Production technologies: Crop and horticultural production, grassland
Production technologies: Forest and NTFP

HOMESTEAD BAMBOO PLANTATIONS

Synopsis: A homestead bamboo plantation is a plantation owned and managed by one family. A homestead bamboo plantation provides income generating opportunities for family members and builds upon their own inherent plant cultivation abilities. The bamboo culms produced may be sold for profit, of may be used within the family for value adding activities, such as mat-weaving, agarbathi stick production, handicrafts or other products. Intercropping is possible in the early years of the plantation.

Detailed description of the technology

PART ONE

INTRODUCTION

DEVELOPMENT ATTRIBUTES, TARGET GROUPS and BENEFITS of a HOMESTEAD BAMBOO PLANTATION

1. Homestead Bamboo Plantations

A homestead plantation is a small plantation managed by one family. Such plantations are rarely larger than one hectare and are usually much smaller. They may be managed for culm production, shoot production or both. They are generally managed as part of integrated homestead activities, and are unlikely to receive full-time attention.

2. Development of the technology in Bangladesh

In recent years, there has been growing concern over the rapidly declining production of bamboo in Bangladesh. Each year, more and more land is being converted into rice fields because of population pressures, an increase in which is also causing an increase in the demand for wood and bamboo. The price of bamboo has increased substantially in the last decade. The combined effect is that in a number of villages, people who used to make a livelihood from bamboo products have either changed their profession or become unemployed. The current demand estimate is about 800 million bamboo culms per year, which will increase to 900 million by the year 2013. At present, 80% of supplies comes from village land and the rest from natural forests. Considering its ecological and economic importance, the Bangladesh Government has emphasized the need for raising bamboo plantations in forests and on private land.

Planting offsets is the traditional, and perhaps the most prevalent, method of vegetative bamboo propagation. The survival rate is low and may vary greatly from 3 to 76 per cent, depending on the species, age of the offset and the time of its collection. Other major disadvantages are that the offsets are bulky and heavy, the method is expensive and the propagules are not available in large quantities or throughout the year. There has been a lack of dependable technology for producing large quantities of planting materials.

In the 1980's Bangladesh Forest Research Institute commenced a programme on developing efficient and effective bamboo propagation techniques as a first step towards overcoming the bamboo supply deficit. Propagation technologies were developed and verified by on-farm trials. Techniques for a range of local Bangladeshi bamboo were developed, including Bambusa balcooa, B. nutans, B. polymorpha, B. vulgaris, Dendrocalamus giganteus, D. longispathus and with special emphasis on Melocanna baccifera, which is the predominant species. Many of the techniques are however generally applicable to many of the tropical clump forming bamboos of the world. Detail procedural differences may exist.

With the newly developed technologies more than one hundred thousand bamboo

propagules have been raised and distributed among the farmers of several districts of Bangladesh. The activities are being performed through Forestry and Agricultural Extension Departments, different Non-Governmental Organizations, tea gardeners, Hilltract Development Board and directly to the farmers/ planters. A number of on-farm training programmes have been arranged in different villages. The response of a case study conducted to elucidate rural people's attitudes to the new bamboo propagation techniques is given in Appendix 1.

3. General development attributes and advantages

The main development attributes of the technology are as follows:

- Creates income generation for poor rural people, especially women.
- Improves and broadens farmers plant cultivation skills base, making them more able to handle shocks and empowering them with new abilities.
- Increasing the area of managed bamboo resources.
- Allows rapid re-greening of denuded and degraded hills and reduces erosion.
- Promotes the sustainable increased use of bamboo as a wood substitute.

The main advantages of the technology are:

- It builds upon rural farmers own inherent plant-cultivation abilities and hence is easily adopted
- It is extremely environmentally friendly - organic inputs such as fertiliser are better for bamboo growth than inorganic ones.
- It provides a cheap supply of raw materials for the family who can use it for income-generating activities.

Bamboo is an indigenous plant of the tropics. The people of Bangladesh have cultivated more than 35 species of bamboo in their homesteads for very many year and so bamboo plants are not unknown to the people but are rather intimately associated with their lives. The new technologies are not contradictory or counter to the culture and ritual beliefs of the local people, but rather build on an inherent knowledge base.

4. Suitable agro-ecological regions

Clump-forming bamboos grow at temperatures ranging from 7 – 400C, and some species can tolerate temperatures as low as 2-30C. In general, higher temperatures accelerate the growth of bamboo and lower temperatures inhibit it. The most common rainfall range is 1200 to 4000mm per year. Rainfall is an important factor and 1000 mm is approximately the minimum annual precipitation required for clumping bamboos. High temperature and humidity are the environmental requirements of bamboo species originating in the monsoon areas of Southeast Asia. Soil with a pH of about 5.0 - 6.5 is the most suitable for bamboo. Bamboos do not grow in saline inundated edaphic climates.

The homestead bamboo plantation may be established in any bamboo-growing region of the world. Additionally tropical or subtropical regions that presently do not have natural bamboos are also suitable. There are many species suitable for different climatic conditions and choice of species will require consideration of the uses to which the culms will be put, and their potential markets. Species with large culms often have a wide range of uses but those with small culms have limited uses. These small species are often the most resilient, as they grow at the fringes of the natural bamboo distribution areas. Thus it is important to determine the suitability of the particular species one wishes to grow.

The following countries and regions are likely to hold most potential for introduction and adoption of the techniques described in this TOTEM: Bangladesh. Cambodia, China, Philippines, Indonesia, Sri Lanka, India, Laos, Malaysia, Myanmar, Thailand, Vietnam, tropical moist Africa and Latin America.

5. Benefits

This TOTEM will help in introducing standard technologies for the production of quality

propagules of superior bamboo species and elite clones. Thus, the rural poor, and particularly rural women, will be able to develop the skills required for establishing and maintaining a homestead bamboo plantation and a source of bamboo for food and wood. There will also be many opportunities for using the bamboo harvested in further processing activities, such as weaving mats or producing goods such as toothpicks, agarbathi sticks, chopsticks, handicrafts and containers, and hence increasing income generation for the family. These activities will directly influence the economy of rural regions by improving the bamboo resource base. This will offer socio-economic benefits to the village people through supplying housing material, agricultural implements, raw materials for handicrafts and furniture at cheap rate and also generating employment both in harvesting and cottage industries.

The plantation of bamboo improves the physical and chemical composition of soil considerably, prevents soil erosion in river and sea banks and preserves water in soil by creating a natural water reservoir. Land productivity per unit area increases, reducing the pressure on land due to high population density. Bamboo also produces more oxygen in comparison to the same quantity of many other trees.

6. Requirement for success

The essential requirements for a successful homestead bamboo plantation are:

- Interest of local families in planting bamboo.
- Land availability, ideally degraded land.
- Access to a nearby source of irrigation water.
- Availability of raw materials - propagules, fertilisers, tools.
- A small amount of finance for the purchase of seedlings, fertilisers and simple hand tools.
- Market for the bamboo culms produced by the plantation, if not used by the family itself.

Concluding remarks

The bamboo sector is not easily affected by climate and environment. Related activities are environmentally friendly and require minimal financial inputs. Initial popularity of the technology may be a problem, but once the benefits are evident, as the experiences of the BFRI illustrate (below):

In the early stages of disseminating the technology it took months and years to convince the people about the efficiency of techniques. Therefore, a number of demonstration nurseries and plantations have been raised in several villages, tea-gardens and forest areas as “seeing is believing” plots to develop confidence regarding the technologies. With these new techniques private planters, tea garden owners and the Forest Department have started raising bamboo plantations. So far, Sylhet Forest Division alone has raised about 680 ha of bamboo plantations. Within a few years these seedlings/cuttings will produce merchantable culms and can compensate for future shortages of bamboo.

PART TWO

THE HOMESTEAD BAMBOO PLANTATION

1. Introduction

The size of the homestead bamboo plantation will depend primarily upon the number of people available to work it and the size of the probable market for the culms and/or shoots it produces. This need careful thought on the part of the homestead owner. The main activities involved in establishing and running a homestead bamboo plantation are:

- Selection of suitable species.
- Selection of land.
- Preparation of propagules and a propagation bed.
- Afforestation.
- Plant cultivation, including weeding, fertilising and pest and disease control.

- Sustainable harvesting.

2. Selection of suitable species.

There are many bamboo species and varieties and over 100 of them are commonly cultivated. Depending on the genetic characters, species vary in growth and development pattern and in their response to environmental conditions.

A list of the 19 most commercially important clump-forming species (tropical and subtropical) with their uses is given below. Selection must also take into account prevailing environmental conditions. INBAR is presently producing a species-to-site matching database and this is available via the INBAR website.

Species and main uses:
B. balcooa: Construction, implements, pulp, fodder.
B. bambos: General purpose, construction, shoots, pulp, furniture, medicine, windbreak.
B. blumeana: General purpose, furniture, chopsticks, handicrafts.
B. polymorpha: Construction, pulp, shoots.
B. textilis: Weaving, landscaping,
B. tulda: Construction, shoots, pulp, handicrafts,
musical instruments.
B. vulgaris: Construction, furniture, pulp, ornament, handicrafts.

C. pergracile: Thatching and walling, furniture,
handicrafts, weaving.

D. asper: Construction (v. good quality), furniture, handicrafts, musical instruments, shoots.
D. giganteus: Construction, pulp, furniture, handicrafts, shoots.
D. latiflorus: Construction, shoots (v. good), furniture, weaving, ornamental
D. strictus: Construction, pulp (v. good), utensils, fodder.

G. apus: Construction, handicrafts, utensils,.
G. levis: Construction, utensils, pulp.
G. pseudoarundinacea: Construction, handicrafts, utensils, chopsticks, shoots (v. good).

G. angustifolia: Construction (v. good)

M. baccifera: Weaving, construction, shoots.

O. species: Pulp, construction, handicrafts.

T. siamensis: Construction, shoots, pulp, handicrafts, ornamental.

3. Selection of land.

Careful site selection for the plantation is important, particularly because bamboos are perennial crops and once established it will be difficult and expensive to move location. Careful site preparation is even more important, again because of the perennial nature of the crop.

- Select land preferably on the lee side of a sunny site with a gentle slope and good drainage and with abundant water resources for easy irrigation.
- The soil should be porous and fertile, sandy loam or loam with a pH neutral or slightly acidic.
- The groundwater lever should usually be below one metre.
- The soil should be friable and with high organic matter content to increase its ability to preserve moisture.

Weeds should be cleared and soil pests and insects should be eliminated. Particular attention should be paid to deep rooted perennial weeds, and care taken to remove them in their entirety. There are few soil borne insect pests of bamboo and deep soil cultivation

during cold months should reduce the populations of overwintering larvae significantly. Chemical control measures can also be utilised. Additionally it is inadvisable to establish a new plantation in an area where bamboo diseases are known to be widespread without first taking advice on the potential for infection of the new plantation.

Soil should be deep cultivated and copious quantities of bulky rotted organic matter incorporated. Attention at this stage to the soil will go a long way towards creating favorable conditions for the long-term growth of the bamboo. Soil preparation is best done in the autumn or the spring, after or before the main bamboo growing periods.

4. Preparation of a propagation bed and propagules.

Preparation of a propagation bed requires more care than the plantation. A propagation bed may be constructed as outlined below:

- Beds are normally approximately 1.2 m x 12 m in size.
- A bed is marked by a boundary of bricks or edgings.
- A bed is a 3-layered sand rooting media, each layer should be 7-10 cm deep and consists of:
- large size sand at the bottom
- medium sized sand in the middle
- fine sand at the top.

Propagation can be done in normal soil if it is felt inappropriate to produce such a bed. However care must be taken to remove rocks, the soil should be broken up and raised beds formed. Finally the surface should be raked smooth. In this case very well drained soil is vital, and the success rate will be lower than with the sand-based bed noted above. Basal fertiliser and/or plant ash may be added.

Watering the rooting cuttings by sprinklers is preferred. Six sprinklers are needed to watering evenly a 1.2 x 12 m propagation bed. Construction of overhead water reservoir, laying out of water distributing lines and upright pipes with sprinklers provides intermittent mist for the cuttings. Sprinklers provide mist to the cuttings through distribution of water under pressure from a small ¼ hp pump. About Tk. 175,000 to 200,000 are required to install and develop these facilities in a nursery. Again, this is a one time expense.

Spraying water manually over the cuttings may reduce the cost of misting. Manual watering does not require the installation of pipelines, sprinklers and electric pumps. All these manual activities are suitable for rural areas where electricity is not available and labour is cheap. This will also create job opportunities.

5. Propagation procedures

? Propagation of bamboo through branch cutting is one of the most practical methods because they are cheap and small in size and as easy to carry and handle as seedlings. Moreover they can be produced in large numbers.
? Thick-walled bamboo species with stout branches are ideal for preparing branch cuttings e.g. most of the species of Bambusa and Dendrocalamus.
? In the field some branches may show natural aerial rooting with rhizome formation. This is seen especially on injured culms and in congested old clumps of bamboo. The use of such rooted branches reduces the time of regeneration dramatically.

i) Branch cutting technology:

a) Collection and preparation of cuttings

- Branches bearing aerial roots, buds and sometimes rhizomes are usually selected. Roots should appear healthy and alive.
- Branches should be selected from 1-2 year old culms.
- Branches are cut carefully from the culm using a saw so that the branch bases are not damaged knives may cause splitting.

- April-June is the suitable time for collecting the branch cuttings in tropical and subtropical areas of the northern hemisphere.
- The bases of the collected branches are kept in water in a bucket or in any moist conditions (large moist gunny bags or polythene bags with moist sawdust) during transportation to minimize desiccation.
- Cuttings are produced by trimming leaves, small branches and the branch tip with secateurs to 2-6 nodes with healthy buds. Cuttings may be 50-80 cm long depending on the species.

b) Suitable time for taking cuttings

- April-July is the best time for cutting preparation as during this time rooting is at a maximum and profuse. In the cold and drier months rooting is delayed and reduced in quantity.

ii) Seedling Production technology of Melocanna baccifera:

April to June is the best time for seed collection. Seeds are green with smooth surface, large, thick fleshy onion-shaped and the apex terminating in a curved beak. The length, diameter and weight varies from 3-11 cm, 2-6 cm and 7-151 g respectively. In some cases seeds as heavy as 300 g may be found. Large and heavy seeds should be selected for maximum germination and to produce healthy seedlings. Seeds should be sown horizontally at least 0.5-1.0 cm below the soil surface. The germination bed should be well drained but not waterlogged. Germination percentage of fresh seeds is higher (70-80%) than stored seeds. Germination is highest under diffused sunlight or partial shade, starts within 5-7 days of sowing and continues for 20-25 days. Generally 1-2 plumules develop and form 1-2 stems. Within four weeks, the plumule elongates into a long (80-100 cm) stem bearing 2-3 leaves alternating at the nodes. New shoots are bigger and taller than the older ones. Rhizome systems are well developed at 6 months of age to support the growth of new culms.

Seedlings should be kept in the nursery for 10-12 months. Seedlings should be shifted from one bed to another after 6 months and then at 3 monthly intervals, to minimize the intermingling of rhizomes and roots to other seedlings in the nursery beds.

The above procedures are specific to M. baccifera, but in practice other bamboos can be propagated in a very similar way. The main differences are that most bamboos do not have large fleshy seeds, but have seeds approximately the size of a grain of rice, and that other clump forming bamboos do not need to be moved, as their rhizomes do not extend a significant distance from the plant. Removal of evidently poor or diseased seeds from a batch should be done before sowing in a well drained, shaded seed bed, ideally of sand. Cover the seeds with fine soil to a depth of up to one centimetre and keep moist, but not sodden, during the first few weeks. Protect the seedbed from birds and rodents.

6. Afforestation and plantation establishment

One year old bamboo plants are ideal for establishing a plantation. A hole twice the width and depth of the rootball should be dug, some fertiliser incorporated into the soil in the bottom, then covered with a layer of soil and the plant planted on top. Firm in carefully. Make a watering channel around the plant at about 50 cms radius and mulch the plant itself. Maintain a close watch on the plantation for the first few weeks to weed out and replace any plants that do not survive. The survival of new plantlets will improve if they are planted after rains when the moisture content of the soil is fairly high.

7. Cultivation, maintenance and harvesting

Bamboo cultivation can be compared to that of horticultural fruit crops as both crops start producing harvestable yields five-ten years after planting. Irrigation is needed at least in the early stage of life, especially in the drier months. In the homestead the fully grown clumps benefit from irrigation during the dry season. Mulching should be done around the base of the seedling after ring weeding at the end of the rainy season, if no irrigation is available. Weeding is necessary to protect the young seedling because they cannot thrive in

areas densely covered with weeds. For adult clumps weeding is not so essential. A bamboo seedling thrives better under partial shade conditions up to the age of two. Leguminous plants are suitable and they also have nitrogen fixing value. In general bamboos do not like sites directly exposed to the sun.

Plantation maintenance is particularly important during first five-years as harvesting usually begins in the fifth year. Therefore, this period is important for establishing the planted clumps. Fertilising of the plants is usually done is spring and autumn with bulky organic matter or well-rotted manure, and can be coupled with weeding and soil loosening activities.

Harvesting culms:

A mature clump should not be congested and thinning, by selective harvesting of culms, is essential for future culm emergence. Over-harvesting will result in a decline of both quality and quantity of shoots in future years and may even cause serious degeneration of the stand.

- Felling should be done in late autumn and winter when the physiological processes in the plants are relative inactive.
- Avoid felling during the shooting season, or it will cause the death of new shoots or produce less-developed culms.
- Avoid felling during the growing season. This will cause considerable loss of nutrients due to profuse exudation from the cut stumps, and the harvested timber will be more susceptible to infestation from fungi and boring insects.

In order to ensure high productivity, a reasonable age-structure and density of culms should be maintained. The usual age structure is 30%, 30%, 30%, 10% for 1, 2, 3 and 4 year old culms respectively per clump.

Yields:

Expect a bamboo propagule to produce merchantable size culms at the fifth year of planting. On average, at the beginning, three culms may be harvested from a clump of a thick-walled species. As mentioned earlier, harvest culms at three-year rotations. Out of a total of 400 bamboo clumps/ha effective harvesting occurs from 133 clumps. The first year of harvest yields about 400 culms (133 clump x 3 culms) from one hectare of plantation of a thick-walled species. After that one more culm per clump is produced annually up to 10 years of age, then the production rate become more or less steady (Table 1). In the case of thin-walled Melocanna species, about 10 culms are produced per clump in the first year of harvest. Based on a three-year rotation, 1,333 culms can be harvested from one hectare during the first year of harvesting (Table1). After seven years Melocanna clumps start producing two more culms per year, and thus in the 8th year about 1870 to 2130 culms/ha can be harvested. After 13-15 years of age clump productivity becomes more or less steady.

Harvesting shoots:

If growing bamboos specifically for shoot production the following harvesting procedures should be adopted. Tropical and subtropical sympodial bamboos produce shoots from May to October (summer) with peak production in July and August. Generally, the early shoots and most of those produced in the peak period are harvested, but those produced towards the end of shooting season are retained as mother culms. The operation of shoot harvesting varies with size of shoots for processing different products.

8. Costs

The primary costs are dependent upon the costs of raising the different types of propagules (see Table 2). The cost of production and planting of a seedling and a branch cuttings is Tk. 9 and 13 respectively. The cost of producing bamboos from offsets is much higher (Tk. 83 each) due to the higher production cost of this method.

Raising a one-hectare bamboo plantation with plants at 5.0 x 5.0-meter spacings requires

400 propagules. Expected mortality is about 10-15 percent. This loss happens during transportation, planting and aftercare. Therefore, 15 percent excess expenditure for mortality has been taken into consideration for a one-hectare plantation, as shown in table 3. The total expenditure for raising a one hectare plantation of bamboo comes to Tk. 38180 for propagation by offsets, Tk. 5980 for propagaion by branch cuttings and Tk. 4140 if seedlings are used.

Cash flow: Financial attributes (Net Present Value, Internal Rate of Return, Benefit-Cost Ratio, Breakeven Period): Financial analysis of two bamboo plantations considers thick-walled B. vulgaris, produced by branch cuttings and thin-walled Melocanna, produced from seeds. The analysis is based on the above establishment and extraction costs. Estimated harvesting and transportation labour costs are Tk. 8 and Tk. 1.60 for thick-walled and thin-walled species, respectively. The analysis reveals that the financial rate of return on investment is attractive for both cases. The thick-walled Bambusa vulgaris bamboo yields a financial rate of return (FIRR) of 37 percent and the FIRR of thin-walled Melocanna bamboo is 18 percent (Tables 4 and 5).

9. Implementation

Role of market and assessment of market requirements (local, export) for successful operation: Seedling propagation and sales are the basis of local commerce in central Bangladesh. At least three local NGOs operate profitable bamboo marketing programs by selling bamboo seedlings and cuttings in village and town markets. Additionally, in the off-season tea garden employees (most often women) are employed in raising bamboo propagules and selling them locally to augment their incomes.

Environmental aspects (use of raw materials, water, energy, pollution, soil degradation): Bamboo cuttings are raised in a propagation bed which are made of sand, and sand is an inert and non-polluting substance. Seeds are germinated in normal soil without any pretreatment. In both the types of propagule production, no chemical pollutants are used. Therefore, bamboo propagation and cultivation techniques are environmentally friendly and beneficial. Moreover they prevents soil erosion, and thereby have positive impacts on soils and the surrounding environment.

Social aspects (labor, gender, children, cultural environment, etc.): Bamboo cultivation provides families with raw materials for housing, fences, baskets, mats, other handicrafts, sports materials, and vegetables. Bamboo also cools the temperature around homesteads providing a better living and working conditions; and provide excellent microclimates for raising livestock and cultivating shade-tolerant crops. Additionally, bamboo produced in homesteads or farm plantations is sold in local markets to augment family incomes. As indicated above, some families also sell bamboo seedlings.

Policy aspects that positively or negatively impact on the successful use of the technology : So far, no negative impact has been observed in respect of social, economic and environmental aspects in successfully transferring bamboo propagation and cultivation technologies. Rather these technologies have created a positive impact on the socioeconomic and environmental conditions of rural Bangladesh.

Appendix 1
An interesting case study

A study, for assessing the response of people towards the ‘Bamboo Propagation and Cultivation’, was conducted in the homesteads of three different villages – Kelishshar, Keochia and Sualok (Bandarban). The first two villages are located in the plain land of Chittagong District and the last one is in the District of Chittagong Hilltract. In all the villages, agriculture is the means of livelihood. A total of 100 randomly selected farmers from each of the villages were interviewed and the supplied questionnaire was filled up.

A vast majority of the people (85-95%) in all the villages was concerned about the rapid depletion of the bamboo resources, and were interested in replenishing and increasing the resources through cultivation. It was apparent from the interview that about 80 to 90 per cent of farmers in both Kelishahar and Keochia (two villages in the plain land) and about

50 percent of those in Sualok (Bandarban) were interested in cultivating bamboos in their homesteads (Table 1). The lesser interest of the Hilltract people is due to abundance of the forest bamboos nearer to their homesteads. Interestingly, 60–80 percent of the non-interested people replied that their lack of interest regarding bamboo cultivation is due to non-availability of the planting material. They also mentioned that the conventional method of propagation (offset planting) is expensive.

The survey also revealed that only 15 – 30 percent of homesteads in Kalishahar and Keochia have bamboo groves, while in Sualok village only 5 percent of homesteads have bamboo. The low-level of occurrence of bamboo in homesteads in Sualok village is a result of the easy availability of thin-walled bamboo in the nearby forest. However, the farmers of Sualok village also expressed interested an interest in cultivating thick-walled bamboo species, such as Bambusa balcooa and B. vulgaris (Table 3). Additionally, it was also found that more than 60 – 80 percent of people in the study sites do not have proper knowledge of bamboo cultivation (Table 2). Only 7-10 percent of farmers surveyed do not have bamboo groves in their homesteads and are not interested in cultivating bamboo (Table 2). It can be concluded that the majority of the farmers are keen to grow bamboo.

Most of the farmers (58 – 68 per cent) preferred to grow Bambusa vulgaris in their homesteads. Other preferred bamboo species were B. nutans and B. tulda (Table 3). People of these villages also showed interest in growing another thick-walled species, B. balcooa, in their homesteads. Farmers of Kelishahar also wanted to grow M. baccifera because the village is far away from the hill forests. Melocanna baccifera being a naturally grown bamboo species in the forests of Chittagong hilltract are easily available to the people of Sualok and, therefore, the species was not preferred by them. In Sualok, people showed an interest in cultivating bamboo species such as Dendrocalamus giganteus, D. longispathus, and Schizostachyum dullooa (Table 3).

The people of Kelishahar and Keochia are Bangalee and plain land inhabitants, while people in Sualok village are of ethnic origin. The ethnic people belong to the Marma tribe and are mostly Buddhist. Dendrocalamus giganteus is treated as a scared plant by the Marma tribe and is usually cultivated inside the temple area. Dendrocalamus longispathus and Schizostachyum dullooa are cultivated by the Marma people in their homesteads for edible shoots and raw material for ‘shiny mats’, respectively.

In each village, 50 interested farmers were selected and bamboo propagules (offsets and branch cuttings) distributed. The people in both the villages of Keochia and Sualok clearly favoured offsets because they were not confident about the growth of the small-sized branch cuttings. The growth performance was recorded on three parameters – total number of culms produced per clump, and the diameter and height of culms produced in the third year of planting. Branch cuttings showed early shoot production, but the shoots were thinner. After three years, shoots produced by branch cuttings were more or less similar in size to those from offsets. The results were adequate proof for the farmers about the viability and performance of the branch cutting technology. In both villages while over 60 per cent of the farmers preferred this method of propagation, they were not sure about the long-term results. It is expected that with increase in the age of the plantation, the farmers will gradually gain confidence in the technology. There were three important conclusions drawn from the experiment: (i) Farmers will accept a new technology only after seeing its performance on the field and hence, demonstration is important; (ii) Literacy is an important factor in the acceptance of a new technology; and (iii) There is a keen interest, especially among women, to cultivate bamboo in homesteads.

In Kelishahar, where the literacy rate was higher than that of Keochia, they were more inclined to try out the new technology and hence, were given one branch cutting each. In Keochia, the farmers were reluctant to take branch cuttings. But since the price of Taka 50-70 per offset was higher than what the farmers could afford, one offset was offered free of cost to each person who would also take a branch cutting and plant it simultaneously with the offset. Each of the 50 farmers thus received one offset and one branch cutting. Three years after planting, the survival rate and growth of each type of propagule in both villages were measured. In both villages, the survival rate of branch cuttings was over 90%, which was higher than that of offsets.

Global farming systems: Coastal Artisanal Fishing (javascript:openPage('fs_descr.asp?fs_id=7',300,350)) | Dualistic (javascript:openPage('fs_descr.asp?fs_id=6',300,350)) | Irrigated (javascript:openPage('fs_descr.asp?fs_id=1',300,350)) | Smallholder Rainfed Highland (javascript:openPage('fs_descr.asp?fs_id=4',300,350)) | Smallholder Rainfed Humid (javascript:openPage('fs_descr.asp?fs_id=3',300,350)) | Urban Based (javascript:openPage('fs_descr.asp?fs_id=8',300,350)) | Wetland Rice Based (javascript:openPage('fs_descr.asp?fs_id=2',300,350)) |

Technical, economic, financial, social and environmental attributes of the technology: Increases employment opportunities |

Factors underlying success: Access to inputs and resources| Farmer's capacity | Incentives, credits and markets| Infrastructure|

Source(s): INBAR TOTEM: HOMESTEAD BAMBOO PLANTATIONS
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Additional external resources: http://www.inbar.int/totem/totemmain.asp (http://www.inbar.int/totem/totemmain.asp)
http://www.inbar.int/totem/ppt/Homesteadbambooplantation.ppt (http://www.inbar.int/totem/ppt/Homesteadbambooplantation.ppt)

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