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Bamboo resources development and utilization in Karassery Grama Panchayath

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Project Particulars

Title of the project	: Bamboo resources development and utilization in Karassery Grama Panchayath (KFRI 562/09)
Department/Organization implementing the project	: Kerala Forest Research Institute, Peechi
Principal Investigator	: Raveendran V.P.
Objectives	: 1. To develop a bamboo belt for river-bank stabilization of Iruvanjipuzha and Cherupuzha under Karassery Grama Panchayath and planting bamboos in other potential areas in the Panchayath with people participation. 2. Capacity development for resource management through training programmes for nursery establishment, plantation management and harvesting. 3. Training for value addition and establishment of a production unit.
Co-investigators	:Dr. S. Sankar Dr. K.K. Seethalaskshmi Dr. K.V. Mohammed Kunhi
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Budget	: Rs. 4.5 Lakhs
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Contents

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Abstract

The Karassery Grama Panchayath, Kozhikode District, Kerala launched a project in collaboration with the Kerala Forest Research Institute (KFRI), Peechi, Thrissur on bamboo resources development and utilization in the Panchayath. The project aimed at creating a bamboo resource base in Karassery Grama Panchayath, which could be primarily used for stabilizing the river bank of two rivers - Iruvanjipuzha and Cherupuzha - draining the Panchayath. KFRI provided technical support and material assistance and further provided training and capacity building in developing and managing bamboo resources. Training programmes on 1. Bamboo planting stock production, 2. Cultivation management and utilization of bamboos 3. Bamboo crafts were organized in Karassey Grama Panchayath and field visits and exposure visits were conducted for farmers, Kudumbasree members, stakeholders and ward members of the panchayath to different locations such as bamboo industries, bamboosetum, bamboo nurseries and handicraft units in Kerala to create awareness on bamboo resources, value addition and uses of bamboos.

The bamboo species namely *Bambusa bambos, Bambusa tulda, Bambusa vulgaris, Dendrocalamus asper* and *Ochlandra travancorica* were planted along a stretch of about 8 km on both sides of the rivers thereby contributed to the strengthening of the banks of Iruvanjipuzha and Cherupuzha. Bamboos were also planted in other potential areas in the panchayath with people's participation and growth and survival of bamboo species were

monitored. The bamboo planting programme was inaugurated by the Honorable Minister for Forest and Housing Sri Binoy Viswam on 18th June 2009. As part of the project, a bamboo nursery was also established at Karassery Grama Panchayath for production of planting stock of different bamboo species ensuring the availability of the bamboo planting materials to the farmers, other stakeholders and various organizations in and outside of the panchayath.

Introduction

In the age of global warming and climate change, bamboos, one of the fastest growing plants of the world, become an effective tool against soil erosion, air pollution, water pollution among others. Bamboo holds not only great economic importance to the rural people of many developing countries but also plays significant role in environmental protection (Byatriakova et al., 2003; Haque and Karmakar, 2004; Ramanuja Rao et al., 2009). Bamboos are very effective against soil erosion especially along river banks. It reduces soil erosion due to its fibrous root system and high capacity of filtering impurities of water. Compared to other plant species it grows very fast and its maintenance is very low, hence most of the industrial firms opted bamboo for developing green belts in order to avoid various types of pollutions. Bamboos are used in various purposes such as household utensils, agriculture instruments, small construction purposes and industrially for paper production. But the introduction of modern durable construction materials such as plastic, iron, aluminum etc. replace bamboos from these areas. In earlier times, bamboos are common sight in our village lands but in the recent decades most of them are weeded out for the convenience for construction of houses and other purposes. State Bamboo Mission and National Bamboo Mission (NBM) aim to support bamboo growers, bamboo industries, technology dissemination and also provides funding for raising plantation and stock improvement in the state. Bamboo Technical Support Group (BTSG) in KFRI, Peechi is the nodal agency of NBM in the southern region of the country. BTSG provides technical support for raising bamboo plantation and conducts training for awareness creation in bamboo sector. KFRI has launched a project in collaboration with Karassery Grama Panchayath, Kozhikode on Bamboo resources development and utilization in the Karassery Grama Panchayath. This

mission aims at creating a bamboo resource base in Karassery Grama Panchayath, which will primarily help in stabilization of the river bank of two rivers - Iruvanjipuzha and Cherupuzha- draining the Panchayath.

Slumping of river banks is a major issue in Kerala. To ensure the protection of river banks and to take steps to remove all types of encroachments, Government of Kerala empowered an Act called the Kerala Protection of River Banks and Regulation of Removal of Sand Act in 2001. Only conventional approaches such as stone pitching, construction of spurs, stone riprap have been adopted so far. Applying the conventional methods of countermeasure, the river bank erosion at short term basis can be obtained whereas, the long term stable channel or regime channel can never be developed (Md. Lutfor Rahman et al., 2011). In recent years, bank stabilization methods have focused on bio-engineering techniques. Bamboo work for bio-engineering purposes was introduced as an alternative measure for bank protection and planting bamboos can stabilize riverbanks by preventing erosion and reducing shallow seated mass movement. Although used widely, use of bamboos for river bank stabilization is very unique to Kerala.

So this project in Karassery Grama Panchayath of Kozhikode District, Kerala, aims at river bank stabilization and to develop bamboo resources and its utilization in the panchayath with the participation of local people. KFRI provided technical support and material assistance and further provided training in capacity building in developing and managing bamboo resources. The whole programme, continuing for a period of 36 months is organized jointly by KFRI and Karassery Grama Panchayath.

The objectives of the study are following:

1. To develop a bamboo belt for river-bank stabilization of Iruvanjipuzha and Cherupuzha under Karassery Panchayath and planting bamboos in other potential areas in the Panchayath with people participation.

2. Capacity development for resource management through training programmes for nursery establishment, plantation management and harvesting.

3. Training for value addition and establishment of a production unit.

Study area

The study area is located in Karassery Grama Panchayath of Kozhikode District, Kerala (Figure 1), lies between the geo coordinates 11° 17' 41.26" to 11° 20' 36.6" North and 75°59' 38.04" to 76° 03' 39.24" East. This Grama Panchayath comes under Kunnamangalam Block Panchayath of Kozhikode Taluk and spread over an area of 26.21 square kilometers. As per 2001 census, the population of Karassery Grama Panchayath is 23659 persons which comprises of 11663 males and 11996 females. The panchayath has a population density of 829 inhabitants per square kilometre and has a sex ratio of 1029 females for every 1000 males, and a literacy rate of 90.91 %. The panchayath includes three main villages namely, Kumaranellur, Kakkad, Kodiyathur with 18 Wards. The Panchayath is surrounded by Thiruvambadi and Koodaranji Grama Panchayaths in its north, Koditathur Grama Panchayath in south, Koodaranji Grama Panchayth in east and Mukkam Grama Panchayath in the west.

Thiruvambadi and Koodaranji Grama Panchayaths in its north, Koditathur Grama Panchayath in south, Koodaranji Grama Panchayth in east and Mukkam Grama Panchayath in the west.

The two rivers namely Iruvanjipuzha and Cherupuzha, flowing through Karassery Grama Panchayath, are the main tributaries of the Chaliyar river drainage system. But the banks of these rivers have been facing acute threats of riverbank erosion for many years.

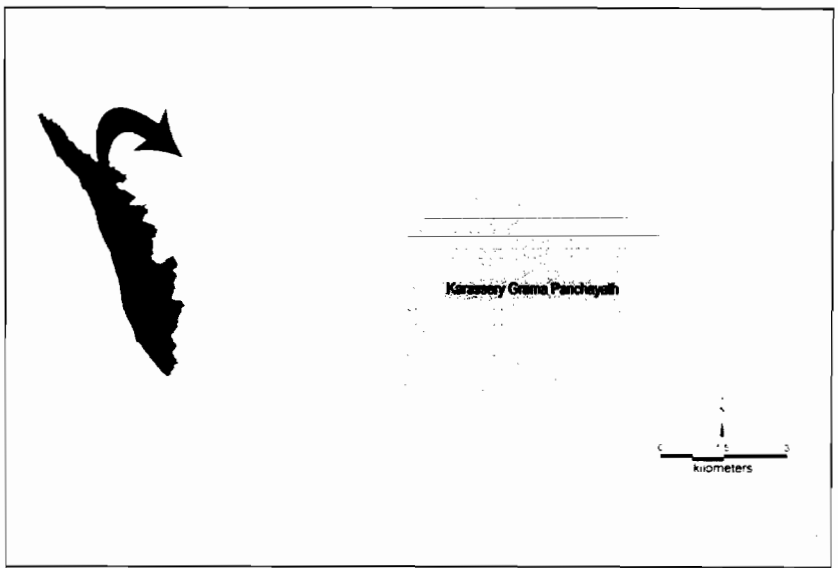

Figure 1. Map showing the study area

Methodology

Capacity development and training programmes

Trainings were conducted for selected traditional bamboo workers and members of Kudumbasree unit in all wards of Karassery Grama Panchayath at Karassery Panchayath Community Hall and the Training Centre at Kerala Forest Research Institute, Peechi. The expertise of various resource personals were sought on general awareness on bamboos, livelihood improvement, planting stock production of bamboo, cultivation and management of bamboo, plantation and harvesting techniques and handicraft production. Successful trainees were awarded certificates issued by Kerala Forest Research Institute. As part of this programme, field visits and exposure visits were arranged for the participants in bamboo industries, bamboosetum, bamboo nurseries and handicraft units in Kerala.

River bank stabilization and planting of bamboos

The river banks of Iruvanjipuzha and Cherupuzha in the Karassery Grama Panchayath was visited by the research team of Kerala Forest Research Institute and a reconnaissance survey was carried out. Experts from KFRI, officials from Karassery Grama Panchayath and Kerala Agricultural Department visited the locations for planting bamboos and examined the site suitable for setting up a bamboo nursery in the panchayath. Species such as *Bambusa bambos, Bambusa tulda, Bambusa vulgaris, Dendrocalamus asper* and *Ochlandra travancorica* were planted on either side of Iruvanjipuzha and Cherupuzha to a distance of 8 km in the Karassery Grama Panchayath.

The locations for planting bamboos were identified. After weeding and clearing the site, planting spots were marked, and pitting and filling works done at suitable spacing for the species to be planted. In order to plant bamboo seedlings, pits of 45 x 45 x 45 cm dimensions were dug in the field. Plants with six month seedlings old were used for planting in the case of *Ochlandra travancorica* and one year old plants were used for other species. The plants are mainly planted in the banks of Iruvanjipuzha and Cherupuzha, barren lands, homesteads and other public places of Karassery Grama Panchayath. After planting the bamboos in the river banks, the survival percentage is enumerated after one year. Growth of bamboo species were measured and the growth parameters such as survival of clumps, number of culms/clump and girth and average height of culms of different species collected from the field in continuous intervals.

Bamboo planting programme

As part of the implementation of the project, a bamboo planting programme was organized in the Karassery Grama Panchayath on 18th June 2009. The project was inaugurated by the Honorable Minister for Forest and Housing Sri Binoy Viswam on 18th June 2009 in a function attended by hundreds and the message on importance of bamboo in rural environment and livelihood was spread. People from different wards of Karassery Grama Panchayath including traditional bamboo workers, Kudumbasree members and those who interested in bamboo cultivation were invited. The function was commenced with a welcome song by the students of Haritha Paristhithi Club Orphanage High School followed by the welcome speech by Shri. Mukkam Muhammad, Vice President, Karassery Grama Panchayath. The function was presided by Shri. V. K. Vinod, President, Karassery Grama Panchayath. Dr. S. Sankar, Scientist, Kerala Forest Research Institute

delivered a speech on bamboos. Shri. V. P. Raveendran, Scientist, Kerala Forest Research Institute explained the activities and expected outcome of the programme and Shri. P. Rajan, Agricultural Officer, Karassery presented the financial report of the programme. Then the felicitations were made by Shri. V. Kunjaali, Vice President, Kozhikode District Panchayath, Shri. T. V. Balan, Chairman, Standing Committee, Kozhikode District Panchayath, Smt. A. Kalyanikkuty, President, Mukkam Grama Panchayath, Shri. T. Viswanadhan, Former President, Karassery Grama Panchayath, Dr. M. N. Karassery, Shri. M. T. Ashraf, Shri. Unus Puthalathu, Shri. Mohanan Master, Shri. Kolay Nasar, Shri. James Joshi, Shri. P. T. C. Muhammad and Shri. P. K. Abdul Rasaq. The inaugural function was concluded with a vote of thanks by Shri. K. Sreedharan.

Bamboo nursery and planting stock production

As part of the project, a bamboo nursery was established at Karassery Grama Panchayath for production of planting stock of *Bambusa bambos* (Thorny Bamboo, *Pattil, Illi* etc.), *Bambusa tulda* (Makar, Bengal bamboo), *Dendrocalamus asper* (Betung bamboo), *Dendrocalamus brandisii* (Velvet leaf bamboo), *Dendrocalamus giganteus* (Anamula) and *Ochlandra travancorica* (Eeta, oda, reed bamboo). Seedlings raised in the nursery at Karassery Grama Panchayath will be supplied to the farmers and organizations in the Panchayath and outside.

At first, planning and making of site lay out for nursery were done taking in to consideration the location and accessibility, soil, water supply, sun and shade. Approximately square shape is opted for nursery as it reduces the fencing cost and convenient to the workers. Then the land was cleared and leveled nursery ground, with a gentle slope of about 5^0, ensuring water runoff. Shade net is used to protect the young

plants from the direct sunlight. For the watering of the plants, a basic irrigation system was established. A potting shed also constructed as part of the nursery and the premises of nursery were protected with proper fencing.

Planting stock production from seeds:

Ploughed the site thoroughly and aligned the beds with the dimension of 12 meter length and 1.2 m width x height 0.3m. Soil was mixed with cow dung and sand in the proportion of 3:1:1.Then the bed was treated with fungicide (Bavistin, 10 gm/10 L) and pesticide (Chlorophyrophos 20 EC, 60 ml/10 L) before the seed sawing. The seeds are sawed and well irrigated twice a day. Seeds usually germinated within 1-2 weeks. These seedlings were potted after two weeks in polythene bags of 5x7 cm. Seedlings were ready for planting after 6 months of potting.

Planting material production by vegetative propagation:

In this method, ploughed the site 30 cm depth and prepared the beds with the dimension of 12 m length, 1.2 m width and height 0.3m. Soil was mixed with cow dung and sand in the proportion of 3:1:1. The bed was treated with fungicide (Bavistin, 10 gm/10 L) and pesticide (Chlorophyrophos 20 EC, 60ml/10 L). Two noded bamboo culm cuttings from two to three year old bamboo culms were selected for propagation. Made a hole in the middle of the nodes of the cuttings and applied rooting hormone – NAA (100-200 ppm) 50-100 ml per cutting and planted horizontally in the prepared beds. Sprouted after one week and started rooting within 30 days. After three months the propagules become ready for planting. A part of the propagule also used for macro proliferation after 6 months.

Using this method 3 to 5 plants were produced from each 6 month old bamboo propagule.

A total of 10 beds of 1100 seeds each were prepared in Karassery Grama Panchayath for the planting material production. In which 5 of them were used for the germination of seeds and remaining 5 beds used for propagation and macro-proliferation techniques of different bamboo species. The seeds of *Ochlandra travancorica* collected from Mankulam Forest Division and planting materials of *Dendrocalamus asper*, *Bambusa tulda* and *Bambusa bambos* were collected from Bamboo Nursery of KFRI Field Research Centre, Velupadam, for macro-proliferation.

Results and Discussion

Capacity building through training programmes

a. Bamboo planting stock production

The training programme on bamboo planting stock production was held at Karassery Grama Panchayath Community Hall on 15th March 2010 and people from different wards of Karassery Grama Panchayath including traditional bamboo workers, Kudumbasree members and those interested in bamboo cultivation actively participated. Shri. P. Rajan, Agricultural Officer, Karassery welcomed the delegates of the training. Dr. K. K. Seethalakshmi, Scientist, KFRI, delivered a speech on general introduction to bamboos and Dr. S. Sankar, Scientist, KFRI briefed on the livelihood improvement of artisans and farmers and Shri. V. P. Raveendran presented the topic species suitable for cultivation and methods of propagation of bamboos and demonstrated the vegetative propagation techniques.

The list of participants are given in **Appendix –1**

b. Cultivation management and utilization of bamboos

This training programme was conducted for the members of different Kudumbasree units of the Karassery Grama Panchayath. This training was organized at Manthra Nursery, Karassey on 26th February 2011 and 21 members (The list of participants and details of selected artisans are given in **Appendix –II**) representing seven Kudumbasree units of the panchayath were participated. The inaugural function of the training started with a welcome speech by Shri. V. P. Raveendran, Scientist, KFRI. Shri. M. T. Asharaf, Vice President, Karaseery Grama Panchayath inaugurated the training and this was followed by

felicitations by Dr. K. Muhammad Kunhi, Scientist, KFRI and Shri. O. Ashraf, Ward Member, Karassery Grama Panachayath. The inaugural function was concluded with a vote of thanks proposed by Smt. K. Sreevidya, Agricultural Officer, Karasserey. During the programme, Shri. V. P. Raveendran, Scientist, KFRI delivered a lecture on traditional methods of propagation ie., offset collection, rooting of stem cuttings and macro proliferation. Demonstration and hands on experience of propagation methods were also given. During the final session fifty propagules of different bamboo species were supplied to each Kudumbasree member participated in the training.

c. Bamboo crafts

Traditional bamboo workers and members of Kudumbasree unit in all wards of Karassery Grama Panchayath were invited to participate in the training programme at Manthra Anganavadi, Karassery on 7th March 2012, organized by Karassery Grama Panchayath and KFRI. It was a thirty day programme in which about 23 persons (The list of participants and details of selected artisans are given in **Appendix –III**) from different wards of the panchayath participated. Shri. V. P. Raveendran, Scientist, KFRI welcomed the participants in the inaugural function. Shri. M. T. Ashraf, Vice President, Karassery Grama Panchayath inaugurated the programme. It was followed by the felicitations by Smt. K. Sreevidya, Agricultural Officer, Krasserey, Shri. O. Noushad, Ward Member and Shri. P. Rajan, Agricultural Officer (Rtd.), Karassery. The inaugural function was concluded with a vote of thanks proposed by Shri. C. E. Suresh Babu, Secretary, Karassery Grama Panchayath. Dr. S. Sankar, Senior Scientist, KFRI delivered a lecture on cluster development and livelihood improvement of artisans and farmers. Shri. C. Krishnan, Master Craftsman explained about bamboo handicrafts. The participants were

well trained to produce value added products like lamp shades, pen stands, pen cups, wall hangers, flower baskets, scale flowers etc. The thirty day training programme concluded on 7th May 2012 with a function organized at Manthra Anganavadi, Karassey. The function started with a welcome speech by Shri. V.P. Raveendran, Scientist, KFRI. Smt. Shynas Chaloli, President, Krarassery Grama Panchayath inaugurated the function. Dr. S. Sankar, Scientist, KFRI and Shri. Antony, Expert on bamboo weaving and craft delivered speeches in this session. Then the training programme was evaluated followed by sharing of experiences by participants. Smt. Shynas Chaloli, President, Krarassery Grama Panchayath distributed certificate to the participants and the function was concluded by a vote of thanks by Shri. M.T. Ashraf, Vice President, Kararassery Grama Panchayath.

d. Exposure visit cum training -1

The National Bamboo Mission - Bamboo Technical Support Group (NBM- BTSG) arranged an exposure visit cum training programme for the stakeholders from Karassery Grama Panchayath. A team of 34 members (list appended in the **Appendix- IV**) including farmers and ward members visited KFRI on 5th July 2008. They were exposed to bamboo nursery and variety of bamboos growing at the KFRI campus, also met and discussed with scientists in various aspects of bamboos. The participants were very much inspired and motivated by the visit and stated that such visits should be there from time to time. A training programme was also provided to the visitors on cultivation and management of bamboos. The programme was held at KFRI Extension and Training Centre and was on the same day. During the training programme, Scientists and resources persons from KFRI, Dr. K. C. Chacko, Dr. K. K. Seethalakshmi, Dr. S.

Sankar, Dr. R. C. Pandalai and Shri. V. P. Raveendran took classes on general introduction to bamboos, species suitable for bamboo cultivation, utilization and value addition of bamboos, plantation and harvesting techniques in bamboo and traditional methods of propagation of bamboo respectively. All the participants actively participated and as a whole, the entire programme was highly informative for the participants.

e. Exposure visit cum training -2

Exposure visit cum training was organized by National Bamboo Mission and (NBM) Bamboo Technical Support Group (BTSG) for the farmers including selected Kudumbasree members and ward members (The list appended in **Appendix -V**) of Karassery Grama Panchayath on 22-23 July 2011. During the visit, they were taken to different Departments of KFRI and Field Research Centre, Veluppadam. They visited the Bambusetum where they could see collection of different bamboo species growing. It was a great exposure to the farmers as they gathered information on growth and development, morphology, cultivation, harvesting techniques of bamboo. A training programme on cultivation and management of bamboos was also conducted for the visitors at KFRI. During this session Dr. K. K. Seethalakshmi, Scientist engaged in discourse on species suitable for bamboo cultivation and Shri. V. P. Raveendran gave information about utilization, management and propagation of bamboos. Dr. S. Sankar gave a class on Cluster development and livelihood improvement of artisans and farmers.

Plate.1 **a**-Training programme on bamboo planting stock production **b**-Training prog ramme on cultivation management and utilization of bamboos **c**-Cultivation manage ment and Utilization of bamboos **d &e**-Training programme on bamboo crafts **f**-Tr aining programme on bamboo crafts - Concluding session

Plate.2 **a**-Exposure visit-I participants. **b**-Exposure visit II participants. c&d- field visits during the exposure visits.

River bank stabilization and planting of bamboos

The banks of Iruvanjipuzha and Cherupuzha, two main rivers flowing through Karassery Grama Panchayath and are facing acute river bank erosion. The main problems being the indiscriminate, unscientific and unauthorized sand-mining in the river areas of Iruvanjipuzha and Cherupuzha.. The land along the river banks is often deepened to support construction activities and cultivation practices in the riverbank .The adverse results are a further lowering of water table of the rivers and the weakening of river banks. As part of implementation of the present project, the site for planting bamboos was selected and planting was done along the banks of Iiruvanjipuzha and Cherupuzha. During this period, a bamboo nursery was also established in the panchayath with the participation of the local NGOs and Kudumbasree units from the panchayath.

Growth monitoring of bamboos planted in the river bank

Bambusa bambos, Bambusa tulda, Bambusa vulgaris, Dendrocalamus asper and *Ochlandra travancorica* were planted along on both sides of Iruvanjipuzha and Cherupuzha to a distance of 8 km in the Karassery Grama Panchayath (Table-1). Growth of bamboo species was measured and the growth parameters such as diameter and average height of culms of different species, average number of tillers, average number of nodes and average number of new shoots were collected from the field. The growth attributes of different bamboo species after six months, one, two and three years of planting were taken and the details are given in the table (3-7). Survival percentage of the planted bamboos are given in the Table 2.The highest percentage of survival observed in *B. vulgaris*, followed by *Ochlandra travancorica* and the least survival percentage is observed in *B.bambos.*

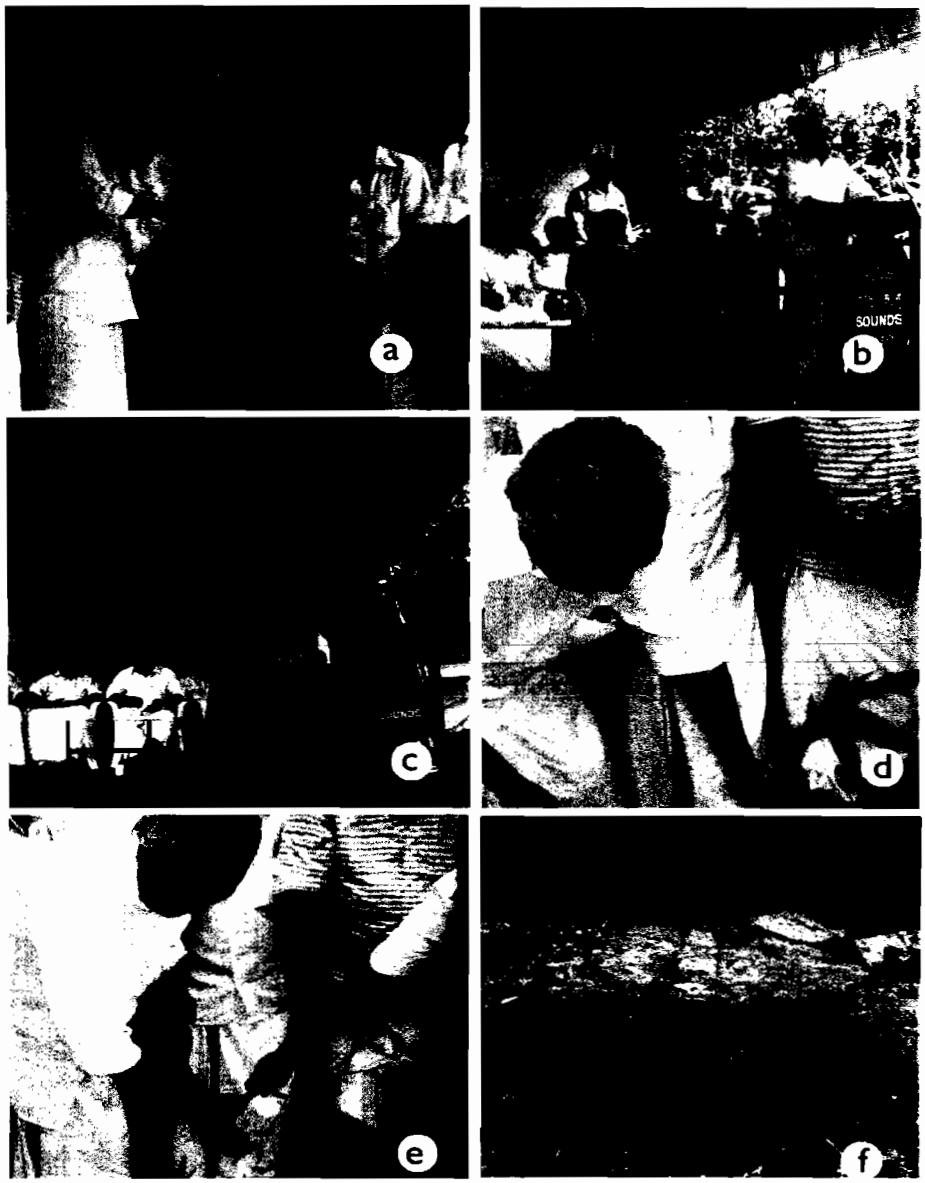

Plate.3 **a-f** .Bamboo planting programme inaugural function at Karassery.

Table 1. Seedlings planted in the river banks of Karassery Grama Panchayath

Sl no.	Species	No. of seedlings planted
1	*Bambusa bambos*	1500
2	*Bambusa tulda*	1080
3	*Bambusa vulgaris*	100
4	*Dendrocalamus asper*	1100
5	*Ochlandra travancorica*	2000

Table 2. Survival percentage of bamboos after one year of planting

Sl. No.	Species	Total no. planted	No. of plants survived	Survival percentage (%)
1	*Ochlandra travancorica*	1500	1200	80
2	*Bambusa tulda*	1080	270	25
3	*Dendrocalamus asper*	100	81	81
4	*Bambusa bambos*	1100	660	60
5	*Bambusa vulgaris*	2000	1560	78
Total		5780	3771	65.24

The growth attributes presented in the Table (3-7) indicates that the species *B.vulgaris* and *O. travancorica* have shown the maximum growth in height and diameter. *B.vulgaris* had an average height of 1.5m., 2m., and 3 m. in the first, second and third year of planting

respectively. The species also had a diameter 4.5cm, 5 cm and 6 cm in the successive three years of planting. Number of tillers and number of nodes increased with age.

Bambusa bambos

The growth attributes of *B. bambos* at different stages of growth are presented in the Table 3. The average height of culms after six months of planting was 50 cm and increased to 2 meters at the end of the observation, in the third year of planting. The maximum growth in height was between first and second year with an average growth of 75 cm. New shoots started developing after first year of planting and the number of new shoots produced per clump in each year was 2-4. The average number of tillers and numbers of nodes were 8 and 14 respectively at the end of the observation.

Bambusa tulda

This species showed the least survival percentage with 25 percent after first year of planting (Table 2). The growth attributes of *B. tulda* at different stages of growth are given in the Table 4. The average height and diameter of culms after six months of planting were 50 cm and 2 cm respectively and it increased to 2m and 5.5 cm respectively at the end of the observation. New shoots started developing after one year of planting and the average numbers of new shoots produced per clump were 2-3. The average number of tillers and average numbers of nodes were 9 and 14 respectively at the end of the observation.

Bambusa vulgaris

The growth attributes of *B.vulgaris* at different stages of growth are presented in the Table 5. The average height of culms after six months of planting was 60 cm and increased to 3 meters at the end of the observation, in the third year of planting. The maximum growth in

height was between second and third year with an average growth of 1m. The average diameter in the third year was 6 cm. New shoots started developing after one year of planting and the average number of new shoots produced per clump in each year was 2-4. The average number of tillers and average numbers of nodes were 8 and 18 respectively at the end of the observation.

Dendrocalamus asper

Highest survival percentage is observed in *D. asper* with 81 percent (Table 2). The average height and diameter of culms after six months of planting were 50cm and 3 cm respectively and it increased to 2m and 5.5 cm respectively at the end of the observation. The maximum growth in height was between first and second year with an average growth of 1.25m. New shoots started developing after one year of planting and the average numbers of new shoots produced per clump were 2-3. The average number of tillers and average numbers of nodes were 10 and 13 respectively at the end of the observation. The growth attributes of *D.asper* at different stages of growth are given in the Table 6.

Ochlandra travancorica

This species showed the higher survival percentage with 80 percent (Table 2). The growth attributes of *O.travancorica* at different stages of growth are given in the table 7. The average height and diameter of culms after six months of planting were 80cm and 3.5 cm respectively and it increased to 3m and 6 cm respectively at the end of the observation. The maximum growth in height was between second and third year with an average growth of

1 m. New shoots started developing after first year of planting and the average numbers of new shoots produced per clump was 2-5. The average number of tillers and average numbers of nodes were 7 and 12 respectively at the end of the observation.

Table 3. Growth parameters of *Bambusa bambos*

Months after planting	Average height	Average diameter	Average no. of tillers	Average no. of nodes	No. of new shoots
6	50 cm	2 cm	3	4	-
12	75 cm	3cm	5	5	2
24	1.5m	4cm	7	11	3
36	2m	5.5cm	8	14	4

Table 4. Growth parameters of *Bambusa tulda*

Months after planting	Average height	Average diameter	Average no. of tillers	Average no. of nodes	No. of new shoots
6	60 cm	2.5cm	3	3	-
12	65cm	2.5cm	5	6	2
24	1m	3cm	7	9	3
36	2m	4cm	9	14	3

Table 5. Growth parameters of *Bambusa vulgaris*

Months after planting	Average height	Average diameter	Average no. of tillers	Average no. of nodes	No. of new shoots
6	60	3cm	2	5	-
12	1.5 m	4.5cm	4	7	2
24	2m	5cm	6	14	2
36	3m	6cm	8	18	4

Table 6.Growth parameters of *Dendrocalamus asper*

Months after planting	Average height	Average diameter	Average no. of tillers	Average no.of nodes	No. of new shoots
6	50cm	3cm	3	4	-
12	75cm	3.5cm	4	7	2
24	2m	4cm	7	9	3
36	2.5 m	4.5cm	10	13	3

Table 7. Growth parameters of *Ochlandra travancorica*

Months after planting	Average height	Average diameter	Average no. of tillers	Average no. of nodes	No. of new shoots
6	80cm	3.5cm	3	4	-
12	1.5 m	4cm	4	6	2
24	2cm	5cm	5	8	3
36	3m	6cm	7	12	5

Bamboo nursery and planting stock production

Seedlings of *B. tulda*, *D. asper* and *O. travancorica* were produced in the nursery at Karassery. Details are given in the Table-1. Seedlings produced in the nursery were also distributed to the Kudumbasree members who attended the training programmes on bamboo planting stock production organized at Karassery. The Kudumbasree members produced more seedlings through the proliferation techniques they studied and contributed to the

nursery stock. The number of bamboo seedlings produced in the nursery at Karassery Grama Panchayath during 2009-2012 is given in the Table-8. A total of 5455 seedlings of six different species *B. bambos*, *B. tulda*, *D. asper*, *D. brandisii*, *D. giganteus* and *O. travancorica* were distributed to different wards of Karassery Grama Panchayath for planting.

Table 8. Seedlings produced in the nursery during 2009-2012

Sl. No.	Species	No. of seedlings produced
1	*Bambusa bambos*	Nil
2	*Bambusa tulda*	960
3	*Dendrocalamus asper*	495
4	*Dendrocalamus brandisii*	Nil
5	*Dendrocalamus giganteus*	Nil
6	*Ochlandra travancorica*	4000

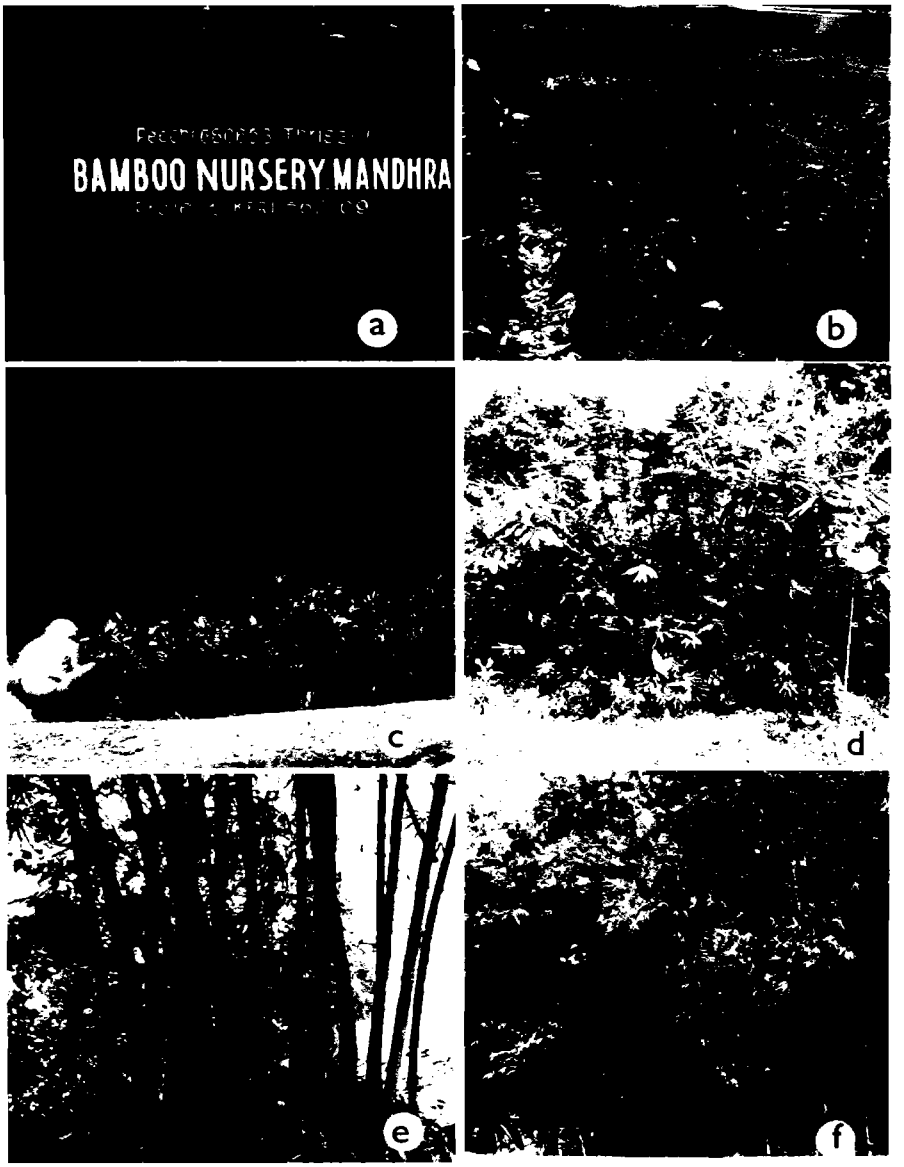

Plate 4. **a, b& c**-Bamboo nursery established at Karassery.**d,e & f**- Bamboos growing in the river banks at Karassery.

Conclusion

Trainings were conducted for selected traditional bamboo workers and members of Kudumbasree units and ward member of Karassery Grama Panchayath. Three training programmes on, bamboo planting stock production, cultivation management and utilization of bamboos and bamboo crafts were organized in Karassey Grama Panchayath. Along with this undertook field visits and exposure visits for the farmers, Kudumbasree members, stakeholders and ward members of the panchayth to bamboo industries, bamboosetum, bamboo nurseries and handicraft units in Kerala. The training programmes and exposure visits were designed to create awareness among the farmers and stakeholders on bamboo resources, value addition and multifarious uses. The programmes also helped them by providing informations regarding the potential of bamboo resources. KFRI provided technical and material assistance to the panchayath in developing and managing bamboo resource in Karassery Grama Panchayath. As part of the project, a bamboo nursery was established in Karassery Grama Panchayath and the seedlings produced in the nursery are being distributed throughout the panchayath ensuring the availability of the bamboo planting materials to the farmers and other stakeholders in the panchayath. Bamboos were planted along the banks of Iruvanjipuzha and Cherupuzha aiming to develop bamboo belt for river-bank stabilization, as the banks of these rivers have been facing acute river bank erosion for many years. Bamboos were also planted in other potential areas in the panchayath with people participation to develop a bamboo resource in the panchayath. *Bambusa bambos, Bambusa tulda, Bambusa vulgaris, Dendrocalamus asper* and *Ochlandra travancorica* were planted along 8 km on both sides of these rivers. The growth of the bamboos planted was

evaluated in continuous intervals and it indicates the species *D. asper*, *O. travancorica, and B. vulgaris* have higher growth performance among the bamboos planted. Now-a-days the bamboos growing in the river banks of Iruvanjipuzha and Cherupuzha of Karassery Grama Panchaytah are providing a valuable resource for the traditional bamboo workers, artisans and farmers and also serving the nature by river bank stabilization.

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Appendix –I

Training programme on bamboo planting stock production held at Karassey on 15th March 2010- List of participants.

Sl. No.	Name & Address	Phone Mob/ Residence
1.	MA Soudha "Ushas" N Karassery P. O. Karassery	0495-2297932 9495977932
2.	Suhara Karuvotu Kizhakkayil S. Karassery P.O. karassery	0495-2297862 9539316440
3.	M. Mohanan Muthadath P.O. kumaranallur Mukkam	9947859782
4.	Santhadevi Mothadath Kumaranur, Mukkam	9562374600
5.	Reji Sebastian Onattu Chuttathumparambil Panampilavu P.O.	9446814377
6.	Rosamma Kuttiakkal Thekkumkutti Alli P.O.	9656290567
7.	Usman Pulikkal Vallathaypara Alli P.O. Mukkam Via	9947186151
8.	Amina Edathil Edathil House Kakkad , Karassery P. O.	9745096738

9.	Asharaf K C Maliyekkal House Karassery P.O.	9846411929
10.	Farook Sukkur A P Alappadiyan House Karassery P.O Kozhikkode 673602	9847295537
11.	Gaseen Chalooly Chalooly House Mysoormala post Mukkum Calicut 673602	9746602777
12.	Abdhul Kareem K Krishibhavan Karassery Alli P.O.	8086735591
13.	Jafar K K Agriculture Assistant Krishibhavan Karassery Alli P.O.	9946911702
14.	N K Anwar Nedumkunnath House Karassery , Mukkam	9846569116 0495-2297259
15.	Suneer K Kolarammal House Karassery Post Mukkam Calicut 673602	9605505685 04953131323

Appendix II

Training programme on Cultivation management and utilization of bamboos held at Manthra Anganvadi Karassery on 26th February 2011- List of participants.

Sl. No.	Name & Address
1.	Suhara Karuvotu Kizhakkayil Karassery P.O. karassery
2.	Sujatha V.R Alullakkandy Karassery
3.	Saraswathi A.P Akkarapparambil
4.	Sobhana .M Thaliparambil
5.	Santha K. Korallur
6.	Kanjana E.P Klarikkandy
7.	Sharada T.P Klathingal
8.	Mariyam Kalathingal
9.	Sunutha Kolorammal
10.	Leela Kolorammal
11.	Usha P. Parakkal Kreettippuzha

12. Devakai
Pruadarsini kudumbasree

13. Padmini
Thathamathu
Navamgi Kudumbasree

14. Bindu
Kunnerimmal
Kumaranellur

15. Subaida N.
Puthiyottil
Kumaranellur

16. Jisha
Kareettippuram
Ethirppara

17. Sathi K.P
Kuvvappara

18. Radhamani K.P
Kuvvappara

19. Meenakshi
Kuvvappara

20. Shylaja O.K
Poolamannu
Karassery

21. Thankam Krishnankutty
Edalambat
Krassey

Appendix III

Training programme on Bamboo handicrafts held at Manthra Anganvadi Karassery on March 7, 2012- List of participants.

SIN o.	Name & Address	Phone No.
1.	Vijayalakshmi	8086570300
2.	Uaha K.C	9048673028
3.	Sindu C.V	9142234764
4.	Radhika.P.K	0405-2291303
5.	Shylaja T	0495 3169909
6.	Anitha K	9745164542
7.	Chithra K	9645138290
8.	Thankamani TG	0495 2299168
9.	Ajitha	0495 3293155
10.	Manikkuty M	9539400249
11.	Haiunnisa N	994689 3690
12.	Leela Anand	9846447423
13.	Viji KC	9539301437
14.	Sajitha TP	9388932794
15.	Rasiya EK	9048771860
16.	Sharadha KP	---
17.	Sakuntha M	9946790926
18.	Shylaja KP	---
19.	Girija CT	---
20.	Prameela AC	---
21.	Valsala P	---
22.	Leela Balan	---
23.	Thankam P	---

Appendix –IV

Exposure visit of stakeholders for development of bamboo recourses under NBM- BTSG, KFRI for Karassery Grama Panchayath, 5 July 2008- List of Participants

Sl. No.	Name & Address	Phone No.
1.	V.K. Vinod Sunil nivas Karassery President Karassery Grama Panchayat	9447066570
2.	P.K.C. Mohammed 'Thazhvara' Karassery P.O. 673 602 Chairman Standing Committee	9446434518
3.	Edathil Abdrahiman Kakkad Karassery Panchayath	9745145682
4.	Mini Kannankara Kamenkara House Karassery Grama Panchayath Karassery P.O.	9946277913
5.	Arun Sathyan C.T. Cholayil thodukayil (H) Mukkam P.O. 673 602	9946277913
6.	Hamza Kannattil 'Kinav', Alli P.O. Mukkam,Kozhikkode	9447384952
7.	C.M. Prakasam Chundakkamannil (H) Kumaranaellur P.O. Mukkam.	9349768083
8.	K. Bhaskaran Kolathumkandiyil	2295580

	Kumaranaellur P.O. Mukkam - 673 602	
9.	Rahmathulla P.K. Parassory House Karassery P.O. Mokkam Via 673 602	9895427590
10.	M.P. Moideenkoya Kalathingal House Karassery P.O. Mokkam Via Calicut Dist. 673 602	9946774143
11.	Subaida P Puttiyyolil House Karassery P.O. Mokkam Via Calicut Dist. 673 602	2297571
12.	Ramesh P Tharamanangalath Kumaranaellur P.O. Mukkam. 673 602	9745735543
13.	Abdul Latheef P.K. Palikunnath House Karassery P.O. Mokkam Via	
14.	Mani Devaraj Valappil House Kumaranaellur P.O. Mukkam 673 602	
15.	K.P. Devaki Kuvaparamal House Kumaranaellur P.O. Mukkam. 673 602	9349203832
16.	P.K. Sharadha Member, Karassery Grama Panchayath Parayarukunnath House Alli P.O., Mukkam Via.	944664608

17.	P. Rajan Agriculture Officer Krishi Bhavan Karassery Alli P.O. 673 602	9446374308
18.	Presanna Kumari T.P. Kunneimal House Member, Karassery Grama Panchayath	9947394202
19.	Rajeesh P Poochettiyil Karassery	9447886269
20.	C.K. Moideenkutty Chonakujammal Karassery P.O. Mokkam Via	9446647106
21.	Noushad V.N Noushad Manzil, Kumaranaellur P.O, Mukkam.	9846997196
22.	Noufal K.K. Kambakkodal House Kumaranaellur P.O. Mukkam, Kozhikkode. 673 602	9946632952
23.	Musthafa P Meladath House Chennamangallur P.O. Mukkam, Kozhikkode- 673 602	04952295355 9846017380
24.	M. Padmanabhan Nair Agriculture Assisstant Krishi Bhavan Karassery	04952208875
25.	Vijila Prakashan Chalili House Karassery P.O. Mokkam Via Calicut Dist, 673 602	9388655647

26.	Parvathi P Pulparambil House Thottakkade , Alli P.O, Mokkam Via.	9846674181
27.	P.P Raveendran Saikathan House Karassery P.O., Odatheruvu, 673 602	9446429048
28.	Sathyan Mundayil Karassery P.O, Mokkam Via 673 602	9946632905
29.	Anvar N.K. Nedumkunnath House Karassery Via	9846569116 9447539116
30.	Abdul Salam E.K, B.R.C. Traineer Kunnamangalam	9846201970
31.	Ambika Devi B.D. Vadakkethodikayil House Anayamkunnu	2291034
32.	Asmabi Latheef Palikunnath House, Karassery P.O. Mokkam Via, 673 602	04952291016
33.	Anvino Signi Valappil House, Kumaranaellur P.O. Mukkam, Kozhikkode. 673 602	9947641820 04952299172
34.	Abdul Kareem K Kobakkattu House, Karuvinpoyil P.O. Koduvally Via.	9495862851

Appendix –V

NBM-BTSG Training cum exposure visit to farmers of Karassery Grama Panchayath , July 22-23, 2011

Sl. No.	Name & Address	Phone Mob/ Residence
1.	MA Soudha "Ushas" N Karassery P. O. Karassery	0495-2297932 9495977932
2.	Suhara Karuvotu Kizhakkayil S. Karassery P.O. karassery	0495-2297862 9539316440
3.	M. Mohanan Muthadath P.O. kumaranallur Mukkam	9947859782
4.	Santhadevi Mothadath Kumaranur, Mukkam	9562374600
5.	Reji Sebastian Onattu Chuttathumparambil Panampilavu P.O	9446814377
6.	Rosamma Kuttiakkal Thekkumkutti Alli P.O	9656290567
7.	Usman Pulikkal Vallathaypara Alli p.O Mukkam Via	9947186151
8.	Amina Edathil Edathil House Kakkad Karassery P O	9745096738