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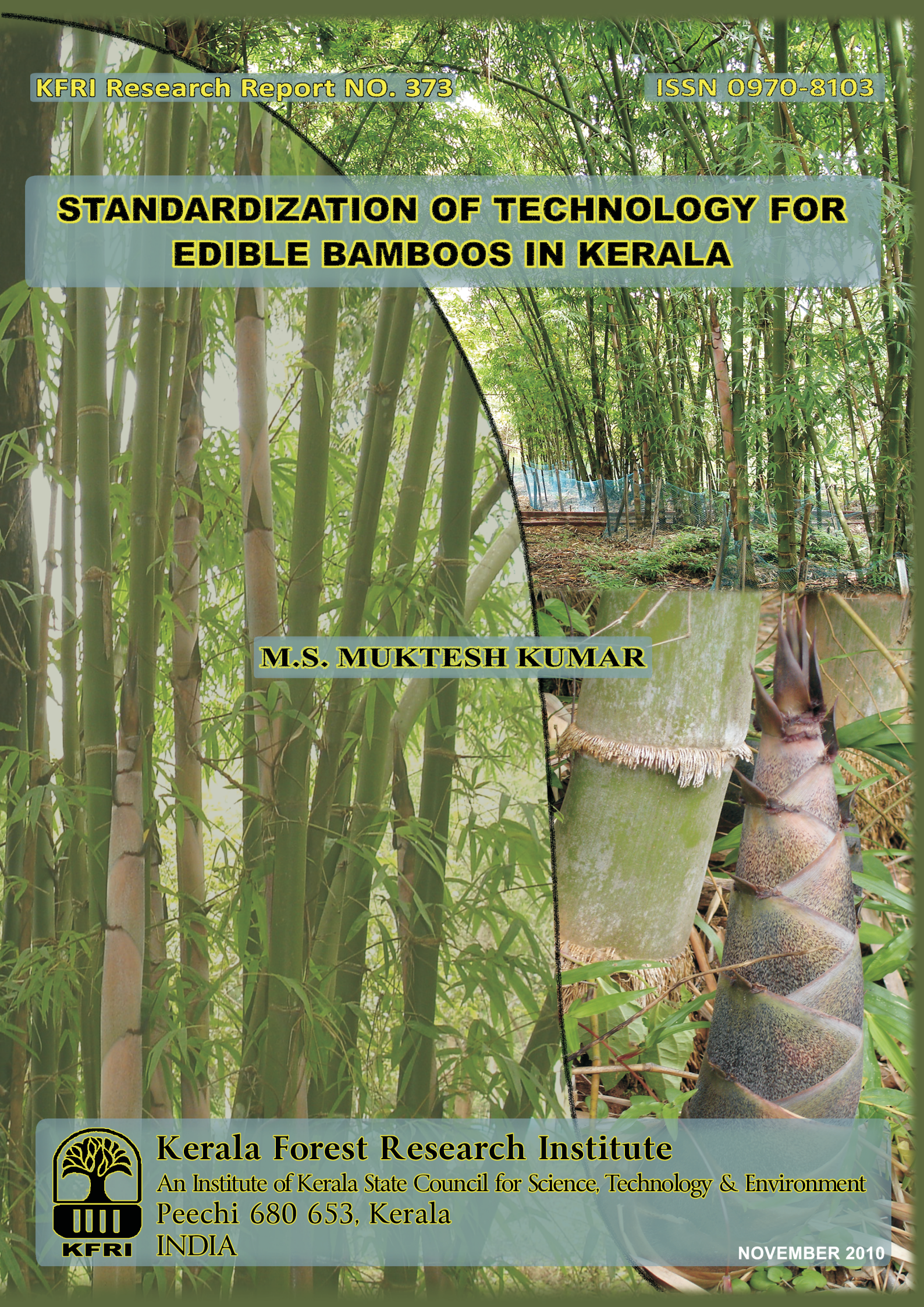
STANDARDIZATION OF TECHNOLOGY FOR EDIBLE BAMBOOS IN KERALA



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INDIA

NOVEMBER 2010

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Standardization of technology for edible bamboos in Kerala

Final report of the Research Project No. KFRI 395/2003

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NOVEMBER 2010

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PROJECT PROPOSAL

Project code	:	KFRI 395/2003
Project Title	:	Standardization of technology for edible bamboos in Kerala
Investigator(s)	:	M. S. Muktesh Kumar Forest Botany Department, Forest Ecology and Biodiversity Conservation Division

Objectives

1. Study the feasibility of production of edible bamboo shoot for commercialization; standardize post- harvest techniques like handling and processing
2. To provide training for farmers and people in harvesting, processing, canning techniques for commercialization of bamboo shoots

Project period	:	April 2003 to March 2005 (extended up to September 2006)
Funding agency	:	KFRI Plan Grant

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ABSTRACT

The multifarious uses of bamboo that contribute to the income of the rural people throughout the world, especially in tropics are well known. Bamboo shoot production is one of the major sources of income for farmers in China, Thailand, Japan, Philippines, Laos and Korea. Bamboo shoot industry is thriving well and fast expanding in Asian countries. In Kerala nine species are known to be edible. *Bambusa bambos* and *Dendrocalamus strictus* are widely used in the northern part of Kerala. Other species such as *Bambusa balcooa*, *B. polymorpha*, *B. tulda*, *Dendrocalamus asper*, *D. brandisii*, *D. giganteus*, *D. hamiltonii* and *D. longispathus* are cultivated in farm lands.

Mostly the tribal communities in Kerala utilize bamboo shoot. Though usage of bamboo shoot in urban areas, especially in Chinese food is gaining popularity, all the demand is met through canned products from North Eastern states. The bamboo shoots based food industry is thriving and fast expanding in the Asian countries.

Bamboo shoots are rich in vitamins, cellulose and amino acids. At harvest, a shoot may contain as much as 90 percent water. The edible content is only about 50 percent. Shoots have a high nutritive value and low fat content and a good fiber source. Nutritional studies on edible bamboo have indicated that it is a good source of food energy. Bamboo shoot contains protein, fiber, minerals like potassium, calcium, phosphorous, ascorbic acid, and tryptophan, besides fat and carbohydrates.

The present study has indicated that bamboo shoot farming has immense potential in Kerala. This can provide job opportunities to women and additional income to farmers/entrepreneurs who take up bamboo shoot production. Popularization of bamboo shoots as food and their commercial production for local market need to be encouraged. An industry based on edible bamboo shoot production definitely has a great potential as an emerging rural industry.

INTRODUCTION

The multifarious uses of bamboo that contribute to the income of the rural people throughout the world, especially in tropics are well known. Bamboo shoot production is one of the major sources of income for farmers in China, Thailand, Japan, Philippines, Laos and Korea. Bamboo shoot industry is thriving well and fast expanding in Asian countries. The edible bamboo shoot production generates good income to the growers. The young shoots of 20 species of bamboos are known to be edible (Kumar, 2005a; 2005b; 2009), in India. In the North Eastern states over seven species of bamboos are used for edible purposes. In Manipur 20 to 30 metric tones of bamboo shoots are consumed annually for the production of canned bamboo shoots (Department of Commerce and Industries, Government of Manipur, Imphal, 2002). Tamang and Tamang (2009) reported that annually, 26.2 tonnes, 435 tonnes and 426.8 tonnes of bamboo shoots are harvested in the States of Sikkim, Meghalaya and Missoram, respectively. The edible species are not raised exclusively for shoot production. People presently collect the shoots from the forests for their personal use in a very small quantity. The demand for bamboo shoot as an ingredient in South East Asian and Chinese cuisine is very high. Bamboo shoot has been absorbed into traditional Indian cuisine quite naturally in areas where it is easily available. Considerable amount of natural bamboo is available particularly in North Eastern India and the Western Ghats of Southern India.

In Kerala nine species are known to be edible. *Bambusa bambos* and *Dendrocalamus strictus* are widely used in the northern part of Kerala. Other species such as *Bambusa balcooa*, *B. polymorpha*, *B. tulda*, *Dendrocalamus asper*, *D. brandisii*, *D. giganteus*, *D. hamiltonii* and *D. longispathus* are cultivated in farm lands.

Mostly the tribal communities in Kerala utilize bamboo shoot. Though usage of bamboo shoot in urban areas, especially in Chinese food is gaining popularity, all the demand is met through canned products from North Eastern states.

During the past few years, KFRI has initiated studies on edible bamboos and has identified the edible bamboo species possible to be grown in Kerala. Their propagation methods and silvicultural requirements have been standardized. It was with this background this project was undertaken. The bamboo shoot processing methods and the techno-economic viability of such units in the Kerala region is focused in the present study.

The prime objectives of the project were to:

- Study the feasibility of production of edible bamboo shoot for commercialization; standardize post- harvest techniques like handling and processing.

- To provide training for farmers and people in harvesting, processing, canning techniques for commercialization of bamboo shoots.

REVIEW OF LITERATURE

The bamboo shoot based food industry is thriving and fast expanding in the Asian countries. Bamboo farming for edible shoot production is well established in China, Japan, Korea, Philippines, Taiwan and Thailand. There is well-developed market in many countries for marketing and sale of bamboo shoots. The edible shoot production per hectare has been estimated to be 10-20 tonnes in Japan. From the world market Japan is importing more than 70% of steamed bamboo shoots, the remaining 30% is imported by Denmark, Germany, Hong Kong, Saudi Arabia, U S and other countries (Potharam and Panchatri, 1985). In Thailand 90 bamboo shoot based industries exist in Zhejiang provenance (Thammincha, 1988). India is one of the leading countries in the world, second to China, in bamboo production with 32.3 million tonne/year (Pathak, 1989). About 10 tonnes in Korea and 15-30 tonnes in China (Hegde, 1990). The market price of bamboo shoots during off season has higher cash value than rice (Tewari, 1993).

More than 20 bamboo species occurring in India yield edible shoots, some are reputed for their high quality. Unfortunately, the edible properties of bamboo shoots have not been given due importance in India mostly because consumption of tender shoots of bamboo is witnessed only in northeast India (Bhatt *et al.*, 2001). In the North East, bamboo shoots are sold at a price of Rs. 8-10 per shoot in local markets. However, if it is processed and canned, it can fetch 5 - 6 times its price. It has been estimated that a freshly harvested young shoot weighing five kg of *Bambusa bambos* could yield 1.5-2.5 kg edible bamboo (Kumar, 2009). Bamboo shoots are consumed in a variety of ways e.g. *Bambusa bambos*, *Dendrocalamus hamiltonii* and *D. giganteus* as vegetables (Singh, 1986; Das, 1988; Mitra and Nayar, 1972), *Bambusa bambos* as pickles (Mitra and Nayar, 1972). *Bambusa polymorpha* shoots are ranked as the best for their tenderness and distinct sweet flavour when consumed raw (Kennard and Freyre, 1957; Vivekanandan, 1987).Besides, they are also processed into consumable products such as curry, candy, chutney etc., for the local markets. In North Lakhimpur Forest Division (Assam) consumption of soft and tender bamboo shoot is considered as an effective birth control measure (Tewari, 1993). National Mission on Bamboo Applications, a unit of the DST, New Delhi has promoted studies on bamboo shoot processing and has also published a manual (NMBA,2005). Considerable work has been carried out by G.B. Pant University of Agriculture and Technology, Pantnagar, on various

aspects of bamboo shoots (Pokhariya, 2007; Awasthi and Tewari, 2008). Effect of ageing on juvenile bamboo shoot was studied by Nirmala *et al.* (2007). Processing, marketing and business opportunity for *Dendrocalamus hamiltonii* and *D. asper* have been studied by the Bangalore based Engineering Resource Group.

The shelf life of the harvested bamboo shoots of *Bambusa oldhamii* has been studied by Kleinhenz *et al*. (2000). They tried three experiments by storing the shoots in open storage as control, using low density polyethylene (10µm thick) film and macro perforated LDPE bags (35-45µm thick). For open storage, the individual shoots were placed in open cardboard boxes. Packaging treatments were exposed to different storage temperature of 8, 20 and 25°C.

The nutritive value of bamboo shoots have been studied by several researchers (Giri and Singh, 1992; Shi and Yang, 1992; Bhargava *et al.*, 1996; Tripathi, 1998; Chen *et al*., 1999; Qiu *et al*., 1999; Bhatt *et al.*, 2003; Sharma *et al*., 2004; Bhatt *et al.*, 2005; Kumbhare and Bhargava, 2007; Nirmala *et al*., 2007, 2008; Satya *et al.,* 2009a, 2009b and Choudhary *et al.,* 2010).

MATERIALS AND METHODS

Production of bamboo shoots

In order to assess the feasibility of establishing a plantation for edible bamboos the present project was undertaken as an experiment. The existing plantations and edible bamboos grown in the germplasm established in FRC Palappilly and KFRI subcentre were used for recording the data on shoot production. Monitoring of the plants for growth and collection of relevant details were done from the trial plots.

Periodical weeding was carried out for obtaining good growth. During the summer months mulching around the culms encouraged growth. During the shoot formation season of each year, the soil was turned over for easy emergence of shoot which were subsequently exposed to sunlight to maintain healthy growth.

Transfer of Technology

In achieving the second objective of the project, a training workshop was organised at the Extension and Training Centre of KFRI, Peechi in the month of July 2005. Majority of the participants were farmers from Wayanad, particularly women from local self help groups.

In the technical sessions, importance and scope of bamboo shoot industry, familiarization of equipment and tools and processing of bamboo shoots were dealt with. The processing

technology introduced to the trainee participants was as per the methodology developed by the Engineering Resource Group, Bangalore, and with the support of NMBA.

The equipments and machinery used in the training of bamboo shoot processing was obtained from NMBA, New Delhi. A list of the equipment utilized in the context are given in Table 1.

Table 1. Processing equipments and machinery used

SI No.	Equipment	Specifications	Quantity (nos.)
1	Table	Stainless steel 304, 3.0×1.2 meters	1
2	Spring balance	50 Kilograms	1
3	Weighing scale	Table-top, 2 Kilograms	1
4	Crates: perforated	Plastic, 0.45 meters wide, 50 litres capacity	15
5	Crates: non perforated	Plastic, 0.45 meters wide, 50 litres capacity	5
6	Drums	HDPE, 200 litres capacity, 600mm diameter	2
7	Tubs	Plastic, 0.55 meters wide, 200/100 litres capacity	2
8	Knives	Stainless steel, 6-8 inch blade	6
9	Pouch-sealing machine	Heat-sealing, semi-automatic, 125 packs per hour	1
10	Labeller	Hand-held labeling machine	1
11	Insectocutor	Equipment to control flying insects	1

(Source: NMBA, New Delhi)

RESULTS AND DISCUSSION

The study on edible bamboo conducted by KFRI on the six species of bamboos namely, *Bambusa bambos, B. tulda, Dendrocalamus brandisii, D. hamiltonii, D.longispathus* and *D. strictus*, has shown that the shoot production season in Kerala is from June - September. The rhizomes start sprouting throwing erect shoots during rainy season and are harvested when they are about 0.5m in height. About 3 - 6 shoots are produced from a clump during this period. Shoots are also produced during November-December when Kerala receives north east showers. However, if regularly watered, the new shoots develop at specific intervals. The shoots can be harvested 7 - 14 days after the emergence where the shoot height will be about 15-30 cm depending upon the species. The time required for first harvesting of shoots is about two and a half years after planting, if seedlings are used. In the case of rooted node cuttings as a planting material, the harvestable shoot is obtained within two years, but it is labour intensive and not cost- effective. The growth of bamboo is very fast and the harvestable maturity is attained in less than five years. The average production of shoot per

year in *Bambusa bambos* is 23 numbers per year with an approximate weight of 30-50 kg. In *Dendrocalamus hamiltonii* the average culm production is recorded to be 53 numbers weighing approximately 20-40 kg.

The tender portions or internodes are cut into small thin pieces and soaked in plenty of water to remove the water-soluble hydrocyanic acid for 24 hours. They are again soaked in fresh water for 24 hours before cooking. The edible shoot pieces can be kept soaked in salt for 3-4 months and then dried in sun and fried to use as vegetable dish. Some pieces can also be eaten raw.

Cultivation

The most appropriate time for cultivating bamboo is during the onset of the monsoon. Depending on the availability of the planting stock, i.e., the seeds, offsets, culm cuttings, rhizomes, the cultivation method also varies. Due to the erratic flowering, poor seed setting, it is mostly the vegetative method that is adopted for growing bamboos. The planting is normally done in 45 cm x 45 cm x 45 cm pits. Depending on the clump size, the spacing for planting is decided and accordingly 3 m x 3 m, 5 m x 5 m, 7 m x 7m spacing is normally provided (Pandalai *et al.,* 2002).

Soil Suitability

Lowland and hardened soils are not suitable for bamboo shoot production. Upland slopes are the ideal locations. The soil should be loose and porous for the easy emergence of the shoots. They must be exposed to plenty of sunshine.

Soil management

The soil management include land preparation, soil loosening, fertilization and mulching. The bamboo shoot grows 10-20 cm under the soil surface. The study indicated that the optimum number of soil loosening and fertilization should be carried out four times a year.

Mulching

The study indicated that shoot formation can be accelerated by covering the base of the clumps with bamboo leaves or weed mulch which will help to increase soil temperature and promote shoot emergence. For the best development of bamboo shoots after the soil is covered, moderate humidity of the soil has to be maintained to prevent drying. The soil should not be too wet so as to prevent decay.

Harvesting bamboo shoots

The time for the first harvest of shoots is about two and a half years after planting, if seedlings

are used. In the case of rooted nodal cuttings as a planting material the harvestable shoot is obtained within two years, but it is labour intensive and not cost- effective. From the experimental plots at Veluppadam, Palapilly it was observed that *Dendrocalamus hamiltonii* produced the greatest number of culms in each of the three years followed by *Dendrocalamus brandisii*, *Bambusa tulda*, *B. bambos* and *Dendrocalamus longispathus*. *Dendrocalamus strictus* had a low number of shoots. From the experimental plot at Sub Centre, Nilambur, the highest number of culm production over the period was observed in *Dendrocalamus brandisii* and lowest was recorded for *Dendrocalamus hamiltonii*. *Dendrocalamus brandisii* produced the largest shoots as indicated by shoot diameter and *Dendrocalamus longispathus* produced the smallest.

However, with good management practices like irrigation and fertilizer application and harvesting only mature shoots, shoot production from the individual species could be extended upto 6 months, with the shoot season of different species peaking at different time maximum shoots can be extracted for a longer period.

Fresh and tender bamboo shoots are used for edible purposes. There are different views on the method of harvesting of bamboo shoots for edible purposes. It is recommended that the shoot is to be harvested by digging below ground and extracting up to the growing tip. Some recommend that the shoot is extracted after the emergence from the ground at different height and age of the shoot.

A regular inspection of the plot is required to observe the emergence of bamboo shoots from the rhizome. When the tips of the emerging bamboo shoots are seen, the shoots can be dug out using a sharp and clean cutting knife. The shoot is cut from near the base with out causing any damage to the rhizome. The cut shoots should be intact with the covering sheaths so as to retain the freshness of the inner portion of the shoots. The area from where the shoots were removed should be covered with soil in order to prevent the mother clump from getting any damage or decay.

The height at which the bamboo shoots are extracted depends upon the species. Generally, when the shoots are 15 to 30 cm tall, they can be extracted. While extracting the shoots, care should be taken that at least a few shoots are retained in the mother clump in order to maintain the clump vigour. It is possible to extract four to six new shoots from a single clump. The extractability of edible portion from the bamboo shoots varies from species to species; from *Dendrocalamus hamiltonii* 45.75 percent can be extracted, from *D. longispathus* 40.0

percent from *D. brandisii* 32.61 percent, from *D. strictus* 20.80 percent, from *Bambusa bambos* 30.25 percent and from *B. tulda* 19.84 percent of the shoot can be used (Kumar, 2009).

Post harvest care

The cut shoots are covered with either a wet cloth or freshly cut leaves for retaining the moisture and freshness. The freshly cut shoots are processed at the shortest time possible; else there are chances of spoilage due to the activity of micro organisms or loss of moisture.

After harvest, if the shoots are not processed immediately considerable loss of weight was noticed. The weight loss can be attributed to the rate of transpiration, respiration and discolouration and decay through microbial activity thereby reducing the storability or shelf life of shoots.

Processing of bamboo shoots

With the range of equipment promoted by NMBA, bamboo shoots can be processed as and when fresh shoots are available.

Cluster level processing: Bamboo shoots can be harvested at the individual/ household/cluster level. The fresh shoots can have shelf life for more than seven days. They can be sold to the required agencies for further processing. The processing cost is low. The shoots can be processed hygienically to remain fresh for 10 days. In this process, the raw shoots are cut, soaked in water to remove the bitter components and then drained the next morning. After draining, the cut shoots are packed in nylon based packages and then potable water is added to keep the cuts soaked in water. After sealing, the packs are labelled with date of packing and price of the packs. The processed shoots are sold to the market on demand, for local consumption and other secondary processing units for canning (Plate 1).

Tender shoots are harvested carefully and the freshly harvested shoots are first washed with water. The outer sheath of washed shoot is peeled off using a sterilized sharp knife. First a small cut is made from the base of the shoot towards the tip all round the shoot and the leafy sheath is peeled off. The peeled shoots are again washed in water and cut into slice or cubes or in desired sizes. The slices are soaked overnight or minimum up to 12 hours, decanted and put in fresh water and washed again in order to remove the cyanogenic compounds. Shoots are cooked in boiling water for about 40 minutes uncovered, to allow bitter substances in the bamboo to dissipate. Those bamboo shoots that remain still bitter after cooking are given a second cooking in fresh water again for additional 10 minutes.

Transfer of technology

As mentioned already, a training workshop was organised at KFRI in July 2005 to provide the required expertise and exposure to the farmers of Wayanad, on bamboo shoot processing. The list of participants is given in Appendix 1.

Importance and Scope of bamboo shoot industry	: Dr. Muktesh Kumar, Scientist, KFRI.
Familiarization of Equipment and Tools	: Dr. S. N. Sanjunath, Project Manager, Engineer Resource Group, Bangalore.
Demonstration of bamboo shoot processing	: Dr. S. N. Sanjunath, Bangalore and Dr. Muktesh Kumar, KFRI.

Dr. J. K. Sharma, former Director, KFRI, welcomed the gathering. A brief account of the workshop was given by Sri. Ramesh Bhaskar, Project Manager, K-bip. Sri. T. O. Sooraj, IAS, Director, K-bip, gave the inaugural address. Sri. C. P. John, Vice Chairman, Kerala Bamboo Mission, Member Kerala State Planning Board, gave the presidential address. Sr. M. K. Sivaraman, President, Pananchery Panchayath, Dr. K. K. Seethalakshmi, Scientist, KFRI and Sri. K. C. Chacko, Programme Coordinator, Extension & Training Centre, KFRI gave the felicitations (Plate 2).

In the technical sessions that followed, various topics were handled by experts in each field.

The response of the trainee participants was very encouraging. A few weeks after the training programme was over, we received a number of queries, particularly from the Kudumbasree units of Wayanad, indicating that the training programme was worth while. Wayanad being an area with pelnty of bamboo brakes, bamboo shoot processing might yield additional income for the village people there or whom the training was focused.

Economic feasibility

Bamboo plantations can produce good quality saleable bamboo shoots each year as a by-product of the plantations, thus giving two separate income-earning crops per year (shoots as well as culms). Studies conducted by KFRI have shown that bamboo nursery of 1000 m^2 produces 3000 seedlings. A plot of one hectare can contain 400 plants. The estimated cost of one plant is Rs. 25 and for 100 plants cost is Rs.2500 therefore, the cost for planting one hectare comes to Rs.10,000. Estimated cost for establishing one hectare bamboo plantation the investment cost for the first year will be Rs.12000/, second year Rs.6000/ and for third

year Rs. 3700/. Income of Rs.17000/ha. can be obtained from sixth year onwards (Seethalakshmi, Personal Communication). With intensive management five fold increases in growth can be attained. Edible bamboo plantation is suitable for small and large scale farmers and for women (Kudumbasrees and SHGs) in local self government departments.

Prospects for bamboo shoot processing units / Edible bamboo shoot Industry

Bamboo shoot processing units can be set up in the districts wherever bamboo resources are adequately available. At present, growth and consumption of bamboo shoots is largely restricted to private use of tribal families. Bamboo shoot farming has immense potential in the rural sector in Kerala. KFRI has identified six edible bamboo species possible to be grown in Kerala. Their propagation methods and silvicultural requirements have been standardized.

Recently, bamboo shoots have formed a growing up market for processed and packaged shoots which has enhanced the opportunity for commercially usable units in India. It is now possible that the bamboo shoot processing units have tremendous potential to be developed as small scale industrial units. Modern processing and packing technologies have developed new dimensions and markets for bamboo shoots. It has now become possible to prepare and pack bamboo shoots even as a village level enterprise. Bamboo shoots carry the potential of value added economic activity and for the income generation at the rural and community level through cultivation and processing. The planning commission has established that the Indian bamboo shoot industry has potential to grow at the rate of 25 percent per annum and capture a market worth Rs.300 crores (Pandey, 2008).

There is enough potential for the development of bamboo sector by setting up bamboo shoot processing units in every district of the State where bamboos can be grown. Though there is little awareness of the bamboo shoot industry to the majority of local communities, there are a few organizations in Kerala where the bamboo shoots are being popularized especially in Wayanad District.

Product and production features

Edible Shoots:

Important ingredient in Asian Cuisine.

Primarily sold through wholesalers, Asian food stores, supermarkets and restaurants.

Suitable for domestic market.

High caloric value and a good source of dietary fiber.

Production features

In 3 to 4 years after initial planting shoots of required size can be harvested for commercial use. Subsequent harvesting can be done annually.

Shoots can be sold either fresh, semi processed or canned.

Tonnage yield per hectare for shoot cultivation is 10-20 tonnes per hectare per annum.

Food stores, supermarkets and restaurants are major outlets for bamboo shoots.

Average price on the domestic market in Mizoram, Manipur and Northeastern States and some parts of Kerala State is Rs.8-10 for fresh shoot per kg.

The bamboo shoots from Natural forests and plantations can substantially contribute a higher income to the rural community. One hectare of bamboo plantation yields 4.5 tonnes of bamboo shoots

Some of the important features that need to be looked into before starting a bamboo shoot industry are the following:

For the development of bamboo shoot industry in Kerala the first thing is to start a commercially viable industrial plant in the State. Determination of the appropriate plant capacity with regard to the availability of feed stock within the region is a pre-requisite.

Determination of product feasibility and cost of production is essential.

Identification and assessment of the preferred product types within the target markets is essential.

Identification of environmental factors associated with the production process.

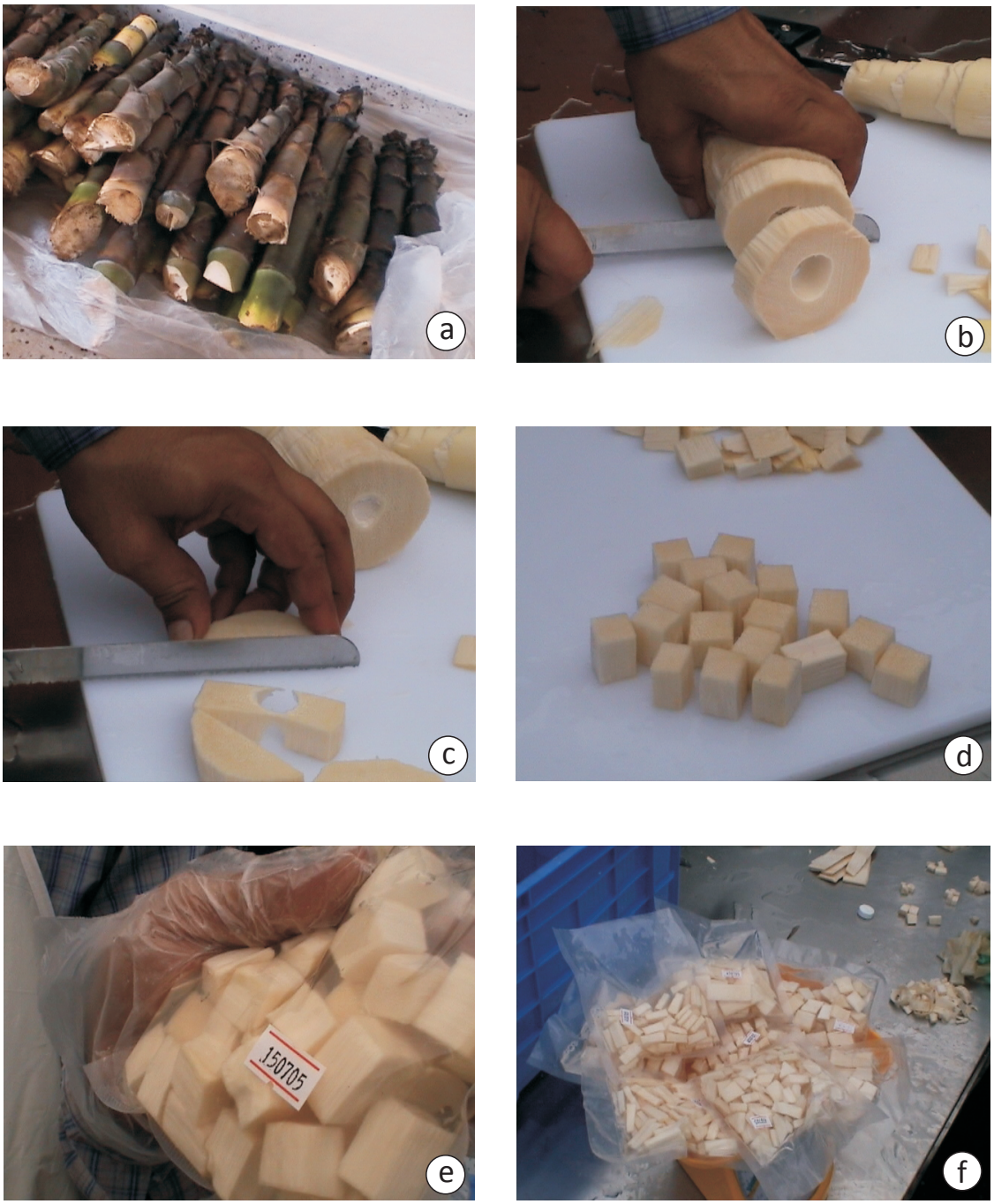
Financial feasibility with regard to the cost of plant and equipment acquisition, land acquisition and construction costs.

Determination of working capital costs required, determination of cost flows and Return on investment.

Environmental Impact Assessment will have to be studied where the proposed plant is to be established

Assessment of joint-venture opportunities and identifying the potential partners.

Plate 1. Fresh bamboo shoot processing for the market (Cluster level)



a. Edible shoots extracted from the field; **b,c,d.** Edible portion being cut into desired shapes; **e.** Fresh cut edible shoot in poly bag (with or without potable water); **f.** fresh shoot ready for market.

Plate 2. Edible bamboo shoot workshop (Cluster level)

a. Dr. J.K. Sharma, Former Director, KFRI giving the welcome address; **b.** Shri. C.P. Jhon, Chairman, Kerala Bamboo Mission, inaugurating the workshop; **c.** View of the participants; **d,e,f.** Demonstration and hands on training of processing of bamboo shoots; **g,h.** Interaction with the participants.

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Appendix 1. List of Participants - Edible Bamboo Shoot Training

Sl No.	Name & Address	Sl No.	Name & Address
1.	**Achamma**, C/o Kunhamma Joseph, Pulikkal Veedu, Pulpally P.O., Wayanad District.	2.	**Ammini**, Anchalummoodu, Thrikkaipetta P.O, Wayanad District, 673577
3.	**Anitha,** Elambrathottathil House Kannara	4.	**Anju Suresh,** Olayankandan House Manjakunnu
5.	**Asha Jiji**, Veliyath Parambil house, Kannara P.O.	6.	**Baiju vargheese**, Pookattu House, Orappan para, Kannara
7.	**Bibitha Baby** Chirammel house Chennaypara	8.	**Bindhu Vijayan,** Parakkal Chanoth Pattikad
9.	**Bindu P.S.** Marrakkal Kannara	10.	**Chandrika Radhakrishnan**, Keezhethu House, Thrikkaipetta P.O, Wayanad District, 673577
11.	**Devi**, C/O Uravu, Thrikkaipetta P.O, Wayanad District, 673577	12.	**Elsy Poulose**, Nallattukudi House, Thrikkaipetta P.O, Wayanad District, 673577
13.	**Gracy George**, Aiswarya Swasrya Sangam, Thekkekulam, P.O. Peechi.	14.	**Kochu Thresia Devassy**, Valli malil house P.O. Kannara Orappanpara
15.	**Kunhamma Joseph**, Pulikkal Veedu, Pulpally P.O., Wayanad District	16.	**Kuriakkose E.V**, Elavan kudiyil House, Orappanpara, Kannara
17.	**Lillikutty. M**, Toppil House, Pavizham Swasrya Sangam, Vilangannur, P.O Peechi.	18.	**Lousie Thomas**, Erumathanath House Narikkundu P O Ambalavayal Wayanad

19.	**Mary Devassy**, c/o Miny Baiju, Pookkattu House, PO Kannara Orappanpara	20.	**Mary K**, RASTA, Kambalakkadu P.O., Wayanad district.
21.	**Mary Kuriakkose**, c/o Miny Baiju, Pookkattu House, PO Kannara Orappanpara	22.	**Mini Jhony**, Parappoparambil House, Kannara P.O.
23.	**Miny Baiju**, Pookkattu House, P.O. Kannara Orappanpara	24.	**Princy Sunny** Amaraparambil Kannara
25.	**Puspha Kumari P. M.**, Parethundathil House, Aiswarya Swasrya Sangam, Thekkekulam, P.O. Peechi.	26.	**Radha Rajappan**, Karipal House, Aiswarya Swasrya Sangam, Thekkekulam, P.O. Peechi.
27.	**Ratnamma. K**, Kottuvala House, Pavizham Swasrya Sangam, Vilangannur, P.O. Peechi.	28.	**Sharada** Thrikkaipetta P.O., Wayanad District, 673577.
29.	**Sheeba Raju**, Mullathodi Veedu, Thrikkaipetta P.O., Wayanad District, 673577	30.	**Shibu**, RASTA, Kambalakkadu P.O., Wayanad district.
31.	**Shylaja, M.R.** Kothiri House Edappalam, Pallikandam	32.	**Sindhu, V.V.** Andiyath house Peechi
33.	**Sindhumol, M.S.** Mohailayalil House Marakkal	34.	**Sosamma Vargheese,** C/o Kunhamma Joseph, Pulikkal Veedu, Pulpally P.O., Wayanad District.

35.	**Sulochana**, Alooppadi House, Thrikkaipetta P.O., Wayanad District, 673577	36.	**Suneesh, C. D.**, Uravu, Thrikkaipetta P.O., Wayanad District, 673577.
37.	**Valsala Bharathan**, Kalarikkal House, Kannara P.O.	38.	**Viji Suresh Babu**, Menoth Parambil House, Kannara P.O.