ESTABLISHMENT OF A CENTRE FOR PRIMARY PROCESSING OF BAMBOO AT KFRI

T. K. DHAMODARAN
V. P. Raveendran
C. K. Soman
E. M. Muralidharan

KSCSTE - KERALA FOREST RESEARCH INSTITUTE
Peechi – 680 653,
Thrissur, Kerala
India

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(Final Report of Project KFRI RP 647.6/2012)

(Project funded by National Bamboo Mission)

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1. OUTLINE OF THE PROJECT PROPOSAL

Code: KFRI RP-647.6/2012

Tile: Establishment of a Centre for Primary Processing of Bamboo at KFRI

Principal Investigator: Dr. T. K. Dhamodaran
Associate Investigators: Dr. E. M. Muralidharan, Mr. V. P. Raveendran & Dr. C. K. Soman

Objective: To establish a centre for value-added mechanical primary processing of bamboo at KFRI
Activities:

      i. Construct a work shed to house the bamboo mechanical processing machineries

      ii. Identify, procure, and install appropriate machineries for the mechanical processing of Bamboo and conduct trial runs.

Tenure: 1 Year (2013 April – 2014 March)

Budget: Rs. 20 Lakhs

Funded by: National Bamboo Mission (NBM)

2. ACKNOWLEDGEMENTS

3. PREFACE

Although KFRI has done considerable research inputs in the bamboo sector during the last few decades, majority of activities were limited to its biology side. Realizing the gap on appropriate up to date technologies on value added utilization of this precious resource on environmental terms, the Institute desired to establish a centre for the primary processing of bamboo. The timely support of the National Bamboo Mission (NBM) of the Govt. of India materialized our dream to establish a center with the available mechanical processing facilities for the value added utilization of bamboo for the benefit of the local marginalized traditional bamboo artisan communities as well as modern industrial entrepreneurs in the bamboo sector. The facilities established under the single roof welcomes all interest groups for training and demonstrations.

Dr. Syam Viswanath
DIRECTOR
KFRI

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5. ABSTRACT

The traditional bamboo utilization industry in the Kerala State being limited to highly unorganized/weaker sector, was found experiencing extreme difficulties in availing the technological developments in the field. Recent invasion of plastic materials caused an evasion of the skilled local traditional bamboo artisan community from the precious eco-friendly livelihood material, bamboo, due to reasons of un-sustainable livelihood. Promotion of bamboo industry is found in question due to the above same reason. As introduction of value addition technology by mechanical processing seems to be the only remedy, an attempt was planned to establish a model bamboo primary processing centre (BPPC) for organizing future R & D works as well as for training and demonstrations for the sustainable development of bamboo utilization sector in the State. As a beginning, it was proposed to establish a model Bamboo Primary Processing Centre in KFRI with all the major mechanical processing facilities. As was found evident from a preliminary informal survey on the traditional skills and industrial product orientation of the location (the Field Research Centre – FRC - Veluppadaam campus of KFRI), production of bamboo slivers and woven mat products were found the traditional areas of skill, appropriate basic machineries suitable for the primary processing of bamboo for the production of slivers required for woven mat production were procured; they were: bamboo cross cutting machine, external knot removal – cum – skin removal machine, hydraulic splitting machine, internal knot removal – cum – skin removal machine, heavy duty slicing machine, and fine/thin slivering machine. The machines were appropriated for use with the local species, the machineries were installed and conducted trial runs successfully. The Bamboo Processing Centre is established as a means of reviving traditional bamboo sector by demonstrating the benefits of mechanized processing of bamboo as well as to motivate modern industrial entrepreneurs interested in bamboo as an eco-friendly industrial raw material. The centre is designed to be capable for undertaking future R & D works along with training and demonstrations required for strengthening the bamboo utilization sector through the inputs from the Institute as well as for the local livelihood improvement in bamboo sector as a future model.

Key words: Value-added utilization of bamboo, Mechanical processing of bamboo, Bamboo livelihood improvement, Bamboo industrial sustenance.

6. INTRODUCTION

The Kerala Forest Research Institute (KFRI) was instrumental since last two decades in laying down a foundation for a modern bamboo economy in the State with input from science, technology, people's participation, industrial application and strong linkage with market capable of meeting global competition. Traditional and marginalized bamboo worker's *per capita* income reported for Kerala was as low as Rs. 20/- (Seethalakshmi *et al*. 2013); bamboo growers were unaware of the potential of scientific methods of management and harvesting and value addition of bamboo for their better livelihood and there were no agency to educate and train them. It was in this context, KFRI undertook several programmes in this line, supported by agencies like IDRC, INBAR, DC (Handicrafts) of GOI, etc. In 2012, KFRI has completed a project for 'livelihood improvement of marginal bamboo dependants, artisans and farmers of selected clusters in Kerala'. Through this project supported by the Plan Funds of KFRI, a team of expert scientists from KFRI and master trainers from the bamboo sector made a scientific intervention in the traditional product manufacturing sector; identified suitable species for cultivation in the region, distributed planting stock to farmers, given training for establishing bamboo plantations. Training was given to bamboo artisans on designing, value addition (preservative treatment), mechanical processing, etc. Realizing the prevailing situation in bamboo utilization in Kerala, In the National Bamboo Mission (NBM) in its Action Plan for the Bamboo Technology Support Group (BTSG) established for the South Zone in KFRI, a component was envisaged to establish a Bamboo Primary Processing Centre (BPPC) in KFRI. Considering the existing low level of awareness in the mechanical processing of bamboo for its value-added utilization in Kerala, to reveal its scope among the traditional marginalized bamboo working backward communities for their livelihood improvement and among potential bamboo-based industrial entrepreneurs, it was planned to utilize the fund available to introduce bamboo processing machineries in the proposed BPPC.

7. ACTIVITIES

The Field Research Centre (FRC) of KFRI at Veluppadam, Thrissur District, Kerala was identified as the location to establish a Bamboo Primary Processing Centre (BPPC). The proximity of the FRC and the bambusetum established there and the occurrence of a marginalized traditional bamboo working backward community (*'Sambavas'*) there, are the other criteria considered for selecting this location to establish the BPPC.

A preliminary informal survey among the *Sambava* community in the area was conducted to assess their bamboo working skills, livelihood situation and scope of establishing the proposed BPPC in improving their livelihood through value-added utilization of their livelihood material, bamboo. This could lead in setting the sub-targets in introducing the type of bamboo mechanical processing machineries and their selection.

Another informal survey on the existing bamboo based industries and bamboo consuming public sector undertakings in the locality helped significantly in identifying and developing the potential linkages for production and marketing of the products that could emerge from the proposed BPPC and also to develop appropriate strategies for the sustainable operation of the enterprise that is going to be established.

Group work, Survey, observation, motivation classes, periodic monitoring and evaluation of the feedback received from the community, etc., were used as tools for achieving the target of utilizing the BPPC for the livelihood betterment of the marginalized bamboo working community of the locality.

The KFRI-BTSG Scientists' group meetings were conducted for arriving at conclusions for deciding the bamboo products target and for identifying and selecting the first stage introduction of the bamboo processing machineries in the proposed BPPC establishment. Accordingly 6 preliminary machineries - bamboo cross cutting machine, external knot removal – cum – skin removal machine, hydraulic splitting machine, internal knot removal – cum – skin removal machine, heavy duty slicing machine, and fine/thin slivering machine were identified. Procurement formalities were completed and purchased one number each of the above machineries of *GARNET* brand and installed in the BPPC. Along with the power operated machine set one number each of low cost manual operating sliver width sizing machine, square stick making machine, slicing machine and sliver thickness finishing machine was also acquired for the benefit of demonstrations to low-end traditional rural bamboo artisan entrepreneurs.

Trial runs of the bamboo processing machines were conducted successfully. The centre is open for training and demonstrations to artisans, interested skill groups and NGOs for the promotion of the value-added utilization of bamboo for livelihood substance of the traditional artisan communities as well as to modern industrial entrepreneurs.

8. ACHIEVEMENTS

- The survey among the marginalized bamboo working communities of the Veluppadam area revealed that the *Sambava* community at Veluppadam had the traditional skill in bamboo mat weaving and producing bamboo mat based products; however, the prevailing socio-economic situation of the invasion of plastic materials inhibited them from continuously using bamboo as their livelihood material employing the traditional craft skill. It was convinced that introduction of value-addition techniques and mechanical processing facilities can bring back their livelihood through improved utilization of bamboo.

- An informal survey on major industrial bamboo products manufacturing units in the locality revealed that bamboo curtain blind is the major end product in many established units. As this requires bamboo or reed in the form of slivers as raw material, it was felt that identification of appropriate basic machineries required for sliver production could be the right beginning. Accordingly six preliminary power operating machineries were identified within the allotted budget. They were: Bamboo cross cutting machine, External knot removal – cum – skin removal machine, hydraulic splitting machine, internal knot removal – cum – skin removal machine, heavy duty slicing machine, and fine/thin slivering machine. Obliging the due procurement formalities existing, purchased one number each of the above machineries of GARNET brand along with the manual machineries wherever available. Installed the machineries (*see* Appendix I, II & III) in a temporary shed available by making it appropriated by slight civil modification works (Fig. 1). Trial runs for the production of bamboo slivers were made successfully. The BPPC is opened for future use (training & demonstrations to traditional bamboo artisans and industrial entrepreneurs/interested NGO groups. The BPPC is proposed to upgrade into a strengthened self-sustainable bamboo common facility centre (CFC) through the NBM-KFRI Action Plan for 2014-'15.

- For the benefit of demonstrations to low-end traditional rural bamboo artisan entrepreneurs, along with the power operated machine set one number each of low cost manual operating sliver width sizing machine, square stick making machine, slicing machine and sliver thickness finishing machine was also acquired (Appendix I).

Fig. 1. Photograph of the modified work shed

9. SUMMARY

The proposed Bamboo Primary Processing Centre (BPPC) was established at the Field Research Centre (FRC) of KFRI at its Veluppadam campus in an already existing work shed appropriated for the purpose. Based on surveys on the local skills and the nature of existing industrial units on bamboo products, mechanical processing facilities for sliver production was identified as a priority area and six appropriated bamboo mechanical processing machineries *viz.,* bamboo cross cutting machine, external knot removal – cum – skin removal machine, hydraulic splitting machine, internal knot removal – cum – skin removal machine, heavy duty slicing machine, and fine/thin slivering machine (one in each type) of *'Garnet'* brand were procured, installed and trial runs were conducted successfully along with a few hand operated basic machines for the above purpose. The Centre is open for use in R & D as well as for training, extension and demonstration activities on mechanical processing of bamboo. The total cost for establishing the machineries was about 5.12 Lakhs in 2014.

10. REFERENCE CITED

Seethalakshmi, K. K., Sankar, S., Muralidharan, E. M., Dhamodaran, T. K. and Raveendran, V. P. 2013. Livelihood improvement of marginal bamboo dependents: Artisans and farmers of selected clusters. KFRI Research Report No. 456. Kerala Forest Research Institute, Peechi – 680 653, Kerala, India. 46 pp.

11. APPENDICES

11.1. Appendix. I. Description of the Bamboo Mechanical Processing Machineries Installed

Power operated machines

1. *Bamboo Cross-cutting Machine*

This machine is used for cross cutting bamboo. The cutting is done by a circular saw unit. Bamboo culms of up to 20 cm diameter can be cut using this machine. Angular cut can also be done by rotating the vice. There is a mechanism in the machine by which the desired length of bamboo to be cross-cut can be preset. Power requirement 2 HP; 3 phase. The motor RPM is 1440.
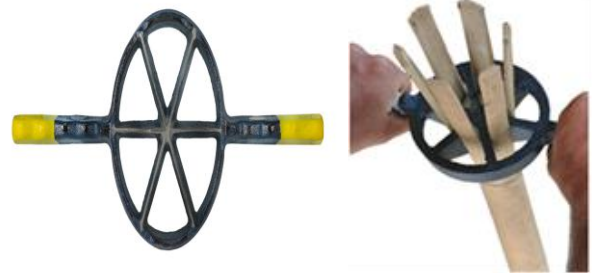

2. *External Knot Removal Machine*
External knots of cylindrical as well as split bamboo pieces can be removed using this machine. The skin at the nodal region also can be removed using this machine. The machine uses specially designed carbide tipped external knot removing cutter. The cutter is dynamically balanced and is suitable for all sizes of bamboo, i.e. up to 200 mm. Power consumption of this machine is 2.25 KW or 3 HP; 3 phase and the spindle speed is 2800 rpm.

3. Hydraulic Splitting Machine

This Hydraulic splitting machine is used to split bamboo culms of up to 6.5 feet length. A ring shaped tool with splitting blades is used as the tool for splitting. Splitting tools are available with blades placed at different interspace. We need to replace the splitting tool according to the required number of splits and diameter of the bamboo used. The piston of the splitting machine pushes the bamboo through the splitting tool to split the bamboo. Since it is a hydraulically operated machine, even bamboo with thicker nodes can be split easily. Adequate personal care should be taken during the operation of the machine to prevent accidents and injury, as it works with great force. The number of splits can be varied by varying the splitting blade. Chain splitters with varying splitting lengths are also available in the market

4. Internal Knot cum Skin Removal Machine

Internal knots and skin of split bamboo pieces are removed using this machine. A slicing knife mounted in the machine horizontally removes the skin and a carbide tipped cutting wheel with a tip width of 40 mm removes the internal knot. In the process of cleaning the upper and the lower skin; the output attains a flat surface on both the sides. This helps in further processing of the splits. Maximum width of bamboo splits that can be fed is 40 mm and maximum amount of material that can be removed is 10 mm. Power consumption of this machine is 3.75 KW or 5 HP; 3 phase.

5. Thick Slivering/Heavy duty slicing machine

Thick slivers of reed and bamboo and reed for making blinds, round sticks, thick mats, trays, etc. can be made using this machine. The slivers used for weaving mats are produced in this machine. A set of rollers pushes the split bamboo towards the slicing blade to make the slivers. The slicing blade mounted horizontally can be moved up and down to adjust the sliver thickness. Slivers of 3 mm to 10 mm thickness can be made by this machine. Power consumption is 1.5 HP 3 phase.

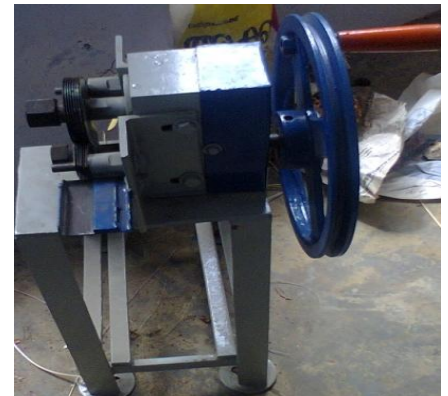

6. Thin Slivering machine

The thin slivers used for weaving fine mats, handicrafts, baskets, etc. can be made using this machine. This machine is mainly used for making reed slivers. Split reed internode pieces with a maximum 10 mm thickness can be sliced in this machine. A set of rollers pushes the split bamboo towards the slicing blade to make the slivers. The slicing blade mounted horizontally can be moved up and down to adjust the sliver thickness. Thin slivers about 0.6-0.8 mm thickness can be made by this machine. Power consumption is 1 HP single phase.

Manually Operating Machines (GARNET Brand)

i. *Square stick making machine*

Bamboo square sticks of 1.5 mm cross section can be made suing this machine. Split reed slivers of 1.5 mm to 2 mm can be fed to this machine. A set of blades placed at 1.5 mm gab splits the sliver into square sticks. The sticks made by this machine can be used for incense sticks, decorative items, etc. The blade sets of the machine can be replaced for varying stick cross sections.

ii. *Thin Slicing/Slivering machine*

Split reed internode pieces with a maximum 10 mm thickness can be sliced in this machine. Thin slivers about 0.6-0.8 mm thickness can be made by this machine. The thin slivers used for weaving fine mats, handicrafts, baskets, etc. can be made using this machine.

iii. *Sliver thickness finishing machine*

It enables to shave bamboo strips to uniform thickness with smooth finish. An eccentric roller enables the thickness quickly. A wing- nut has been introduced for easy loosening and tightening. A vertical line printed on the machines helps for zero adjustment of the blade.

iv. *Sliver Width Sizing Machine*

Bamboo strips can be sized to uniform width. To cutting blade fixed on metal blocks move on a screw. Screw is threaded with opposing screw thread angles on either side. A bottom groove above the blocks on the surface of the main body has been introduced to guide the blocks. Blocks are also spring loaded to ensure firm movement of the blocks without lateral shake. The body is cast in aluminium alloy. Blades are made of hardened strings steel. Width sizer can be fixed with to screws on any wooden surface.

11.2. Appendix. II. Details of Machines installed & Suppliers

Sl. No.	Machine	Details of Supplier	Cost* (Rs. In Lakh) (in 2014)
	Power Operated Machines		
1	Bamboo Cross-Cutting Machine		0.17
2	External Knot Removal Machine		0.37
3	Hydraulic Splitting Machine		1.98
4	Internal Knot cum Skin Removal Machine	M/s. Garnet Tools 2-D, Industrial Area Ujjain Road, Dewas Madhya Pradesh – 455 001 Ph:07272 228719 Mobile; 9827333191 E-Mail: info@garnetindia.com Web:<www.garnetindia.com>	1.47
5	Thick Slivering/Heavy Duty Slicing Machine		0.74
6	Thin Slivering machine		0.21
	Manual Machines		
7	Sliver Width Sizing Machine		0.0075
8	Sliver Thickness Finishing Machine		0.0075
9	Square Stick Making Machine		0.0850
10	Thin Slicing/Slivering Machine		0.0750
		Total Cost	5.1150

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

11.3. Appendix III. Photographs of Machines in Operation
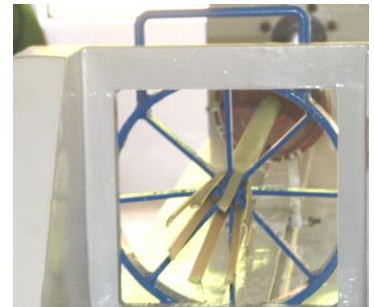
Bamboo cross cutting machine in operation

Different views of the External knot removal machine

Hydraulic splitting machine & parts

Internal knot removal – cum- skin removal machine

Thick slivering/Heavy duty slicing machine

Thin slivering machine & slivers produced

Workers & Supervisors

Sliver Production

Sliver-based woven mat basketry products