Pseudoxytenanthera bourdilloni* and *Thyrsostachys oliveri* from the first of view of handicrafts.

Reasons for short fall, if any

The major constrain faced was that most of the bamboo species preferred for planting in homesteads are thornless varieties which produce seeds very rarely due to long flowering intervals. Methods like tissue culture have not developed to that stage of mass production of planting material using mature buds as ex-plant. Even the macro-propagation methods are not developed for these species and it requires a great deal of initial standardization. These species are

available mainly in non-forest areas and the stock is limited to a small number of clumps. So getting enough propagation material to run a standardization experiment meeting the requirement for minimum replication for a statistical design itself becomes very difficult. Further, most of the preferred species used for weaving are thin walled bamboo which are difficult to root species. When large-scale production of planting stock is considered still we face problem to raise sufficient quantity of planting materials for bamboo species which are not frequent seed producers. However from these studies we expect to develop package of practice for propagation of five commercially important species (*O. beddomei*, *D. giganteus*, *D. brandisii*, *P. bourdilloni* and *T. oliveri*).

1.3. DEVELOP PACKAGES FOR NURSERY AND SILVICULTURAL TECHNIQUES

Duration: 30 months (March 2000-August 2002)

Objective

To develop nursery and silviculture techniques for cane bamboo species used in handicrafts.

Programme of activities

1. Collection of information on nursery and silviculture techniques practiced in Kerala and North-Eastern States.
2. Standardization of practices for different climatic conditions and regions.
3. Preparation of an Information Bulletin on package of nursery and silviculture techniques for cane and bamboo species used in handicraft industry

End out put

Packages for nursery and silvicultural practices for growing cane and bamboo which can be used by farmers, forest department, NGOs and other interest groups will be available.

A. Work done during March - 2000

Physical targets

Compilation of information

Achievement

Initiated the programme

B. Work done during April 2000 to March 2001

Physical targets

Compilation of the available information and preparation of Handbook.

Achievement

A draft of the publication in Malayalam prepared (copy enclosed).

C. Work done during April to June 2001

Physical targets

1. Editorial scrutiny of the draft Handbook
2. Preparation of the Handbook in progress.

Achievement

Work in progress and expected to be complete by October 2001.

Present status since inception

Compilation of information has been completed. Draft of Handbook on Nursery and Silvicultural Techniques for Bamboo has been prepared in Malayalam and draft of English version is ready. Preparation of the Handbook for cane is in progress.

Reasons for short fall, if any

Nil

Introduction

Bamboos are monocotyledonous plants usually forming a rich belt of vegetation in moist deciduous, semi-evergreen, tropical and subtropical forests. Bamboo farming is an economically viable option/alternative especially in private lands where protection costs will be very low, and returns on investment are comparable if not higher than any other method of farming, especially on the marginal and degraded lands. Annual income from bamboos, after a short establishment period makes them eminently suitable for smallholdings. A family can continue to get steady annual income for a substantial period of time depending on the age of the bamboo clump and the scientific management followed.

Site conditions

As in the case of many tropical plants, growth, development and productivity of bamboos is influenced mainly by three factors viz., temperature, precipitation and soil conditions.

Bamboos grow in a wide range of edaphic and climatic conditions. Topography does not play a serious role in bamboo growth. Most of the tropical bamboos grow in areas and with a mean annual temperature ranging from 8°C to 36°C, which receives an annual rainfall of 1200 mm to 4000 mm (Sharma, 1982). The growth rate was considerably low in semi-arid conditions with 762 mm to 1016 mm precipitation. Most of the bamboo species will grow practically on all types of soil, provided there is good drainage. However, waterlogged conditions in wet marshy areas and heavy soils, pure clay, or soils with high lime content, may not be suitable for bamboo cultivation (Tewari, 1992).

Monocarpic nature of the plant

Bamboos being a monocarpic plant, availability of seeds is very erratic. Seedlings germinated from seeds after an year of nursery growth is preferred for planting in the field.

Site preparation and planting

(a) Site preparation for planting

The best land for planting of bamboo species is loose and fertile sandy loam, with sufficient sunshine, water and humidity. (The planting density of 600 clumps /ha are recommended in the case of bamboo species. Where condition permit, base fertilizing should be done (15 to 25 kg of organic fertilizer, mixed with fine top soil)

Alternatively the offset planting is commonly used for bamboo propagation in many parts of the world. The offset cutting should be extracted with great care preferably during the summer months of March to May, planted either in gunny bags or in the field, provided with sufficient shade and water. Once new sprouts are produced the shade and watering can be reduced very gradually. One year old potted and sprouted propagules can be planted.

(b) Planting season and methods

The one-year-old rooted plants are planted in the field with onset of monsoon rains. The planting is normally done in 45 cm³ pits dug in advance and a minimum spacing of 5 x 5 m has to be provided (ICFRE, 1991). The planting areas should be protected from fire and grazing and fenced with barbed wire or stonewall depending on the availability of labour and raw material. Generally three knife weeding in the first year, two in the second year and one in the third

year are carried out. The application of anti-termite insecticides and fertilizer in the pits is essential.

Management of bamboo stand

Bamboos are worked under selection system. Usually the felling cycle is 4 years and yield is regulated by area. The felling series will be divided in to as many annual equiproductive coupes, as the number of years in the felling cycle. Cutting the culms at a height between first and second node above the ground level, leaving adequate number of mature culms, felling of culms well distributed in the clump for providing support to the current years tender culms and felling only during the mid October to mid June period are the most important felling rules (ICFRE, 1991).

Some important general rules followed while working in a bamboo plantation are given below.

(a) Soil treatment

The soil should be loosened two times in every year for rhizome growth and shoot bearing. Soil working also improves the capacity of water retention and fertility; adjusts temperature and air permeability, improves soil physical and chemical composition and decreases weed competition for water and nutrients.

(b) Watering

Watering is needed in the dry season to keep the moisture balance inside the mother bamboo favorable to survival of newly planted bamboo and rhizome expansion and shoot bearing in older bamboo. In the rainy season ditches should be dug in plains forestland to protect the rhizome from rooting by food-induced diseases.

(c) Pruning/cleaning

Pruning of bamboo thorns from 5th year onwards is beneficial for the growing clump and intermediate income for the farmer. Thorns are in great demand especially in rural areas for fencing. Removing the dead and dying culms and thinning the clump by the removal of undesirable culms from the clump generally do cleaning of the clump.

(d) Fertilizer applications.

Fertilizing is an important measure to ensure high and suitable yield organic fertilizer is best applied during winter or dry season, while chemical fertilizer may be used in early spring and late summer or during wet season. An NPK fertilizer can be applied for bamboo stand at the rate of 3790/ha. Application is by spreading on the ground as well as in ditches of 15 cm depth dug around the stand. If the stands are situated in steep slopes, it is better that the fertilizer is directly applied at the base of the clump. But excess chemical fertilizer (above 7500 kg /ha) will decrease the yield.

The small granular compound fertilizer can also be used. This fertilizer can be applied by digging a ditch all around the clump, application of appropriate quantity of the fertilizers and subsequently covering the ditch by soil. It is advisable to fertilize the clumps during the rainy season.

(e) Harvesting

Harvesting is very important in managing the bamboo stand. With systematic felling, clump yield can be maintained for longer period. The following important factors are to be considered for the management of bamboo stands.

a. Harvesting of mature bamboo culms (greater than three years old only) should be carried out on a 70% felling intensity i.e., 70% of the total mature culm per clump can be felled selectively. The mature culms are usually found in the middle of the clump and they are to be harvested during the initial years.

b. Old culms have to be cut or harvested for new shoots to emerge. Culms should be felled according to the following proportions in each clump. 40% of the clump, three year old or 30% of the clump 2-3 year old, 20% of the clump 1-2 year old, 10% of the clump one year old and below depending on their vigour and general health according to Azmy *et al.* (1977).

c. Culms should be cut as low as possible leaving only one internode above the ground. If it is cut leaving more than one internode above the ground, bushy and twisted culms will be produced in the future stand and this will affect the quality of the culms.

d. Bamboo culms should not be clear felled. Clear felled clumps generally degenerate into a bushy form and will take extra few years to produce mature culm from normal shoot again.

e. All cut debris should be kept at least 1 m away from the clump. This is to keep the clump free from pest and diseases.

f. Clumps, which show sporadic flowering, should be removed if they have already shed the seeds before they die.

Treatment of congested clump.

To relieve congestion clumps are worked in a horseshoe pattern. Some general rules followed while working congested clump are given below.

(a) An opening in the clump is made opposite to where the maximum production of new culm is noticed.

(b) All the old culms and dry and rotten stumps in the interior of the clump are to be removed leaving only one year old straight and vigorously growing culms and an equal number of straight and evenly spaced older culms.

(c) The culms standing over the periphery are thinned; retaining all one-year-old culms unless they are crooked, retaining the old culms subject to a maximum of five and spacing them evenly. Using a sharp axe in cutting to avoid splitting, cutting the culms as low as possible at a node to avoid collection of rainwater and consequent rooting.

Management in gregarious flowered clumps

The major activity in the event of gregarious flowering, in an area would be the removal of dead bamboo culms as quickly as possible. In gregariously flowered areas the following system of management can be generally adopted.

The extraction has to be limited to the flowered area only and to the entire seeded clumps. However, the clumps are clear felled and removed only after the seeds have fallen to the ground and collected for the nursery use.

Complete fire protection is to be provided to these areas. Grazing is to be prohibited, some times physical barriers like trenches and mounds will have to be created around groups of bamboo seedlings in an attempt to rehabilitate the forest (Sharma, 1982).

Pest and disease control.

Monitor pests and diseases, especially ants, crickets or other insects, appropriate control measures should be taken as necessary up to the age of one year.

കുറുകെപ്പലയ്ക്കുകയ്ക്കുനടേ ജ്യാദം ചൂറക - ഉള്ള ക്ഷമിയേറ വിഭവവർദ്ധനവു
പരിണാമകൃത്യമിട്ടിട -
കോട്ടനീർജ്ജ്വരം - പരിവേഷനം, വിഭവവർദ്ധനവ്
രേഖ - അർ. പി. പത്മനാഭൻ. തിരുവനന്തപുരം വിവി. 1967

കുളികളുടെ പരിവേഷനവും നദികളിലെ

വനവിഭവങ്ങളിൽ ഏതൊരു വോഡയ്ക്കുമുള്ളതായി വന്നിടങ്ങളിലെ
കുളിപ്പണിയിൽ ഉള്ള ഇതിന്റെ പ്രധാന കാരണം വെട്ടിപ്പണിയിലൂടെയും
നീർപ്പിന്നിടങ്ങളിൽ വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
വിവിധ നീർപ്പിന്നിടങ്ങളിൽ എങ്ങനെ എങ്ങനെ എങ്ങനെ എങ്ങനെ എങ്ങനെ
1250 - 1250 പ്രവൃത്തിക്കുന്നതിൽ ഉള്ളിൽ ലോകത്തെക്കുറിച്ചും കണ്ടുവെച്ചു.
ഇതിലും കണ്ടുപിടിച്ചിട്ടില്ലാത്തവ എത്രയും കണ്ടു വെച്ചു. 1

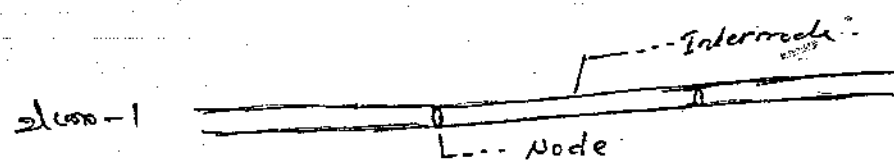
വളരെ കുറുകെപ്പലയ്ക്കുകയ്ക്കുനടേ ജ്യാദം ചൂറക ജീവിതചക്രങ്ങൾ
സംഗ്രഹിക്കുന്നത്. പക്ഷേ വർദ്ധിക്കുന്ന പദ്ധതികൾ ഉണ്ടാക്കി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
വളരെ കുറുകെപ്പലയ്ക്കുകയ്ക്കുനടേ ജ്യാദം ചൂറക എല്ലാതരം കുളികളും ഉണ്ടാക്കി വെള്ളം കെട്ടി
അതിൽ വെള്ളം അത് നശിച്ചു വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
പ്രകൃതിയുടെ കീഴിൽ കാരണങ്ങളില്ലാതെ, ഉദാഹരണമായി ഉദാഹരണങ്ങളുള്ള
കുളികളും ഉണ്ടാക്കി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
ചില കുളികളുടെയും വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
ചില കുളികളുടെയും വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
എല്ലാ കുളികളുടെയും വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
നല്ലതരം പരിവേഷനങ്ങൾ. ഉദാഹരണമായി എല്ലാ കുളികളുടെയും വെള്ളം കെട്ടി
പരിവേഷനങ്ങൾ ഉണ്ടാക്കി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
എല്ലാ കുളികളുടെയും വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
ഇത്ര കിടന്നു വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
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കുളികൾ പലതരം കുളികളിൽ പലതരം കുളികളിൽ പലതരം കുളികളിൽ പലതരം കുളികളിൽ
കുളികൾ പലതരം കുളികളിൽ പലതരം കുളികളിൽ പലതരം കുളികളിൽ പലതരം കുളികളിൽ

കോട്ടനീർജ്ജ്വരം പരിവേഷനവും

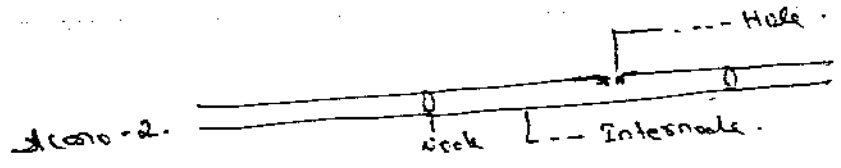
കുളികളുടെ പ്രവൃത്തികൾ ഉണ്ടാക്കിയതിലുള്ളതാണ്. അതിന്റെ
കുറുകെപ്പലയ്ക്കുകയ്ക്കുനടേ ജ്യാദം ചൂറക അല്ലെങ്കിൽ വെള്ളം കെട്ടി വെള്ളം കെട്ടി
കാട്ടനീർജ്ജ്വരം കാര്യങ്ങളാണ് കോട്ടനീർജ്ജ്വരം കോട്ടനീർജ്ജ്വരം
വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി വെള്ളം കെട്ടി
കുളികൾ നദികളിലെ പദ്ധതികൾ

കുളികൾ നദികളിലെ പദ്ധതികൾ
കുളികൾ നദികളിലെ പദ്ധതികൾ
കുളികൾ നദികളിലെ പദ്ധതികൾ
കുളികൾ നദികളിലെ പദ്ധതികൾ
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സൂക്ഷ്മ കലയുടെ മുൻപ് ചിത്രങ്ങൾ. അതുകൊണ്ട് ശ്രദ്ധിക്കേണ്ട കാര്യം
 2 cm നീളം കാണാൻ വേണ്ടി നിന്നു കേൾക്കേണ്ട വലിയ മുൻകാല
 ക്രമം അത് പ്രയോജനപ്പെടുത്തേണ്ട സാഹചര്യങ്ങളിൽ ഉണ്ടായിരിക്കണം.
 അങ്ങനെ ഉണ്ടാകാൻ വേണ്ടി ഒരു വലിയ പേപ്പറിന്റെ കിഴക്കു ഭാഗത്തു
 വെട്ടിക്കൊണ്ടു വരണം. അതിനു ശേഷം ക്രമമായി 20 cm നീളം
 കണ്ടുകൊണ്ട് മുൻകാലത്തേക്ക് മുൻപു വെട്ടിയെടുക്കേണ്ടതാണ്. അതിന്റെ മുൻകാല
 വലിപ്പം അതിനു ശേഷം വലിപ്പം ഉപയോഗിച്ചു വെട്ടിക്കൊണ്ടു വരിക
 അതും മുൻകാലത്തേക്കാണ്. അതിനു ശേഷം സാധിക്കുന്ന വലിപ്പം
 ട്രേസ് ചെയ്ത് വെട്ടിക്കൊണ്ടു വരിക. ട്രേസ് ചെയ്ത് മുൻകാലത്തേക്ക്
 ക്രമം 1. അതിന്റെ ട്രേസ് ചെയ്ത് മുൻകാലത്തേക്ക് വെട്ടിക്കൊണ്ടു വരിക
 അതിന്റെ ക്രമം അതിന്റെ ക്രമം ട്രേസ് ചെയ്ത് മുൻകാലത്തേക്ക്



ചിത്രം-1
 ഉപയോഗിച്ചു വെട്ടിക്കൊണ്ടു വരിക. അതിന്റെ മുൻകാലത്തേക്ക്
 വെട്ടിക്കൊണ്ടു വരിക. അതിന്റെ മുൻകാലത്തേക്ക് വെട്ടിക്കൊണ്ടു വരിക
 മുൻകാലത്തേക്ക് വെട്ടിക്കൊണ്ടു വരിക. അതിന്റെ മുൻകാലത്തേക്ക്
 ക്രമം 2. അതിനു ശേഷം അതിന്റെ മുൻകാലത്തേക്ക് വെട്ടിക്കൊണ്ടു വരിക
 വെട്ടിക്കൊണ്ടു വരിക 100 ന്നു വെട്ടിക്കൊണ്ടു വരിക. അതിനു ശേഷം അതിന്റെ
 ക്രമം 3. അതിന്റെ മുൻകാലത്തേക്ക് വെട്ടിക്കൊണ്ടു വരിക.



ചിത്രം-2.
 സാധിക്കുന്ന 100 ppm, 200 ppm (വലിയ ഉപയോഗ പ്രയോജനത്തിനു
 ഉണ്ടായി ഉപയോഗിക്കേണ്ടതാണ്.
 100 ppm കൂടി വലിയ വെട്ടിക്കൊണ്ടു വരിക
 സാധിക്കുന്ന 1 ppm കൂടി വെട്ടിക്കൊണ്ടു വരിക
 1 ന്നു സാധിക്കുന്ന ഒരു ലിറ്റർ വെട്ടിക്കൊണ്ടു വരിക.

സംഗമം
കൂട്ടിക്കൽ ഉപപരിപാടികളിലെ അടവുകളിലൂടെ ൨.൩൮ പദ്ധതിയെ പരിപാടിയുമാക്കി
കേന്ദ്രം വളർത്തും.
സുരക്ഷിതം.

കേന്ദ്രം അടവുകൾ നൽകുന്നതിനുള്ള സുരക്ഷിതം കൂട്ടിക്കൽ ഉപപരിപാടിയുടെ ഭാഗമായി
വളരെ പ്രധാനപ്പെട്ടതാണ്. ൧൯൭൦ നീൽ കൃഷി വളരെ ഉന്നിയപ്പെട്ടിട്ടുണ്ട്
പോലും പരിഷ്കരിക്കുകയാണ് കേന്ദ്രം ചെയ്യുന്നത്. ഇത് നൽകുന്നതിനുള്ള
രണ്ട് വർഷത്തോളം തുടർച്ചയായും പിന്നീടുള്ള വർഷങ്ങൾ
വളരെ പദ്ധതികൾ ആവിഷ്കരിക്കണം. കൂട്ടിക്കൽ വേഗത കൈക്കൊള്ളാൻ
ജില്ലാ ഉദ്യോഗസ്ഥർ ഉത്തരവാണ്.

വള പ്രയോഗം

പി.പി.എം ഉപപരിപാടിയുടെ ഭാഗമായി വള പ്രയോഗം
കേന്ദ്രം വളർത്തുകയും കൂട്ടിക്കൽ വളർ ലഭിക്കുന്നതിൽ പദ്ധതികൾ
വള പ്രയോഗങ്ങൾ അവലംബിക്കുന്നതാണ്. അതിനായി പരിപാടികൾ
ഉപയോഗിക്കുന്നതിനായി ഉത്തരവ്. എൻ.പി.ഒ.ക. 15: 17: 17
എന്ന അപരിപാടിയുടെ ഉപയോഗിക്കുന്നതിന് നയതന്ത്രം ഉപയോഗിക്കാൻ
നൽകിയിട്ടുണ്ട്. ഉപപരിപാടിയുടെ ഭാഗമായി വള പ്രയോഗം
വളപ്രയോഗം ൧ kg നീക്കം എൻ.പി.ഒ.ക. 17: 15: 17 ഉപയോഗിക്കുന്നതിന്
നയതന്ത്രം ൨൦ / വരും അധികമായി ലഭിക്കുന്നതിനായി ഉപയോഗിക്കുന്നതിന്
നയതന്ത്രം നൽകിയിട്ടുണ്ട്. വള പ്രയോഗം ഉപയോഗിക്കാൻ കേന്ദ്രം
കൂട്ടിക്കൽ വളർ ഉപയോഗിക്കുന്നതിന് ഉത്തരവ് നൽകിയിട്ടുണ്ട്.
ന.പി.എം.പരിപാടിയുടെ ഭാഗമായി നൽകുന്നതിനായി ഉത്തരവ് നൽകിയിട്ടുണ്ട്.
നയതന്ത്രം വളർ ഉപയോഗിക്കുന്നതിന് ഉത്തരവ് നൽകിയിട്ടുണ്ട്.
എന്നതിന് ഉത്തരവ് നൽകിയിട്ടുണ്ട്. ഉത്തരവ് നൽകിയിട്ടുണ്ട്.

വിളവെടുപ്പ്

കേന്ദ്രം വിളവെടുപ്പ് തിന്മകൾ പരിപാടിയുടെ ഭാഗമായി
വളരെ പ്രധാനപ്പെട്ടതാണ്. പ്രധാനപ്പെട്ടതാണ്
സുരക്ഷിതം കേന്ദ്രം വളർത്തും ഉപയോഗിക്കുന്നതിന്.

1.4. ESTABLISHMENT OF GERmplasm BANKS FOR CONSERVATION AND PROPAGATION REQUIREMENTS

Duration: 30 months (from March 2000 to August 2002)

Objective

Establishment of a live collection of important cane and bamboo species used in handicraft industries in Kerala

Programme of activities

1. For canes, seeds of different species will be collected from various populations and seedlings raised in the nurseries. Seedlings will be out-planted in 5 ha after one year of hardening with a spacing of 4 x 4 m to establish conservation plots.
2. For bamboo, planting materials will be raised using seed, if available or by vegetative methods and out-planted at selected sites for conservation of useful species.
3. Planting stock will be exchanged between KFRI and other collaborating institutions from North Eastern States for introduction of better species for handicrafts.

End out put

1. One gene bank each for cane and bamboo with various cane and bamboo species suitable for handicrafts will be established in Kerala.
2. Farmers and artisans will be able to assess growth and other features of different cane and bamboo species in the live collection and select suitable species for their crafts.
3. Exchange of planting materials between North-East and South India will help to introduce better species in these regions.

Work done during March - 2000

Physical targets

No work done as per the activity schedule since the work could be started only in April.

Achievement

Nil

A. Work done during April 2000 to March 2001

Physical targets

1. Collection of seeds/propagation materials for both cane and bamboo species.
2. Establishment of new plots for germplasm and extension of the current germplasm in the Field Research Station at Velupadam, KFRI.
3. Exchange of planting materials

Achievement

A. Cane

Seeds of seven species (*Calamus thwaitesii*, *C. hookerianus*, *C. brandisii*, *C. gamblei*, *C. pseudotenius*, *C. rotang* and *C. travancoricus*) were collected from Western Ghats and established nursery each in Peechi, Velupadam and Nilambur (main campus and sub-centres of KFRI).

A plot of one ha area was selected in the campus of KFRI sub centre Nilambur and the area planted with seedlings of the above species. The area was weeded, managed and establishment and growth recorded.

B. Bamboo

A nursery of 16 species of bamboo (*Bambusa balcooa*, *B. glaucascens*, *B. membranaceus*, *B. nutans*, *B. polymorpha*, *B. vulgaris*, *B. wamin*, *Dendrocalamus brandisii*, *D. giganteus*, *D. longispathus*, *D. hamiltonii?*, *D. strictus*, *Oxytenanthera monostigma*, *Pseudoxytenanthera ritcheyi*, *Schizostachyum sp.*, *Thyrsostachys oliveri*) was established at Velupadam Field Research Centre, KFRI. Vegetative propagation technique standardised by KFRI was used and 80 per cent rooting of cuttings were observed in most of the species.

Seeds of *Ochlandra travancorica* was provided to collaborating Institutions. Planting materials of four bamboo species was collected (Table 1).

Table 1. Species collected from NE during April 2000

Sl. No.	Species collected	Place of collection	Date of collection
1	<i>Phyllostachys bambusoides</i>	Hong Village, Zero Arunachal Pradesh	23/4/2000
2	<i>Dendrocalamus asper</i>	SFRI, Itanagar, Assam	24/4/2000
3	<i>Pseudosasa japonica</i>	SFRI, Itanagar, Assam	24/4/2000
4	<i>Phyllostachys pubescens</i>	SFRI, Itanagar, Assam	24/4/2000

B. Work done during April to June 2001

Physical targets

- 1 Collection of different bamboo and cane species from all over India to strengthen the germplasm from the point of conservation of all species used in handicrafts .
- 2 Preparation of planting stock using conventional methods like production of seedlings or by vegetative methods depending on the availability.
- 3 Establishment of germplasm bank and extension of the current germplasm collections by planting additional species/clones.
- 4 Exchange of planting stock between KFRI and collaborating institutions in NE.

Achievement

1. Collected 26 bamboo and 7 cane species and raised planting stock.
2. Planted the collected species in the germplasm plots. For bamboo the planting was done in Velupadam (in the existing germplasm of KFRI and for cane in Nilambur (List of species attached).

Present status since inception

Twenty-six bamboo species and seven cane species were planted in the germplasm. Seeds of one species was sent to NE and four species were introduced to KFRI collection.

Reasons for short fall, if any

It is necessary to include all genetic variations of the same species in germplasm to conserve natural variation. It is essential to collect different cohorts of bamboos. The lack of information on flowering of various species used in handicrafts restricts the collection of flowering genotypes.

ENCLOSURES

PROFORMA (THREE NUMBERS) FOR COLLECTION OF DETAILS FOR GERMPLASM OF BAMBOO

Proforma I

Nursery Details

- 1 Seed source :
- 2 Date of collection :
- 3 No. of seeds/kg :
- 4 Date of sowing :
- 5 Date of germination :
- 6 Date of pricking out :
- 7 Seedling growth in polybags :
(twice in a month)
- 8 Date of macro proliferation :
- 9 No. of sister plants obtained :
from a clump
- 10 Growth of sister plants in :
polybag

Proforma II

Site Details

- 1 Species commonly used for. : 1)
handicraft manufacturing 2)
3)
4)
5)
- 2 Location : A. State :
(details ? of the site where B. Forest Division :
the species grows) C. Range :
- 3 Habit of clump : 1) Clump forming (sympodial)
2) Solitary culms (monopodial)
- 4 Habitat details : 1) Rainy months :
2) Rainfall (mm) :
3) Temperature (°C) :
4) Soil type or texture :
5) Marshy site :
6) Homesteads or natural forests
7) No. of culms produced during each season
- 5 Grazing intensity : 1) Light
2) Moderate
3) Heavy
- 6 Remarks :

Proforma III

Clump Development Details

- 1 Clump diameter : 1) Diameter 1
2) Diameter 2
- 2 Clump perimeter :
- 3 No. of culms per clump :
- 4 No. of culms produced in :
the previous year
- 5 Characteristic features of :
culms produced in the last
year
- 6 No. of culms produced in :
the present year
- 7 Characteristic features of :
the culms produced in the
present year
- 8 Mortality rate of culms :
- 9 General remarks :
- 10 Culm growth details : Daily observation on culm height

Proforma IV

Morphological Characters of the Clump

- Selection criteria :
- 1 Erect, straight and stove :
culms
 - 2 Tall and large in size :
 - 3 Thick wall to solid internode :
(more than 1 cm)
 - 4 Branching mostly at the top :
and no or less at the bottom
 - 5 Open, not congested clump :
 - 6 More number of culms per :
clump
 - 7 More vigorous and erect :
culms
 - 8 Clumps healthy and not :
infected by disease or
insects
 - 9 Selection intensity : Not less than 1% (i.e. is the best one of
the 100 clumps and not more than 2
clumps per km² of bamboo forest or
plantation)

**List of Bamboo species used in handicrafts and planted
in the germplasm bank of KFRI - April-June, 2001**

Sl.No	Species name
1	<i>Bambusa albociliata</i> (?)
2	<i>B. albostriata</i>
3	<i>B. blumiana</i>
4	<i>B. dissimulata</i>
5	<i>B. multiplex</i> var. <i>varigata</i>)
6	<i>B. multiplex</i> (Yellow)
7	<i>B. oldhami</i>
8	<i>B. textilis</i>
9	<i>Schizostachyum pergracile</i>
10	<i>Dendrocalamus giganteus</i>
11	<i>D. hamiltonii</i> (Tissue culture plantlets)
12	<i>Gigantochloa atroviolacea</i>
13	<i>Ochlandra beddomei</i>
14	<i>O. species</i> (Yet to be identified)
15	<i>O. talbotii</i> (to be confirmed)
16	<i>O. travancorica</i> (to be confirmed)
17	<i>O. wightii</i>
18	<i>Phyllostachys bambusoides</i>
19	<i>P. species</i>
20	<i>P. sulphuria</i>
21	<i>Pseudosasa japonica</i>
22	<i>Pseudoxytenanthera monadelphica</i>
23	<i>P. stocksii</i>
24	<i>P. bourdillonii</i>
25	<i>P. ritcheyi</i>
26	<i>Tienostachyum atunatum</i>

2.1. SET UP TISSUE CULTURE LABORATORY

Duration: 30 months (from March 2000 to August 2001)

Objectives

1. Raising tissue cultured plants through setting up of a tissue culture unit for production of planting material of cane and bamboo species used in handicrafts.
2. Production and distribution of plantlets of cane and bamboo species suitable for handicrafts.

Programme of activities

1. A tissue culture plant propagation unit incorporating cost and energy saving measures will be established for cane and bamboo.
2. Standard tissue culture methods for micro-propagation using seeds, seedlings and buds of cane and bamboo species suitable for handicrafts will be adopted.
3. Large scale multiplication will be carried out using successful protocols and plantlets will be distributed.
4. Cultures will be maintained for long-term benefit.

End out put

1. Standardization of protocols for micro-propagation of cane and bamboo species used in handicrafts.
2. Large scale production of plantlets using successful protocols.

A. Work done during March - 2000

Physical targets: Establishment of facilities.

Achievement: Work on estimate and planning of the laboratory facilities initiated. Quotation for purchase of equipment invited from suppliers.

B. Work done during April 2000 to March 2001

Physical targets:

- i. Establishment of Laboratory facilities
- ii. Initiation of cultures
- iii. Multiplication of cultures

Achievements

1. Equipment procured

The following equipments for the tissue culture lab were procured and installed.

	Item	Cost in Rs.	Dealer	Purpose
1	Central Island Table	49,250	Scientific Enterprises, Kochi	Lab. table for media preparation etc.
2	Vertical Storage Chamber	17,160	"	Storage of glassware
3	Horizontal Sterilizer	120,520	Trichur Surgicals, Thrissur	For steam sterilization of culture media and glassware
4	Laminar Flow Bench	51,000	MAF, Chennai	For sterile inoculations and subculture work
5	Air-conditioner- 2 Nos.	64,767	Carrier Ltd. Thrissur	Maintenance of temperature and humidity in culture room
6	Air Curtain	10,500	Scientific Enterprises Kochi	For maintaining sterility of clean rooms
7	Tissue culture rack.	48,000	Saveer Biotech, N. Delhi	For placing tissue cultures in the incubation room
8	CO ₂ Control Unit & Accessories	75,000	Techins-Illeco, Chennai	For hardening experiments under enhanced CO ₂ environment
9	Sprayer pump	13,500	Peekay Farm Equip., New Delhi	Accessories for hardening chamber
10	Deep freezer	48,000	Vestfrost	Storage of culture media & chemicals
11	pH meter	16,800	ChemInd	Media preparation

The purchase of the SPV module has been delayed because of a poor response from the suppliers in submitting their quotations. Purchase of items required for the hardening facility was given less priority since it was required only later when production of plantlets has started.

2. Establishment of laboratory

Civil work and installation of equipments is nearing completion. Some of the equipment delivered but awaiting installation.

3. Selection of cane and bamboo species for tissue culture

List of the priority species of bamboo obtained from scientists working in other components. Bamboo species selected for tissue culture work are *Thrysostachys oliveri*, *Dendrocalamus giganteus* and *D. brandisii*.

4. Initiation of cultures

Experiments conducted for standardization of protocol for each species

Bamboo species

Cultures are being established using explants containing a node taken from secondary branches. Explants are surface sterilised using 0.1 - 2.0 % Mercuric chloride solution after cleaning and pretreatment with various systemic antibiotic solutions. Use of Bavistin, Dithane M45, Nystatin, Greseofulvin, Benomyl as antifungal compounds and Gentamycin as antibacterial adjuvant has been tested. Control of contaminants is still not complete particularly due to the monsoon season.

Basal medium used is Murashige and Skoog's minerals and vitamins supplemented with sucrose (2 %). Sprouting of buds are induced on hormone free medium to screen out contaminated explants. After a week of culture the buds are shifted to basal medium supplemented with the cytokinin BAP or BAP with NAA at various concentrations. Sprouted buds are then shifted at various stages of growth to liquid media (shake flasks or with different types of supports like PU foam, Floats etc.) to induce multiplication. Subcultures are carried out every 2-3 weeks to fresh medium.

Rooting is induced by two means

- i. *In vitro* rooting by transfer of excised shoots to a medium consisting of IBA or NAA at 2- 10 mg/l. When roots develop the shoots are transferred to soil and hardened in the mist chamber.
- ii. by direct rooting of microcuttings through a brief dip in IBA (500 to 1000 ppm); planting in vermiculite and incubation in the mist chamber.

Rooting and establishment of shoots of seedling origin is >80 %. Rooting in shoots of mature plant origin is expected to be much lower.

Rattan

Cultures are established using immature or mature embryos excised from surface sterilised seeds. Developing

embryos are placed on a medium consisting of Murashige and Skoog's minerals and vitamins supplemented with different levels of Benzyl adenine, Kinetin with or without auxins (NAA or 2,4-D). Solid media is found to produce better results. Multiplication rates differ with species but range from 2-10 per culture.

Rooting is induced by transfer of shoots to MS supplemented with NAA 2 - 5 mg/l. Direct rooting of rattan shoots is also being tested. Plantlets are transferred to a soil: vermiculite mixture when roots have developed. Hardening is carried out in a mist chamber. Survival is about 50 %.

Number and stage of cultures in stock at present:

a. Bamboos:

Establishment stage:

D. strictus : 150 Nos.

T. oliveri : 400 Nos.

Multiplication stage:

D. strictus : 60 Nos.

B. bambos var. gigantea: 10 Nos.

T. oliveri : 60

Sprouted nodes (mature) :

T. oliveri: 40

D. giganteus: 20

Rooted plantlets:

B. bambos var. gigantea : 70 Nos.

Somatic embryogenesis (cultures)

D. strictus : 20 Nos.

b. Rattans

Multiplication stage

C. vatayila : 65

C. travancoricus : 200

C. prasinus : 40

C. karnatakensis : 25

C. thwaitesii : 40

C. hookerianus : 40

<i>C. stoloniferus</i>	:	20
<i>C. rotang</i>	:	40
<i>C. nagbettai</i>	:	25
<i>C. lakshmana</i>	:	43
<i>C. gamblei</i>	:	10

Plantlets:

<i>C. travancoricus</i>	:	10 Nos
<i>C. rotang</i>	:	20Nos.

C. Work done during April to June 2001

Physical targets : i. Multiplication of cultures
ii. Plantlet production

Achievements

Number and stage of cultures in stock at present

Bamboos

Establishment stage:

D. strictus : 300 Nos.

T. oliveri : 830 Nos.

Multiplication stage:

D. strictus: 100 Nos.

B. bambos var. gigantea : 35 Nos.

T. oliveri : 106

Sprouted nodes (mature) :

T. oliveri : 106

D. giganteus: 20

Rooted plantlets:

B. bambos var. gigantea : 125 Nos.

Rattans:

Multiplication stage

C. vatayila : 65

C. travancoricus : 300

C. prasinus : 77

C. karnatakensis : 45

C. thwaitesii : 85

C. hookerianus : 97

C. stoloniferus : 30

C. rotang : 80

<i>C. nagbettai</i>	:	85
<i>C. lakshmanae</i>	:	60
<i>C. gamblei</i>	:	20

Plantlet production

Plantlets:

<i>C. travancoricus</i>	:	20 Nos
<i>C. rotang</i>	:	35 Nos

Plan of work for the next quarter

Further experiments are being planned to grow rooted bamboo culm cuttings in pots with drenching and spraying with systemic fungicides and to use explants from such plants. The effect of season and continuous pruning is also to be tested on contamination rates. The use of smaller explants, growing shoot tip explants and testing of additional antimicrobial compounds for pretreatment and addition to medium, induction of direct rooting of sprouted nodes without multiplication etc. is envisaged in the next quarter.

Present status since inception

A tissue culture laboratory was established and work initiated in May 2001. Cultures have been established in six species of bamboo and eleven species of rattan and multiplication in progress. Plantlet production has been started.

Reasons for short fall, if any

Delay in appointment of the staff and the need for training them initially in tissue culture techniques affected the schedule of work proposed in this component.

Since the species suitable for handicrafts and in demand by the trainees for growing in homestead are the ones those which do not produce any seeds, the cultures had to be established from mature buds as ex-plants. The protocol for

production of plantlets from matured tissue of the selected species have not been worked out anywhere in the case of bamboo/canes.

Since the initiation of bamboo cultures could be done only at the onset of the monsoon, and also from parent plants growing in natural conditions contamination of initial cultures was extremely high. Better results are expected only after fresh cultures are established during the coming dry season and from potted plants kept under controlled conditions.

2.2. SET UP PLANT MULTIPLICATION NURSERIES

Duration: 30 months (from March 2000 to August 2002)

Objectives

1. To establish plant multiplication nurseries using conventional propagation techniques for bamboo species suitable for handicrafts in Kerala and North East.
2. To distribute planting stock to farmers, NGOs and others interested in bamboo cultivation.

Programme of activities

1. Bamboo species suitable for handicrafts will be chosen from Kerala and North-Eastern India.
2. Advance booking for planting stock of selected species will be made (through Activity No 3 Setting up farms with NGOs).
3. Suitable sites in Kerala and North East two ha each will be selected to establish a multiplication nursery and live collection to retain as mother clumps in the multiplication nursery.
4. Planting stock of selected species will be raised by macro-proliferation (if seedlings are available) or by a combination of rooting of culm cuttings and macro-proliferation.
5. One year old planting stock (with rhizome) will be given to farmers, NGOs and others interested to cultivate bamboo species on first come first serve basis.
6. Fifty mother plants of different cohorts of selected species will be planted in a multiplication garden for use in the multiplication nursery.
7. A survey will be conducted after a period of three years to evaluate the performance (establishment and growth) of planting stock distributed from the plant multiplication nursery.

End out put

1. Multiplication nurseries for production of planting stock of all bamboo species used in craft will be set up.
2. Planting stock of bamboo will be provided for establishment of demonstration plots and setting up farms as per activity no. 3

A. Work done during March - 2000

Physical targets

- 1 Selection of suitable bamboo species for handicrafts.
- 2 Selection of suitable sites for establishing multiplication nurseries.
- 3 Registration of user groups for planting stock.

Achievements

1. Three sites were selected for nursery (KFRI, Peechi, Nilambur, Velupadam).
2. Since the project was initiated in March other targets were not achieved.

B. Work done during April 2000 to March 2001

Physical targets

- 1 Selection of suitable bamboo species for handicrafts.
- 2 Establishment of multiplication nurseries.
- 3 Establishment of mother plant collection.

Achievements

1. Fifteen species of bamboo suitable for handicrafts were selected for production of planting stock (List given in the Appendix).
2. Four multiplication nurseries were established. The details of planting stock produced from different nurseries are given in Appendix.
3. One block containing 20 plants of 15 selected bamboo species was planted in the mother plant collection (in the campus of FRC, Velupadam).

C. Work done during April to June 2001

Physical targets

- 1 Establishment of multiplication nurseries.
- 2 Establishment of mother plant collection.

Achievements

- 1 Selected 8 trainees for establishment of nurseries in private sector and made an agreement with them.
- 2 Two blocks of mother plant collection were planted.

Present status since inception

Four nurseries were established. The position of seedling production in the nurseries given in the following tables

Reasons for short fall, if any

The demand for planting stock is mainly for thornless bamboo and seeds of these species were not available, except for *Ochlandra*. Since the planting stock had to be raised vegetatively; large number of cuttings are required. The parent plants available were restricted to small populations available in natural forest, homesteads and in germplasm collections. Hence, meeting the demand for planting stock is time consuming. Efforts are being made to establish multiplication nurseries with the help of farmers and NGOs.

**LIST OF BAMBOO AND CANE SPECIES FOR WHICH PLANTING STOCK IS BEING
RAISED IN KERALA**

BAMBOO SPECIES	CANE SPECIES
1. <i>Bambusa balcooa</i>	1. <i>C. thwaitesii</i> (thin and thick types)
2. <i>B. glaucascens</i>	2. <i>C. hookerianus</i>
3. <i>B. membranaceus</i>	3. <i>C. brandisii</i>
4. <i>B. nutans</i>	4. <i>C. pseudotenuis</i>
5. <i>B. polymorpha.</i>	5. <i>C. rotang</i>
6. <i>B. vulgaris</i>	6. <i>C. travancoricus</i>
7. <i>B. wamin</i>	7. <i>C. delessertians</i>
8. <i>Dendrocalamus brandisii</i>	
9. <i>D. giganteus</i>	
10. <i>D. longispathus</i>	
11. <i>D. hamiltonii</i>	
12. <i>D. strictus</i>	
13. <i>Pseudoxytenanthera monostigma</i>	
14. <i>Pseudoxytenanthera ritcheyi</i>	
15. <i>Schizostachyum sp</i>	
16. <i>Thyrsostachys oliveri</i>	

LIST OF BAMBOO SPECIES SELECTED FOR KERALA AND PLANTED IN THE
MOTHER PLANT COLLECTION AT KFRI FIELD RESEARCH CENTRE, VELUPADAM
FOR MULTIPLICATION

1. *Bambusa balcooa*
2. *B. bambos*
3. *B. nutans*
4. *B. polymorpha*
5. *B. tulda*
6. *B. vulgaris*
7. *B. wamin*
8. *Dendrocalamus brandisii*
9. *D. hamiltonii*
10. *D. longispathus*
11. *D. membranaceous*
12. *D. giganteus*
13. *D. strictus*
14. *Pseudoxytenanthera stocksii*
15. *Thyrsostachys oliveri*

**Details of cane and bamboo planting stock (KFRI) after
distribution to farmers for planting season (2000)**

Name of cane species	Nilam bur	Peec hi	Wayan ad	Velu- padam	Total
<i>Calamus. hookerianus</i>	1500	Nil	Nil	2500	4000
<i>C. Pseudotenuis</i>	750			750	1500
<i>C. rotang</i>	1000			1500	2500
<i>C. thwatesii</i>	2000			1500	3500
Grand Total					11500
Name of Bamboo species					
<i>Bambusa bambos</i>	5800	3400 0	10000	Nil	49800
<i>B. balcooa</i>	110	190	Nil		300
<i>B. tulda</i>	140				
<i>B. vulgaris</i>	150	110	100		360
<i>Dendrocalamus membranaceous</i>	15		30	30	75
<i>Ochlandra travancorica</i>	3200	5100	5600	5500	18300
<i>Ochlandra ebracteata</i>				2200	2200
<i>Pseudoxytenanthera ritcheyi</i>	150				150
<i>Thyrsostachys oliveri</i>		18			18
Grand Total					71203

Production of planting stock of bamboo in KFRI, Peechi nursery during 2001

Bamboo species	Method	No. of Cuttings planted	No. of Planting Stock	Given to farmers	Balance
1. <i>T. oliveri</i>	Culm Cutting	916	384	378	6
2. <i>D. longispathus</i>	"	194	30	30	0
3. <i>B. balcooa</i>	"	673	651	471	180
4. <i>B. vulgaris</i>	"	500	506	446	60
5. <i>D. stricuts</i>	"	12	19	13	6
6. <i>D. membranaceus</i>	"	60	74	74	0
7. <i>D. giganteus</i>	"	15	22	12	10
8. <i>B. polymorpha</i>	"	4	5	5	0
9. <i>B. bambos</i>	Seeds	3.5 kg	46000	5679	41321
10. <i>Ochandra sp.</i>	Seed	5000	4000	3295	705

Production of planting stock of bamboo in KFRI, Nilambur nursery during 2001

Species	Method	No. of Cuttings planted	No. of Planting Stock	Given to farmers	Balance
1. <i>D. giganteus</i>	Culm cuttings	450	252	0	252
"	Branch cuttings	1080	9	0	9
"	Nodal bud chips	200	12	0	12
2. <i>D. longispathus</i>	Culm cuttings	100	60	60	0
3. <i>B. polymorpha</i>	"	120	75	60	15

Production of planting stock in KFRI, Velupadam nursery

Species	Method	No. of Cuttings planted	No. of Planting Stock	Given to farmers	Balance
1. <i>B. balcooa</i>	Culm cuttings	Data compilation not completed. Plants from this nursery was used for planting in Mother plant collection			
2. <i>B. nutans</i>	"				
3. <i>B. polymorpha</i>	"				
3. <i>B. vulgairs</i>	"				
4. <i>B. wamin</i>	"				
5. <i>D. giganteus</i>	"				
6. <i>D. hamiltoni</i>	"				
7. <i>D. brandisii</i>	"				
8. <i>D. membranaceus</i>	"				
9. <i>D. longispathus</i>	"				
10. <i>T. oliveri</i>	"				
11. <i>T. regia</i>	"				

KERALA FOREST RESEARCH INSTITUTE, PEECHI

Lecture note provided for the classes on propagation of bamboos

Propagation of bamboo

Bamboos are arborescent grasses belonging to the family Poaceae. India has second largest resources of bamboos in terms of species diversity (about 18 genera and 128 species) and extent of distribution (occupies 12.8 per cent of the forests). Bamboos form an important raw material for traditional and modern industries. In addition to this there are about one thousand five hundred documented uses for bamboos from cradle to coffin. Over-exploitation, lack of proper regeneration after gregarious flowering and inadequate maintenance of the bamboo stands has resulted in dwindling of the resources. Attempts are now being made to raise bamboo plantations in large-scale. For the last two decades Kerala Forest Research Institute had been involved in standardization of techniques for artificial regeneration of bamboos. In this paper an attempt is made to give the details of various methods including seed and vegetative propagation for raising planting stock of bamboos.

Propagation from seed: Based on the flowering cycle bamboos are classified into three types. (1) Annual or continuous flowering: Species which flower every year and do not die. (2) Gregarious or periodic flowering: the whole clump flowers in an extensive area and die after seed setting. The flowering may continue for two to three years in the same area or in the same clump. (3). Sporadic or irregular flowering: occurs in isolated clumps or in parts. Most of the commercially important bamboos belong to the group of plants that flower periodically and gregariously in cycles ranging from 25 to 60 years and die after seed ripening. When gregarious flowering occurs seeds are produced in bulk. Three types of seeds have been reported for bamboos (1) Caryopsis (eg. seeds of *Bambusa bambos*) glans (eg. Seeds of *Dendrocalamus strictus*) and bacca (eg. Seeds of *Ochlandra travancorica*). Seed longevity and storage behaviour was based on the type of seed.

Collection of seeds: For collection of caryopsis and bacca type of seeds, the ground area under clumps were weeded, cleaned free of stones and a slurry of cow-dung was applied which formed a clean surface for sweeping seeds. If this is not practical plastic sheets can be spread on the ground and the seeds fallen in the sheet can be easily collected. Good seeds were separated from the chaff by winnowing and the soil particles, stones and other impurities were removed by hand picking. For seeds of bacca type (*Ochlandra sp*) mature seeds, which were distinct from immature seeds by their characteristic colour were collected by hand picking from the ground and clumps directly. Germination and moisture content of seed lots

were determined immediately after collection. For determining the moisture content, the seeds were oven-dried at 100 ° C for 48 hours and the dry weights were taken. The moisture content (MC) was expressed as percentage on dry weight basis. Viability was determined by germination test. For seeds of bamboos polyurethane sheet and for reed bamboos soil sand mixture (1:1) were used as germination medium. The number of seeds germinated was counted every day till the germination was completed. Viability was expressed as percentage of germination.

Production of seedlings: Bamboo seeds have no dormancy. Seeds can be sown directly in nursery beds or soil filled poly-bags. Partial shade is necessary for initial germination and establishment. Protection from ant and rodents is essential. The seedlings can be poly-potted after 45 days if sown in nursery beds. One or two-year old seedlings can be used for field planting. Establishment and growth of two year old seedlings are better than one year old.

Storage of seeds: Two storage method are found effective for caryopsis and glans type of seeds. (1) dry storage with control of MC (2) dry storage with control of MC and temperature. While selecting seed samples for storage due care may be given for the following (a) Seed lots should be processed as quickly and transferred to storage condition (b) Only seed lots with high percentage of germination and without fungal and insect attack should be taken for storage.

- (1) *Dry storage with control of moisture content:* Keeping seeds in relatively lower humidity will help to maintain the seeds with slow respiration and thus prolong aging. Seed lots having high germination percentage (above 80 per cent) initially dried to 8-10 per cent MC are filled in air tight plastic containers. These containers are placed in a desiccator with anhydrous calcium chloride or silica gel as desiccant. The weight of desiccant required is about one-tenth of the weight of seeds. Seeds can be stored in this condition for about four years.
- (2) *Dry storage with control of moisture content and temperature:* Like MC, temperature also affects seed viability. At lower temperature, as a result of lower rate of respiration, the life span of seeds can be increased. For this a deep-freeze or cold-room can be used depending on the size of sample. Plastic containers with seeds having a MC of 8-10 per cent is stored at temperature -10 to -14 ° C. Continuous power supply to the storage unit is required.

Vegetative propagation: Since seeds are not available regularly and viability of the seeds is very short, propagation by vegetative methods is required for many bamboos. A brief account of various methods used for vegetative propagation of bamboos are given below and a simple method of rooting culm cuttings developed in KFRI is elaborated.

- (a) *Seedling multiplication*: When the seedlings start developing rhizomes, the new sprouts with a portion of rhizome are severed from mother seedling and planted separately. About 3-5 planting units can be obtained from one-year old seedling.
- (b) *Offset or clump division*: The rhizome portions and offsets are separated from mother plant during the active phase of bud development. Offsets or rhizomes of one-year old culms are found better.
- (c) *Rhizome cuttings*: This is mainly done for bamboos having monopodial rhizome. Rhizome cuttings of about 40 - 50 cm are taken from the mother clump.
- (d) *Layering*: The mother culms from the parent clump are bent and held in contact with soil in such a way that the nodes remain in contact with soil till roots are developed. The rooted nodes are separated from mother plant and used for planting.
- (e) *Pre-rooted and pre-rhizomed branch cuttings*: Chopping of the top of one-year old culms and removal of all the emerging culms induced in situ roots and rhizome formation at branch bases of many bamboos. These branches are removed from the main stem by a hack-saw and planted in glass tent for development. The fully developed branches are later field planted.
- (f) *Branch cuttings and nodal bud chips*: The branch cuttings and nodal chips which are trimmed while processing the culms after harvest can be propagated using growth regulating substances. About 50 per cent rooting is possible under ideal conditions.
- (g) *Tissue culture*: Tissue culture is found successful with various bamboo species and used in large scale.

Rooting of culm cuttings: A method of vegetative propagation using culm cuttings has been standardised at KFRI. This involves treatment of culm cuttings with growth regulating substances for inducing root formation. The method was tested for 21 species of bamboos which are economically important and found successful. The details are given below

- Extract 2 to 3 years old culms from healthy clumps by cutting above the first node during March-April.
- Trim the leaves and branches leaving the basal part of branches intact.
- Transport the culms to the nursery site as quickly as possible after taking due care to prevent drying.
- Prepare two noded cutting using a sharp knife or saw.
- Make an opening or drill two holes in the inter nodal region
- Prepare 100 ppm of NAA solution. For this 10 g of 1-naphthalene acetic acid) in 250 ml of 90 per cent ethyl alcohol and make up the solution to 100 litres.
- Pour about 100 ml of the solution to the culm cavity. Close the hole by wrapping with a polythene strip
- Prepare raised nursery beds and fill with a mixture of soil and sand 3:1

- Place the cuttings horizontally in the nursery beds and cover the cuttings with a thin layer of soil
- Provide a thatch with coir-mats or shade nets for initial two months
- Water the nursery beds twice a day as per requirement
- Rooted cutting can be uprooted and transplanted after 4 months.
- Further multiplication can be done from rooted cuttings after one year

3. SETTING UP FARMS INVOLVING NGOS AND FARMERS

Duration: 30 months (from March 2000 to August 2002)

Objectives

1. To set up the demonstration plots in farmers land and forest land for the cultivation of different bamboo and cane species by involving individual farmers, farmers' clubs and NGOs in Kerala.
2. To support participant groups from Kerala with technical inputs needed for cultivation, management and utilisation of bamboo and cane, using appropriate communication media and techniques.
3. To use demonstration plots for the region to promote bamboo and cane cultivation by a wider audience of farmers and other target groups.
4. To organise field day and farmers visit to familiarise with cane and bamboo cultivation.

Programme of activities

1. Interested farmers, NGOs and farmers clubs will be identified in Kerala.
2. Training will be given to project staff and other team members from North East on setting up nurseries and plantations and the trainees will visit Bambusetum, canetum, nurseries and plantations in Kerala.
3. Planting materials, technical help and subsidies will be provided for farmers and other interest groups to set up farms.
4. Farms of participant groups in Kerala will be visited to demonstrate and provide necessary field guidance relating to raising nurseries locally and subsequent planting operations.
5. Frequent visits by the participant groups to regional institutions will be organised to demonstrate and provide necessary technical input related to tending and management of experimental plots.
6. Visits by other interested farmers and target groups to experimental plots and regional institutions will be organized .

7. Groups of dedicated field workers either in the NGO sector or farmers club or government sectors both in Kerala will be formed. These teams will be linked with KFRI in order to offer them necessary guidance and technical input for expanding the bamboo and cane cultivation in the region.
8. Outcome of the whole program will be disseminated through publication and media.

End out put

1. At the end of the project period, farmers, NGOs and other target groups associated with the program will be in a position to establish and manage large-scale farms of different species of bamboo/canes.
2. The participants will also be in a position to train other target groups using their bamboo/cane farms as demonstration plots.
3. The project will help the local governments (panchayats) to incorporate bamboo and cane cultivation and utilization program as tools to increase the regional economy and also enhance the employment opportunities in the rural sector.

A. Work done during March - 2000

Physical targets

- 1 Selection of interest groups by notifying in news papers and announcement in AIR and Dooradarshan
- 2 Formation of farmers team
- 3 Visit of the participant group

Achievement

No work could be initiated during this period since the project was formally approved only in March 2000

B. Work done during April 2000 to March 2001

Physical targets

- 1 Selection of interest groups by notifying in news papers and announcement in AIR and Dooradarshan.
- 2 Organization of visits and meeting and visit by KFRI staff to the field of farmers

- 3 Visit of participants group to KFRI and formation of farmers team
- 4 Supply of planting materials to selected interest groups

Achievement

1. Advertised about the training through media and to invite farmers/NGOs and others interested in bamboo and cane cultivation.
2. More than 200 applicants were received and each case was standardized on certain criteria for selection.
3. The applicants were called in five batches for training. (Training modules are given under activity 8. Training).
4. After the oral presentations on various topics a field visit was organised for the participants. FRC, Velupadam for introducing bamboo and cane species used in handicrafts to the trainees.
5. Supplied a total ---- number of ----- planting materials of bamboo and cane to 25 trainees belonging to nine districts in Kerala (list enclosed).
6. Since it was difficult to meet the demand for planting stock, steps were initiated to establish bamboo nurseries as a joint venture with trainees. Applications were invited and 24 trainees expressed their interest (List attached).

C. Work done during April to June 2001

Physical targets

To continue the programme as mentioned under physical targets above (part B).

Achievements

1. Another advertisement was given through media.
2. Seventy persons applied and they were registered for training.
3. One training programme was organized in April and the details are given in the following Table.

Training programmes conducted for farmers/NGOs and other institutions.

No.	Venue and date	Total No. of Trainees	Category of Trainees		
			Farmers	NGOs	Others
1	KFRI, Peechi 27/06/2000	38	25	12	1
2	KFRI Sub Centre, Nilambur 29/06/2000	50	46	3	1
3.	Muthanga, Wyanad 10 June 2000	31	23	7	1
4.	KFRI, Peechi 30/10/2000 and 1/11/2000	30		30	
5.	KFRI, Peechi 1/2/2001	40	38	1	1
6	KFRI, Peechi 30/04/2001	45	36	9	0
	Total	234	168	62	4

4. Initiated the work for formation of Bamboo and Cane Club. A proforma was sent to the trainees and information was given through media. About 165 persons expressed their interest in formation of the Group.
5. Examined the site (area) of eight trainees for establishment of a nursery. Since monsoon started by this time the work was postponed to December (next season suitable for establishment of nurseries).

Present status since inception

1. A list of farmers/NGOs/others interested in cane and bamboo cultivation from Kerala was prepared from the applications received in response to publicity through media.
2. Technology for cultivation of cane and bamboo developed by KFRI was transferred to farmers through six training programmes. A total of 234 farmer/NGO were trained.
3. The demand of trainees for planting material was met for cane and partially for bamboo by the planting stock raised in the multiplication nurseries under Activity 2.2 of the same project.
4. Since it was difficult for KFRI to meet the demand for planting stock of bamboos the possibilities for establishment of nurseries under the leadership of private/NGOs are being investigated.

Reasons for short fall, if any

It was difficult to meet the requirement of planting stock by trainees.
Possibility of establishment of private nurseries is being investigated.

- 4
Mr. George Joseph
Kakkanattu

Punchavayal
504, Mundakkayam
Kottayam
- 6
The Managing Director
Grammen Development society
P.B.No:111, Kanjirapally
Kottayam-686 507
- 9
Mr.George Philip
Vilakupattathil
Thiruvalla
P.O. Chatrankary
Pathanamthitta
- 12
The Secretary
Search
Vattilappara-680 721, Chalakkudy
Thrissur (Dt.)
- 15
Mr.A.D.Thampi
Kallivalappil House
P.O.Kattakampal
Thrissur-680 544
Thrissur (Dt.)
- 18
Mr.Shamsudeen.K.M.
Late.S/o.Mohammed Rasheed
Karukkapadath
P.O.Eriyad, Udumanchalil
Trichur
- 21
Mr.Selin V.Thomas
CHRDM-Board

Centre for HortiRural Dev
Pazhakutty.P.O.
- 24
- 5
Chair person
Housing & Urban
Development
Agency (HUDA)
Kanjirapally-686 507
Kottayam
- 7
Mr. T.V. Banchamin
Badhani House
Kulanada. P.O, Panthalam
Pathanamthitta (Dt.)
- 10
K.H.S. Kumar
Panochoth House
Kanan Nagar
Manackala, P.O, Adoor
Pathanamthitta
- 13
Mr. K.G. Jose
Kochuthottiyil
Ramavarmapuram
Thrissur (Dt.)
- 16
Dr.C.R.Rajagopalan
National Service Scheme
Sree Kerala Varma College
Thrissur-11
- 19
Mr. Velayudhan.
C/o Mr.P.A.Radhakrishnan
Pookottil House
Mundoor
Peramangalam.P.O. Trichur
Dt.
- 22
Mr.R.Gopinathan Nair
Maruthara Building

P.O.Vanchiyoor-Attingal
Trivandrum
- 25
- 6
Mr.R.Udaya Varma Raja
Paikattu Kovilakam

Eastern Gate
Vaikom-P.O. 686 141
Kottayam
- 8
Mr. Sahadevan V.
Karuvanthudill House
Azhikunnam, Sasthamkotta
Kollam - 690 521
- 11
Mrs.Elsy Alexander
Kallottu House
Kilivayal,
Vadacadathu.P.O., Erathu
Pathanamthitta
- 14
Mr.A.V.Thomas
Brain Society
P.O.Mala -680 732
Thrissur (Dt.)
- 17
Mr. K.S.Raveendran.
C/o Smt.Kadeeja Beebi.N.I.
Head Mistress
G.H.S. Edavilangu-680671
Thrissur (Dt.)
- 20
Mr.T.R.Viswanathan
Thottungal Naduthara
Wadakkanchery.P.O.
Trichur-680 582
- 23
The Secretary
Kuttukudumba Dharma
Sangam
Chandiroor.P.O.
Alleppy
- 26

Mr.Suresh.B.
Naluthundathil
Chennithala.P.O.
Mavekikara-690 105
Alleppy

Mr.V.K.Sasikumaran Nair
Vallanezhathu House
Sherthallai-688524
Alleppy

The Secretary
Kerala Rural Development
Puthiyakkavu
Pattanakad.P.O.688 531
Alleppy

27
Mr.Mahesh Mangatt
Director
Thapovanam
Ochanthuruth-682 503
Ernakulam

28
Mrs.Leela Chandran
President Kerala Mahila
Sangam
Ezhattumugham.P.O.
Ernakulam - 683 577

29
The Secretary
Thabor Vriksha Snehi Samgam
Kothamangalam
Palamattam.P.O.
Ernakulam - 686 691

30
Mr.Abi Peter
Pandikudyil House
Vengoor.P.O.683546
Ernakulam (District)

31
Mr.Gomgy Jose
Vettikkal House
Kalarkuzhi
Mukknloor.P.O.-683577
Ernakulam District

32
Mr. Shibu C.C.
Chalackal House
Meladoor P.O.
Thrissur - 680 741

33
Mr.Pradeepkumar.S.P.
Srayeekatt
Spring vally.P.O. Kumally
Idukki- 685 509

34
Mr. Benny Mathew
C/o Dr.S.N.Potty
Indian Cardamom Research
Insti.
Kallasandadu.P.O.
Idukki -685 553

35
Mr. Rajan K.S.
Brain Society
Mala P.O.
Thrissur Dt.

36
Mr. Rajan, K. S.
Kuluvalappil House
Thekkumkara PO
Punnamparambu

37
Mr. Shibu. C. C.
Chakkalal House
Meladoor, PO
680741

38
Mr. Sahadevan
Kuravanthundil House
Azikunnam
Sasthamkotta PO

Training 2. Venue: KFRI Sub-Center, Nilambur. Date: 29
June2000

1
Smt.Sushama
Puthery House
Annara
Thiroor-676101
Malappuram

2
Mr.Salih
Puthanpurakkal House
Kodimaram
Kondotty.P.O.673638
Malappuram

3
Mr.Muhammed Rafeeq.C.T.
Cheruthodika House
Kodimaram
P.O.Kondotty- 673 638
Malappuram

4
Dr. A. Prasad
Ushus
Kadalundinagaram
Malappuram

5
Mr.E.P.M.Rehman
H.S.Road
P.O.Chandakkunu
Malappuram-679 342

6
Mr.EPM. Rehman
H.S. Road
P.O. Chandakkunu, Nilambur
Malappuram-679 342

- | | | |
|---|--|---|
| 7
Mr.P.I.Markose
Pulickal House
Erymamunda.P.O.
Malappuram-679334 | 8
Mr.K.C.Suresh Raja
Pallavi
P.O.Ramankuthu
Nilambur.R.S.
Malappuram.Dt. | 9
M. Ramachandran
Ushus
Kadalundi Nagaram
Pin 673 314 |
| 10
Mr.Kesavachandran.C.
Oppethkalam

Kulukkalloor.P.O.
Palakkad | 11
P.Swaminathan
Kollamkkode
gramapanchayath
P.O.Kollenkode,
Palakkad-678 506 | 12
The Secretary
Janaseva Sangam

Kollengode
Palakkad-678 506 |
| 13
The Secretary
Koottakkadavu
Nemmarapadam
Padasekhara samithi
Vithanassery,Nemmara
Palakkad-678 508 | 14
Smt.R.Sudhakumari
D/o.M.Sreedharan Nair

S.S.Nilayam
Akathethara
Palakkad-8 | 15
Mr.O.N.Damodaran, Engineer
Olappamanna mana

Vellinezhi
Palakkad-679 504 |
| 16
Mr.P.V.Philip
Cholodkalam
C.N.Puram
Palakkad-678005 | 17
Mr.Sureshkumar
Manimandiram
Bagavathi Nagar
Puduserry
Palakkad-678007 | 18
Mr.Jayendran.T,
Panchavadi , Chennankode
Kanimangalam ,Nenmara
Palakkad-678508 |
| 19
Mr.Rajupathayapuram
Kaippachery
P.O.Ayeeloor
Palakkad-678510 | 20
Mr.Kittumani.M.
Thumblumcode House
Pudiyankam.P.O.
Palakkad-678545 | 21
Mr.V.C.Yousaf
Vendasery House
Valliyode
Achumurthy.P.O.
Palakkad-678682 |
| 22
Mr.K.Mohamedkutty
Banna Manzil
Ezhuvanthala.P.O.
Palakkad-679335 | 23
Mr. K. J. Nainan
Kambyeel House
P.O. Manykkalasery
Palakkad (Dt.) | 24
The Principal
M.E.S.Kalladi College
P.O.Mannarghat College
Palakkad -678 583 |
| 25
Mr.Tony Thomas
Kizhakkekara
Irumpakachola.P.O.
Palakkad -678591 | | |
| 26
Smt.Sushama | 27
Mr.Salih | 28
Mr.Muhammed Rafeeq.C.T. |

Puthery House
Annara
Thiroor-676101
Malappuram

29
Dr. A. Prasad
Ushus
Kadalundinagaram
Malappuram

32
Mr.P.I.Markose
Pulickal House
Erymamunda.P.O.
Malappuram-679334

34
V. P. Unnichekku
Prongodu
Malappuram

37
Samuel. P. M.
Parayil Veedu
Melangadi P. O.
Kondotti, Malappuram

40
Santhosh. P. M
Parathanathe house
Chempenkolly
Uppada P.O. 679 354.

43
T. C. Shahabudheen
Vettilappara- 673 639

46
Yousaf
Tholloor, Melatoor PO
Malappuram Dt.

Puthanpurakkal House
Kodimaram
Kondotty.P.O.673638
Malappuram

30
Mr.E.P.M.Rehman
H.S.Road
P.O.Chandakkunu
Malappuram-679 342

33
Mr.K.C.Suresh Raja
Pallavi
P.O.Ramankuthu
Nilambur.R.S.
Malappuram.Dt.

35
Anil John
Pottikallu
Pookottumpadam
Nilambur- 679 332

38
Musa Kuppanath
Kottala House
Thiruvalli. P.O
Malappuram

41
T. Somasekharan
Thulasibhavan
Pathirippadam, PO
Edakkara, Malappuram Dt

44
P. V. Cheriyan
Planthottu, Uppada
Pathirippadam, PO

47
V. P. Abdul Rasheed
Vellarampara House
Nelangeri, PO
Kallekavu, Malappuram
676525

Cheruthodika House
Kodimaram
P.O.Kondotty- 673 638
Malappuram

31
Mr.EPM. Rehman
H.S. Road
P.O. Chandakkunu, Nilambur
Malappuram-679 342

36
P. Ravindran
Pookkottupadam
Poolakkal

39
Mohammed. V. P.
S/o Moideen
Parakadakadavu
Moonniyoor, P. O.
Thirurangadi, Malappuram Dt.

42
K. J. Johnachan
Kathiramold
Panampatta, Karappuram PO
Nilambur, Malappuram, Dt

45
Mrs. Fuolet
Seby Nivas, 679329

48
Abdul Vahid. P. E.
Panachiparambil
Erumamunda
Nilambur

49
P. A. George
Pulivelil
Muthedam. P. O.
Edakkara, Malappuram

50
K. K. Verghese
Jyoti Arcadia
Moothedam. P. O.
Edakkara, Malappuram

Training 3. Venue: Muthanga, Wayanad Date: 30June 2000

1
Mr.K.K. Ragavan
Ragam House
P.O.Vattolly
Kozhikkode

2
Mr.M.P.Rajan
Maniyoor, Pattika Jathy
Service Sahakarana Samjam
P.O.Palayattunada-673530
Kozhikkode

3
Mr.Terry Thomas
Thomson Farm
Peruvayal
Calicut-673024
Kozhikkode

4
Mr.Shaji.K.S.
Nagarjuna
Nallakam Padom Bazar
Kozhikkode-673027

5
Smt.Savithri
Darsanam Samskarika Vedi
Chelavoor P.O.
Kozhikkode- 673 571

6
Mr.Chengot Jayanandan
P.O.Nellikode
Kozhikkode-673 16

7
Mr.Govindan Nair
Kandoth Thazha
Kothamagalam
Quilandy.P.O.
Kozhikkode-673305

8
Mr.K.Narayanan
Lakshmgiri House
West-Kallachi
Kozhikkode-673506

9
Mr.Anil George
Kazhukanolikal House
Thamarasery (via)
P.O.Chamal
Kozhikkode-673573

10
Mr.O.K.Vipinachandran
Koyambarth Kandy
Kakkanchery.P.O.
Kozhikkode-673620

11
Mr.T.P.Ajayan
Co.Odinator.OISCA
Koothali High School
P.O.Perambra-673 525
Kozhikkode

12
Mr.George Thomas
Dy.Director of Industries
District Industries centre
Kasargod

13
Mr.A.M.Chako
Araikal House
Konnakkad.P.O.
Kasargod-671533

14
Mr.Joseph.D.
Thulavunkkal
Kacherykadav.P.O
Kannur-670706

15
Mr. Jery Thomas
Samskriti
Pariyaram-670 502
Kannur (Dt.)

16
Mr.L.P.M.Hashim
CPC Ltd.
Thayalangadi,Tellicherry
Kannur-670101

17

18

19

Mr.P.P.Raghavan
Puthiyaparambil
Therthally.P.O.
Kannur-670571

20
Mr. Salim. P.M.
Picham House
Puzhamudi PO
Kalpetta

23
Mr. Raju M. R.
Mullathodi House
Thrikaipetta PO
Meppadi Via Waynad

26
Mr.Manikandan.U.
Uppidikkunnu
Via-Meppadi
P.O.Trikkypatta
Wayanad

29
Mr.N.P.Govinthakurup
Panthalath House
P.O.Kakkavayal
Wayanad-673 122

Mr.N.K.Prakasan
Chittarikkun House
Kakkayaghad.P.O.
Kannur-670673

21
Mr. Ramesh. R.
Puthoorvayal
Kalpetta

24
Mr. Baburaj
Mullathodi
Cheekalloor
Kaniyampatta. PO, Wayanad

27
The President
Women's Welfare Society
Vemom.P.O.Mananthavady
Wayanad-670 645

30
Mr.Santhosh Mathew
Thadathil puthen purayil
Manjura.P.O., Pazhuthana
Wayanad-673 575

Mr.K.P.Premarajan
Kunduparabath House
Chedayad.P.O.
Kannur-670692

22
Mr. Suresh. P. V.
Puthoorvayal
Kalpetta

25
Mr. Suneesh. C. D.
Uravu, Thrikkaipatta, Waynad

28
The Secretary
Women Welfare Charitable
Society
Vemom.P.O., Mananthavady
Wayanad-670 645

31
Mr.S.K.John
Haritha Farm Club
Moolankkav.P.O.S.Bathery
Wayanad-673 592

Training No. 4. Venue: KFRI, Peechi. Date 30 Oct and 1 Nov 2000

1. Mr. M.R. Raju
Thrikaipetta
Wyanad

4. Ms. M sobha
Thrikaipetta
Wyanad

7. Ms. N. Sajina
Thrikaipetta
Wyanad

10. Ms. Ambily
Thrikaipetta
Wyanad

2. Ms. O. Sreeja
Cheekalloor
Kaniyambetta

5. Mr. Baburaj
Cheekallore
Wyanad

8. Ms. Bheem Chaple
Thrikaipetta
Wyanad

11. Ms. N.A Bindhu
Thrikaipetta
Wyanad

3. Mr. T.Sivaraj
Thrikaipetta
Wyanad

6. Ms. A.K Kavitha
Thrikaipetta
Wyanad

9. Ms. V.K Vijayakumar
Kakkavayal
Wyanad

12. Mr. C.H Kalyankumar
Thrikaipetta
Wyanad

- | | | |
|--|---|---|
| 13. Ms. K.V Vanitha
Thrikaipetta
Wyanad | 14. Ms. M.J Laila
Thrikaipetta
Wyanad | 15. Mr. Suneesh
ThrikaipettaW
Wyanad |
| 16. Ms. Smitha
Thrikaipetta
Wyanad | 17. Ms. Bharathi
Thrikaipetta
Wyanad | 18. Ms. V. Padma
Thrikaipetta
Wyanad |
| 19. Ms. Manjula
Thrikaipetta
Wyanad | 20. Ms. M. Vanajakumari
Thrikaipetta
Wyanad | 21. Ms. V. Latha
Cottanad
Wyanad |
| 22. Ms. V. Sheeba
Cottanad
Wyanad | 23. Ms. V. Sindhu
Cottanad
Wyanad | 24. Mr. Buram Srinivas
Thrikaipetta
Wyanad |
| 25. Ms Sheeba Raju
Thrikaipetta
Wyanad | 26. Ms. Vigi Varghese
Thrikaipetta
Wyanad | 27. Mr. Sini Varghese
Thrikaipetta
Wyanad |
| 28. Ms. E.M Indira
Thrikaipetta
Wyanad | 29. Ms. Deena Varghese
Thrikaipetta
Wyanad | 30. Mr. P.R Krishnankutty
Thrikaipetta
Wyanad |
| 31. Sreeja Padmanabhan
Thrikaipetta
Wyanad | 32. Ms. P.K Sulekha
Meppady
Wyanad | 33. Ms. P.K Sahida
Meppady
Wyanad |
| 34. Ms. M.M Jameela
Thrikaipetta
Wyanad | 35. M. Ummukulsu
Thrikaipetta
Wyanad | 36. Ms. C.K Haseena
Mandad
Wyanad |
| 37. Ms. Sindhu Babu
Thrikaipetta
Wyanad | 38. Ms. Jeessy Issac
Thrikaipetta
Wyanad | 39. Ms. O.K Suma
Thrikaipetta
Wyanad |
| 40. Mr. C.V Antony
Thrikaipetta
Wyanad | | |

Training No. 5. Venue KFRI, Peechi Date 1 February 2001

- | | | |
|--|--|---|
| 1. Mr. K.RAJENDRAN,
SAFALLYA. PUNNAKKULAM,
K. S. PURAM (PO), PIN-
690544, KARUNAGAPPALLY,
KOLLAM | 2. Mr. KRISHNAN M. N.,
KARIKADETH (H),
KOTTAPURAM (P.O), PIN-680
584, ERUMAPPETTY (VIA),
TRICHUR | 3. Mr. V.A AHAMMED,
VALIYAVEETIL,
EDAVANAKKAD (PO),
PIN-682 402. |
|--|--|---|

4. Mr. ANANDAN P.A.,
PAYYAPPILLY,KUNDOOR
(P.O), PIN-680 734,
THRISSUR
5. Mr. JOSEPH LUKOSE.
POONDIKULAM (H),
EDAPPADY, KOTTAYAM,
BHARANANGANAM -
686578,KOTTAYAM.
6. Mr. P.C THAMBI,
PANGOLAKKUDY,
THOTTUVA, KOOVAPPADY
(PO), PERUMBAAVOOR,
PIN-683 544.
7. Mr. S. SWAMINATHAN,
NEDUMPURATTIL (H),
VAGAMON TEA GARDEN,
VAGAMON (PO), IDUKKY-
685503
8. Mr. JAMES
PUTHENPURACKAL,
KORANCHIRA(PO),
PALAKKUZHI,
KIZHAKKUNCHERI.
9. Mr. V .SONEY, EKKITHARA
HOUSE, EVOOR NORTH P.O.
CHEPPAD, KAYAMKULAM,
ALAPUZHA -690553.
10. Mr. M.A. IYYUNNI,
MALIAKKAL HOUSE,
PUTHENPEEDIKA
(PO),THRISSUR.
11. Mr. A. CHANDRABABU,
ALPATTA HOUSE,
PUZHAKKATTIRI
(PO),ANGADIIPPURAM (VIA),
PIN - 679321,
MALAPPURAM.
12. Mr. C.M DHAMODHARAN,
CHELLARIVEED
THANIPPADAM
CHUVANNAMANNU (PO),
PIN - 680652.
13. DR. PK RAMACHANDRAN,
PEEDIKAPARAMBIL,PERINGA
NAM WEST, THRISSUR -
680686 IRINJALAKKUDA
14. Mr. M. DASAN,
POTTALATHACHIRAYIL,
KONATHUKUNNU (PO),
PIN -680123.
15. Mr. K. M. PRAKASH,
TECHNICAL
OFFICER,KRISHIVIGYAN
KENDRA,INDIAN INSTITUTE
OF SPICES RESEARCH,
PERUVANNAMUZHI,
CALICUT -673528
16. Mr. V. PRATHAPAN,
SECRETARY,KERALA RURAL
DEVELOPMENT
ASSOCIATION,
PADANNAKKAD (PO),
CHERTHALA, ALAPPUZHA
17. Mr. P INDUSEKHARAN,
NARAYANANIVAS,
KONATHUKUNNU (PO), PIN -
680123, IRINJALAKKUDA,
PIN. -688531
18. Mr. DEVADAS,
SREEKRISHNAKRIPA,PANNIC
ODE, KUNISSERY
(PO),PALAKKAD -678681.
19. Mr. N M SUSRUTHAN
VAIDAR, NALUMAKKAL
HOUSE, KARUMATHRA (PO),
THRISSUR.
20. Mr. T M MATHEW,
THUMPASSERY,
3/152, MATHER NAGAR,
COCHIN -33
21. Mr. M.J JOSEPH, FIELD
OFFICER, MALANKARA
ESTATE, THODUPUZHA -
685584, IDUKKY
22. Mr. M. C CHACKO,
MULANJANANIYIL, KUNINJI
(PO), VAZHITHALA,
IDUKKY - 685583
THODUPUZHA
23. Mr. E. T RAJENDRAN,
MADHUBEN ESTATE,
LAKKIDI, NEAR - MICRO
WAVE STATION, WYANAD.
24. Mr. RENJI GOERGE,
VELLOKUNNEL HOUSE,
CHEMMALAMATTOM (PO),
KANJIRAPALLY (VIA),
KOTTAYAM -686529.
25. Mr. P. V THOMAS, PANCKAL,
CATTLE MARKET ROAD,
PERUMBAAVOOR,
PIN-683542.
26. Mr. C SASIDHARAN,
CHOLAPARAMBATH HOUSE,
T N PURAM,
PULAMANHOLE (PO),
MALAPPURAM -679323.
27. Mr. JOSE JOSEPH,
VELLOKUNNEL,
NADAMADAM, THIDANAD
(PO), PIN - 686123,
KOTTAYAM.
28. Mr. N.P. KANNAN, VINEETHA
HOUSE, KARINGAD (PO),
KAVILUMPARA (VIA),
KOZHICODE -673513.
29. Mr. SIBIKURIAKOSE,
INFAC, KIZHATHADIYOOR,
PALA -686574, KOTTAYAM.
30. Mr. C .M RAJAN NAIR,
CHILANKA, ELANAD ROAD,
PAZHAYANNUR (PO),
THRISSUR, PIN -680587.
31. Mr. Y.GEEVARGHESE,
THAMGAVILAIL, C/O
KALLIVAYLIL ESTATE,
KUTTIKANAM, PEERUMADE ,
IDUKKY.
32. Mr. K .K GOERGE PAULY,
KAKKANAT HOUSE,
KALAMASSERY (PO), KOCHI
-683104.
33. Mr. K.K PAULY, KAKKANAT
HOUSE, KALAMASSERY (PO),
KOCHI -683104.
34. Mr. AUGUSTINE JOSEPH,
PALIYARMATTATHIL,
CHERUKKADU (PO),
KOZHICODE -673527.
35. Mr. V. DILEEPKUMAR,
VELLAMPANAL, ANICKAD,
PO, KOTTAYAM-686503.
36. Mr. P.V GEORGE,
ANCHORAGE, MUTTAM,
ALUVA -683106,
ERNAKULAM.

37. Mr. V.A JALALUDHEEN,
VADAKKEVEETIL,
EDAVANAKKAD (PO),
ERNAKULAM.

38. Mr. C. T KURUVILA,
KURUVILA & SONS, MARKET
ROAD, COCHIN -682014.

39. Mr. MADHUNARAYANAN,
KANNANKARAKUNNATH,
KARINPINPUZHA (PO),
KOTTARAKKARA, KOLLAM,
PIN -691513, PUTHOOR
ROAD, NEAR - PANGOD.

40. Mr. GEORGE ABRAHAM,
PULLEN HOUSE,
MURINGGOR,
CHALAKKUDY -680316.

Training Programme No. 5. Venue: KFRI, Peechi, Date : 30 April 2001.

- Jayakumar, M
Secretary
Kurushetrakala samskarika
Samithi
Nellithara, Anandashramam (P.O)
Pin, 671 531, Kasaragod District
2. Mr. K. Mohandas
Lakshminivas
Kundankunnu (P.O)
Mannarkkad College
Pin 678 583, Palakkad
3. Mr. T.K. Bhakthavalsalan
Thalappotta House
Near L.P. School
Kunnathoormaed. (P.O)
Palakkad 678 013
4. P. Abdul Rahiman Kunju
B. 21. Cottage
Near K.S.R.T.C
Kalady (P.O), Malappuram
Pin 679 582
5. Joby
Secretary
Kottayam Social Service Society
Thellakom (P.O), Kottayam
Ph: 0481 598185/595185
6. Baburaj, B
Akkarakavu
Green life Nature Club
Mathoor Agraharam (P.O)
Pin 678 571
Ph: 0492 - 272766
7. K. Kunjukuttan
Cherukodu House
Vilayannur (P.O)
Palakkadu, Vilayanchathan
Pin 678 671
9. Babu, K.K
Deepthi Handicrafts
Kattungachira
Iringalakkuda (N)
Thrissur
10. Saju E.M
Eachampura
Paruthippully(P.O)
Palakkadu 678 573
11. Gopi
Secretary
Demos Eco Watch Society
Ambalathara
Pullur (P.O)
Kasargod, Pin 671 531
12. K.V. Sugathan
Secretary
Kalakayika Samskarikavedi
(FASCA), Kalkandi. (P.O)
Attappadi 678 582
Palakkad
13. Mr. T.B. Narayanan
Thottungil Kalathil House
Padincharaeyakkara
A.K.G. Nagar, Pin 678 001
14. Mr. K. Swaminathan
Pannikode House
Kannady (P.O)
Palakkad
15. Mr. T. Saji
Thazhathethil
Peringode (P.O)
Pin 679 535
Palakkad
16. M. Kishor
Anandabhavanam
Nenmeni (P.O), Kollengodu
Palakkad, Pin 678 506,
Ph: 362742
17. Mr. Abdul Rahiman
President
Yuvasakthikalakayika Samithy
Kalyanakapp

- Pallikunnu (P.O)
Pin 678 583, Mannarkad
Palakkad
18. Mr. Sureshkumar
Nageswarath House
Kazhani- Chunkam
Kavasseri (P.O)
Pin 678 543, Palakkad
19. Rangakrishnan T.K
Secretary
Janani Recreation Club
Paruthipully (P.O)
Pin 678 573, Palakkad
20. Mr. Thomas Joy
Pulimkalayil House
Bharatha
Ponnukkara (P.O)
Pin 680 014, Thrissur
21. Mr. M.K. Moidheen kutty
Mayilkanakath House
Poozhimkunnu
Alathiyoor (P.O), Palakkad
22. Mr. M. Radhakrishnan
Madathil House
Pallikurup (P.O)
Thatchambara (Via)
Pin 678 593, Palakkad
23. Muraleedharan
President
Janaseva sangham
Kollengode, Pin 678 506
Palakkad
24. Mr. Kasim Alayan
Alayam House
Alanallur (P.O)
Palakkad District
Pin 678 601, Ph: 462349
25. Johny, K.J
Kuruthukulangara House
Valapad (P.O), Pin 680 567
Thrissur
26. Mr. K. Muhammed Kanhi
Agriculturist
Menonpara (P.O)
Pin 678 556, Palakkad
27. K.H. Sheriff
Secretary
Green nature club
Mathilakam
Pin 680 685, Thrissur
Ph: 800 138, 817 199
28. Mr. Delson
Padinjatthinkara House
Kottathara (P.O)
Kalpetta (Via)
Wayanad, Pin 673 121
29. Mr. T.K. Kumaran Nair
Thazhathkalam
Mothur, (P.O)
Kuzhalmandam (Via)
Pin 678 571, Palakkad
Ph: 0492 273867
30. M.V. Subrahmanian
Muriyanadath House
Nellayi (P.O)
Ulumbathkunnu, Pin 680 305
Thrissur
31. T. Kirosh Peter
Thengugal House
Thrissur Road, Kunnamkulam,
Pin 680 503, Ph: 523 124
32. P. Unnikumar
Anaswara
Pallanchattanur (P.O)
Chungamannam
Palakkad, Pin 678 575
33. Abdul Rahim
Chennampilly House
Cheranelloore (P.O)
Kochi 682 034
34. Santhosh Mathew
Thadathil Puthaanpurayil
Manjoora (P.O)
Pozhuthana (Pazhi)
Wayanad
35. Mr. Arumugan
Secretary
Haritha Development
Association
Pathichira, Muthalamada P.O

LIST OF FARMERS, NGOS AND ARTISANS INTERESTED TO ESTABLISH
NURSERY OF BAMBOO /CANE

Reg. No.	Name and address of the interest group	Category
1.	Mr. K. Rajendran - Ph : 0476-626961. Kerala Rural Development Agency, Punnakulam, K. S Puram (P.O.), Karunagappally, Kollam-690544	NGO
2.	Mr. P.A Anandan, Payyappilly, Kundoor 680734, Thrissur.	FARMER
3.	Mr. M.A Iyyunny, Ph: . 272328 Maliakkal (H), Puthanpeedika (P.O) , Thrissur (D.T)	FARMER
4.	Mr. A . Chandrababu, Ph-329008 Alpatta (H), Puzhakkattiri (P.O.), Angadippuram via, Malappuram	FARMER
5.	Dr.Ramachandran, Ph: 816649 Peedikaparambil, Peringanam west, Thrissur-680 680	FARMER
6.	Mr. P. Indusekharan, Ph: 862627 Narayana Nivas, Irinjalakkuda, Konathukunnu - 680 123	FARMER
7.	Mr. George Abraham, Ph: 9548- 708577 Pullen House, Muringoor, Chalakkudy -680 316	FARMER
8.	Mr. M. C Chacko, Ph: 0486- 285038 Mulanjanayil, Kuninji (PO), Vazhithala, Thodupuzha -685 583, Idukki	FARMER
9.	The Manager, Ph: 95486 255433; 255760 Malankara Estate. Thodupuzha -685584, Idukki	INDUSTRY

- | | | |
|-----|--|---------|
| 10. | Mr. P.V Thomas, Ph: 523031
Panckal,
Cattle Market Road,
Perumbavoor- 683542 | FARMER |
| 11. | Mr. N.P Kannan, Ph: 565472
Vineetha House,
Karingad (PO),
Kavilumpara (via),
Kozhikode -673513 | FARMER |
| 12. | Mr. Sibikuriakose, Ph: 0482- 211997
INFACT, Kizhathadiyoor,
Pala -686574, Kottayam. | NGO |
| 13. | Mr. C. Sasidharan Ph: 367929
Cholaparambath House,
T.N Puram ,
Pulamanthole (PO),
Malappuram -679323 | FARMER |
| 14. | Mr. Augustine Joseph, Ph: 95496- 660888 PP
Paliyarmattathil,
Cherukkadu (PO),
Kozhikode - 673 527 | FARMER |
| 15. | Haritha Development Association,
Ph: 0492-375257.
Pathichira,
Muthalamada,
Palakkad - 678 507 | NGO |
| 16. | Mr. Tony Thomas, Ph: 438253
Kizhakkekara House,
Erumbakachoala (PO),
Palakkad, Pin -678591 | FARMER |
| 17. | Mr. Rajan K Ramesh, Ph: 0498-423414, 422377
Botany Department,
MES Kalladi College,
Mannarkad, Palakkad -678 583 | COLLEGE |
| 18. | Mr. P.V Chamukuttan, Ph: 0492 -343697, 342409
Kottakadav,
Vithanassery,
Nenmara -678 508,
Kavalappara, Palakkad. | FARMER |
| 19. | Mr. T.V Benchamin,
Bethany House,
Kulanada (PO),
Panthalam, Near - St' Jude Church, Pathanamthita. | NGO |
| 20. | Mr. T.P Ajayan, Ph: 611027 | SCHOOL |

Koothali High School,
Pithoth , Perambra (PO),
Kozhikode, PIN -672535

21. Mr. T.C Shahabudheen, Ph. 0493 759132 FARMER
Kuniamoochi Estate,
Vettilappara, Malappuram, PIN -673634
22. Mr. Veerankutty, Ph: 710017 NGO
KAHDS(Kondotty Agro Horti Development Society), Kondott,
Malappuram, PIN -673638

List of farmers supplied with planting stock of bamboo, reed bamboo and rattan under UNDP cane and bamboo project during the planting season 2000

Name and Address of farmer	Bamboo		Reeds		Rattan	
	No:of seedlings given.	No:of seedlings planted*	No:of seedlings given	No:of seedlings planted*	No:of seedlings given	No:of seedlings planted*
1. Malappuram District						
1. Somasekharan Pathripadam Malappuram.	50	50ss	10	10	10	10
2. Santhosh.P.M Uppada.P.O Malappuram.	5	5	10	10	-	-
3. Jhonachan Karuppiram.P.O Malappuram.	-	-	-	-	50	0
4. Varghese Muthedam.P.O Malappuram.	35	0	17	0	-	-
5.P.A.George Muthedam.P.O Malappuram.	16	16	17	17	-	-
6.P.Raveendran Poolakkal Malappuram.	10	10	10	10	-	-
7. C.K.Muhammed Neelanchery.P.O Malappuram	18	18	20	20	20	20
8. V.P.Unnichekku Poongodu.P.O Malappuram	-	-	20	20	20	20
9. Suresh Raja Ramankuthu.P.O Malappuram	560	560	30	30	-	-
10. Yoosuf.T Melattoor.P.O Malappuram.	10	0	10	0	10	0
T.C.Shahabudheen Vettilappara Malappuram	1	1	10	10	-	-
11. Kondotty Agro-Horti Social Development Society. Malappuram	14	0	67	0	3	0

2. Palakkad District						
12. Rajan.K.Ramesh MES. Kalladi college Palakkad	175	20	150	0	150	0
13. Tony.Thomas Erumpakachola. Palakkad	70	0	50	0	10	0
14. Philip.P.V C.N.Puram.P.O Palakkad	35	25	25	25	25	25
15. P.V.Chamukkuttan Vithanassery Palakkad	1204	25	260	0	200	0
3. Kottayam District						
16.Udayavarma Raja Vaikkom.P.O Kottayam	75	0	25	0	25	0
4. Idukky District						
17.Pradeepkumar. Springvalley.P.O Idukky	52	52	50	0	50	20
5. Pathanamthitta District						
18.T.V.Benchamin Kulanadu.P.O Pathanamthitta	20	0	-	-	100	0
6. Kollam District						
19.Sahadevan Sasthamkotta Kollam	2	0	25	0	25	0
7. Kozhikode District						
20.Vipinachandran Kakkanchery.P.O Calicut	4	4	4	4	-	-
21. T.P.Ajayan Perambra.P.O Calicut	25	0	5	0	5	0

22. K.Narayanan West-Kallachi Calicut	6	0	4	0		
8. Wayanad District						
23. S.K.John Moolankavu.P.O Wyanad	30	15	10	5	20	10
24. Ramesh.K.N Nadavayal.P.O Wyanad	2	2	-	-	3	3
25. URUVU, Trikkaipectta Wyanad.						
9. Eranakulam District						
26. Abi Peter, Pandikudiyil House Vengore P.O Ernakulam District	255				275	
Total	2674	803	829	161	1001	108

* Some of the farmers were not able to plant the seedlings immediately after distribution since monsoon had already receded in these areas. Contrary to expectation North-East monsoon was a failure during this year in Keala

Kerala Forest Research Institute, Peechi
Bamboo and Cane Project

Formation of bamboo and cane clubs in Kerala

To,

Dear

We are happy to inform you that a large number of farmers, farmers' clubs, NGOs, Governmental and private agencies have shown great enthusiasm in cultivation, management and use of bamboo and cane. This is evidenced by the interest shown by all user groups in the activities organized by KFRI like training, planting of bamboo and cane etc. as part of the UNDP funded Project on bamboo and cane.

As part of the above project, we are planning to form clubs consisting of members in the field of bamboo and cane resource management and utilisation. These clubs are expected to continue to provide information on various aspects of bamboos and canes to a wider user community.

A meeting of interested people, particularly those who have undergone training conducted by KFRI, will be organized in May/June 2001 to form clubs and chalk out their mode of operations. If you are interested please fill the enclosed proforma and return it to the undersigned within two weeks.

Thanking you,

Yours sincerely,

Dr. KK Seethalakshmi
Coordinator
Bamboo and Cane Project
Kerala Forest Research Institute
Peechi-680 653
Thrissur District.
Phone: 0487 282037
Fax: 0487 262249

Kerala Forest Research Institute, Peechi
UNDP-GOI Bamboo and Cane Project

Proforma for formation of Bamboo and Cane Club

Name	:	
Address	:	
Telephone Number	:	
Occupation	:	
Experience in Bamboo/Cane	:	
Expectations from BCC	:	

Signature with date

Kerala Forest Research Institute, Peechi
Bamboo and Cane Project

Terms and conditions and Memorandum of Understanding (MOU) for
becoming a member of the proposed bamboo and cane clubs in
Kerala

Terms and conditions

1. You should have already undergone training conducted by KFRI and /or involved with KFRI either in the establishment of bamboo/cane or cultivation of bamboo/cane in the farmers' field.
2. You should have already member and actively involved in a club/forum working in the field of forestry and agroforestry.
3. You should have interest in working as an active and honorary member of the proposed bamboo and cane.

Memorandum of Understanding

I read above mentioned terms and conditions and agreed to them. I am willing to become an honorary member of the proposed bamboo and cane club in Kerala.

Signature with name and date

Address including pin code and contact phone number:

5. SETTING UP OF OIL CURING UNITS AT THE SITES OF EXTRACTION/SUPPLY OF CANES

Duration: 12 months (April 2000-March 2001)

Objectives

1. To set up three oil-curing units one in Kerala and two in Northeast.
2. To provide training to entrepreneurs and artisans in oil curing of canes.

Programme of activities

1. With the participation of major cane suppliers in North-east and Kerala oil curing facilities will be set up in cane extraction/supply sites.
2. Field demonstration and on the job training in oil curing techniques will be organised initially in 2-3 schedules.
3. Subsequent activities will be sustained with self generated funds.

End out put

1. Technology for oil curing of canes will be transferred to the user groups.
2. Three units for demonstration and training will be set up - one in Kerala and two in NE.
3. About 200 persons will be trained in oil curing technology from Kerala and four states from North-East.

A. Work done during March - 2000

Physical targets

Work not done during the reporting period. This activity was proposed only during second year.

Achievement

Nil

B. Work done during April 2000 to March 2001

Physical targets

1. Setting up of oil curing unit in Kerala at Nilambur.
2. Provide training to the entrepreneurs and artisans from Kerala and responsible scientists from collaborating institutions.

Achievement

1. One oil curing unit was established in Nilambur.
2. One training programme was conducted in Nilambur. Twenty-four participants from various parts of Kerala attended the programme. (The list of participants attached).

C. Work done during April to June 2001

Physical targets

Establishment of oil curing units in collaborating institutions

Achievements

Discussions were held with the responsible scientists from NE and fabricated two units in Kerala.

Present status since inception

One oil-curing unit was set up in Kerala. Two oil curing units have been fabricated for establishment in NE. One training programme was conducted.

Reasons for short fall, if any

Initial programme was proposed to establish two units one in Kerala and one in NE and impart training to trainers from NE. Since the suggestion in the Review Meeting held on 26th June 2001 at KFRI was to establish three units under KFRI budget (one in Kerala and two in NE) it is necessary to continue the work during the third year also (April 2001-March 2002) to accomplish the target.

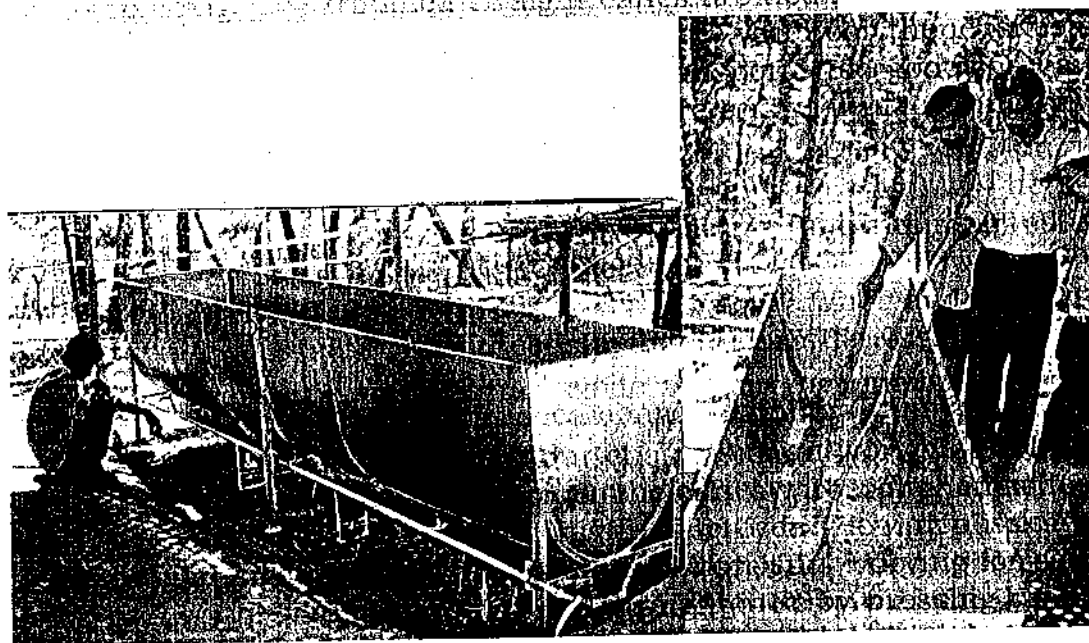
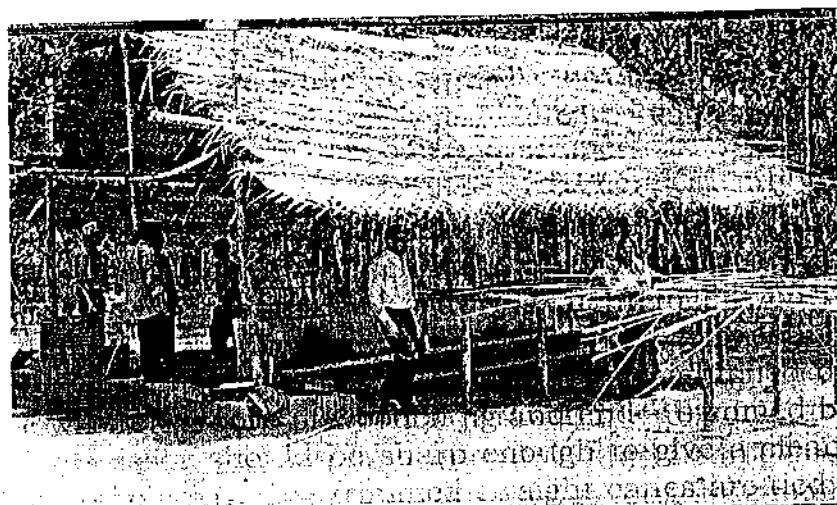
OIL CURING OF RATTANS

One major problem in the rattan trade is that the quality of Indian rattan products is poor compared of that of South - East Asian products. However there is already an awareness that with appropriate preliminary processing techniques and with the application of simple processing tools, devices and equipments the quality of Indian cane products could be improved in order to compete in the domestic as well as export market.

One processing technique for improving the appearance and finishing of rattan products is curing freshly cut green canes in hot oil/oil mixtures (100% kerosene or 90:10 Diesel and coconut oil). The advantages of oil curing are recognized as : (a) obtaining an ivory white colour (which is more desirable for export markets) probably due to the conversion of chlorophyll into pheophytins in the stem skin, (b) rapid reduction of the moisture content in rattans (which will help to reduce the chances of immediate fungal infestation after harvesting resulting discoloration) and (c) removal of waxy or gummy/mucilaginous substances for better appearance and for better finishing qualities. The canes needs to be oil cured within 2 - 4 days after harvesting.

For the application of the cane curing technique the primary infrastructure requirement is a curing tub of appropriate length (8 - 12 or 16 ft length, 2.5 ft width, 2.5 ft height, 2 - 4 mm thickness, made in mild steel). For heating the oil mixture fuel wood or kerosene or cooking gas can be used, accordingly the design of the heating system varies. Use of fuel wood requires a hearth and chimney. Use of kerosene or gas requires burners. The best curing medium is either kerosene alone or a mixture of 90 parts of Diesel oil and 10 parts of coconut oil. About $\frac{3}{4}$ th of the tub is to be filled with the chosen oil mixture and to be heated to just below boiling. The temperature has to be mentioned at that level. High temperature will cause damage to rattans (shrinkage) and can initiate fire hazards. In each batch 4 - 6 bundles of rattans can be boiled. The curing time should be 20 minutes for small diameter, 30 minutes for medium and 45 minutes for large diameter rattans. Curing periods of lesser or higher durations than these prescriptions will have adverse effects on their properties. Also it has been proved that oil curing has no adverse effects on most of the physical and mechanical properties. After boiling, the bundles are taken out one by one and placed conveniently to drain the oil. The oil cured poles are rubbed using coir or waste gunny cloth. This process removes most of the gummy or mucilaginous and waxy substances, and to some extent the silica deposits found the stem skin. The subsequent rubbing of cleaned poles with a dry gunny cloth imparts good polish and improves the glossiness of the skin. The polished canes are to be spread out in an open area for sun - drying

for a week. Gradually the skin colour changes to an ivory white. In the drying process, it is essential to cover the canes with polythene sheets or plaited coconut leaves during night to prevent dew deposits and subsequent fungal infection and staining. After sun - drying for seven days, the ivory - white dry canes are straightened by pressing up and down in a groove of wooden jig and end - trimmed by special scissors. The scissor should be sharp enough to give a clean cut and to avoid end - splitting. The trimmed straight canes are tied into tight bundles of 100 pieces, neatly stacked and covered with polythene sheets/ plaited coconut leaves for further transport to godowns and marketing. Canes can be supplied to traders and manufacturing units from such godowns.



Nomad type of cane curing unit at KFRI Sub centre, Nilambur

**One-Day Field Demonstration / Training Programme on Oil-Curing of Canes (Rattans), 16 March, 2001 at Kerala Forest Research Institute (KFRI) Sub-centre, Nilambur-
A Report**

Field demonstrations of oil curing of canes, conducted by the Kerala Forest Research Institute (KFRI) in 1992, for quality improvement of cane furniture/handicraft products received tremendous response from the small-scale/cottage type and larger industries alike. While many major cane traders from Kolkata and Andaman regions now choose to supply oil-cured canes for manufacture of quality products, several units in the country have planned to modernise the processing factories with the technical advice from KFRI and with the financial support of rural institutions like Khadi and Village Industries. As an example, one of the beneficiaries of the cane research and training programme of KFRI (M/s. Shine Indoors, Alappuzha, Kerala) is now able to manufacture high quality furniture and cane craft for house-boats and for many holiday resorts which aim to preserve the aesthetic cultural value of the traditional and indigenous resources to promote eco-tourism in Kerala.

In addition, many State Forest Departments have acknowledged the improvement of cane quality by oil curing at the extraction sites. While Karnataka Forest Department has already made a significant headway, Kerala Forest Department has agreed in principle to take over the direct control of rattan extraction from the current practice of leasing to tribal societies for the following reasons:

- More judicious and scientific extraction followed by oil curing for rational supply of quality raw material to various manufacturing units.
- Rural communities, who are socially and economically weaker sections of the society, can derive greater benefits of full collection charges without the involvement of middlemen.

Training with the Modified Design of Oil Curing Unit as part of Simple Rural Technology

It is in the above context that, as part of the UNDP-Government of India (Ministry of Textiles - Development Commissioner-Handicrafts) project, KFRI organised one-day field demonstration and training programme on 16th March 2001 at KFRI Sub centre, Nilambur. The major objective of this training programme was to introduce oil-cured high quality cane raw material, which is free from fungal discolouration, in the manufacture of bright/ivory-white coloured furniture and handicraft products of better aesthetic/export value. The prospective beneficiaries of the above training programme are traders and cane entrepreneurs including rural artisans. About 20 trainees from Kerala participated in the programme in addition to a



Fig. 1. Training imparted at KFRI Sub centre, Nilambur

special beneficiary from Institute of Rain and Moist Deciduous Forests (IRMD) Jorhat, Assam to absorb and adopt the simple rural technology in North eastern India, the main source of cane supply in the country, besides the Andamans (See enclosed list of participants).

A nomad type of cane curing unit has been recently installed at KFRI sub-centre, Nilambur to have immediate access to the freshly extracted canes for cost-effective treatment. The open-hearth and curing tub designed earlier (1992) had the risk of fire hazard, as the flame can sometimes contact the oil mixture. Fire safety consideration was uppermost in mind while modifying the design of the curing tube. Either kerosene or cooking gas (LPG) can be used as the fuel for heating. Flame spreading from the three burners is prevented by providing a GI bracket below the tub. A kerosene pressure stove provided with a pedestal pressure pump is used to heat the system.

The cost estimate (Appendix I) indicates the economic viability of the cane processing programme before the supply to manufacturers. The additional cost estimated in cane curing at Nilambur Unit is within the limits of Rs. 5.75 for a large diameter cane (29% of the original value) which is well justified in the context of improved quality and ready acceptance by the manufacturers.

One-day Field Demonstration and Training

In his welcome speech, Dr. K. M. Bhat, the Co-ordinator, stressed the importance of application of improved processing practices for the value addition of rattans. Dr. R. Gnanaharan, Research Co-ordinator of KFRI, on behalf of the Director, while inaugurating the Workshop, stated that value addition of rattans is unavoidable in the present context of globalisation and liberalization policies in industries. Unless we produce high quality products, we cannot compete in the domestic / export markets. Value added products from foreign countries are going to flood in the market, Dr. Gnanaharan added. Dr. T. K. Dhamodaran, investigator of the project on rattan processing, added that mechanization to a certain level is inevitable for improving the

quality of Indian rattan products. Knife marks, nail corrosion marks and charring black marks make Indian products inferior. The use of round rod making and peeling machines, steam bending facilities, nail shooting device and paint spray gun/booth will definitely improve the quality of our furniture while making the product from oil cured rattans. Use of corrosion resistant high quality nails is also very important. He also urged the interaction of consumers with manufacturers for incorporating the right technology at the right instance in the process flow. Mr. D. Gurung, the Research Officer from Assam informed that the application of improved technology is in an infant level in the North-East States. Mr. Mohammed Shareef (DFO, Nilambur) and Dr. N. C. Induchoodan (Scientist-in-Charge, KFRI Sub centre, Nilambur) offered felicitations. Mr. Shareef mentioned that the State Forest Department could definitely consider the application of oil curing technique at the right instance before supplying the canes to end-users.

The training schedule, in addition to the inaugural session, included oral presentations in Malayalam and English by the scientists of Wood Science Division of KFRI (Dr. T. K. Dhamodaran, Mr. P. K. Thulasidas and Dr. K. M. Bhat respectively) on the resource base, extraction, the facilities and methods developed by KFRI on oil curing of canes. This was followed by the field demonstration of oil curing of canes in the nomad curing unit established in the KFRI sub centre, Nilambur.

Outcome and Resolutions of Field Demonstration/Training Programme

A special session was held to receive the feedback from the trainees. Trainees felt that oil curing of canes would enhance the value of raw material and contribute to value addition of the above non-wood forest product. A strong recommendation was that oil curing of canes be made mandatory near the cane extraction sites before the supply to manufacturers and immediate action should be initiated to adopt this simple technology through co-operative institutional support.

To facilitate the implementation of the right processing practices, it was resolved that

1. State Forest Departments of cane growing states be urged to make an agreement with the Federation of SC/ST cane extracting societies on adoption of cane curing technology before permitting the extraction.
2. A charitable society by name "CANEFED" be established with the participation of traders and manufacturers with the technical advice from KFRI scientists in order to establish a tie and trading relationship with the local federations of cane extraction societies in North-eastern states and Andamans who engage themselves in cane extraction.

3. The institutional support should be sought for establishing 'Common Facility Centres' (CFC) to have access the small- scale manufacturers to simple machinery in the conversion process of oil-cured canes and manufacture of quality products for export and craft purposes. As a first step, a model CFC consisting of peeling and round rod making machines plus steam bending, nail shooting and paint spray booth facilities may be started.

FOLLOW-UP ACTION

Under the UNDP-Govt. of India Cane and Bamboo Project, a charitable society - 'CANEFED' was established to increase the awareness and pursue the goal of implementing cane curing process and introduction of low cost mechanisation in downstream processing with the involvement of KFRI scientists and cane traders/entrepreneurs.

**Cost Structure of the Cane Curing Unit established at KFRI Sub
centre, Nilambur, as on March 2001**

Item	Quantity	Cost (Rs)
Non-recurring		
Curing tub (366cm x 76.2 cm top width x 30.5 cm bottom width x 76.2 cm height)	1	19,500
Accessories (pressure / drainage pumps)	1	670
Miscellaneous (barrels, knives, gunny cloths, temporary installation cost including labour, etc.)		5000
Total		25,170
(a) Recurring Cost (1000 canes)		
Diesel	180 litres	3420
Coconut oil	20 litres	700
Kerosene	30 litres	540
Labour charges (cutting, bundling, transportation to road side, etc.)	36 man days	3600
Transportation to curing site + labour (boiling, drying, watch & ward, etc.)		2000
Large canes (Extraction site)	1000 @Rs.20	20000
Total		30260
Cost of oil curing		6660
(b) Depreciation Allowance (Non-recurring)		
92		
(25,170 x 1000 / 275,000 *)		
Total (a+b)	6660+92 = 6752	
Additional Cost (without the cost of Rs. 1000 for clearing & drying in traditional processing)	6752-1000 = 5752	(29%)

**Number of large diameter canes that can be processed during the period of 3 years (life of curing tank)*

LIST OF PARTICIPANTS

Mr.R.Thampi, President

Mr.S.Raju

Varkala Rattan

Co-Operative Society Ltd.

Palachira.P.O., Varkala

Thiruvananthapuram Dt.,

Kerala.

Mr.Mohandas, President

Thonnakkal Rattan

Harijan (Industrial)

Co-Operative Society No. C-

IND-T.375

Kudavoor. P. O., Vengod

Thiruvananthapuram

Dt.,Kerala.

Mr. M.B.Shine

Managing Partner

Mr.R.Vasudevan Pillai,

Mr.M.Pandian

Mr.K.Suresh Babu

Kala Cane Industries

Pookkottumpadam.P.O

Nilambur., Malappuram Dt.

PIN 679 332, Kerala.

Mr. P. Natarajan

Adiakandiyoor

Thavalam.P.O

Attapadi., Palakkad Dt.

PIN 678 589, Kerala.

Mr. Bhuvanedaran, President

Mr. Prakashan, Secretary

Karichara Rattan Workers'

Industrial

Co-Operative Society No: C-

IND.T-140.,

Karichara, Pallipuramm P.O

Thiruvananthapuram Dt.,

Kerala.

Mrs.P.N.Ammi,President

Mr.K.Suku Mohan, Secretary

Ex-Trainees Girijan Vanitha

Karakaushala Vyavasaya

Sahakarana Sangham

Cholanavayalil,

Adichipuzha.P.O

Pathanamthitta Dt.

Kerala PIN 689 711

Mr.Binoy Jacob

Mr.Sibi Joseph

Mundakkayam Handicrafts

Village Industrial Co-

Operative Society

Mundakkayam.P.O

Kottayam. Dt., Kerala.

Mr. D. Gurung

Research Officer

Institute of Rain and

Moist Deciduous Forests

(ICFRE)

P. O. Box 136

Jorhat 785 001

Assam.

Mr.M.P.Jaison,

A.G.U.S Enterprises

St.Thomas Church Junction,

M.C.Road, Pulluvazhy P.O

Perumbavoor, Eranakulam Dt.

Kerala

PIN 683 541

Mr.Paul Chethalan

Doors 'N' Interiors

Christhuraj Complex,

M.C.Road, Perumbavoor

Eranakulam Dt., Kerala.

PIN 683 542

Mr.Roy Joseph

Kannachel Cane Works

Perumpayikad, P.O

Kottayam.Dt., Kerala.

PIN 686 028

Mr. T.Sajeev Kumar

Thekkeparambi House

Perumpayikad, P.O

KottayamDt., Kerala.
PIN 686 028

Mr.K.Mohammad
Irayathara House
Valliyamapadam,
Chandakunnu.P.O
Nilambur, Malappuram Dt.
Kerala.

Mr. V.Mohammadali
Valapra House
Muthalakuzhi
Chandakunnu.P.O
Nilambur, Malappuram Dt.
Kerala.

Mrs.Thankamma Joseph

Nadupallil House
Chandakunnu.P.O
Karimpuzha, Nilambur.
Malappuram Dt., Kerala.

Mrs.K.Saraswathi
W/o.K.Mohanan
KFRI Subcentre,
Chandakunnu.P.O
Nilambur, Malappuram Dt.
Kerala.

Mr.C.P.Ummer
S/o.Moideen
Janathapadi
Chandakunnu.P.O
Nilambur, Malappuram Dt.
Kerala.

**Resource persons and participants from KFRI,
Peechi 680 653, Thrissur District, Kerala**

Dr.R.Gnanaharan

Dr.K.M.Bhat

Dr.T.K.Dhamodaran

Dr.N.C.Induchoodan

Mr.T.V.Sajeev

Mr.P.K.Thulasidas

Mr. Subhash Kuriakose

8. TRAINING

Duration: 30 months (from March 2000 to August 2002)

Objective

To organise a series of specialised training in cultivation, harvesting and processing of bamboo and cane.

Programme of activities

1. Farmers, NGOs, artisans and designers from Kerala and north-east India will be invited to participate in the training program by advertising in news papers and other mass media. Certain key persons in the region will also be contacted to identify suitable trainees.
2. A list of potential trainees will be identified and schedule of training programmes will be prepared.
3. Training materials on cultivation, harvesting and processing of cane and bamboo will be produced as print, video and CD ROMs.
4. Training will be given to selected trainees in KFRI and North East and these trainees will train large groups.

End out put

1. Capacity development in Cane and bamboo cultivation and better processing methods for cane
2. Production of training materials for cultivation of cane and bamboo

A. Work done during March - 2000

Physical targets

No work was due

Achievement

Nil

B. Work done during April 2000 to March 2001

Physical targets

1. Publicity for inviting participants for training
2. Preparation of training materials on propagation, plantation and management of bamboo and cane
3. Organization of training programmes

Achievements

1. Organised one training for trainers in the Institute of Rain and Moist Deciduous Forest Research, Jorhat during 17-19 April 2000. Detail report and list of participants attached. About 24 participants including four resource persons from KFRI attended the programme.
2. Prepared a handbook on Nursery, Plantation and Management of Cane and bamboo in Malayalam. Copies were distributed to all trainees.
3. The details of training programmes conducted for farmers/NGOs and other organizations on cultivation of cane and bamboo are given under activity 3. Setting up of farms.
4. The details of training programme organized for oil curing of canes are given under activity no. 5. Oil curing of canes.

C. Work done during April to June 2001

Physical targets

Organization of training programmes

Achievements

Organized one training programme on nursery and plantation techniques for cane. Details given under Activity No. 3. Set up farms

Present status since inception

Six training programmes on cultivation, one training on oil curing and one training in NE for trainers were organized.

Reasons for short fall, if any

Nil

REPORT OF THE VISIT OF KFRI SCIENTISTS TO NORTH EAST - 15 TO 28th APRIL 2000

Drs. K. K. Seethalakshmi, C. Renuka, Muktesh Kumar and R. C. Pandalai, a team of four KFRI Scientists involved in the UNDP cane and bamboo project visited the collaborating institutes from North East and organised a workshop on field identification, nursery and plantation techniques for cane and bamboo with the help of IRMDFR, Jorhat. A report of the visit and abstract of discussions are given below.

The team reached Jorhat on 16th April 2000 and received by the collaborating Scientists Mr. T.C. Bhuyan and Mr. S. Pattanaik of IRMDFR. A brief discussion was held with Dr. K. G. Prasad, Director of IRMDFR about the organisation of workshop in IRMDFR.

Meeting with the Collaborating Scientists, Visit to Divisions and Experimental plots of IRMDFR, Jorhat - 17th April 2000.

A meeting was organised at IRMDFR on 17th April 2000 morning. All the collaborating scientists (Dr. K.C. Pathak, Mr. T.C. Bhuyan and Mr. S. Pattanaik) and Group Coordinator Mr. Kharshi-ing of IRMDFR were present. The KFRI Scientists explained the scope of the UNDP project, details of various components and the mode of operation of the project. In the discussion that followed Dr. Pothook mentioned that mainly six bamboo species are used for handicrafts. These include *Bambusa balcooa* (Bholuka), *B. bambos* (Katoha), *B. pallida* (Bijuli), *B. nutans* (Mukalbah), *B. tulda* (Jathiba), *Dendrocalamus hamiltonii* (Kakobah). Pathak also mentioned about bamboo cycle, two types of bamboo walling used in house construction and edible bamboos. Mr. Kharshi-ing mentioned about a small edible bamboo from Manipur and another species used as fishing rods from Nagaland known as Naga bamboo. The need for correct taxonomic identification of species used for various purposes was stressed. During the discussion mention was made about the success of tea plantations in Assam and how it was organized. Similarly people also will take bamboo and cane if a concerted effort is made. The primary requirements are setting up of cane and bamboo nurseries and information about the benefits of cane and bamboo planting. The participants from Assam felt that swampy areas in the state can be used for cane plantations.

After the discussions the scientists visited Entomology, Pathology, Tree Improvement, Silviculture, Forest Management and Ecology Divisions. This was followed by the visit to experimental plots. There was a germplasm collection of candidate plus clones (CPCs) of important bamboo species collected and maintained by Dr. Pathak as a part of the ICFRE project. Flowering of *B. nutans* was observed in this plot but no

seed setting was observed. Mr. Pattanaik had already initiated experiments on vegetative propagation of bamboo species of Assam. The details of organizing the workshop at IRMDFR were discussed and the necessary arrangements were made. In the evening nodal officers from Assam, Arunachal, Manipur and Tripura were contacted to confirm their participation.

Workshop on Field identification, Nursery and Plantation techniques for Cane and Bamboo, IRMDFR, Jorhat. - 18th to 19th April 2000.

The workshop was inaugurated by Mr. Kharshi-ing, Group Co-ordinator (Research), IRMDFR. During the inaugural talk he emphasized about the reduction of cane and bamboo resources and the need to protect them. The UNDP project is timely and he promised to extent all the support possible from IRMDFR for the success of the scheme. Dr. K. K. Seethalakshmi, Cooridnator of the UNDP project explained the details of the project to all the participants. Self-introduction of the participants followed this. During the introduction the participants were requested to emphasise on their experience with cane and bamboo and the problems they face in the field. From the information provided by them it was understood that the practicing foresters have many problems in the field as given below.

1. Poor germination and delay in germination of cane seeds
2. High cost involved for Rhizome planting of bamboo
3. Poor survival of cane rhizomes in the field when transplanted.
4. Short storage life of cane seeds
5. Lack of scientific identification of species
6. Problems for marketing and value addition
7. Rules and regulations affecting extraction and sale of bamboo and cane
8. Non availability of planting material and absence of authorized cane and bamboo nurseries
9. Lack of information about Silviculture of cane and bamboo
10. Lack of information about cost benefit of cane or bamboo planting

Dr. Renuka gave a detailed presentation on cane species of North -East. She emphasized on the characters used for identification. Also the details for collection of materials for identification from the field were provided. Dr. Haridasan from SFRI, Itanagar, provided information about the cane species used for handicrafts in the Northeast with their scientific names and properties.

Dr. Pandalai dealt methods of seed collection, processing and germination during the afternoon session. He also covered different methods used for establishment and maintenance of cane plantations. There was a detailed discussion on various aspects of cane after the lectures.

On 19th April Dr. Mukthesh Kumar showed the diversity of bamboo species, mainly species occurring in South India and provided the guidelines for bamboo herbarium collection. This provided an idea to the participants how to collect materials for identification. Dr. Seethalakshmi followed with various methods of bamboo propagation, both from seed and by vegetative methods. Dr. Pandalai educated the participants on silviculture and management of bamboo. Dr. Pathak presented the details of NE bamboos and their potential uses.

During the discussion that followed, the need for establishing cane and bamboo nurseries where people can get authentic planting stock was stressed by many participants. The Scientists felt that with the technology available now, Forest Departments and Research Institutes should join their hands for this. If a concerted effort is made, nurseries can be set up within a period of three years. The necessity for value addition was pointed out by the participants from Tripura. The Scientists gave the details of the programs already initiated and handled by other Institutes for value addition under the UNDP project.

When the responses about the workshop were invited from participants the following comments were made.

1. The duration of the workshop is very short
2. The Printed material for the workshop should be increased
3. Importance should be given for the training on value addition also
4. More field training should be provided than class room lectures
5. Information centres on cane and bamboo accessible to common man should be set up in various locations
6. Co-operative societies or associations like Tea association should be set up for organizing cane and bamboo planting and marketing

The resource persons answered that a detailed training program is envisaged in KFRI for a longer duration with more field visits and training during the end of the year.

A field visit was arranged in the afternoon. The participants were taken to the experimental plots in the campus of IRMDFR. These include bamboo nursery, CPC collection, medicinal plants, tree improvement

seed setting was observed. Mr. Pattanaik had already initiated experiments on vegetative propagation of bamboo species of Assam. The details of organizing the workshop at IRMDFR were discussed and the necessary arrangements were made. In the evening nodal officers from Assam, Arunachal, Manipur and Tripura were contacted to confirm their participation.

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1. Poor germination and delay in germination of cane seeds
2. High cost involved for Rhizome planting of bamboo
3. Poor survival of cane rhizomes in the field when transplanted.
4. Short storage life of cane seeds
5. Lack of scientific identification of species
6. Problems for marketing and value addition
7. Rules and regulations affecting extraction and sale of bamboo and cane
8. Non availability of planting material and absence of authorized cane and bamboo nurseries
9. Lack of information about Silviculture of cane and bamboo
10. Lack of information about cost benefit of cane or bamboo planting

Dr. Renuka gave a detailed presentation on cane species of North -East. She emphasized on the characters used for identification. Also the details for collection of materials for identification from the field were provided. Dr. Haridasan from SFRI, Itanagar, provided information about the cane species used for handicrafts in the Northeast with their scientific names and properties.

Dr. Pandalai dealt methods of seed collection, processing and germination during the afternoon session. He also covered different methods used for establishment and maintenance of cane plantations. There was a detailed discussion on various aspects of cane after the lectures.

On 19th April Dr. Mukthesh Kumar showed the diversity of bamboo species, mainly species occurring in South India and provided the guidelines for bamboo herbarium collection. This provided an idea to the participants how to collect materials for identification. Dr. Seethalakshmi followed with various methods of bamboo propagation, both from seed and by vegetative methods. Dr. Pandalai educated the participants on silviculture and management of bamboo. Dr. Pathak presented the details of NE bamboos and their potential uses.

During the discussion that followed, the need for establishing cane and bamboo nurseries where people can get authentic planting stock was stressed by many participants. The Scientists felt that with the technology available now, Forest Departments and Research Institutes should join their hands for this. If a concerted effort is made, nurseries can be set up within a period of three years. The necessity for value addition was pointed out by the participants from Tripura. The Scientists gave the details of the programs already initiated and handled by other Institutes for value addition under the UNDP project.

When the responses about the workshop were invited from participants the following comments were made.

1. The duration of the workshop is very short
2. The Printed material for the workshop should be increased
3. Importance should be given for the training on value addition also
4. More field training should be provided than class room lectures
5. Information centres on cane and bamboo accessible to common man should be set up in various locations
6. Co-operative societies or associations like Tea association should be set up for organizing cane and bamboo planting and marketing

The resource persons answered that a detailed training program is envisaged in KFRI for a longer duration with more field visits and training during the end of the year.

A field visit was arranged in the afternoon. The participants were taken to the experimental plots in the campus of IRMDFR. These include bamboo nursery, CPC collection, medicinal plants, tree improvement

programs on *Gmelina arborea*, *Dipterocarpus retusus* etc. The workshop was concluded at 5 p.m.

Regional Research Laboratory - 20th April 2000.

On 20th morning the scientists made use of the opportunity to visit Regional Research Laboratory on the way to Itanagar from Jorhat. Dr. B. G. Unni who had visited KFRI earlier took them around and showed various divisions and library of RRL.

Homestead bamboos, Kasiranga National Park - 20th April 2000

On the way to Itanagar, *Bambusa balacooa*, *B. bambos*, *B. nutans*, *B. pallida*, *D. hamiltonii*, and *D. giganteus* were found grown in many homesteads. Most of the homesteads had good bamboo garden either around the pond or on the boundaries. Most of the houses were made with bamboo walls. On the way, had a glimpse of Rhino in the swamps of Kasiranga National Park. The swamps were rich in canes.

Sessa Orchid Sanctuary, Tippi -21st April 2000

Arunachal Pradesh is rich in Orchid flora and the Tippi orchid station had a valuable collection of them. Dr. A. N. Rao, Assistant orchidologist showed the orchidarium, the nursery, tissue culture laboratory, mist chamber and orchid nursery where commercial cultivation of orchids and distribution of seedlings to farmers are being done.

Canetum, Karsingsa - 22nd April 2000

SFRI has established a canetum with five species in Karsingsa. The six species planted are *Calamus flagellum*, *C. erectus*, *C. tenuis*, *C. leptospadis*, *C. acanthospathus*. The seedlings were in the initial stages of growth.

SFRI sub centre, Chessa - 22nd April 2000

In Chessa, there is a medicinal plant collection, bambusetum, teak seed orchard, *Terminalia meriocarpus*, cane plantations etc. In the bambusetum there were 60 species of bamboos collected from NE and other regions India. Some seedlings of *B. bambos* supplied earlier from KFRI were found to grow very well there. Some of the prominent species

in the bambusetum were *B. pallida*, *Oxytenanthera abyssinica*, *O. nigrociliata*, *Schizostachym pergracile*, *B. polymorpha*, *Pseudostachyum polymorphum*, *Pseudosasa japonica*, *B. affinis*, *B. wamin* etc. Rhizomes of *Pseudosasa japonica* and *Pseudostachyum polymorphum* were collected for KFRI bambusetum.

Apathani tribals and Hong village - 23rd April 2000

The team visited Hong village where a group of tribals viz. Apathani, grow Chinese bamboo. The entire house of Apathani is made of bamboo. The bamboo culms are split into two and the knots are removed. These bamboo pieces are used for thatching. The houses are raised from the ground and made on a bamboo platform. The place under the houses is used for poultry or goat keeping. The bamboo species grown around the house is identified as *Phyllostachys bambusoides*. A piece of rhizome was collected for the germplasm.

Visit to SFRI - 24th April 2000

Dr. Haridasan and Dr. Ahlawat showed the nursery and shade houses in the SFRI campus. Seedlings of cane and bamboo, fern house, medicinal plants and broom grass, were found in the nursery. Made collections of seedlings of *Dendrocalamus asper* and *Phyllostachys pubescense* for germplasm.

A meeting was organized with the Director, collaborating scientists and staff of SFRI. Dr. Haridasan introduced the resource persons from KFRI to SFRI staff. SFRI Director, Mr. Deori, welcomed the visitors. Dr. Seethalakshmi gave an outline of UNDP project. Dr. Pandalai gave a talk on Silviculture of cane and bamboo followed by presentation of Dr. Muktesh on field identification of bamboo species. The presentations were followed by discussion. Participants expressed their doubt why *Zhalaca* is not considered as a cane. One participant mentioned that while extracting canes, artisans prefer the canes from the shade and not from open areas. A difference in the quality of cane growing in open and shade is suspected. The meeting came to an end at 1.00 p. m with the vote of thanks from Dr. Ahlawat.

In the afternoon the team members met Mr. S. R. Mehta, PCCF and briefed about the project. The delay in getting approval of the collaboration with SFRI was brought to the attention of PCCF and Chief Secretary Mr. P.M.. Nair. Both of them promised their best to get it approved. PCCF in his discussion pointed out about the problems for marketing for cane and bamboo in Arunachal Pradesh. At present it is exported to various parts of the country and when production increases

he anticipates that marketing will be a problem . Cane and bamboo artisans are less in Arunachal Pradesh when compared to Assam.

Meeting with Director, IRMDFR - 26th April 2000

Scientists from KFRI and IRMDFR had a meeting with the Dr. K. G. Prasad, Director, IRMDFR, in the forenoon. Director had a detailed discussion with the scientists and the main points of discussion are given below.

1. The need to incorporate visit to other cane and bamboo growing countries by collaborating scientists for better exposure in cultivation was emphasized.
2. In addition to what is proposed already, there should be one Common Facility Centre (CFC) each, in all the Collaborating Research Institutes with equipment and oil curing unit for training. CFCs organized in Research Institutes should be maintained for training and testing of materials. He expressed his doubt about the feasibility of fabricating the machines required for all the CFCs by IPIRTI within the time schedule. He was of the opinion that atleast three sets of machines required for the CFC training Centres should be imported.
3. A questionnaire will be prepared by Scientists involved from KFRI for survey and documentation and sent to collaborating institutes for suggestions. This will be finalized after incorporating the suggestions and circulated to artisans to collect information about the species used in Handicrafts. The information will be compiled and a handbook will be prepared with state wise information on species, their local names, products and availability of resources. During publication due credit will be given for all the scientists involved.
4. For adoption of techniques and package of practices all the three institutes will compile the available information. For collecting information on cultural practices a questionnaire will be prepared to record the experience of traditional cane and bamboo farmers from each state.
5. For the germplasm, species used in handicrafts from each state will be assembled, planting stock will be exchanged and the information on growth will be recorded in a uniform pattern with the help of a observation sheet developed by Dr. R..C. Pandalai from KFRI. For establishing the germplasm a statistical design after consulting with the statistician need to be developed. Spacing should be planned as per the clump size of the species to be planted.

6. Most of the species used in handicrafts come from homesteads and the role of forest departments in this program need to be clarified. The multiplication nurseries will produce planting stock of species selected in bulk and distribute to farmers and Forest Department.
7. For setting up demonstration plots along with farmer's land forestland also should be considered.
8. When demonstration nursery and field plots are ready field days should be organized (Publicity about field day will be given through media. That day the public can visit the demonstration nursery and plots and experts will be available to clear the doubts). One of the demonstration plots should be near the CFC.
9. The necessity for organizing meetings of collaborating scientists periodically to assess the progress of work and proper evaluation was emphasized. The Co-ordinator suggested that such meetings can be organized annually.
10. He also mentioned that the scientists would like to modify the amount in the sub components of the allowed budget to IRMDFR to suit their requirements. This will be sent to Project Coordinator at the earliest.

It was agreed that the proposal will be reorganized after incorporating modifications made by collaborating Institutes and arrangements for money transactions will be made.

The team returned on 27th April 2000 from Jorhat.

The visit of the KFRI Scientists to Northeast helped to discuss the project in detail with the collaborating scientists. Also KFRI team got an idea about the capabilities of collaborating institutions with regard to cane and bamboo research. The team members were able to represent to the PCCF regarding the need for the timely approval of the collaboration from SFRI in order to initiate nursery work without missing this reason.

Representative from three northeastern States (Arunachal Pradesh, Assam and Tripura) participated in the workshop on Field identification, Nursery and Planting techniques of Cane and Bamboo at IRMDFR, Jorhat on 18 and 19th April 2000. The practicing foresters were able to get information on cane and bamboo cultivation. Various problems faced in the field were pointed out by participants.

9. PUBLICITY AND AWARENESS

Duration: 30 months (from March 2000 to August 2002)

Objective

1. To prepare information bulletins and handbooks on cultivation, management and utilisation of canes and bamboo species used in handicrafts.
2. To prepare an annotated bibliography of bamboo and cane and launch a website using the same information.
3. To prepare a directory of researchers, institutions, artisans, entrepreneurs, designers and technologists in the field of bamboo and cane.

Programme of activities

1. A set of booklets and brochures on bamboo and cane on (a) seed collection and storage methods, (b) nursery practices, (c) propagation techniques, (d) harvesting and post-harvest management, (e) economically important species and their uses, (f) economics of cultivation will be published in English, Hindi and Malayalam.
2. Publication of directory: A directory of researchers, institutions, artisans, entrepreneurs, designers and technologists in the field of bamboo and cane will be published.
3. An annotated bibliography of bamboo and cane will be published in CD - ROMs. The same information can be used in the proposed website.

End out put

1. Through the handbooks Information will be available on cultivation, management and utilisation of cane and bamboo species used in handicrafts.
2. The bibliography and web site will provide complete published information on cane and bamboo.
3. The Directory will give region-wise information about various groups like Scientists, Artisans, entrepreneurs, designers and others working on bamboo and rattan.

A. Work done during March - 2000

Physical targets

Preparation of publicity materials
Preparation of Directory

Achievement

Initiated the work in March

B. Work done during April 2000 to March 2001

Physical targets

- 1 Preparation of publicity materials
- 2 Preparation of Directory
- 3 Preparation of bibliography
- 4 Preparation of handbooks

Achievement

1. Prepared one brochure on UNDP project - copy enclosed.
2. A meeting of the scientists were organized for preparation of handbook and responsibilities were assigned - details given in appendix
3. Initiated collection of information for directory and bibliography.
4. Information on craft units involved in bamboo and cane work was collected from various agencies

C. Work done during April to June 2001

Physical targets

- 1 Preparation of publicity materials
- 2 Preparation of Directory
- 3 Preparation of bibliography
- 4 Preparation of handbooks

Achievement

Work in progress

Present status since inception

A brochure on UNDP cane and bamboo project was printed

Twenty five percent of the work of other components completed

Reasons for short fall if any

There is a delay in this component. Since the investigators are involved in other components priority was given for field work so that nurseries, demonstration plots and germplasm can be done first. Now top priority will be given for this component and draft of all the publications will be submitted by December positively.

APPENDIX. Titles of handbooks under preparation

1. Commercially Important Species and Economics of Cultivation
2. Plant Production (seed collection, storage methods, propagation techniques, nursery practices)
3. Stand establishment, Management and Harvesting
4. Post-harvest Technology (Preservation)

One each on cane and bamboo (totally 8) handbooks will be prepared