PROPAGATION OF BAMBOO IN MANIPUR

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Introduction

Manipur is a State in North-eastern India having its capital in the city of Imphal. Manipur is situated between 23.83°N - 25.68°N latitudes and 93.03°E - 94.78°E longitudes. The state is bounded by Nagaland in the North, Mizoram and Mayanmar in the South, Upper Myanmar in the East and Cachar District of Assam in the West. Encircled by nine hill ranges, Manipur is marked out by a picturesque valley in the midst. The total area of Manipur is 22,327 km^2. Out of this only 2,238 km^2 is valley while the remaining areas are covered with hilly tracts. The hills around the cup-shaped valley add to the natural beauty of Manipur. The hills are part of the Himalayas and are termed as sub-Himalayan ranges. By virtue of its geographical situation, Manipur is a shining pearl in the Himalayan system. Manipur boasts of an exotic landscape with gently undulating hills, emerald green valleys, blue lakes and dense forests. Manipur had been a Union Territory from 1956 and became a full-fledged State from 1972.

Propagation of Bamboo

Since Manipur has a very large standing resource of bamboo, mostly in the forest areas and there is a tradition in valley and hills of the State for small-scale homestead cultivation of bamboo for self consumption, the commercial cultivation of bamboo is not found normally. In view of commercial utilisation of bamboo as a substitute for the fast depleting timber resources, enhancement of employment opportunities for artisans, promotion of value-addition through better and well designed products, optimum propagation and conservation, there is a need for a comprehensive programme of bamboo cultivation for sectional upgradation.

The commercially viable species recommended for plantation in Manipur are detailed in Table 1.

Propagation technique of the selected bamboo species are give in Table 2.

Bamboo Nursery

Site selection for Nursery: For making available sufficient quality planting stock for bamboo plantation, both temporary and permanent nurseries are established. Bamboo nurseries are situated centrally with reference to the area to be planted and preferably be near an office or near a village and having good accessibility round the year for close and regular supervision and transportation of media to the nursery and seedlings from nursery to the plantation site. Care is taken that the planting material for vegetative propagation is available nearby to avoid expenses and other technical difficulties.

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Table 1

Commercially viable species recommended for plantation in Manipur

Sl. No.	Botanical Name	Local Name	English Name
1	*Bambusa balcooa* Roxb.	Leewa, Ching Saneibi, Pulka	
2	*Bambusa bambos* (L.) Voss.	Saneibi	Thorny Bamboo
3	*Bambusa nutans* Wall. ex Munro	Wootang, Utang	
4	*Bambusa pallida* Munro	Nachei-wa, Moirang-wa	
5	*Bambusa tulda* Roxb.	Wtang, Wakok	Indian Timber Bamboo
6	*Bambusa vulgaris* Schard. ex Wendl.	Bakal, Lam Saneibi, Jai-baruwa	
7	*Dendrocalamus asper* (Schult.) Back. ex K. Heyne		
8	*Dendrocalamus giganteus* Munro	Maribob	
9	*Dendrocalamus hamiltoni* Nees & Arn.	Unap, Wanap, Retcha	Giant bamboo
10	*Dendrocalamus strictus* Nees.	Unan	Male Bamboo

Table 2

Propagation technique of the selected bamboo species

Sl. No.	Botanical Name	Propagation techniques
1	*Bambusa balcooa*	Culm-cutting, Branch cutting, Offset/Rhizome
2	*Bambusa bambos*	Seeds, Culm-cutting, Offset/Rhizome
3	*Bambusa nutans*	Culm-cutting, Branch cutting, Macroproliferation, Offset/ Rhizome
4	*Bambusa pallida*	Seeds, Culm-cutting, Macroproliferation, Offset/Rhizome
5	*Bambusa tulda*	Seeds, Culm-cutting, Macroproliferation, Offset/Rhizome
6	*Bambusa vulgaris*	Culm-cutting, Marcotting/Ground layering, Offset/ Rhizome
7	*Dendrocalamus asper*	Culm-cutting, Branch cuttings, Offset/Rhizome
8	*Dendrocalamus giganteus*	Seeds, Branch cutting, Offset/Rhizome
9	*Dendrocalamus hamiltoni*	Seeds, Culm-cutting, Macroproliferation, Offset/Rhizome
10	*Dendrocalamus strictus*	Seeds, Macroproliferation, Culm-cutting, Branch cutting, Offset/Rhizome

In the hills, a gentle slope not exceeding 5° is selected near and preferably below a perennial water source. The sandy loam or loamy soil with pH value from 4.5 to 6.5 is selected for the nursery site. The clayey soil is mixed with sufficient quantity of river sand to improve their aeration and drainage. The land selected is a high land without any water stagnation and well drained. Water logged area are avoided for bamboo nursery.

Area of the nursery and its planning : For bamboo nursery, 0.1 - 0.2 ha area is selected for producing 10,000 to 20,000 seedlings in temporary field nursery where as 0.25 - 1.0 ha area is selected for producing 50,000 - 2,00,000 seedlings in permanent centralized nursery. After selection of the site a rectangular area of desired size depending on the type of nursery and number of seedlings to be produced are demarcated and planned depending upon the shape and size. The area demarcated is fenced with fencing made of bamboo. After demarcation and site clearance, the nursery area is divided into rectangular blocks with paths. The blocks are subdivided into rectangular nursery beds of size 10 m x 1.2 m divided by 0.5 m wide paths. Sufficient areas are reserved for seeds/planting materials storage/treatment and for media preparation. In hills, nursery beds are made after terracing the area. The widths of the terrace are kept at least 2 m wide.

Preparation of germination beds : Generally, beds of size 10 m in length and 1.2 m in width are laid. In special cases, lengths of the bed are kept 5 m. For preparation of germination and vegetative propagation beds, the beds are dug to a depth of 0.30 m to 0.45 m. The gravely soil is sieved through wire netting. The dug out soils are cleaned and mixed with river sand, fully decomposed FYM/Compost in the proportion of 1 : 1 : 1, 3 : 2 : 1 or 2 : 1 : 1 depending upon type and properties of the soil. The nursery beds are raised to 0.15 m above the level of the paths. The raised beds are supported by splited bamboo strips. One week prior to showing or laying culm or branch cutting, the nursery beds are drenched with insecticide and fungicide to prevent termite and fungal attack.

Seed Collection : Seeds from gregarious or sporadic flowering are collected, cleaned, graded and dried in the sun for 1-2 hours. Seeds of most bamboo species are short-lived and the viability of seeds is lost gradually if not stored with proper ventilation for seeds respiration, controlled moisture, low temperature, etc. The seeds are sown soon after collection as far practicable. Surplus seeds are stored to prolong viability by reducing the seed moisture content down to 8% at low ambient temperature and dry environment i.e. 0-25°C and 20% humidity.

Seed Sowing : Seeds are sown as soon as possible after collection. Sowing is done in germination beds in 5 cm deep furrows made across the beds. A thin layer of soil is used to cover the seeds and beds are watered lightly once in a day. The beds have facilities for overhead shades. Seeds treatment prior to sowing is done in form of soaking the seeds in water overnight or for 24 hours to break dormancy and water is drained out properly half an hour before sowing. The seeds are also treated with fungicides and insecticides before sowing to reduce damping off and damage from the insects. Seed starts germinating after 3-7 days and continue upto 15-25 days of

sowing. Seedlings are left in the germination bed for 2-3 months till they reached a height of 8-10 cm and produce 4-6 leaves. Regular weeding, mulching and watering of beds are done.

Pricking out : The poly bags filling media are prepared by collecting top soil and mixing with river sand and well decomposed FYM or compost in the proportion of 1 : 1 : 1, 3 : 1 : 2 or 2 : 1 : 1 depending upon the soil type and texture of the soil. The potting mixture is treated with insecticide and fungicide one week in advance before filling the poly bags. The required numbers of poly bags of size 15cm x 22.5 cm - 250 gauge are filled and arranged in nursery beds of size 10 m x 1.2 m and supported with split bamboo strips.

Seedlings are pricked out and transplanted in poly-bags after 2-3 month of sowing when they reached the height of 8-10 cm and are at 4-6 leaf stage. The transplanted seedlings are kept in partial shade initially for a month or two and then shifted to open beds. Except for rainy season seedlings are watered regularly, preferably in the evening. Regular weeding is also done. Organic fertilizer is applied to make the seedlings grow healthy. Inorganic fertilizer is applied only in exceptional cases. Compost incorporated with rotten leaves of bamboo makes a good organic fertilizer because the leaves of bamboo are rich in silica. Seedlings are shifted after 3 months locally to avoid root penetration. About 1 year old seedlings are used for plantation.

Species propagated from seeds are : *Bambusa bambos, Bambusa pallida, Dendrocalamus giganteus, Dendrocalamus hamiltoni and Dendrocalamus strictus.*

Propagation

Propagation through Vegetative Methods : As most of the time seeds are not available in case of many species, bamboos are propagated vegetatively. Various methods of vegetative propagation like off-set/rhizome planting and culm cuttings are commonly used for different bamboos. Vegetative propagation through branch cutting, marcotting and layering are not commonly used.

Propagation through Off-set planting : Vegetative propagation by rhizome or off-set planting is an age old traditional method and most commonly used method of propagation of bamboos. Off-sets from 1-2 year old culms are selected and clums are cut at about 1.0 - 1.8 m height from ground with 3 to 5 nodes bearing viable and active branch buds and excavated along with a portion of rhizome with its root system. The rhizomes are separated by cuttings from its neck carefully causing minimal damage to rhizome and roots during excavation. Offsets are taken and planted just before the rainy season. In field, preferably the top of culm is covered with polythene bag or alternatively with soil-cow dung mix.

Propagation through culm cutting : To meet the larger demands of planting stock, more effective techniques which can result in mass seedlings production are adopted. The techniques commonly used are culm cutting and macro-proliferation.

Collection of bamboo and preparation of cuttings : One to two years old culms from healthy clumps of bamboos are extracted by cuttings them at the ground level or just above the first node during beginning of rainy season. The tender top part of

culm bearing leaves (shoot) is removed and the side branches trimmed. Care is taken not to injure the axillary buds on nodes while re-moving leaves and side branches. Cuttings with 2-3 nodes leaving 5-7 cm on either side of nodes are prepared using preferably a hacksaw or a sharp knife (dao). An opening of about 2 cm in length and 1 cm in width are made in the centre of internode. Care is taken that while making hole, the axillary buds and branches on the nodes must lie in lateral plane to the ground.

Treatment and planting of cuttings : A solution 20 g NAA or Boric Acid are prepared in 100 litres of water and mixed thoroughly. About 100 ml of the solution is poured to each culm cavity. The holes are sealed by wrapping and tying with a polythene strip. It is ensured that the polythene wrapping is tight. Now the cuttings are kept horizontally with the opening facing upwards. For planting of the cutting in the prepared and treated nursery bed, 10 to 15 cm deep furrows at a distance of 40 to 50 cm apart are made across the nursery beds. Depth and distance of furrows are decreased or increased depending on the diameter of culm cuttings. The cuttings are placed in furrows horizontally across the nursery beds in such a way that the hole/opening facing upward and buds placed laterally. The cuttings are covered with 2-3 cm layer of soil. Nurseries beds are provided with a layer of mulch i.e. thatch or dry grass/ straw/bamboo leaves to conserve the moisture and protect the cuttings from direct sunlight. The beds are watered regularly in the morning and evening. Due care is taken to avoid over watering and water logging. Sprouting is noticed within 15 days and root development takes about 1-2 months. Rhizome development and new shoot emergence takes 3-4 months. After a month of the planting, the sprouts are treated with 0.01% a.i. (active ingredient) of Bevistin to avoid fungal attack. Additional fully decomposed farm yard manure is applied to increase the vigour of the sprouts. This can be applied when sprouting is completed, otherwise shoots emerging from soil may get damaged during application.

Transplanting : Rooted cuttings with fully developed rhizome are excavated after flooding of beds and loosening the soil. The well rooted plants are detached from the culm and separated into single culm with rhizome and well developed roots carefully without damaging the rhizome and root with sharp and sterilized tools. The excavated and separated plants are transplanted in polybags and stored in over head shaded beds. These beds are watered daily and weeded regularly. When plants are established properly in bags, they are shifted to open beds.

Species propagated through culm cutting are: *Bambusa balcooa, Bambusa bambos, Bambusa nutans, Bambusa vulgaris* and *Dendrocalamus asper*.

Macro-proliferation : This method is generally practiced in small seedlings usually raised through seeds. Seedlings with 4-5 culms are taken out from the bed and then the soil is removed by washing or shaking. Each culm with a piece of rhizome and roots are carefully separated using sharp knife or secateur and planted in separate poly-bags as seedlings. In order to minimize casualties of the seedlings, after separation, seedlings are kept in shade and watered regularly. By this technique large planting stock are made available.

Bamboo Plantation

Site Selection : The site is selected preferably in plain or slightly sloping area having sand loam soil with pH ranging from 4.5-6.5 (moderately acidic). Highly vertical and completely dried area are avoided. The waterlogged and rocky areas are also avoided for most of the commercial bamboo species. Ample water, fertilizer, protection from competitive weeds, a windscreen and light shade in early stages of establishment is provided.

Species Selection : The selection of species is based on altitude, soil, and its commercial/industrial significance and availability of market for local demand and post harvest processing facilities. The features helpful in selection of species for plantation at various elevations and its habits for commercial application are as given in Table 3.

Site Preparation : Depending on the vegetative cover on the plantation site, selection of suitable clearing method is selected before ground preparation. In forest lands only ground cover and lower canopy comprising of shrub, bushes and grasses/weeds are cleared without disturbing the economically important species of vegetation. If required thinning of middle and top canopy at a distance of 6-7 m are done. The cut vegetation is cleared by controlled burning after they get dried. In non-forest area all weeds, grasses and shrubs are cleared and land is preferably ploughed once.

Plantation season and methods : The majority of the bamboos are planted during pre-monsoon rain and before the onset of monsoon (early summer planting) preferably in the month of March-May at the time of active growth stage. The planting are done during the month of

Table 3

Features helpful in selection of species for plantation at various elevations and its habits for commercial application

Sl. No.	Botanical Name	Type	Elevation (m)	Culm Ht. (m)	Culm Dia. (cm)	Length of Inter-nodes (cm)	Wall thickness
1	*Bambusa balcooa*	Sympodial	0-700	16-20	7.5-15.0	30-45	Thick walled
2	*B. bambos*	Sympodial	0-1000	20-30	10.0-15.0	35-40	Thick walled
3	*B. nutans*	Sympodial	700-1500	15-18	4.0-8.0	40-45	Thick walled
4	*B. pallida*	Sympodial	0-1500	15-20	2.5-3.5	45-75	Thin walled
5	*B. tulda*	Sympodial	700-1500	15-20	5.0-10.0	30-45	Thin walled
6	*B. vulgaris*	Sympodial	0-1200	12-15	5.0-12.0	30-45	Thin walled
7	*Dendrocalamus asper*	Sympodial	700-1800	15-20	12.0-15.0	40-50	Thick walled
8	*D. giganteus*	Sympodial	0-1200	18-30	12.0-18.0	30-45	Thin walled
9	*D. hamiltoni*	Sympodial	0-1000	15-18	12.0-18.0	30-50	Thick walled
10	*D. strictus*	Sympodial	0-1000	12-15	2.5-7.5	25-30	Thick walled

June-July also with less success but not during the month of August or latter. The late planting survival is poor and does not produce shoot in next season even if it survive in the field.

The planting layout for the plantation is carefully planed. The laying of planting lines and position of pits in the adjacent line are planed in such a way so as to provide optimum sunlight to all the plants. For rhizome planting, pits of size 60 cm x 60 cm x 60 cm are dug at a distance specified for the species. For planting bamboo from seedlings raised from seeds, or cuttings planting pits of size 45 cm x 45 cm x 45 cm are dug at a spacing of 5 m in the line and 7 m between the line to line. The layout planning and pit digging are completed one-two months before the planting. At the time of planting about 0.5-1.0 kg of well decomposed FYM are used in each pit and mixed with topsoil.

Planting out : The seedlings raised from the seeds or vegetative propagation and transplanted into polybags are planted into the field during pre-monsoon preferably during April-May and latest by June-July. Late planting is avoided as there are no sprouting in the plants planted late. About 10-12 months old healthy, disease free and vigorously growing seedlings with 3-5 culms are selected for planting out in pre-prepared planting pits. The seedlings having less than 3 culms are left in the nursery beds. The some of leaves of the seedlings are pruned to reduce transpiration after planting. After planting the plants are watered till it gets established.

SUMMARY

Bamboos, which are widespread in Manipur, offer numerous opportunities in this regard, and there is much potential for expanding it. In view of commercial cultivation and economic utilisation of bamboo as a substitute for the fast depleting timber resources, a comprehensive programme of bamboo for sectional upgradation, enhancement of employment opportunities for artisans, promotion of value-addition through better and well designed product development, optimum propagation and conservation and diversifying production and processing activities through organized community action has been taken up. In view of commercial utilisation of bamboo as a substitute for the fast depleting timber resources, enhancement of employment opportunities for artisans, promotion of value-addition through better and well designed products, the need for a comprehensive programme of commercial propagation of bamboo with quality planting material has been realised. For making available sufficient quality planting stock for bamboo plantation, propagation from seeds and culms cuttings in place of traditional off-set planting has been taken up for the species based on its commercial/industrial significance and market for local demand.

Key words **: Bamboo, Commercial Utilization, Propagation, Manipur.**

मणिपुर में बांसों का प्रवर्धन

पी०एन० प्रसाद

सारांश

बांस मणिपुर में दूर–दूर तक फैले हुए हैं और इसके प्रवर्धन के लिए वहां बहुत–सारे अवसर तथा इसका विस्तार करने की बहुत संभावनाएं विद्यमान हैं। तेजी से घटते जा रहे प्रकाष्ठ संसाधनों के प्रतिस्थापन्न रूप में बांसों के लाभकारी उपयोग और इसकी व्यापारिक कृषि को ध्यान में रखते हुए कुछ वर्गों को ऊपर उठाने, कारीगरों

के लिए रोजगार पाने के अवसर बढ़ाने, श्रेष्ठतर और सुआकल्पित उत्पाद विकास द्वारा मूल्य–अभिवर्धन प्रोत्साहित करने तथा संगठित सामुदायिक कार्य द्वारा इष्टतम प्रवर्धन और संरक्षण एवं विविधायित उत्पादन और विधायन कार्यो को कराकर बांसों का एक सर्वसमावेशी कार्यक्रम आरम्भ किया गया है। तेजी से घटते जा रहे प्रकाष्ठ संसाधनों की जगह बांसों के व्यावसायिक उपयोजन, कारीगरों के लिए रोजगार के अवसर बढ़ाने, श्रेष्ठता और सुआकल्पित उत्पादों द्वारा मूल्य अभिवर्धन को प्रोत्साहित करने को दृष्टिगत रखने के कारण उत्तमकोटि रोपणसामग्री वाले बांसों का व्यापारिक प्रवर्धन कराने वाले सर्वसमावेशी कार्यक्रम की आवश्यकता को समझ लिया गया है। बांस रोपवनों के लिए पर्याप्त मात्रा में अच्छी गुणवत्ता वाली रोपणसामग्री उपलब्ध कराने के लिए, बांस के टुकड़े रोपने की पारम्परिक रीति की जगह उस जाति के व्यापारिक/औद्योगिक महत्व और स्थानीय मांग के बाजार पर आधारित करके उसे बीजों और सन्धिस्तम्भ कलमें रोपकर प्रवर्धन कराना आरम्भ किया गया है।