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**STRENGTHENING OF BAMBOO PROCESSING COMMON FACILITY CENTRE AT KFRI
PHASE II**

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STRENGTHENING OF BAMBOO PROCESSING COMMON FACILITY CENTRE AT KFRI - PHASE II

(Final Report of Project KFRI RP 712.7/2015)

(Funded by National Bamboo Mission)

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1. OUTLINE OF THE PROJECT PROPOSAL

Code: KFRI RP-712.7/2015

Title: Strengthening of Bamboo Processing Common Facility Centre at KFRI - Phase II

Principal Investigator: Dr. T. K. Dhamodaran

Objectives:

1. To further strengthen the Bamboo Primary Processing Centre (BPPC) established at FRC, Velupadam campus of KFRI with additional machinery required for the manufacture of diverse products from value added raw material employing the mechanical processing facilities established.
2. Introduce Bamboo Seasoning Kiln for the proper drying of bamboo for dimensional stability of products
3. Impart training to bamboo artisans in value addition through state of the art interventions in product design and quality finishing and manufacturing bamboo products with high marketability.

Activities:

- i. Procure and install additional down-stream processing machines such as power operated bamboo Round rod/stick making machine, Stick sizing machine, Stick polishing machine, and an Incense stick making machine all of which will facilitate demonstrations in the use of bamboo for incense sticks.
- ii. Procure and install a Bamboo Mat Weaving machine and Bamboo Seasoning (Drying) system (Kiln) for demonstration and training purpose.
- iii. Conduct training to artisans in the manufacture of diverse bamboo products employing the mechanical processing facilities established

Tenure: 1 Year (17th September 2015 to 16th September 2016)

Budget: Rs. 22.20 Lakhs

Funded by: National Bamboo Mission (NBM)

Outcome:

1. A Training and Demonstration Common Facility Centre (CFC) for mechanized primary and downstream processing of bamboo representing all major processing machineries and equipments will be made available for the traditional bamboo workers and artisans as well as industrial entrepreneurs and for taking up future R & D and Extension projects for promoting the value-added utilization of bamboo for livelihood improvement and industrial sustenance.
2. Capacity building of artisan groups through training in manufacture of value added bamboo products of improved marketability
3. Diversified range of value added quality bamboo products with improved marketability will be available.

2. ACKNOWLEDGEMENTS

The financial support from the National Bamboo Mission is gratefully acknowledged. Sincere thanks are due to Dr. E. M. Muralidharan, NBM Project Coordinator in KFRI for the effective coordination between the various components and investigators of the entire project and to Dr. C. K. Soman, Scientist - In - Charge of the Field Research Centre (FRC), Velupadam of KFRI where the Bamboo Primary Processing Centre facility is established and for the local care taking of the project component activities. Acknowledgements are due to Engr. Jino Johny., Dr. T. M. Ganesh Gopal, and Shri. V. K. Suthesh, Project Fellows of the Wood Science and Technology Division of KFRI for technical and field assistance and coordination. Also acknowledging the then Director, Dr. P. S. Easa and the present Director Dr. Syam Viswanath for their valuable leadership.

Also acknowledging M/s. Garnet Tools, Ujjain for supply and installation of the appropriate plant and machineries for the mechanical processing of local bamboos. Acknowledgements are due to the KFRI Scientists Dr. R. V. Varma (Rtd.) and Dr. K. K. Seethalakshmy (Rtd.), and Dr. V. B. Sreekumar for their valuable inputs in editorial scrutiny of the manuscript.

3. PREFACE

A Bamboo Primary Processing Centre (BPPC) was established in KFRI during 2012-'14 with the Annual Plan Programme support of the National Bamboo Mission (NBM) of the Government of India. Major machineries for the mechanical processing of bamboo were installed during the 1st phase of the project in 2012-'13. This was followed by the addition of some of the important downstream processing machineries and equipments during the 2nd phase of the project in 2013-'14. Facilities for mechanical processing being the basis for quality improvement as well as for mass production for modern industrial/commercial scale operations and sliver based woven basketry mat products and related handicrafts production are found to be the local skills of the traditional artisan community, typical appropriate basic mechanical processing facilities along with pressure treatment and seasoning facilities were made available to the stakeholders/potential entrepreneurs as a Common Facility Centre (CFC) for training and demonstrations. Through the present project, the centre is provided with bamboo kiln drying facility, a mat weaving machine and a full set machineries for demonstrating the potential of bamboo for incense stick manufacture.

The strengthened BPPC is now open to the end use community as a CFC. As an experiment, the centre is in the pipeline of employing the CFC facility the livelihood improvement of the needy local community as well as a self-sustained model enterprise for the promotion of the value added utilization of bamboo clubbed with entrepreneurship development.

Dr. Syam Viswanath
DIRECTOR
KFRI

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5. ABSTRACT

Realizing the situation of non-availability of a common facility centre (CFC) for training and demonstration on value-added utilization bamboo through mechanical processing in the State, a Bamboo Primary Processing Centre (BPPC) was established in the KFRI during 2012-'14 through the financial assistance from the Annual Action Plan Programme of the National Bamboo Mission (NBM). The centre was equipped with all the major machineries for the mechanical primary as well as downstream processing of bamboo. The Centre was further strengthened with more diverse recent machineries such as the power operated bamboo mat weaving machine and model machineries for incense sticks production from bamboo so as to facilitate the conduct of future training and demonstrations and the undertaking of R & D and Extension projects on value-added utilization of bamboo. The Centre was tuned to slowly shift into the mod of a Common Facility Centre (CFC).

Linkages already established with existing local industries and interested NGO groups for running the centre and marketing the products was further strengthened by means of making arrangements for employment generation to the local skilled bamboo artisans by way of extending the services of recognized skilled trainers to the needy bamboo artisan community enterprises. Trainings were given in the design and manufacturing of high quality market demanding trendy bamboo products. The BPPC established is thus further strengthened to a model self-sustainable CFC with the Annual Plan Programme support of the National Bamboo Mission (NBM) of the Government of India. Two training programmes of 2 to 5 days duration were conducted and more than 50 artisans were trained in the manufacture of diverse bamboo products employing the mechanical processing facilities established. All the trainees were exposed thoroughly to the primary and downstream mechanical processing of bamboo and the machineries installed at the CFC. The Centre is designed to be capable for conducting training and demonstrations for strengthening the bamboo utilization sector through the inputs from KFRI as well as for the local livelihood improvement in the bamboo sector as a future model.

6. INTRODUCTION

A Bamboo Primary Processing Centre (BPPC) was established for training and demonstration as well as entrepreneurship development in bamboo sector in the Field Research Centre (FRC) campus of KFRI at Velupadam during 2012-'14 with the initially identified appropriate mechanical processing facilities (power operated cross cutting, external knot removal - cum - skin removal, hydraulic splitting, internal knot removal - cum - skin removal, heavy duty slicing, and fine/thin slivering machine; and manual machines for square stick making, thin slicing/slivering, and sliver thickness finishing machines) along with the later incorporated downstream processing facilities for commercial scale pressure treatment of bamboo, bamboo curtain blind making machine, and a Laser Engraving Machine for souvenir works (Dhamodaran *et. al.* 2019 a & b).

The need of proper space was felt as the immediate concern to properly house the major machineries procured under a single roof, for convenience of efficient usage and management as a single unit. A new work shed of an approximate area of 1500 sq. ft. was planned to develop.

Considering the scope of expansion of the BPPC established for future purposes on training and demonstrations in the remaining fields of value-added utilization of bamboo, it was further planned to strengthen the centre again in terms of other diverse down-stream processing facilities too including a dry kiln for bamboo seasoning (drying), a bamboo mat weaving machine and machineries for the production of incense sticks from bamboo for providing training and demonstrations to the needy stakeholder community and to undertake future R & D as well as Extension Projects in value-added utilization bamboo.

As far as the traditional local skill of bamboo working communities are concerned, mat weaving (especially, by the major strength of women members of the socially backward communities) falls in the first position. The Kerala State Bamboo Corporation (KSBC) is the giant industrial consumer of hand woven bamboo mats made by the local bamboo working communities, for the production of bamboo ply boards. Thus any attempts to promote the production of mats from the mechanically produced slivers necessitate training to such groups on the use of mechanical processing machines. The next right step could be to familiarize them with the use of power operated mat weaving machines and hence, it was planned to procure and install one bamboo mat weaving machine too.

Sensitization Programmes, skill development programmes (SDPs) and Specific product oriented SDPs of various durations were planned for training the entrepreneurs.

7. ACTIVITIES

A new work shed of approximate area of 1500 sq. ft. was planned to establish for properly housing the machineries and equipments. Procedural formalities were completed for identifying the Architectural consultant - cum - builder and the building and the civil work contract was awarded to the selected firm.

The locality where the Bamboo Primary Processing Centre (BPPC) is established had a good population of was found enriched with the traditional bamboo artisan community, 'Sambavas', skilled in bamboo mat weaving; in order to demonstrate the capability of using slivers produced by mechanical processing machine in the manufacture of woven mats mechanically, a **bamboo mat weaving machine** (*Garnet* brand) was procured and installed (Fig. 1). Trial runs for mat production were conducted successfully.



(Fig. 1)

A *GARNET* brand bamboo drying (seasoning) kiln was procured and installed (Fig 2). Trial runs on the drying of bamboo were conducted successfully.



(Fig. 2)

Four *GARNET* brand machineries, viz., Bamboo Round Rod/stick making machine (Fig. 3), Stick polishing machine (Fig. 4), Stick sizing machine (Fig. 5), and Incense stick making machine (Fig. 6) were procured and installed; conducted trial run and successfully demonstrated the potential of bamboo for incense stick manufacture.

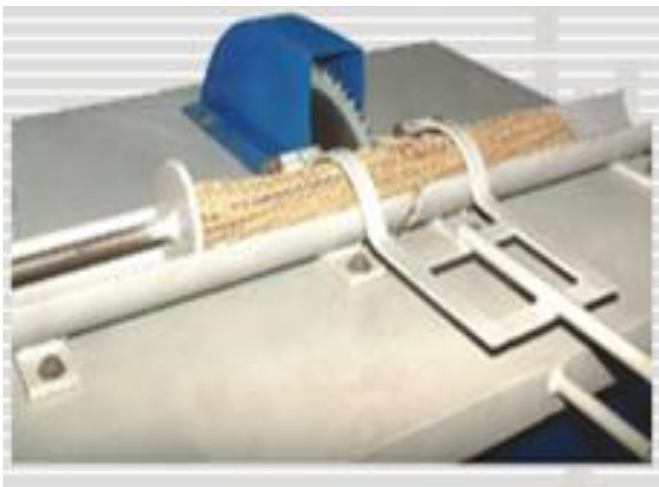
Photographs of Bamboo Incense Stick Making Machines



(Fig. 3)



(Fig. 4)



(Fig. 5)



(Fig. 6)

As part of training and demonstration of the facilities established, sensitization programmes were planned, followed by skill development programmes (SDPs) of 2 to 5 days duration.

8. ACHIEVEMENTS

- The Bamboo Processing Centre building of an approximate area of 1500 sq. ft. was constructed as per the plan and estimate prepared by the Identified architect - builder firm, M/s. HABITAT TECHNOLOGIES, Thiruvananthapuram, Kerala, to house the bamboo mechanical processing machineries in an ambient proper spacing. The civil construction work was completed and started the functioning the Centre by mid-2015 (Fig. 7 & 8).



(Fig. 7)



(Fig. 8)

- Bamboo mats were made successfully by employing the mechanical mat weaving machine installed (see Fig. 1 & Fig. 9).



(Fig. 9)

- Round and split bamboos were seasoned (dried) by employing the bamboo drying kiln established (see Fig. 2)

- The Bamboo Round Rod making machine was tested satisfactorily for its potential for the production of rods for incense sticks manufacture (see Fig. 3 & Fig. 10).



(Fig. 10)

- The stick polishing machine was tested against polishing the sticks produced by way of removing the dust and irrational surfaces by friction (see Fig. 4).

- The stick sizing machine was tested for edge sizing the polished sticks (see Fig. 5 & 11).



(Fig. 11)

- Incense sticks were made employing the Incense stick making machine (see Fig 6 & 12)



(Fig. 12)

- Through sensitization programmes followed by Skill Development Programmes, training and demonstrations were provided to a total of about 54 entrepreneurs; all of them were thoroughly exposed to all the mechanical processing facilities installed. Special emphasis was given to demonstrate the bamboo mat weaving machine to potential entrepreneurs.

9. SUMMARY

The Bamboo Primary Processing Centre (BPPC) established at the Field Research Centre (FRC) of KFRI at its Veluppadam campus was strengthened by providing bamboo seasoning (drying) facility and a mat weaving machine. A full set of machines for demonstrating the potential of bamboo for incense stick production was also added. The machineries were accommodated in a new work shed of an approximate area of 1500 sq. ft. Trial productions were made successfully and the Centre was commissioned. Arrangements were also in pipeline for the sustainable operation (training & demonstrations) of the Centre for motivation of entrepreneurs. Training was provided to more than 50 entrepreneurs on mechanical processing of bamboo for the manufacture of value-added products, with special emphasis to demonstrate the potential of bamboo mat weaving machine.

10. REFERENCES CITED

- Dhamodaran, T. K. Muralidharan, E. M., Raveendran, V. P. and Soman, C. K. 2019. Establishment of a centre for primary processing of bamboo at KFRI. Final Report of a Project (KFRI RP 647.6/2012) supported by National Bamboo Mission, GOI. Kerala Forest Research Institute, Peechi - 680 653, Kerala, India. 18 pp.
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11. APPENDICES

11.1. Appendix. I. Description of the Bamboo Downstream Processing Machines Installed

- **Bamboo Stick Making Machine** is designed to make round, oval, semi-circle, square or triangle sticks from the bamboo slices. The sticks made are ready to be used to make incense sticks, toothpicks, mats, carpets, curtains, handicraft items, etc. The machine uses special carbide tipped stick making cutter set for the operation. By changing the cutter-set bamboo sticks with round, oval, semi-circle, square or triangle cross-sections can be made. Size of the sticks that can be made by this machine ranges between 1.5 mm to 6 mm. Dimension of the machine is 1.5m × 1m × 1.2m. Power consumption required is 9 HP, 3 phase.
- **Bamboo Incense Stick Sizing Machine** is employed for mass edge sizing of the bamboo sticks made. A circular saw is used to finish the edges of the sticks and makes them of uniform size. There is a clamp with a handle which holds the sticks together and the cutting operation is carried out safely. Maximum height of lump that can be cut is 100 mm. Dimension of the machine is 1.2m × 1m × 1.2m. Power consumption of this machine is 2.25 KW, 3 HP.
- **Bamboo Stick Polishing Machine** is employed for polishing by the friction generated between the sticks with the reciprocating motion of the machine. The bamboo dust and loose fibers are thus removed and a smooth finish is obtained without wasting any material. These sticks are used for various applications such as making incense sticks, mats, toothpicks, handicraft items, etc. Power consumption of this machine is 2.25 KW, 3 HP; 3 phase. Dimension of the machine is 2.5m × 1.4m × 1.2m. Maximum length of sticks that can be achieved is 0.6 m.
- **Bamboo Incense Stick Making Machine** is used to bind the incense material in the sticks already produced. It is a semiautomatic machine. The round sticks of approximately 1.5 mm diameter are fed manually. The incense powder mixed with water from the top container sticks around the sticks to form incense stick. Only semiskilled labor is required. 40 - 50 sticks can be made per minute. Dimension of the machine is 1.5m × 1m × 1.2m Power consumption of this machine is 1 HP.
- **Bamboo Mat Weaving Machine** is a semi-automatic one, used to weave mats mechanically out of the bamboo slivers produced mechanically. These mats could be used for making bamboo ply boards. This machine is designed for making use of thick as well as thin slivers. Maximum width of the mat that can be made is 1.22 m in the present machine. Dimension of the machine is 2.2m × 1.2m × 1.2m; power consumption is 0.75 KW, 1 HP.
- **The Bamboo Dry (Seasoning) Kiln** is basically a dehumidifier type dry kiln that can be employed for the drying of round or split bamboo. Dehumidifier drying reduces the risk of developing drying defects. Dimensions of the kiln are 5 × 3 × 3 m and power consumption is 12 HP, 9 KW; 3 phase.

11.2. Appendix II. List of Trainings Conducted

Sl. No.	Training Details	Date	No. of Trainees	Remarks
1	2 Days Motivation/Sensitization - cum - Product Specific Skill Development Programme & 'World Bamboo Day Celebrations 2015' & Initiating Bamboo Cluster Development Activities	17-18 Sept. '15	28	Mrs. Dhayabhai addressed the gathering on the occasion of the World Bamboo Day on 17 Oct. 2015. An additional Training on Bamboo Lamp shade Making was also provided <i>Trainer:</i> Smt. Jameela, URUVU, Wayanadu. Ph: 9747749510.
2	5 Days Skill Development Programme	14-18 March '16	26	The products to be trained are categorized into three, which were: Handicrafts, Woven Products, and Bamboo Ornaments. There were three Trainers for handling the training from Uravu, Wayanad, recognized by NABM and KSBC. Training was given on the value-added production of about 15 products. <u>Trainers:</u> Mr. Rakesh (Ph: 9947874834), Mrs. Shailaja (Ph: 9526184763) & Mrs. Jameela (Ph: 9747749510) from M/s. URUVU, Wayanadu & Mrs. Kavitha Benny (Ph: 9495240567), Haritham Art & Crafts, Wayanad. Special demonstrations on the bamboo mechanical processing machineries installed in the CFC were provided to the participants. The potential of bamboo mat weaving machine was high-lightened.
		<i>Total:</i>	54	

11.3. Appendix III. Details of Machines installed & Suppliers

Sl. No.	Machine	Details of Supplier	Cost* (Rs. In Lakh) (in 2014)
1	Bamboo Round Rod/Stick Making Machine Model No. 259, <i>GARNET</i> Brand	M/s. Garnet Tools 2-D, Industrial Area Ujjain Road, Dewas Madhya Pradesh - Pin: 455 001 Ph:07272 228719 E-Mail: info@garnetindia.com www.garnetindia.com	1.98
2	Bamboo Stick Sizing Machine, Model 260, <i>Garnet Brand</i>		0.45
3	Bamboo Stick Polishing Machine, Model No. 270, <i>Garnet Brand</i>		0.45
4	Bamboo Incense Stick Making Machine, Model No. 346, <i>Garnet Brand</i>		1.10
5	Bamboo Mat Weaving Machine, Model No. 287, <i>Garnet Brand</i>		2.25
6	Bamboo Drying (Seasoning) System, Model No. 267, <i>Garnet Brand</i>		8.95

*Cost excluding packing, forwarding, insurance, transportation, installation, trial runs & commissioning charges

11.4. Appendix IV. Photographs of Training Activities

Skill Development Programme, 16-18 March 2016 & Products Developed



Design Developments - Bamboo Ornaments Developed



Two Days' Motivation/Sensitization - cum - Skill Development Programme & 'World Bamboo Day Celebration 2015' & "Bamboo Cluster Development Activities"



Smt. Dayabai addressing the participants in presence of the Thrissur DIC GM Dr. Kripakumar



Dr. T. K. Dhamodaran, Chief Scientist (Wood Science and Technology), KFRDI & the Project PI addressing the participants