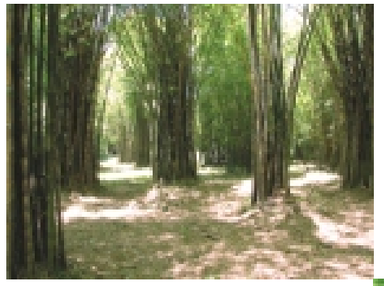
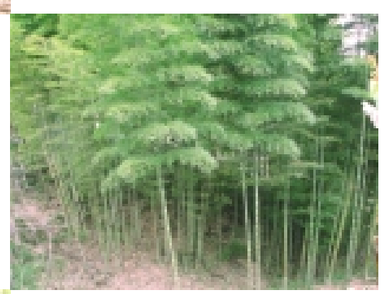
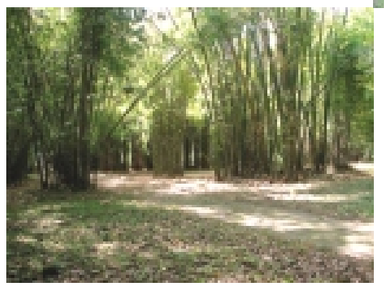


Kanakaich : Thyrsostachys oliverii
in a plantation in Arunachal Pradesh



Moso : Phyllostachys pubescens chinese
bamboo introduced in Arunachal Pradesh



View of a Bmaboo Garden
Bambusa balcooa in the front

NATIONAL MISSION ON BAMBOO APPLICATIONS
Technology Information, Forecasting, and Assessment Council (TIFAC)
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NMBA
National Mission on Bamboo Applications

INFO-SHEET
VPC Establishment

IS 06 09/07

Establishing a Vegetative Propagation Centre for Bamboo

Bamboo is a woody and fast growing grass. It is a strong, versatile and highly renewable material. There is a growing demand for bamboo in the country especially for new applications. Bamboo is raised in private and homestead lands at farmer level and entrepreneurial level commercial plantations. With growing demand for quality raw material for a variety of value added products and applications, cultivation of bamboo, especially in highly productive plantations, has generated a great deal of interest. The cost of plantation as well as its productivity critically depends on methods of propagation, quality of plant material and availability in large quantities.

The easiest way, even cheapest, method of propagation is through seeds but they are not commonly available since most species have long flowering cycles and some others do not set seed at all. Even when seeds are available, they have short viability and have low germination percentage. Traditionally bamboo has been propagated through vegetative means for milleniums. However for large scale production such efforts require minimal infrastructure and facilities in standardized vegetative propagation centres (VPC). NMBA with its inhouse expertise has designed, and field tested, model VPCs in different parts of the country for decentralized production of quality seedlings of upto 35000 number per annum. The experience gathered through these efforts has prompted the production of this infosheet.

This info-sheet explains the processes to set up the facility for good quality planting material using vegetative propagation methods.

Vegetative propagation

The basic principle underlying vegetative propagation is the capacity of plants to reproduce vegetatively through different plant parts like stem, branches, rhizome etc. The plant part taken for multiplication should have growth buds which will grow to produce the plant. The buds on the culm are located on alternate sides marginally above the nodes. Successful vegetative propagation requires the development of key morphological structures of the bamboo plant -rhizomes, roots, culms, branches and leaves. Failure of any one of them to develop will lead to the failure of the plant system. The plants produced will be clones of the mother plant and will carry all its characteristics.

Establishing the centre for propagation

Vegetative propagation can be carried out at different scales of activity, where thousands of plants can be produced. The basic principles of VPC establishment are:

- Scale of activity
- Identifying methods of propagation
- Identifying source of plant material
- Selecting nursery site
- Planning, layout and preparing site
- Managing propagation activities
- Control of pests and disease.

Scale of Activity

Scale of operation proposed in this infosheet will provide a capacity to produce 35,000 plants annually in 2- 3 cycles of production.

Propagation Methods

There is a range of methods to choose from, including rhizome offsets, culm and branch cuttings and layering. Rhizome offsets, though traditionally known and successfully practiced, cannot be used for mass multiplication since only a few can be extracted from a clump. Layering is labour intensive, is difficult to manage in field conditions and the plant produced have low survival percentage and thus less preferred.

Vegetative Propagation Centre (VPC) will be using culm cuttings and branch cuttings along with macroproliferation of tillers with rhizomes. These two methods are cost effective, simple and useful for large scale production. Also, there are little seasonal limitations for using them. However, these are not suitable for species having thin walls (culm cuttings) and thin branches (branch cutting method), but can be used for the thick walled species.

Using branch cuttings, more number of cuttings can be obtained in the same collection area, compared to culm cuttings, although, success rate is better with culm cuttings.

Macroproliferation can be used to multiply rooted plants. However in macroproliferation plant vitality will reduce over time and thus fresh rejuvinated stock will be needed.

All these three techniques will be used concurrently to meet the targeted number.

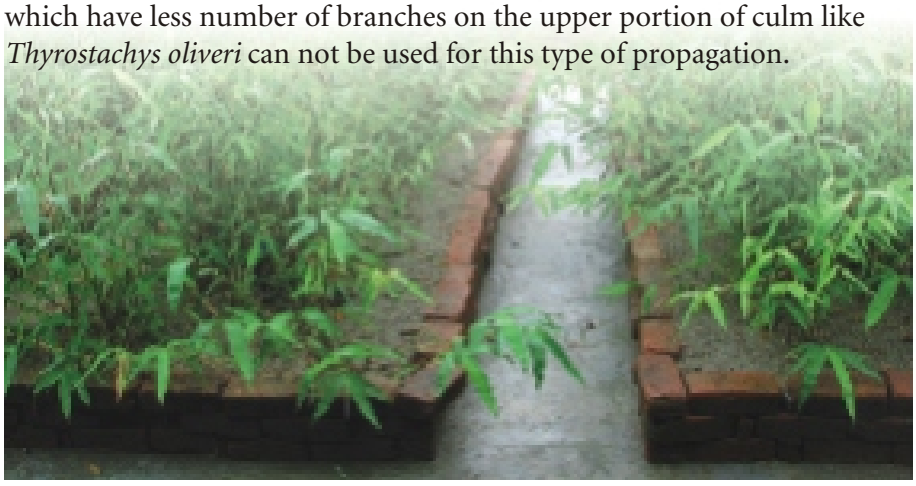
Source of Plant Material

The source of plant material should preferably be in the near vicinity to ensure availability at comparatively low prices. This also helps in getting material afresh for trials. The source or sources of good quality planting material should be identified in advance, and an assessment of the likely quantities and price should be done.

Site selection

- Site should be on level ground, well drained and preferably close to the plantation site.
- Reliable source of water to provide adequate water throughout the year.
- Easy access for transport, communication and resources.
- The nursery site will require protection against depredation by animals.

Species to be propagated: Since this facility is based on branch cuttings, culm cuttings and macroproliferation methods, species which are thick walled and are large sized can be multiplied in the nursery. Many of the NMBA prioritised species like *Bambusa balcooa, B. nutans, B. tulda, B. bambos, B. vulgaris, D. hamiltonii, D. giganteus,* are amenable to such propagation. For branch cuttings, the same rule applies. However species which have less number of branches on the upper portion of culm like *Thyrostachys oliveri* can not be used for this type of propagation.



Area

An area of 2 hectares will be required for setting up a VPC.

Infrastructure required

The break up of area required is:

1.	Brick platform with cement mortar edging-1000 square meter for accommodating 60 propagation beds of 1.2 meter wide, 6 meter long and 21 cm deep	1000 sq. m
2.	Open nursery for placing the poly bags having rooted cuttings	1000 sq. m
3.	Net shed (50%) of 510 square meter for hardening of rooted cuttings	300 sq. m
4.	Plantation of clumps to provide mother material for future requirements	17000 sq. m
	Total	19300 sq. m or say 20,000 sq.m

Infrastructure for the facility

The VPC is scaled to produce 35,000 plants per annum in two or three cycles of plant production. Adequate infrastructure is provided as under.

A. Propagation beds

While setting up a VPCs, innovative and non-conventional approach of rooting cuttings in sand medium is being recommended.

Rooting is initiated from the growth buds, present at the nodes of the cuttings. The required nutrition is met from the stored food material in the cuttings. Addition of soil and manure in the rooting media can cause infection as they may harbour pathogens. Further, soil retards the process of drainage of water and aeration in the propagation bed. Thus use of sanitised sand alone is recommended as the media for rooting.

The cuttings sprout and are allowed to remain in propagation beds till development of independent root system. This usually takes 40-60 days depending on the climate, species used, season of collection, and the plant material that has been selected and used. The rooted cuttings are extracted and shifted in to poly bags and rooting sand media is taken out from the bed, cleaned, spread over in sunlight and is filled in for the next cycle of propagation.

Providing shade to the cuttings : The cuttings and the new sprouts should be covered to prevent drying due to intense heat but having enough sunlight to carry on photosynthesis. Heavy shading promotes

Nursery beds should be on cemented platform

moulds and rotting of cuttings. Thus partial shade (50%) is ideal for meeting the requirements of plants for sunlight. However, shade should be removable so that it may be taken off during overcast days.

A. Propagation bed: Steps leading to the making of a propagation bed:

- Beds are raised on a cemented platform to check infection from soil.
- Beds are demarcated and three layers of bricks, on top of each other are placed along the perimeter of the bed.
- Bricks are not joined with mortar; as this will lead to stagnation of water that is undesirable for plant growth. The beds are filled with sand which is clean, sterile and neutral in pH.
- Sprinkler irrigation is recommended to ensure even distribution of water over the bed. It has the following advantages:
  - Provides water uniformly over the bed
  - Small drop size does not damage delicate shoots and displace sand.
  - Maintains high humidity to reduce water loss from the leaves to a minimum.

B. Net-shed

The plants are taken out from propagation beds and shifted into poly bags. These are brought to the sheds (50%) shade and kept for hardening for seven - ten days. Black colour net should be preferred for raising net sheds.

C. The open area

Plants are kept in the open till all systems develops fully and are ready for lifting or sold. The polythene bags are kept on a brick platform to prevent the root striking the soil and facilitate lifting.
The duration of stay of plants in the open nursery is 3-4 months or till the time the plant system gets fully established.

Planning the lay out and preparing the land

A. Preparation of Propagation Beds

I. Preparing cemented platform

- The required dimensions of the platform are 11.0 m in length and 7.0 m wide. Prepare a cemented platform using bricks and a mixture of cement, sand and stones in the ratio of 1:2:4.
- The cemented platform should be left for two days before making propagation beds. Prepare 12 such platforms, keeping a workable distance from one another. Approximately 1000 square meter of area will be required to make the platforms.

Use black shade net for the net shed

II. Preparation of beds on cemented platform

- Demarcate a bed of length 6.0 m and a width of 1.2 metres. Demarcate five such beds on the platform such that a footpath of 0.75 metres is provided between two adjoining beds .
- Now place one layer of bricks along the demarcations flat and lengthwise. Place two more layers of bricks in a staggered manner one above the other over this to complete the bed (see picture).
- Considering the thickness of the brick to be 7.0 cm, the height of the platform will be 21.0 cm. Raise similar propagation beds over the remaining 11 platforms.

III. Putting up the net on the propagation beds :

- Use one net shed having 50% shade to cover the five beds on a cemented platform. Thus approximately 150 sq metre will be used for a net shed 2 metres in height. Make a frame for supporting the shade net and then affix it over the beds.
- The total requirement of the net shed over 12 platforms will be 1800 sq m.

IV. Procedure for filling the beds

- Two types of sands- coarse and fine will be required. The particle size of coarse and fine sand is 0.5 -1mm and 0.05-0.1 mm respectively. Fill half of the height of the bed with coarse sand and add fine sand at the top each approximately 10 cm deep.

V. Installing the sprinklers

- Sprinklers with small size should be selected as they produce smaller drops. Water supply will be through a main feeder pipeline along the centre of the bed with 90 cm long uprights having baffle-type nozzles spaced 1.0 m apart.
- Thus five nozzles will be required per bed. A pressure of at least 30 pound per square inch (psi) should be maintained in the sprinklers.

Do not plaster or apply mortar between the bricks

B. Procedure for making the net-shed

Demarcate 15m x 20m space (300m^2) for the shed facility. The requirement of shed will be 510m^2 of net. The height of the shed should be 3 m.

C. Making the open nursery

Demarcate 1000 sq. m of area in vicinity of the net sheds. Level the ground and lay single layer of bricks to make a levelled platform.

The infrastructure requirements for the VPC have been tabulated at Annexure-I

Consumables for the facility

Consumables like polythene bags, soil and cow dung for filling the poly bags, tools, chemicals (hormones) and glassware are required in the facility.

1. **Polythene bags :** The suitable size of the bags is 15x 21 cm. Take soil, sand & cow dung in the ratio 2:1:1 and fill the poly bag with this mixture.
2. **Small tools:** Only small tools like knife, secateurs, spade, hack saw and jumper are required for various operations.
3. **Chemicals:** Rooting hormones like Indole Butyric Acid (IBA), Naphthalene Acetic Acid (NAA) and glassware are required while preparing the cuttings. Alternately Boric acid or commercial preparations like Rooton, Rootex, Seridex etc can be handy.

However, since the cuttings have reserve hormone stock in them, these chemicals may or may not be required. It has been observed that cuttings taken in spring give good sprouting even without hormones.

Use sand only for propagation bed.

But actual practice can be standardised only with experience at site, species selected for propagation and season specific variations.

Using IBA and NAA : 200 ppm (parts per million) IBA is used for dipping the cuttings. A combination of the two hormones, i.e. NAA(100 ppm) & IBA (200 ppm) can also be used.

Preparation of IBA solution: To prepare one litre of 200 ppm solution of IBA , dissolve 200mg of the IBA in about 10 ml of ethyl alcohol, in one litre volumetric flask. Add distilled water to make the volume.

Preparation of NAA solution: Take 100 mg of NAA and dissolve in a few drops of ammonium hydroxide . Make up the solution to one litre with distilled water.

After preparing the hormone solution, dip the branch cuttings in it for 15-24 hours.

In case of culm cuttings wrap the buds with cotton soaked with hormone solution for 15-24 hrs.

Use of Fungicide

The cuttings should be dipped in a solution of fungicide (0.1% Bavistin) for 30 minutes. However, this should be done only when the beds are infected. If clean, sterile sand is taken the use of fungicide can be avoided.

Managing propagation activities

After construction of propagation beds installation of sprinklers and net shed, the facility is ready to be used.

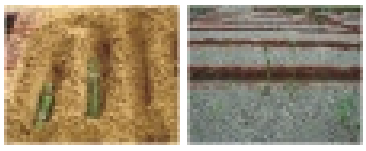
This facility will use primarily culm and branch cuttings for multiplication. Fresh plant material should be collected and prepared for propagation. There should be minimum time lapse between collection and planting of the cuttings.

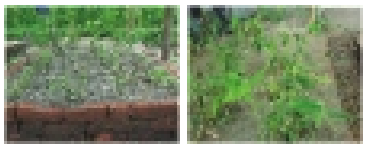
Care during transportation

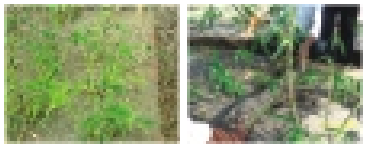
While transporting the cuttings humidity should be maintained by wrapping these in a wet cloth or similar material. For long travels periodic sprinkling with water may be required. Damage to buds should be avoided and care taken during stacking/ bundling for transporting. Direct sunlight and exposure to heat should also be avoided.

Watering the beds

The beds should be saturated with water till the water starts seeping out from the beds. Care should be taken so that the root zone remain wet. The frequency and duration of watering will depend up on the season.







A. Multiplication using Culm cuttings:

1. Selection and preparation of suitable multiplication material

- Look for healthy clumps in the vicinity. Select the culm cuttings with two nodes (which would mean two active buds and thus two prospective plants) from lower to mid zone of the culm. The selected culm should not be more than 2 years old.
- Culms that emerge early in the growing season show better response in root induction; mark these culms by painting/ marking.
- Separate the culm into 2-node segments. Always use a sharp knife or saw to avoid splitting at the cut especially in thin walled species. The cut ends should be atleast 5-10 cm on either side of a node.
- Immediately after cutting, the cut ends should be sealed with wax or wraped with moist gunny bags with moist sawdust/coconut husk/straw to minimise water loss from cut ends. Dip the cuttings in hormones and fungicide.
- The collected cuttings should be transported with least delay to the propagation bed.

2. Putting the culm cuttings in to the beds

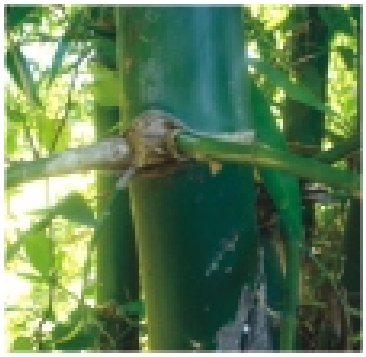
- Remove the lateral branches from these segments using a secateur taking care that, buds are not disturbed.
- Fill the hollow portion at both end of the cutting with sand. Make an appropriate sized trench in the bed for placing the cutting. 5-7 cm below the surface of the bed. Cover the culm segment with sand so that no part is visible.
- Water the beds immediately and, thereafter, regularly with sprinkler.

3. Sprouting and rooting

- Within 10-15 days cuttings will sprout and within 40-50 days enough root system will have developed to make the cutting independent. After this take out the cutting from the bed and transfer it to net-shed.
- Emergence of roots can be guaged by inserting a finger adjacent to the sprout and moving it along the cutting. Alternately lift one end of the cutting slowly from the bed to see if the roots are developed. Few such testing may be required as some buds may not produce roots though in other places it may be present.

4. Number of plants from culm cuttings

- Considering the approximate average length of a 2 node cutting to



be 40 cm, about 5 cuttings can be placed longitudinally along the length of bed. Thus in one row, 11 cuttings can be accumulated, keeping 15 cm gap between two cuttings. Therefore one bed will have 55 such cuttings (2 noded) and thus 110 active buds from which sprouting can take place. (The actual number may vary depending upon the proficiency of the staff).

- From 30 beds, 3300 cuttings can be obtained. Considering 70% success rate of germination, 2310 cuttings can be obtained. If the process is carried out in three cycles, up to 6930 plants can be produced.

B. Multiplication using branch cuttings

The branch cuttings of thick walled species generally have spontaneous rudimentary roots and sometimes even have rhizomes at their swollen bases. This is an ideal material for producing plant by propagating them.

1. Selection of branch cuttings

- Select the branches from culms less than 2 years of age and separate them from the culm without damaging the buds. Make the cut at the point of connection of the branch to the culm using a saw, alternately from the top and bottom portion of the branch.
- Repeat this till the branch is cut completely severed. Remove the upper portion to retain 3-6 nodes. Slightly press the buds to ensure that they are active and healthy. A trimmed branch should be 40-60 cm long having 2-4 nodes with healthy buds.
- Dip the branch in the hormone and then in the fungicide. Cut the sub-branches and leaves using a secateur. Seal the cut end with wax/cow dung
- The branches should be wrapped with wet gunny bag containing moist sawdust for preventing loss of water during long transportation. Care should be taken to prevent drying of cut ends.

2. Imbedding branch cuttings

- The final trimming including removal of sub branches should be done just before putting the branches into the rooting medium. Place the branch cuttings vertically, in the sand at 7-10 cm depth .
- The sand should be pressed firmly around the cutting with fingers. The cut-end of the branch tip should be covered with cow-dung or wax.
- The distance between two cuttings should be 10 - 15 cm. Operate the misting immediately after imbedding the branches and thereafter irrigate frequently and regularly.
- ***Note: In windy and exposed areas the branch cuttings should be kept in poly tunnel to retain humidity and temperature.***

Always keep culm cuttings horizontally below soil 2 or 3 nodded cutting are better.

3. Sprouting and rooting

- The cuttings sprout within 7-10 days and produce profuse active roots in the propagation bed depending on the season and species within 4-8 weeks (for cuttings taken during April-August) or 8-10 weeks (for cuttings taken during October- November).

4. Number of branch cuttings

- About 50 branch cuttings can be placed in one row along the length (6.0m) of a bed and 7 numbers in the width, 50x7 =350 branch cuttings can be placed in a bed. With the average of 70 % success in rooting from one bed we can obtain 350x0.7 = 245 rooted cuttings may be obtained from a propagation bed. (As in the case of culm cutting this number may also vary and perhaps only 300 cuttings could be accommodated).
- From 30 beds : 30x 245 = 7350 x 2 times a year = 14,700 (app.) branch cuttings are expected.

C. Transfer of the plants (from culm cuttings and branch cuttings) to Net-shed

- After root initiation, take out the cuttings from the propagation beds and wash them carefully with clean water.
- Place the rooted cuttings in the prepared poly bags (containing a mixture of soil: sand and FYM in ratio 2:1:1) and place them in the net shed.

Never take juvenile plants form propagation bed to open nursery.

- The leaf development will take 7 -10 days. Plants need to be irrigated continuously during this time. After this the plants are ready to be taken to the open nursery. Keep the plants in the open nursery for at least 2-3 months before planting in the field. They should be watered regularly in the nursery.

D. Multiplication through Macroproliferation

Rooted culm and branch cuttings can be further multiplied through macroproliferation. By cutting the rhizome system into segments, each with independent root and shoot, to produce a large number of entire plants.

Steps for macroproliferation

1. Remove the soil to expose the rhizome in the plants. Separate the individual shoots with clean and sharp cut at the rhizome neck region with secateur such that each shoot retains a part of the rhizome system and roots.
2. Trim the upper portion of the shoots leaving two nodes, to restrict apical dominance and production of more shoots.
3. Seal the cut surface with wax. Dip the cuttings in Bavistin (0.1 %) solution before planting them in multiplication bed or in polypots.
4. Replant, water and harden the cuttings under shade for 3-5 days before bringing them to the nursery bed in the open.

Macroproliferation is best done during active growing season.. Depending on time constraints around, 10,000 - 15,000/annum additional plants can be produced through macro-proliferation of selected seedlings (juvenile collection), branch / culm cuttings in the VPC.

For branch cuttings use polytunnel over the propagation bed.

Production capacity of the VPC

A combination of the three techniques can be adopted to produce 35,000 plants in a year by cycling the facility twice or thrice annually:

Method	No. of cuttings per bed	No. of cuttings, assuming 70% success rate	No. of beds	Total no. of cuttings	No. of cycles per annum	Total no. of plants
Culm cutting (2 noded, 40 cm in length) (CC)	11X5=55 Buds X2=110	77	30	2310	3	6930
Branch cutting (BC)	50X7=350	245	30	7350	2	14700
Sub-total						21,630
Macro-proliferation	*Out of the total produce, 14,000 will be taken to generate another 14,000 plants by macro-proliferation*					14,000
TOTAL						35,630*

Say 35,000 (Thirty five thousand only)
* Conservative estimation but better results can be achieved by skilled persons.

Precautions

1. Don't use soil or homemade compost as a medium to start cuttings because they harbour disease. Mixtures of sand, peat moss, sphagnum, perlite and vermiculite work best. Perlite and vermiculite provide aeration and drainage. They retain substantial amounts of water and release it slowly maintaining an ideal humidity profile.

2. After completion of one cycle in the propagation beds, the rooting media bricks and sprinklers have to be sterilised before reuse.
3. Suitable time for planting : In eastern and North East part of India mid-February is the best time for collection of cuttings. However success is good till August. Within these 7 months the propagation activities can be carried out 3 times, each with an average 65 days duration in the beds. In other parts of the country, monsoon season is the best time for taking up the activity. June onwards, the cuttings can be prepared and planted.
4. The cuttings should be preserved in moist condition immediately after collection. If the collection site is nearer to the nursery the collected branches can be carried in a bucket containing water.
5. The leaves, axillary branches and tips of the branch cuttings need to be trimmed carefully. In case of culm cuttings, the branches and leaves should be extracted while taking care that buds are not affected.
6. The platform should be made slightly sloped so as to avoid any water retention.

Control of diseases

Leaf rust and leaf spot are the most common diseases observed in bamboo nurseries.

- Leaf rust affects most bamboo species. The infection appears as grayish-brown minute flecks on mature leaves, which later spread and form large spindle-shaped lesions. Severe infection causes withering of affected foliage. The remedy is fungicidal application.
- Leaf blight and leaf spot that are caused by different fungi, occur commonly in bamboo nurseries. The severity of the diseases depends on the bamboo species, the causal agent and nursery practices. Application of fungicides in appropriate dosages is recommended.

Annexure I

Infrastructure for setting up

Component	Numbers
Bricks for cemented platform	32500
Bricks (propagation beds)	12500
Bricks (open nursery)	45000
Cement mortar for edging	(LS)
Sand for rooting media-	120 cubics meters
Net for propagation beds	1800 sq.m
Net (50%) - for 'Net Shed'	510 sq. m
Misting facility with piping, overhead tank and pump	LS
Labour cost for laying and fixing	LS
Fencing (optional)	
Small working tools including trolleys	
Total	

Material/consumables

Component	Numbers/unit
Culm and branch cutting	51,480
Polythene bags	50,000
Soil and cow dung per bag	
Labour per plant	
Chemicals-rooting hormones and insecticides	

List of NMBA Supported existing VPC network in India

No	Location	Contact address	Tel/ fax & e mail
1	Bangalore, Karnataka	Head Tree improvement & Propagation Division, Institute of Wood Scince & Technology, 18th Cross, Malleswaram, Bangalore 560 003	tsrathore@iwst.res.in sviswanath@iwst.res.in 080-23346811
2	Chessa, Papum Pare Dist. Arunachal Pradesh	Director, State Forest Research Institute, Van Vihar, P.B. No 159, Itanagar 791 111, Arunachal Pradesh.	directorsfri@hotmail.com telefax: 0360- 2203566
3	Palampur, Himachal Pradesh	Head Biotechnology Division, Institute of Himalayan Bioresource Technology, Pos Box 6, Palampur Himachal Pradesh. PIN. 176061	kukisood@yahoo.co.in Tel.01894-30742-33338-39 , Fax: 01894-30433
4	Pantnagar Uttarakhand	National Coordinator, Bamboo Coordination Centre. G B Pant University of Agriculture & Technology, Pantnagar - 263 145, Uttrakhand	saliltewari@yahoo.com Tel: 05944 -234631
5	Basishta, Guwahati, Assam	State Silviculturist, Forest Complex, Basishta, Guwahati, Assam 781 029	parthasdas@sify.com 0361 - 2540469 (F) 0-986440-92055
6	Karigaon, Kokrajhar, BTC, Assam	Divisional Forest Officer, Haltugaon, Bodoland Territorial Council, Kokrajhar, Assam 783 370	rajenchoudhury@ sancharnet.in Tel No. 03661 270 224, Mob. 94350 26385
7	Lathao, Lohit District, Arunachal Pradesh	Divisional Forest Officer, Namsai Forest division, Lohit District, Arunachal Pradesh.	Tele fax No. 03806 262223
8	Zunheboto, Nagaland	Member,NBM _ IT & Nodal Officer VPC Nagaland Bamboo Development Agency, Red Cross Building, P.R. Hills, Kohima, Nagaland	vikatoc@yahoo.com 03862-2229415, Tel. 09436012125. Fax 03862 -241305
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List of NMBA prioritized bamboo species

Sl. No.	Species	Local Name
1	Bambusa balcooa	Bhaluka, Boro bans, Wamna, Beru, Barak, Leewa
2	Bambusa bambos	Kotoha, Illi mula, Kanta Bans, Seneibo, Mungil, Mullu Vedaru, Bongu vedaru
3	Bambusa nutans	Mokal, Malla, Makla, Kali, Badia bansa, Uttang, Rungazumi
4	Bambusa pallida	Bijuli, Bakhal, Barwal, Tesero, Watoi, Pushee Loto
5	Bambusa polymorpha	Betwa, Bari, Narangi bans, Jama Betwa
6	Bambusa tulda	Jati, Kiranti, Wati, Makar, Mirtinga, Rowthing, Paoshiding, Ying, deobans
7	Bambusa vulgaris	Basini Bans, Bakal, Lam Sameibi, Vairua, Sundrogai, Ketuna,
8	Dendrocalamus brandisii	Bulka, Wanan,
9	Dendrocalamus giganteus	Maipo, Bhalo bans, Mari bol, Sadiya Kako
10	Dendrocalamus hamiltonii	Kako, Fonay, Pecha, Taqma, Unep, Wanoke, Pao, Phulrua, Maggar
11	Dendrocalamus strictus	Lathi bans, Kanka Kara, sandapa veduru, Karal, Nakur bans, Kallan mula, Kurathi mula, Narvel, Salia, Kal mungil
12	Melocanna baccifera	Mautak, Tarai, Arten, Muli, Watrai, Moubi, Turiah
13	Ochlandra travancorica	Eera, eatta, Oda, Odai,
14	Pseudoxytenanthera stocksii = Oxytenanthera stocksii= Dendrocalamus stocksii=	Konda,Oor-shema, Uyi, Chivari, Mes
15	Schizostachyum dullooa	Dolo, Tolluwa, Rawthla
16	Thyrsostachys oliverii	Kanakaich, Kerakwa
17	Dendrocalamus asper	Asper
18	Gudua angustifolia	Guadua
19	Phyllostachys pubescens	Moso

FAQ

1. **Can I use all the culms in a clump for vegetative propagation.?**

Ans: No you should use only culms less than two years old from a superior clump. So is for branches which should also be collected from less than two year old culm

2 **What should be the colour of shade net for net shed?**

Ans: Preferably black for improved photosynthetic efficiency.

3. **Can I add cowdung or manure to the propagation bed?**

Ans: Not recommended as it can cause fungal infection. However the sprouting is a function of food in the buds and is independent of nutrient availability in the rooting media

4. **Should the brick border of the sand beds be cemented?**

Ans: No, they should only be stacked one above the other for facilitating water drainage. (See illustration)

5. **If seed is available should I go for vegetative propagation?**

Ans: If the seed is from a superior mother plant and viable then it is the cheapest alternative.

6. **Can I place the culm cuttings vertically in the propagation beds to save space?**

Ans: No. Successwill be drastically reduced.

7. **Which is better one node cutting or 2-3 node cuttings?**

Ans: It is always better to go for 2-3 node cuttings to reduce failure. Even if all nodes sprout and survive these can be separated to have as many numbers of plants.

8. **Can I extract the sprouted plants and straight plant in the field?**

Ans: Not suggested, except for heavy rain fall areas. It is better to keep them in hardening facility for a few days and then keep it in open nursery to get fully hardened before planting.

9. **Can I do macroproliferation in the plants produced vegetatively?**

Ans: Yes it is possible. You should only ensure there is a rhizome formation and roots and shoots in each tiller so separated.

10. **Can all species of bamboos propagated using culm and branch cutting?**

Ans: Usually it is the thick walled and low branched bamboos are responding better to vegetative propagation.

11. **What is the chance of my VPC raised plants flowering soon?**

Ans. As all vegetatively propagated bamboos the VPC raised plants too will flower synchronously with the mother clump. You should take care not to use propagation material from a near flowering clump and check up the history of flowering in the area.

12. **Is the target of production of VPC achievable?**

Ans. Yes. For this we need to carry out the operations regularly at the prescribed manner. One can operate in a year 3 (three) cycles of propagation activity covering culm cutting and branch cutting in all the 60 beds along with macroproliferation that will yield the desired number of planting material. In the very first year it is likely that we may be able to produces 5000 to 10000 plantlets for reasons of accumulating hands on experience and streamlining the operations.

13. **Can I use local material instead of bricks in case of non availability or being very expensive?**

Ans. Yes. Locally available stones for platform or treated bamboo splits for edging are some of the alternatives that can be thought of.

National Mission of Bamboo Applications: Requisition for Publications

Name/ Organisation			
Address			
Telephone/ Fax	**Signature**		
Publications	**Price**	**Quantity**	**Value**
1. Field Guide : The Book of Bamboo (FG 02 05/05)	200/-		
2. Training Manual : Building with Bamboo (TM 01 02/04)	200/-		
3. Training Manual : Bamboo shoot processing (TM 02 10/05)	100/-		
4. Training Manual : Propagating Bamboo (TM 03 11/04)	150/-		
5. Training Manual : Propagating Bamboo (TM 03 H 12/05) - Hindi	200/-		
6. Training Manual : Propagating Bamboo (TM 03 M 12/05) - Malayalam	150/-		
7. Training Manual : Propagating Bamboo (TM 03 A 12/05) - Assamese	150/-		
8. Training Manual : Propagating Bamboo (TM 03 B 12/05) - Bengali	150/-		
9. Training Manual : Cultivating Bamboo (TM 04 11/04) -	200/-		
10. Training Manual : Cultivating Bamboo (TM 04 H 12/05) - Hindi	200/-		
11. Training Manual : Cultivating Bamboo (TM 04 M 12/05) - Malayalam	200/-		
12. Training Manual : Cultivating Bamboo (TM 04 A 12/05) - Assamese	200/-		
13. Training Manual : Cultivating Bamboo (TM 04 B 12/05) - Bengali	200/-		
14. Training Manual : Culm container craft (TM 05/ 01/06)	150/-		
15. Training Manual : Micro-propagation (TM 06 08/06)	200/-		
16. Annotated bibliography of bamboo (BG 01 02/04) - CD	250/-		
17. Market assessment - Flooring (MA 01 02/04)	250/-		
18. Market assessment - Furniture components (MA 02 02/04)	250/-		
19. Cultivating & Propagating CD	100/-		
20. Atlas of Bamboo Devices	200/-		
21. Info-Sheets : Maturity Marking/Charcoal/TPF/Gasification	10/-		
22. NID : Cane & bamboo craft - NE (hardback)	370/-		
23. NID : Cane & bamboo craft - NE (paperback)	300/-		
24. NID : Textile & bamboo craft - NE	150/-		
25. NID : Innovating with bamboo	175/-		
26. Venu Bharati (English/Hindi)	250/-		
Gross Total			
Discount (10%) for sale over Rs. 3,000			
Net Total			