NMBA
National Mission on Bamboo Applications

indian handicrafts
हस्तशिल्प
continuing tradition

TRAINING MANUAL

Bamboo Craft: Culm Containers

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CONTENTS

PREFACE

IN OUR COUNTRY bamboo is in the process of being rediscovered. The fact that this natural and highly renewable resource is capable of myriad and diverse applications is drawing increasing attention.

Recent advances in technology and product development have opened up new vistas for usage and enterprise. The manufacture of bamboo boards, plywood and laminates, and the conversion of bamboo to charcoal, activated carbon, fibre and even gas to produce electricity represent some of the rapidly developing areas.

At the same time, there is a recognition of the fact that bamboo is a people's resource, one that has sustained people over the ages, before plastics and alloys became commonplace.

In India, people and communities have long known the virtues of bamboo and the fact that it can be used to make thousands of products that are functionally useful and also attractive. Over centuries, local traditions of usage and skill have developed, that continue to exist even today.

The usage of bamboo culms to make practical, sturdy and elegant containers is one such tradition. Even today, it is possible to find living examples of such usage. These have survived because of the strong functionality of such products – and because of the fact that a resource that is commonly and inexpensively available is all that is needed to make them.

This training manual builds on this legacy of skill and craftsmanship, to show the way to adapt time-tested and traditional products in the form of whole bamboo culm containers, to the needs and desires of contemporary markets.

The manual was developed by Minhazz Majumdar, and draws extensively on the experience of Ms. Majumdar and Shahriyar Choudhury and their organization, "The Earth and Grass Workshop'. New Delhi, of working for over a decade with bamboo to craft products for modern markets. They have designed over 200 contemporary bamboo products, and have been involved in the training and capacity-building of craft communities across India, particularly in the North East, to produce these bamboo items. They are also active in building marketing links, national and international, to promote sustained livelihoods.

Golak Khandual painstakingly made the illustrations, spending weets at observing processes and product-making.

Deepti Dabas and Suneel Pandey of the NMBA reviewed successive drafts and made vital contributions to the development of the training manual.

The preparation and publication of this training manual has been supported by the Development Commissioner (Handicrafts), Ministry of Textiles, Government of India. Shri Sanjay Aggarwal, Development Commissioner (Handicrafts), and his colleagues, notably Shri G.K. Asthana took a keen and personal interest in the development of the manual.

We hope that this manual, the first developed by the NMBA and DC (Handicrafts) specifically for the bamboo craft sector, will indeed prove useful.

Vinay Sheel Oberoi
Mission Director
January 2006

01 Introduction

BAMBOO IS EMERGING as an excellent material for the twenty-first century – it is a renewable resource. Using bamboo makes good ecological and economic sense. It is easy to work with, and enterprise can be established with little investment.

As a design medium, bamboo is extremely adaptable, lending itself to both traditional and contemporary designs. Its circular hollow form, flexibility and lightweight structure allows bamboo to be used in many different ways, from making earthquake-resistant housing to smart interior accessories.

Bamboo is one of the fastest growing plants in the world. It is highly renewable, taking 3–5 years to mature. Culms from a bamboo clump can should be harvested every year. Bamboo can be grown on degraded land. Bamboo serves as nature's band-aid, its extensive roots binding soil together and its rapidly growing green cover releasing much-needed oxygen into the air.

There are over 1,500 documented uses of bamboo worldwide. Bamboo needs little preparation for it to be worked with. It puts reduced pressure on resources and is easier to use compared to other materials like plastics and metals, which require intensive processing and energy.

Traditionally, bamboo has been used for products as diverse as baskets, fishing rods, smoking pipes and weapons, as well as for housing and fencing. Artisan communities across the country are dependent on bamboo crafts for their livelihoods. In recent times, new technological innovations have resulted in a range of industrial bamboo products such as laminated bamboo flooring, bamboo board and corrugated roofing. These products have the potential to replace timber conventionally used in houses for doors, windows, furniture and flooring. Bamboo is also gaining popularity as an eco-friendly and cost-effective medium for interior décor and packaging. New designs add to the novelty of this ancient material, and succeed in creating new markets and uses.

The structure of the bamboo culm with its hollow internodes nestled between two successive nodes allows for the creation of a range of

containers to store and package a variety of products. Such containers, traditional or modern, capitalize on the bamboo's natural structural features and use whole bamboo sections.

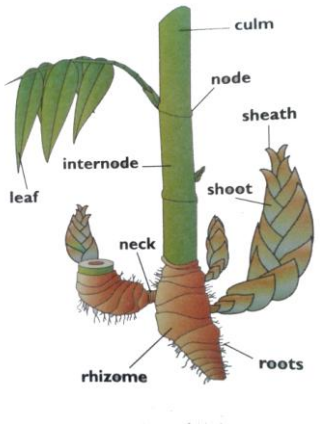
Depending on the bamboo's dimensions, these culm containers can vary in length and thickness, from small to large. Contemporary whole bamboo culm containers that have a great market potential include pen-stands, flower vases, boxes and planters. Lidded bamboo containers, horizontal or vertical, are eco-friendly packaging options for gifts during the festive season. These containers can be used to pack sweets, chocolates, dry fruits, pens, jewellery, watches, as well as small textiles such as ties and scarves. Whole bamboo culms can also be used to craft tabletop accessories such as scoops, tongs and CD racks.

The market for these products is also expanding due to the following factors:

- Increase in disposable income amongst the middle classes in metros and small towns across India.
- Increased awareness of ecological issues, and the need for wood and plastic substitutes.
- In urban areas, lifestyles have changed and there is greater emphasis on novelty, style, presentation and packaging.

In recent times, in India, bamboo-based crafts have proved to be extremely adaptive. Entrepreneurs and designers working both on their own and with traditional craft communities are creating innovative bamboo products suited to contemporary tastes and trends. There is increased awareness and interest in the potential of bamboo crafts, and a new paradigm is being set for bamboo crafts. This involves not only more design strategies but also a degree of mechanization, and tolling and adoption of new finishing techniques and processes. There is growing recognition of the tremendously positive contribution, both ecological and economic, that the bamboo craft sector can make to national development.

02 The Bamboo Culm



BAMBOO BELONGS TO the grass family. It is a hardy and vigorous plant, capable of growing in a variety of soils and climates.

There are over 90 genera and 1,200 species of bamboo worldwise, with 18 genera belonging to 130 species available in India.

The bamboo plant is a complex system. Its most striking feature is the stem which emerges from the grounds as a tender shoot, and grows quickly into tall and woody culm. The culm is usually a hollow cylinder tapering towards the top. It is the most commonly used part of the bamboo plant.

The culm arises from the rhizome, a part of the underground network of the bamboo plant. An emerging culm is called a shoot. The shoot grows very quickly into a culm, reaching its full height in only a few months.

A bamboo plant system consists of many culms. Each year new culms are added, which, unless extracted, will live for 7–9 year. An individual culm attains its maximum diameter and height in a single spurt of growth, typically within a period of between 80–110 days after emergence from the ground.

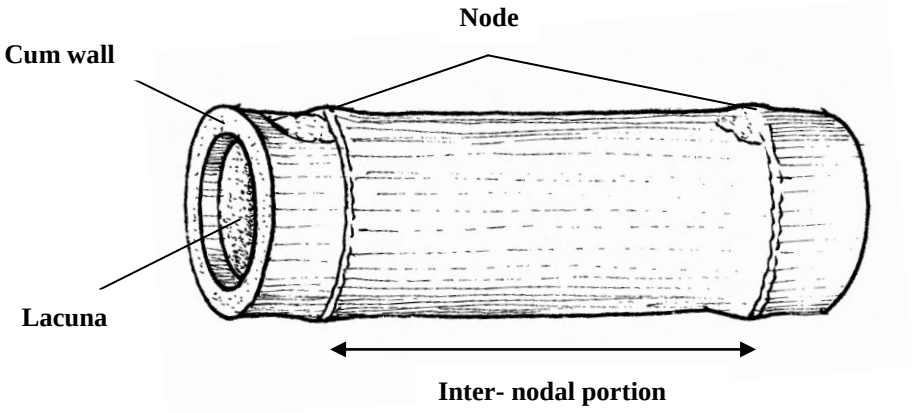
The bamboo culm has joints or nodes which divide it into sections. Each culm section starts and ends with a solid part called the node. The Culm section between two successive nodes is called the internode. Bamboo fibres run longitudinally down the internodal portion, making splitting easier. At the node, the bamboo fibres run transversely.

Tubular in structure, the culm develops as a cylinder that tapers towards the top. It is usually hollow but sometimes solid. The culm wall varies in thickness depending on the species, the management practices adopted for

cultivation and local climatic conditions. In drier areas the bamboo is smaller in diameter, with thinner culm walls; the bamboo culm tends to become semi-solid, i.e. with a smaller hollow space in the portions between the nodes.

The empty space within the internode is called the lacuna. The outer part of the culm – the skin or rind – is called the cortex, and its main function is to protect the inner tissues and repel water. Bamboo fibres along the cortex contain lignin and silica, which strengthen the outermost layer.

The culm is the part of the bamboo plant used for crafting containers.



03 Bamboo: Usage and Craft

BAMBOO HAS BEEN used by people since time immemorial to craft a variety of utilitarian, decorative and even ritualistic objects. In one form or the other, bamboo features dominantly in the craft traditions of many communities.

Over time, people have developed a deep understanding and special skills with regard to this versatile material. Form housing to agricultural implements, from musical instruments to storage baskets, bamboo is suitable for many uses.

Bamboo offers many advantages as a material for craft-based products:

- It is a strong and versatile material that is easy to work with.
- It comes naturally pre-finished, with a smooth luster.

- It does not need extensive cleaning (removal of bark/branches) prior to use.

- The unique tubular structure of the bamboo culm, its strength and flexibility allow it to be used in a variety of applications.

- Bamboo is easy to grow and harvest, and is widely available throughout the country. It is a highly renewable resource.

- It can be easily split and woven into a variety of products. It can be cut into different sections for different uses.

- Bamboo products are washable and do not deteriorate when in contact with water.

- With very few and simple tools, many different products can be made out of bamboo. In fact, even today, many bamboo craftspersons use only a single tool, normally a *dao* or a machete.

- The initial investment (in raw materials and machinery/tools) is low, especially for bamboo handicrafts.

Bamboo can be used in any one or a combination of the following forms to make craft products.

Whole Bamboo

Whole bamboo crafts utilize the characteristic typical of most bamboo species – the fact that they are natural hollow containers. With a little bit of imagination and ingenuity, several useful and interesting containers can be created from whole bamboo, using one node or keeping both node walls intact.

Whole bamboo craft products focusing on bamboo as container include bamboo boxes, mugs, jugs, water storage pipes, grain measures. Other whole bamboo craft products exploit the strength, length and flexibility of bamboo culms, and include furniture items, walking sticks, candle-stands, tongs and scoops of varying dimensions

Slatted Bamboo

Bamboo lends itself easily to being slatted at the fibres along its length split under slight pressure. These slats can be of varied dimensions and shapes – flat slats, squared slats or even rounded ones. They can then be

made into different products by nailing or binding them with cane or yarn, sometimes in combination with whole bamboo or wood.

Examples of slatted bamboo products include doormats, tablemats, fruit-dishes, photo-frames, coasters and trays.

Woven Bamboo

Fine silvers can be easily made from bamboo, as it has a tendency to split along its length. Craftspersons are aware of this unique property of the plant, and have capitalised on it to create a range of products.

Bamboo silvers of varying dimensions are woven into basketry products of all shapes and sizes, and for different uses – from seed baskets to baskets for transporting poultry, winnowing trays to fish traps. They can also be need to weave functional or decorative mats.

04 Culm Container Craft

BAMBOO CULMS MAKE natural containers. Their naturally rounded form and the solid nodes that segment the hollow internodal portions enable them to be used as holding and storage devices.

Each section between two nodes can be used as a container; with lids fashioned from the same bamboo culm, two containers can be made.

The dimensions, shape and size of culm containers that can be made vary with the diameter and wall thickness of the bamboo culm, and the internodal length.

Whole bamboo containers have the following characteristics:

- They can be either vertical or horizontal, depending on how they are positioned and intended to be used, and where the opening of the container is located
- In vertical containers, the whole bamboo culm section rests on one of its node ends, and the top end is cut off. The nodal diaphragm forms the base of the container.
- In horizontal containers, the whole bamboo culm section rests on one side of its rounded culm wall and an opening is cut at the opposite end. Both the node walls remain intact in horizontal containers, effectively closing the ends.
- The container can be open at the top, or closed and secured with a lid which is also made of bamboo.
- Depending on the length of the internodes, the container will be long or short.
- Depending on the thickness of the bamboo culm, the container will be narrow or wide.

- The bamboo container will be leak-proof due to the firmness and characteristics of the bamboo culm wall, and the natural joints of the container are seamless.

People and communities have long known the usage and value of bamboo culm containers. Long before plastics were invented, such containers have been fashioned and used.

Made from a natural and highly renewable resource, traditional bamboo containers are functional. They are aesthetic too. They blend easily into the environment in which they are used, and do not stand out, unlike coloured plastic material or steel. Sturdy and light in weight, they can be carried easily.

TRADITIONAL CULM CONTAINER PRODUCTS

Water Container

The most widespread traditional use of bamboo culm containers if for carrying and storing water and food articles. These are especially common in the North East, but are also used in other parts of the country where good-sized bamboo is easily available.

Containers to carry and store water are of several types. The most common ones consist of a single node, with an open-top internodal section of 2–3 feet. Another type of container uses two internodal lengths,

with the solid node in the middle of the container pierced to make a longer container.

The open end of the container may be stuffed with bamboo leaves, to function as a stopper to prevent water from spilling out. Sometimes, lids are fashioned from a bamboo culm for the same purpose. In a useful variant, the upper portion of the container is cut in a slanted manner, making the pouring out of water easy.

Containers can be carried in a basket, or strapped on to the back, to fetch water from the source to the house.

These containers are also used to store locally brewed liquor, or even tea. Such containers are invariably lidded and use a single node. If the outer skin is taken off, as is normally done, the beverage will retain its freshness, since the softer inner skin allows a limited degree of evaporation.

Storage Containers

Culm containers of varying sizes, conveniently placed in the cooking area, are used to store salt, condiments and even grain. These are almost always single-noded and lidded. These containers can last for a very long time, since smoke from the hearth ensures seasoning and protection from insects and pests.

Culm containers play a role in agricultural operations too. Seeds can be stored safely in these containers; in some areas, the containers are filled with soil, and seedling are grown and carried to the planting site in them.

Drinking Mugs

Drinking mugs can be quickly fashioned in only a few minutes from freshly cut and green bamboo culms in the jungle, using a *dao* or a machete. For use in the home, however, such mugs are carefully and elaborately crafted, varying across communities in their styling, surface finish and handles. Designs can be carved into the outer surface, and tassles and other embellishments added.

Measures and Scoops
Using the solid node and half-curved extended culm section, whole bamboo sections can be made into scoops and rice measures. Often, a small part of the culm section on the other side of the node is whittled down to make a handle.

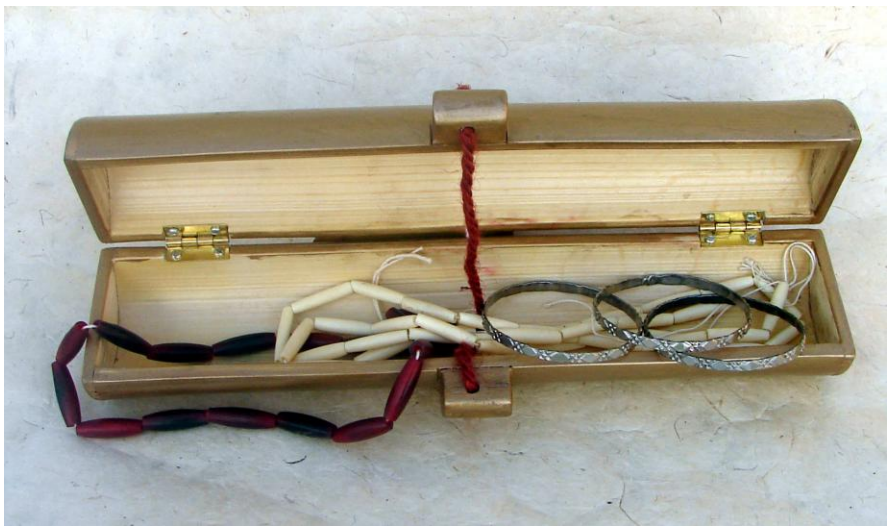
CONTEMPRORARY BAMBOO CONTAINER PRODUCTS

Bamboo is a people-friendly material. Over the ages, bamboo products have evolved in response to local and functional needs. Practical and elegant, these are suited to the local contexts in which they are used. Traditional whole bamboo containers and products are well suited to the local contexts in which they are used. They have evolved over centuries of usage, their design and construction adapted to local needs and tastes. However, the use of these traditional whole bamboo containers is limited in contemporary urban settings as people's needs are different. For instance, the whole bamboo water carriers, so popular in hilly regions, are redundant in towns and cities where there is piped water. Yet, whole bamboo containers such as flower vases or pen-stands can work very well in any modern home or office.

A new range of whole bamboo containers and products can be created keeping in mind contemporary needs and designs, and to cater to the growing demand for eco-friendly home accessories. These products focus on the bamboo's natural ability to hold and store, but are designed to fit into modern décor and use.

Contemporary whole bamboo products can be designed as any of the following:

Open Containers
These include table-top accessories such as pen- or pencil-stands, pin holders, visiting card holders, flowers vases, spoon stands, napkin or toothpick holders, paint-brush holders, beer or water mugs, jugs, candle holders. The use of these open containers is extensive, depending on the size and dimension of the products required to be stored.

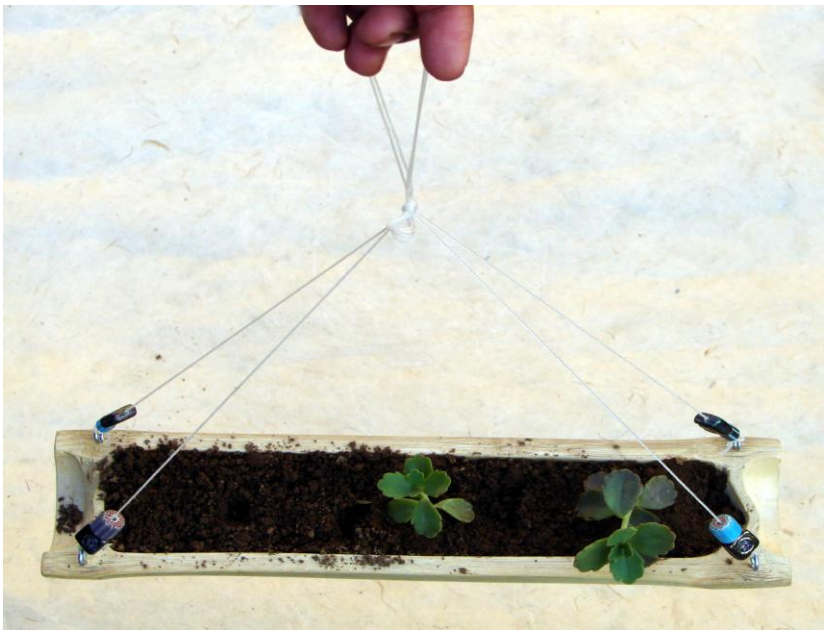


Lidded Horizontal or Vertical Containers

These include containers to store and gift dry-fruits and chocolates, or to make jewellery, spectacle and watch cases, and even pencil or pen boxes. Bamboo bottles can be made to store lentils, spices or dry snacks. Given the growing demand for new and innovative gift packaging, whole bamboo containers can become an attractive and viable option.

Planters

Bamboo containers make excellent planters, as they do not spoil when in contact with water. A variety of planters can be made with whole bamboo culms, ideal for home gardens in cities where people do not have large gardens and often have to plant in containers.



Tableware

Whole bamboo sections can be turned into attractive tableware such as serving scoops, spoons and tongs. These products are based on the fact that the rounded hollow form of whole bamboo can pick and hold things easily.

The range of products that can be made is limited only by the imagination and creativity of the product-maker. In this manual, a range of basic products are described. They are a good starting point, and an enterprising and innovative product-maker can create many more, depending on the market and the set of skills developed.

05 Selection of Bamboo

BAMBOO FOR CRAFT activities can procured from nearby markets, or, in bamboo growing areas, even collected directly from growers.

The first task is to identify the species that can be used.

- Fungi, borers or other disease-causing organisms should not have affected the bamboo. Fungal attack can leave ugly stains that reduce the aesthetic value of the bamboo and ultimately of the product. It can also weaken the outer layer of the culm.
- The culms should have the dimensions needed for the target product. Key dimensions are diameter of the culm, the wall thickness and length of the internodal portion.
- The culms should be free of irregularities and bends. This will avoid making irregularly shaped and less efficient products.

HARVESTING OF BAMBOO

If the artisans are using bamboo growing locally and are able to harvest culms as per their requirement, care should be taken to ensure that only mature bamboo culms are cut. Good harvesting practices will make available the required raw material over a longer period of time and will not hamper the normal growth of the mother clump.

Good harvesting practices include:

- *Proper selection of bamboo culms*: Choose mature culms of the requisite diameter for containers. The culms should be approximately 2–3 years old for use as containers and less than 2–3 years old for basket weaving purposes.
- *Selection of suitable harvesting period*: It is best to harvest bamboo in the dry season; harvesting in the rainy season or when the bamboo is flowering should be avoided. During in dry season, i.e. after the rains,

The hollowness of particular bamboo species is dependent on the growing conditions – the same species of bamboo grows differently in different climatic and soil conditions. For instance, in dry regions, the culms of Dendrocalamus strictus tend to be solid. It must also be noted that the entire length of a bamboo culm cannot be used as a container – usually, it is the upper portion that has the requisite length and hollowness.

the starch content of the bamboo is at its lowest, thereby reducing chances of attacks by borers and fungus, which feed on the starch.

- *Use of suitable cutting equipment*: Culms should be cut with a sharp cutting tool in one clean quick movement to avoid damage both to the cut culm and the underground rhizome. The best tool is a heavy sharpened axe, a machete or a hacksaw blade.

- *Proper harvesting practice*: The culm should be cut at a distance of 40–50 cms above the ground, keeping at least two internode lengths away from the ground level.

Dendrocalamus giganteus: **very large diameter culms**

SPECIES PREFERRED FOR WHOLE BAMBOO CONTAINERS

Whole bamboo containers can be made from a section of a bamboo culm that is straight, has a sizeable hollow centre and sufficient internodal length.

Bamboo species with low wall thickness or small diameter are not very suitable for use as containers due to insufficient hollow space. Bamboos in which the internodal space is not long enough are also not suitable for containers s the size of the container may become too small.

Some species of bamboo are more suited than others for use as containers because they have a good internodal length, diameter and wall thickness. The straight portions of the culms of these species should be selected. The tapered portions of the culms are difficult to use; these portions should therefore be lopped off and used for making other products, on in a different manner.

Bambusa balcooa: **large diameter culms**

Species with culms of very large diameter:

- *Dendrocalamus giganteus*

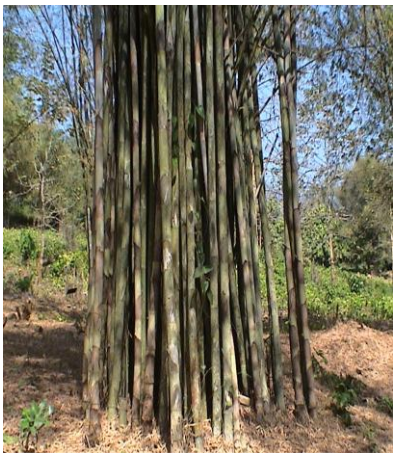
Species with culms of large diameter:

- *Bambusa Balcooa*
- *Bambusa bambos*
- *Bambusa polymorpha*
- *Dendrocalamus brandisii*
- *Dendrocalamus hamiltonii*
- *Dendrocalamus hookeri*
- *Dendrocalamus sikkimensis*

Species with culms of medium diameter:

- *Bambusa mutans*
- *Bambusa pallida*
- *Bambusa tulda*
- *Bambusa vulgaris*
- *Teinostachyum dullooa*

Bambusa bambos: **large diameter culms**



Bambusa polymorha: **large diameter culms**

Dendrocalamus bransdisii: **large diameter culms**

Dendrocalamus sikkimensis: **large diameter culms**

Bambusa pallida: **medium diameter culms**

Bambusa tulda: **medium diameter culms**

Bambusa vulgaris : **medium diameter culms**

The local names – the names by which these species are known in different parts of the country – are as follows:

Bambusa balcooa	Assam ***Bhaluka***; Meghalaya: Garo Hills ***Wamnath, Beru;*** Nagaalnd: Ao ***Oti/ Oyu***, Angami ***Vuteya***, Sema ***Awuti,*** Lotha ***Avuthi;*** Tripura ***Barak, Boro Barua***; West Bengal ***Balku bans***, North Bengal ***Boro bans***
Bambusa bambos	Andhra Pradesh ***Bongu veduru, Mulla veduru;*** Assam ***Kotoha;*** Karntaka ***Bidduru, Gatte;*** Kerala ***Illi, Mula, Pattill***; Gujrat ***Toncur***, Manipur ***Saneibo;*** Orissa ***Kanta bans***; Punjab ***Nal bans;*** Tamil Nadu ***Mungil;*** West Bengal ***Kanta bans, Behar bans***
Bambusa nutans	Assam ***Makaal, Jatia***; Orissa ***Badia bansa***; Sikkim: Lepcha ***Mallo, Mahi bans***; Tripura ***Makla;*** Uttar Pradesh ***Maala bans***; West Bengal ***Makhla, Mal, Aile***
Bambusa pallida	Arunachal Pradesh: ***Nyishi Hojoe***; Assam: Barak Valley ***Bakhal, Burwal***, Brahmaputra Valley ***Bijuli,*** Karbi-Anglong ***Loto***; Meghaalaya: Khasi Hills ***Seskien, Skhen, Tneng, Uskn***, Nagalang ***Teor, Wataoi***; Sikkim: Lepcha ***Pashipo;*** Nepal ***Kalinga***; Tripura ***Makal***
Bambusa polymorpha	Assam ***Jama betwa, Betwa***; Madhya Pradesh ***Narangi bans***; Tripura ***Paura;*** West Bengal ***Jama betwa, Betwa***
Bambusa tulda	Arunachal Pradesh: Adi ***Dibang***, Nuishi **Hotoe**; Assam ***Jati;*** Bihar ***Deobans***; Kerala ***Makar,*** Meghalaya: Garo Hills ***Wati***; Mizoram ***Rawthing***; Nagaland: Ao ***Longmi***, Angamin ***Khoprei,*** Sema ***Api***, Lotha ***Tsuntsan***, Konyak ***Ngetme***i, Reng ***Gunyan;*** Sikkim: Lepcha ***Paoshiding, Ying,*** Tripura ***Mirtinga, Mitinga;*** West Bengal ***Jati,*** Dooarsa ***Kiranti***
Bambusa vulgaris	Manipur ***Bakal***; Mizoram ***Vairua;*** Orissa ***Sundrogao, Suderkania bansa***; Sikkim ***Bongsing;*** Tripura ***Bari, Jati;*** West Bengal ***Basini bans, Bakal***
Dendrocalamus brandisii	Bengal ***Bulka;*** Manipur ***Wanan***
Dendrocalamus giganteus	Arunachal Pradesh: Khamti ***Maipo;*** Assam ***Worra;*** Manipur ***Maroobab***; Sikkim ***Bhalo bans***
Dendrocalamus hamiltonii	Arunachal Pradesh: Nyuishi ***Eo***; Assam ***Kako***, Karbi-Anglong ***Fonay***; Haryana, Punjab and Himachal Pradesh ***Maggar***, Manipur ***Unep***; Meghalaya: Garo Hills ***Wanoke***; Mizoram ***Phulrua***; Nagaland: Ao ***Auo***, Angami ***Vuprie***, Sema ***Tughakhahu***, Lotha ***Vepvu***, Konyak ***Yo***, Rngma ***Apuchye;*** Skkim: Lepcha ***Pao,*** Nepali ***Choya bans;*** Tripura ***Pecha***; West Bengal ***Pecha,*** Darjeeling ***Tama***
Dendrocalamus hookeri	Arunachal Pradesh: Adi, Nyishi ***Aepoi;*** Manipur ***Ooei;*** Meghalaya: Khasi ***Seiat, Sejsai, Sijong, Ukotang, Ussey***; Sikkim: Nepali ***Tili bans***
Dendrocalamus sikkimensis	Meghalaya:Garo ***Wadah;*** Mizoram ***Rawami, Sangaur***, Sikkim: Nepali ***Bhalu bans***
Teinostachyum dulloa	Assam ***Dolo***; Manipur ***Guh***; Meghalya: Garo Hills ***Wadroo;*** Sikkim ***Tokri bans***, Tripura ***Dolu***
Throstachys oliveri	Kerala ***Thottimula, Lathimlua;*** Tripura ***Kanak kaich***

Of these species, some have particularly good internodal lengths, relative to the overall culm structure. These include *Bambusa tulda, Bambusa polymorpha, Dendrocalamus giganteus, dendrocalamus hamilitonii, Teinostachyum dullooa* and *Thyrsostachys oliveri,* making them extremely suitable for culm container craft.

The selection should also take into account the availability, quality and price of the culms.

Availability should not be only for a point of time but should be seen in relation to the requirement over a period of time, so that product-making is not hampered by irregular supply.

For product-making, especially culm container products, it is important to use only mature bamboo. Although bamboo culms will attain their full physical dimensions in only a few months of emergence from the ground, the process of attaining maturity, i.e. of attaining their full strength will take place over the next 3–4 years. Immature culms, i.e. culms harvested in the first two year, will tend to be weak, and vulnerable to borders and termites. These should not be selected.

As far as practicable, select freshly cut of green bamboo. It is useful to have some knowledge of where the culms have been sourced from, and the practices followed for harvesting, storage and transportation.

Bamboo culms should preferably be seasoned for a few months before making whole bamboo based product. This will ensure that there are no splits in the products.

06 Treatment

BAMBOO IS A natural material and is prone to attacks by insects pets as well as fungi. Also, like any other natural material, decay will set in once the bamboo has been served from the plant system.

To protect and preserve bamboo for longer periods of time, it is necessary to treat bamboo. Once treated, bamboo can last for several year without decay and deterioration. It can be used for building purposes, and for making utilitarian or decorative products.

Treatment is also necessary to ensure that the bamboo is not susceptible to fungal attacks, which can stain and blemish the product.

COMMON BAMBOO PESTS

Bamboos are susceptible to attacks from certain insects and fungi.

- *Border Beetles*: These beetles live inside the bamboo, entering it through scars and cut ends. They consume the starch present in the bamboo, making multiple hollow tunnels along the length of the culm. These tunnels reduce the strength of the bamboo. The presence of these beetles can be detected by the appearance of fine bamboo dust powder from the tiny exit holes bored by them. Sometimes one can even hear the beetles eating the bamboo.

- *Termites*: Bamboos kept on the ground or dug into the ground (for construction purposes) are vulnerable to termite attacks. Improper storage over long periods of time also makes it susceptible to termite attack. They can rapidly eat away the bamboo.

- *Fungi*: Both moulds and fungi attack bamboos, especially when they are kept in damp conditions. These fungi not only mar the appearance of the bamboo leaving dark stains but also weaken it structurally.

Abiotic facators like storing the culms outdoors and continued exposure to sunlight may also affect the quality. These may result in cracks and splits in the bamboo culms.

PRESERVATION METHODS

Method to preserve bamboo can be broadly categorises as:

- Traditional methods
- Chemical processes

The traditional methods are simple and offer protection to a degree against borers. However, these methods do not offer total protection against termites and fungus. Chemical diffusion methods use various chemical products to increase the bamboo's ability to withstand borers, termites and fungus attacks. These chemicals range from relatively harmless boron salts to toxic arsenic and chrome mixtures, which need to be handled very carefully.

Traditional Methods

The traditional methods to ensure better preservation and durability of bamboo are as follows:

1. *Post-Harvest Preservation*: Protection of bamboo needs to begin the moment it is harvested. Post-harvest, the cut bamboo with its leaves and branches intact should be stored vertically in a sunny spot for 2–3 days for the photosynthesis process to continue. This helps to reduce the starch content in the bamboo.

2. *Water Seasoning*: The bamboo culms can be seasoned by soaking in water for a few week, immediately after felling. The starch in the bamboo leaches out into the water, providing the bamboo some protection from borer attacks. However, this seasoning does not prevent fungus attacks.

3. *Heat Treatment*: In the process, the bamboo is rubbed with castor oil and then heated over a gentle fire. A tarry substance oozes out of the bamboo and the bamboo becomes dark brown in colour.

4. *Smoke Treatment*: Bamboo culms are placed over a fire or in a smoking chamber and exposed to smoke for a certain amount of fire. Smoking reduces moisture content and imparts a protective layer of tar on culm surface.

Chemical Process

In order to further preserve the bamboo, certain chemical preservatives are recommended. However, it must be kept in mind that these preservatives are not safe and caution has to be exercised while using them to prevent damage to both humans and the environment. Care has to be taken for safe usage and disposal of these chemicals.

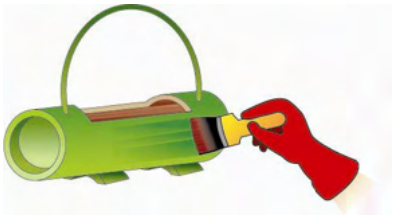
The preservatives commonly used are:

1. *Boron Salts*: A mixture of boric acid and borax in ratio 1: 1.5 is taken and a 5% aqueous solution is prepared. This solution is then used to

treat bamboo. It is the least harmful to use as it is not toxic and is specially recommended for use with woven strips of bamboo and for products intended to be used fro storing food. Boron salts are effective against termites and fungi. They are not toxic, and when used in concentrated solutions impart a degree of fire retardance as well.

2. *Creosote*: This is a toxic chemical, essentially tar oil with both fungicidal and insecticidal properties.

3. *Copper Chrome Arsenic*: One of the most effective treatments for bamboo, this is available in a solvent form for brush application or in a soluble form for dipping whole bamboo. However it is highly toxic and the use of Arsenic is banned in some countries. Good for usage in bamboo furniture and other handicrafts but not suitable for products which will be in contact with food.



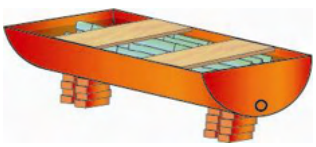
4. *Acid Copper Chrome*: It is a mixture of copper and chrome salts, with fungicidal properties, but with limited effectiveness against insects.

5. *Copper Chrome Boron*: It has good fungicidal properties, and is a preferable alternative to Copper Chrome Arsenic but less effective with a lower degree of fixation.

There are several ways by which these chemicals are applied to the bamboo. These include

1. *Smearing*: This is the simplest way to apply the chemicals by rubbing them onto the bamboo. However, this is not a foolproof method of treatment as it is not fully effective, with the chemicals failing to fully penetrate into the bamboo.

2. *Penetration*: The internal structure of the bamboo along its culm walls is such that it allows fro liquids to travel quickly through the entire length of the bamboo. Thus any chemical solution applied to one end of the bamboo is likely to be drawn in along the entire bamboo. Penetration of the preservatives can be achieved in the following manner:



    a. *Steeping*: Even after a bamboo culm is cut from the plant, photosynthesis continues for a few days if the leaves and branches are kept intact. During this process, nutrients move along the internal structure. If the freshly felled culms are kept standing in a drum containing concentrated water-borne preservative solution. The nutrient juices which get used up are slowly replaced by the chemical solution over a period of 7–14 days.
    b. *Dipping or Soaking*: In this process, freshly cut culms are dipped in the solution of the appropriate chemicals for a period of two weeks or more. The culms should be weighed down to ensure complete sap replacement. Holes drilled at each node will help the solution penetrate better.
    c. *Modified Boucherie method*: In this process, two thirds of a tank is filled with a preservative solution and a hand-pump is used to

raise the pressure on the solution to between 1 and 1.4 kg/cm2. Freshly cut bamboo culms along with the leaves are capped rubber tubes and connected to the solution in the tank. The preservative solution is forced by pressure into the butt end of the trunk whilst the sap drains away from the top end. To attain the pressure, the solution may be kept at a height in an overhead tank.

TREATMENT FOR WHOLE BAMBOO CONTAINERS

For whole bamboo containers, depending on the scale of operations, the following treatment processes are recommended:

Small-scale Treatment

If the whole bamboo containers are being processed at a small scale of activity, the most viable treatment options are as follows:

- Borax and Boric Acid is mixed in the ratio of 1:1.5, which is then used to make a 5 percent solution in water. Now the culms can be immersed in this solution for half an hour.

- Proprietary chemical preservatives such as ASCU PS2 [solvent based Copper, Chrome and Arsenic solution] available in solution form at hardware and chemical goods stores can be applied to the products, prior to finishing. These products can either be dipped in the chemical or the preservative can be applied by brush. Allow to dry completely before proceeding with the finishing processes.

Large-scale Treatment

If the containers are being produced by a community initiative or as part of a production line of a bamboo enterprise employing 10 or more artisans, and the scale of production is substantial, the Boucherie method is recommended. This will help in reducing treatment time and also, the other parts of bamboo not used for the containers can be drawn into production of other handicraft lines.

To ensure safety while using chemical preservatives, the following procedures should be followed:

- Wear protective gear such as gloves, facemask, eyeglasses and aprons. In case, any chemical comes in contact with the skin, wash immediately with clean water.

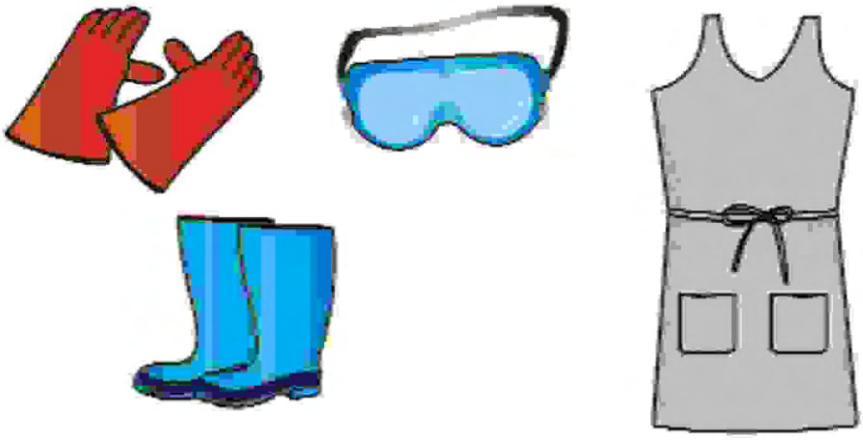
- Do not allow children to come into the treatment area.

- No smoking, eating or drinking should be allowed in the treatment area.

- Follow the manufacturer’s instructions and safety procedures totally.

- Keep the treatment area clean with no chemical spills lying around.

- Store the chemicals in a dry area.
- Dispose of used chemicals in safe manner.



07 Tools

TO CREATE GOOD quality contemporary bamboo products, a certain degree of mechanisation is recommended. While it is true that bamboos can be worked with the simplest of tools to create a range of products, proper use of tools and machines facilitates volume and standardized production.

Using mechanized equipment and tools presents the following advantages:

- Production times are lessened considerable.
- Greater degree of standardisation is achieved.
- Volume production is facilitated.

Tools are important to achieve good quality of construction of the product and to ensure a good finish. For example, the use of a measuring tape will guarantee accuracy of size, and the use of a sander belt will result in smooth surfaces and better finish. The price of a product depends to a great extent on the quality of the product, both in terms of structure and finish.

To create containers of different kinds out of whole bamboo, the following tools are required:

Tool	***Function***	***Recommendations***
1. Machete	To fell bamboo and for cutting to length	Long, heavy blade made of hardened steel
2. Hacksaw with fine teeth	To cut internodes from a length of bamboo	Molybdenum steel blades with 18–24 teeth per inch
3. Tape measure or scale	To measure the desired length	Preferably metal
4. Small knife, 3–4-inch blade	For making bamboo nails and for scraping the bamboo surface	The blade should be strong, preferably hardened metal
5. Drill machines	For drilling holes	Hand or power drill with metal drill bits in assorted sizes (1/8 to ¼ inch)

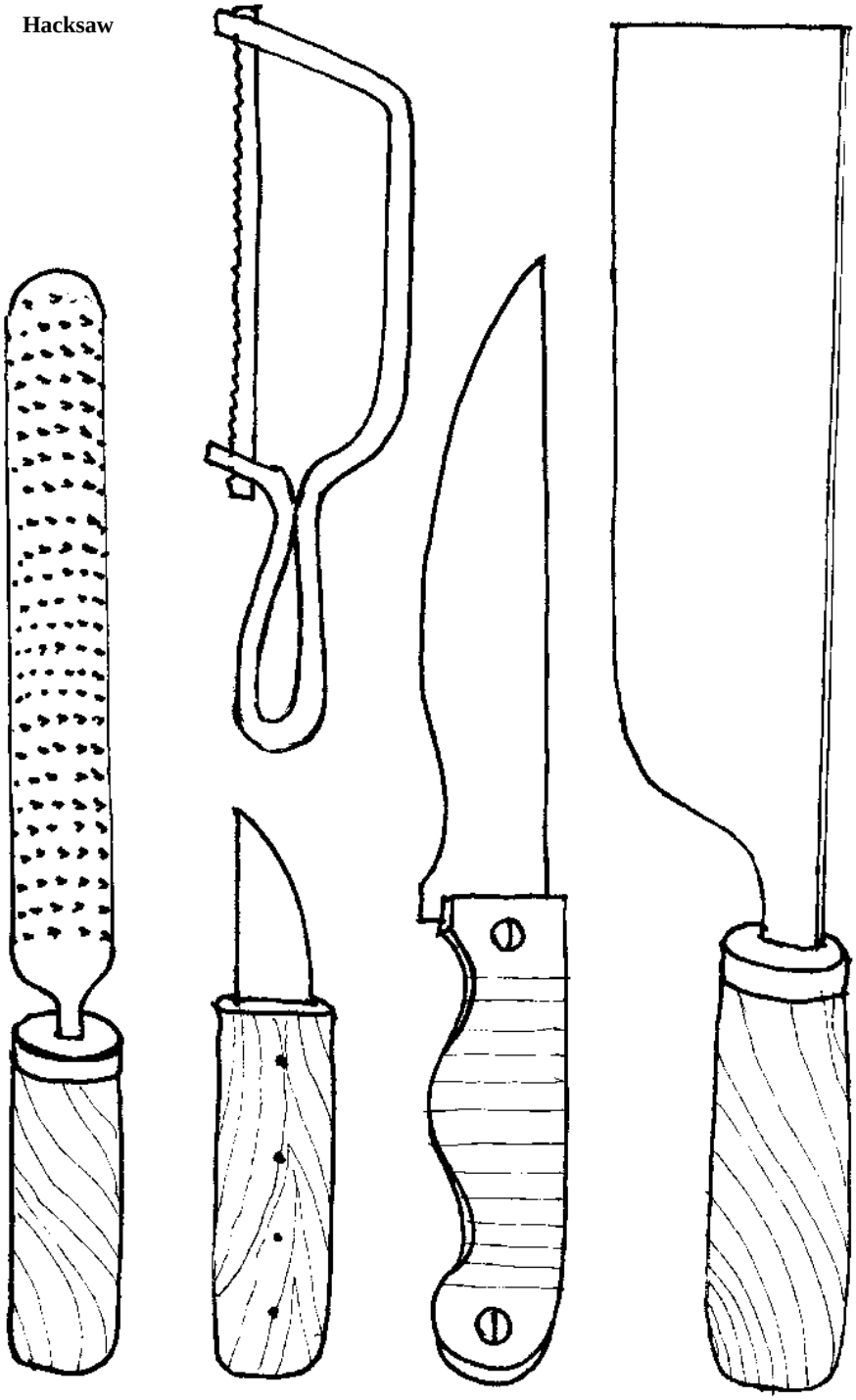
6. Wood rasps	For rough finishing and smoothening nodal areas	Large (10-inch) and small (6-inch) sizes, with one side flat and the other convex
7. Sander belt (electrically operated)	For finishing the surface of products quickly	Table top model using a 6-inch-wide aluminum oxide (ALO)-coated cloth sanding belt
8. Modified disc cutting table (electrically operated) or cross cutting machine	For faster cutting operations	Use disc with tungsten carbide teeth
9. Different grades of sand-paper	For scraping outer skin and smoothening surface area of the product	For rough sanding, use aluminum oxide-coated cloth
10. Saw (can be used only with electrically powered drill machine)	To cut bamboo	Saws available from 1/2-inch to 3-inch diameter; hardened metal
11. Hammer	To fix nails	Hardened metal
12. Chisel	To gouge out material	Hardened metal

BUYING TOOLS

When buying tools, it is important to choose tools of good quality. The market has tools that range from cheap to expensive, so it critical to examine their quality. Investment in tools of good quality is definitely high but, in the long run, they are a better option as:

- they ensure good results;
- they last longer.

It is advisable to select the best tools to buy after a thorough market survey. Other users can be consulted about a particular tool or the make of a tool.

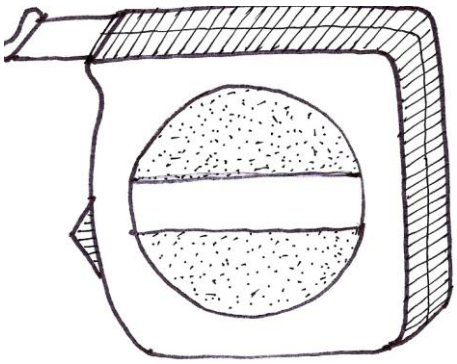

Hacksaw
Wood rasp
Small Knife
Big Knife
Machete

MAINTAINING TOOLS

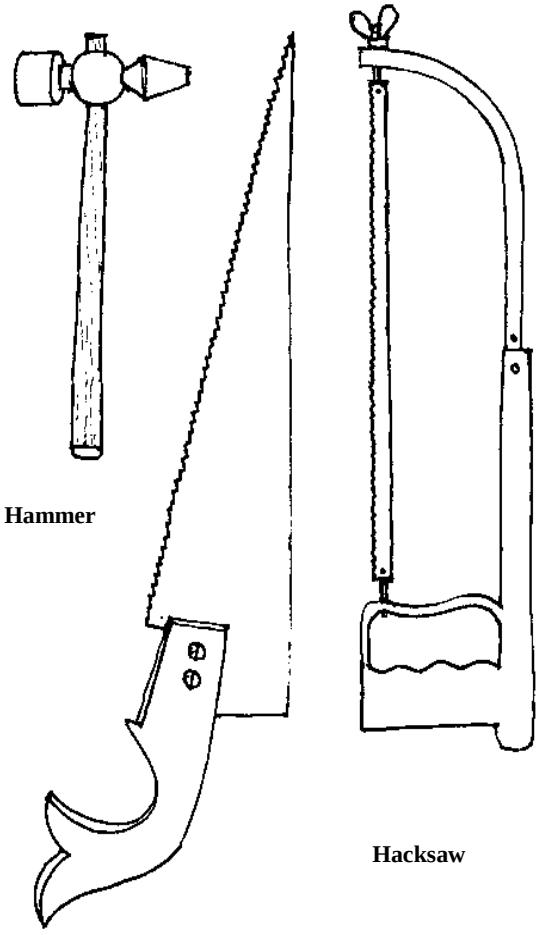
- The high silica content in bamboo makes blunt the sharp edges of tools like knives and machetes. Use sharpening or grinding devices to maintain the effectiveness of these tools.

- For cutting tools like hacksaws, make sure that the blades are of Molybdenum steel or any other hard alloy, as they will wear out less, and need replacement less often. They will also cut evenly and quickly.

- After usage, tools should be wiped to remove dust and dirt, and stored in a dry place.



Tape measure



Hammer

Hacksaw

Saw

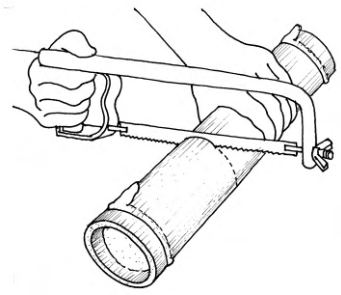
08 Process

BAMBOO CULMS CAN be obtained in local markets, or harvested from the field. Typically, culms are available in local markets in lengths varying from 15 feet to 30 feet.

These culms will need to be cut into sections of the desired size; several usable sections can be obtained from a single culm. The number of such section will be determined by the desired length, and by whether single-noded or double-noded sections are required.

For large-scale operations, electrically powered cross-cutting machines can be used to cut the bamboo culms. These may not however be required or economical for craft and small-scale needs

Bamboo can also be cut, as it has been for thousands of years, with very simple tools like a machete or *dao*. For making of culm container products, however, it is recommended that a good-quality hacksaw be used. This will enable clean cuts without jagged edges. It will also reduce effort and wastage.



CUTTING BAMBOO

Bamboo should be cut into desired lengths with a hacksaw. A hacksaw with Molybdenum blades, preferably with 18 to 24 teeth per inch, is recommended. Prior to cutting, it is useful to mark out a line where the cut is to be made. Keeping the hacksaw perpendicular, cut along the marking. This will ensure a clean and neat cut.

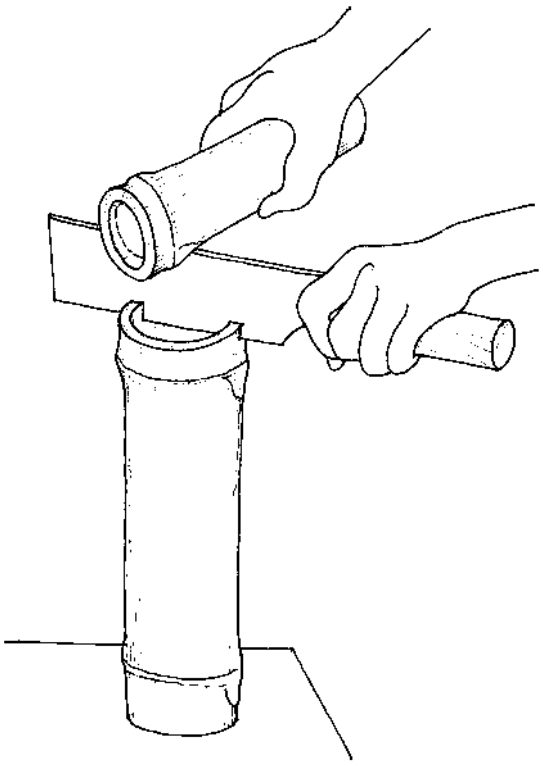
SPLITTING BAMBOO

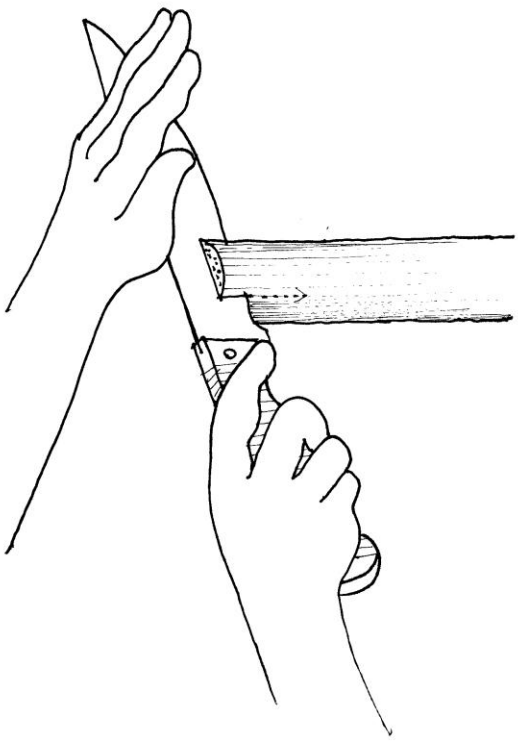
Bamboo can be split with a sharp and heavy machete. Splits from small pieces of bamboo can be made with a knife.

To split the bamboo with a machete, the blade is wedged into the bamboo and pounded hard with a hammering tool or even a small culm section.

Due to the fact that the fibres run along the length of the bamboo (except at the node), once the initial cut is made, the bamboo splits easily along its length.

For smaller sections, a knife is similarly wedged, and pressure applied till it cuts through the bamboo.

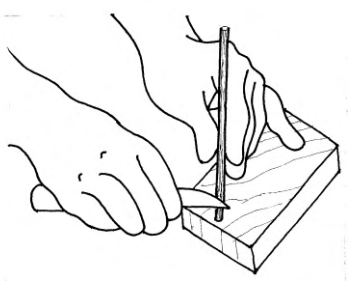




FILING

Filing cleans and smoothens the surface of the bamboo by abrasion. To do this, files and rasps are used. They are tools with an abrasive surface and are made of hardened metal. During the process of filing, the file or rasp is pulled along the surface of the bamboo, resulting in extra or waste material being pared down.

Grip the bamboo culm section in one hand and work the filing tool with the other hand in a steady motion, applying consistent pressure on the surface. Make sure that the grip is firm, and that the hand holding the culm section is kept out of the way of the file. Care should be taken that the file does not slip off the surface of the culm, so that the gripping hand is not injured.



MAKING BAMBOO NAILS

Bamboo nails should be used for culm container products. They are actually thin, strong slivers of bamboo cut from a radial section, and are used to join and hold in place bamboo segments. Bamboo nails are strong

and add aesthetic value as well. Iron nails can cause splits and cracks that are unsightly, and can weaken the structure of the product. They are also prone to rusting, especially when the product is exposed to water.

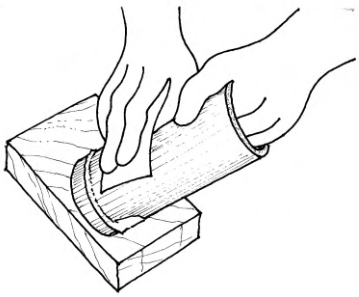
To make a bamboo nail, take a radial section of bamboo 1/4 inch by 1/4 inch. Using a sharp knife, pare down the section by turning it around on its axis. Continue doing this till a cylindrical profile is achieved and a diameter of approximately 1/8 inch is achieved. For thicker bamboo nails, use thicker radial sections of bamboo. Make sure that no loose strands of fibre remain on the nail.

DE-SKINNING

This is a process used to take off the skin of bamboo prior to polishing or painting. The skin contains silica, which tends to repel paints and polishers. Therefore, to ensure a proper finish, it is essential to take the skin off.

In this process, the skin of bamboo is peeled of slowly with a sharp knife. Make sure that an even pressure is exerted while peeling throughout the length of the bamboo or else there will be knife-marks where excess pressure has been exerted.

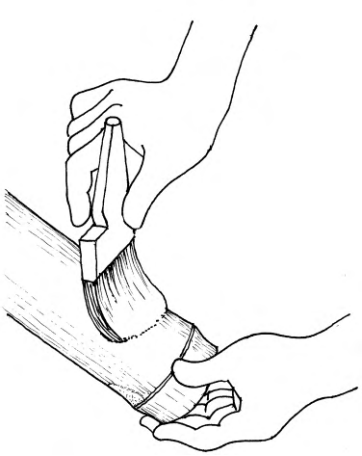
SANDING



Sanding smoothens the surface of bamboo and helps to achieve a good finish. In this process, the bamboo section is rubbed gently with different grades of emery paper, beginning with a rough grade (No. 80 ALO coated cloth) and moving on to finer grader (No. 100 and No. 120).

Emery paper has an abrasive material adhered to its surface. Rubbing with emery paper helps to make surfaces smoother (for painting and lacquering), or to remove a layer of material (such as old paint), or sometimes to make surfaces rougher (prior to sticking something). Take care while sanding to use long even strokes and exert equal pressure along the length – this will ensure a smooth finish.

FINISHING



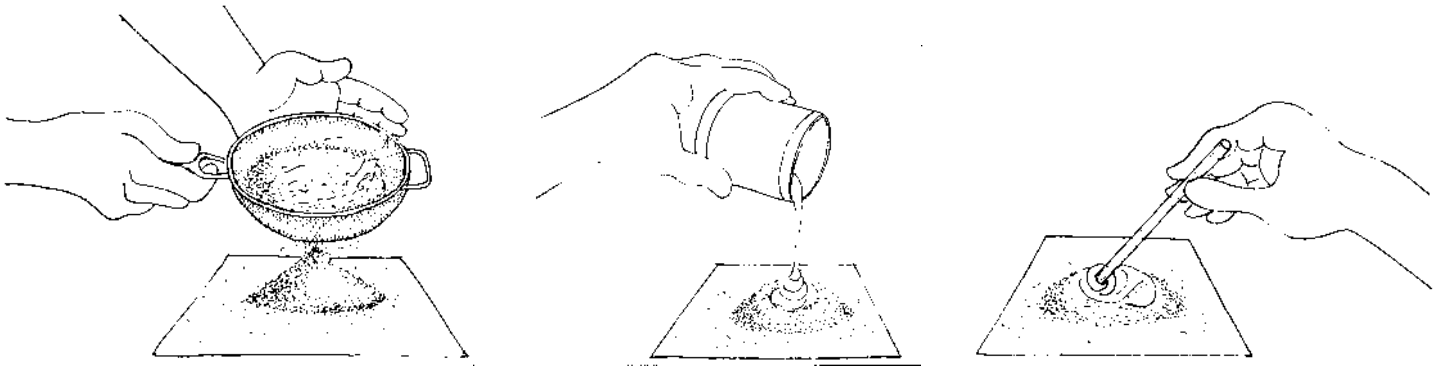
Finishing is a process that results in the application of a protective and decorative coating on the surface of bamboo. This protective coat can be paint, spirit polish, linseed oil, enamel or metallic paints.

Before applying the coating, it is important to ensure that the product surface is clean, and free of dust and impurities. Coatings can be sprayed, or applied evenly with a brush of the appropriate thickness.

MAKING BAMBOO FILLING

This filling, a paste of bamboo dust and glue is used to fill surface cavities. Collect bamboo dust while sawing bamboo and sieve it. Add a water-based adhesive like Fevicol to this sieved dust and knead this mixture till putty-like consistency is achieved. If the mixture is too thick a small quantity of water may be added.

Try to use the paste as soon as possible, before it dries and hardens. If there is a need to store the filling for a day or two, ensure it is packed tightly in a plastic bag till used.



09 Product-Making

A RANGE OF products can be made from whole bamboo, making use of the hollow space between the two node walls and the rounded from the bamboo. These products include mugs, candy baskets, pencil holders, CD racks, storage boxes and vases.

The products can be utilitarian or functional, as well as decorative. Usually, functional products have a larger market than decorative ones, as more people buy these. Also, functional products need to be replaced after some time. Purely decorative items are a one-time purchase and can last for several years without needing to be replaced.

The products detailed here have been styled keeping in mind contemporary trends and tastes. They are easy to make, even by beginners, and can quickly be replicated, allowing for large-scale production. These designs use the whole bamboo section in two ways – resting it vertically on one node end (e.g. bamboo mug) or resting it horizontally on its rounded side wall (e.g. candy basket).

SELECTION OF BAMBOO CULMS FOR PORDUCTS

While selecting bamboo culms for culm container products listed here, the following should be taken in to account:

- The middle and upper-middle part of the bamboo culm is best as the diameter, internodal length and wall thickness of this part are good for containers. These portions tend to have a larger circumference, and an equal diameter along their length.

- The lowest part of the bamboo culm tends to have internodes with thick walls and less hollow space, making these sections unsuitable for use as containers.

- The upper-most portion of the bamboo culm normally tapers towards the top. Culm sections from this portion will not have a uniform diameter; they will be larger at the bottom and narrower towards the top, making them unsuitable for container craft.

- For bamboo containers such as pen-stands where one end is a closed node wall and the other end is open, every internode section can be used. Depending on the length of the container, each internode can be cut into one or two containers, each with a node wall at one end.

- For bamboo containers such as planters where both node ends are required, only alternate sections can be used.

- When a complete internode is cut from the length of bamboo with node walls at both ends, the internode sections on either side will not have one node wall.

- Waste will result if a container is taken out of one internodal length and the remaining bamboo discarded.

- Select only internode sections that are straight without any bends, and are free of surface stains and damage.

- Make sure the bamboo has been treated with the appropriate preservatives

MATERIALS REQUIRED

In addition to treated bamboo culms of particular dimensions, the following items are required for production of various bamboo items

- Measuring tape

- Pencil

- Piece of board 18 by 12 inches

- Bamboo nails

- No. 80 Aluminium Oxide (ALO) coated cloth

- No.100 Emery paper

- Old rag

- Matal hinges (1 by ½ inch, for bamboo horizontal lidded containers)

- Fish-eye hooks (1/2 inch, for bamboo planters)

- Cane strips (for bamboo tongs)

- Thin diameter cane (for candy baskets)

- Bamboo filling (mixture of bamboo dust and glue).

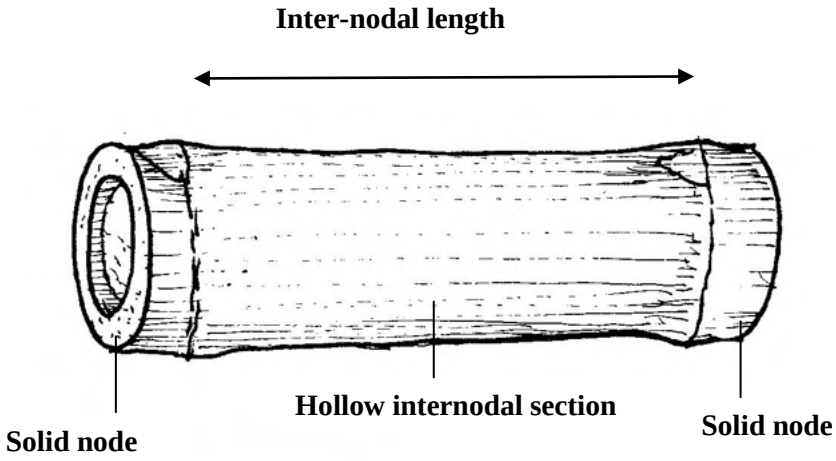
BAMBOO PEN-STANDS/ SPOON HOLDERS

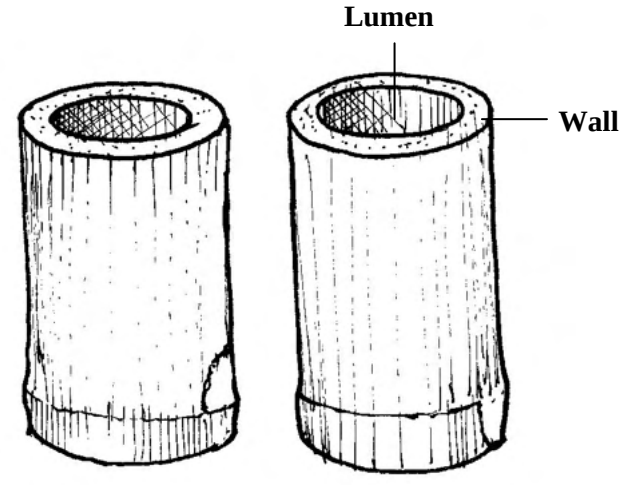
An attractive utility product: the pen-stand is an elegant accessory for the office. In the spoon holder variant it can be placed on a dining table or in the kitchen.

It is a good example of creative utilization of bamboo node- from one single node with both ends, two containers can be created, with little waste.

To make pen/spoon stands up to 4 inches in length of at least 8 inches and a diameter:

- Select a treated bamboo culm with an internode length of at least 8 inches and a diameter of at least 3 inches. The wall thickness should be between 1/8-1/4 inch.
- Cut a section of the culm with both node ends present.
- Using a measuring tape and pencil, mark the centre of the bamboo section. Draw a line around the centre.





Using a hacksaw, cut across the line so that the node gets divided in to two equal parts. Ensure that the saw is kept perpendicular so that the cut is straight. Each part with a nodal wall across the base is a container.

- Place the bamboo container on its node end a piece of board. Using a file, scrape and smoothen the base of the bamboo container so that it can rest straight and is stable.

- De-skin the container with a small knife.

- Apply any of the following finishes; natural oil finish (linseed oil), clear polymer finish, enamel paint or colour stained finish.

Variations

The best design of the container can be altered, both structurally and in finish, to create variations.

Variation in structure

The stands can be made more artistic by cutting the top ends in a slant.
The steps are:

- Once the node has been cut in to half, on the top of each cut section, mark a taper using a measuring tape and pencil. For a 4-inch stand, a taper of 1 inch from the top is ideal. Depending on the length of the container, one can mark out a corresponding taper-the longer the length, the greater the taper.

- Cut carefully along the marking with haksaw.

- Finish the containers as desired.

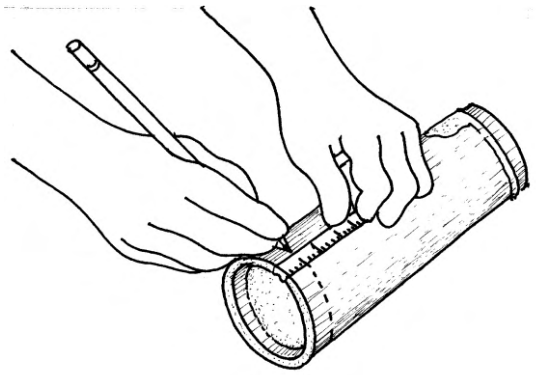
Variation in Finish

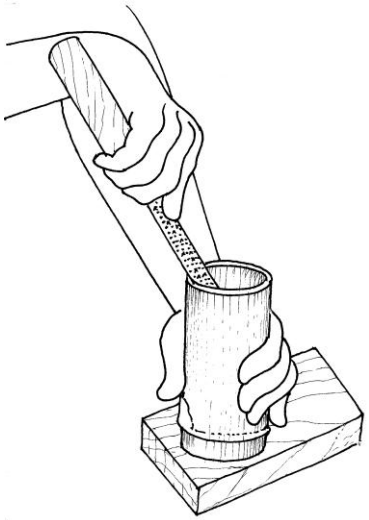
The stands can be used as corporate gifts with a slight variation in the finishing process. Once the container has been pre-finished (filed and sanded to make it smooth), the company logo/massage can be painted on to the container. One can choose to paint directly on the bamboo surface, or, if desired, first apply a background colour, allow it to dry and the paint. Once the paint is dry, a final coat of varnish can be applied.

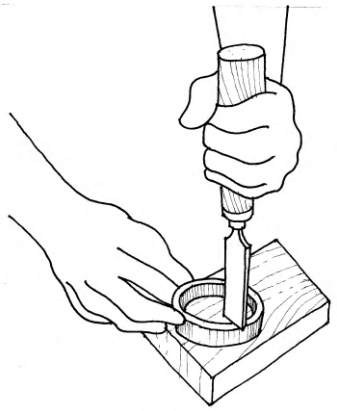
BAMBOO MUGS

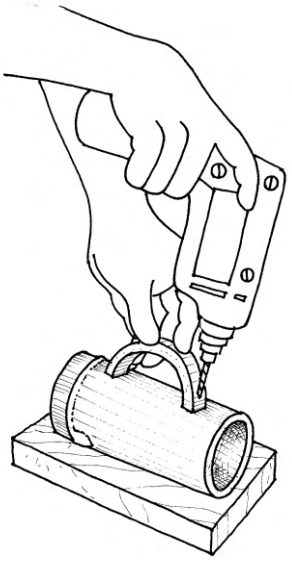
Bamboo mugs are a popular way of using the bamboo culm's natural ability to be a container. A bamboo mug it both a novelty item and a functional product. Besides being used for drinking, it can serve as innovative packaging for sweets and dry fruits. This product is a good example of optimum utilisation of a bamboo node – from a single internodal section of appropriate length, two bamboo mugs can be created. Bamboo mugs are taller than pen stands and hence they should be made using a culm section with greater internodal length.

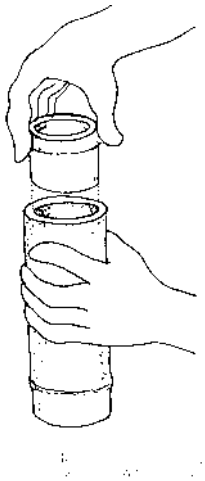
- Choose a cleaned and treated bamboo culm with internodal length of at least 12 inches and diameter of at least 3 inches. The wall thickness should be neither too thick nor too thin (1/8–1/4 inch). The bamboo should be treated with non-toxic preservatives such as boron salts. Cut a section with both node ends present.
- Using a measuring tape and pencil, mark the centre of the node. Draw a line across of the bamboo.
- With a hacksaw, cut across the line so that the node is divided into two equal parts. Each part with a node wall across the base can be used as a mug.
- Place the bamboo container on its node end on the piece of board. Using a file, scrape and smoothen the base of the bamboo container so that it can rest straight and is stable.
- De-skin the outer surface of the mug with a small knife.
- Prepare the rim of the mug to make it suitable to drink from – the rim must not be too thick. Using a small knife, scrape away part of the inner wall so that the inner part of the rim slopes into the body of the mug.
- The mug now needs a handle to make it easy to hold. To make the handle,
    - Select a culm of wide diameter (at least 4 inches across). Cut a slice 1-inch thick across the bamboo in the shape of a bangle. Cut the circle into half – two handles are created simultaneously.
    - Mark out the position of the handle on the mug, keeping distance between the ends of the handle and the top/bottom end of the mug.
    - Using a waterproof adhesive (Araldite, Feviquik or similar, quick-drying formulation), fix the handle on to the mug.
    - Once the adhesive is dry, use a hand-drill or power drill to make a hole at each end of the fixed handle.
    - Using a drop of the adhesive, push a bamboo nail into the hole at each end to permanently fix the handle. Wait for the adhesive to fully dry.
    - After the handle has been fixed and the adhesive is dry, finish the mug by smoothening rough edges with No. 80 ALO coated cloth and then No. 100 emery paper.
    - Rub with linseed oil on the outer surface to give an attractive luster.











BAMBOO LIDDED CONTAINERS

Containers with lids are an attractive way of storing articles or liquids in the home and workplace. If a bamboo container has a lid made of bamboo as well, it adds to product attractiveness and appeal. For making these containers, the bamboo culm should have a minimum length of 8 inches and diameter of 4 inches. The wall thickness should be a maximum of 1/8 inch. The wider the diameter, the bigger the container. The culms should be straight without any bends.

Vertical Lidded Container

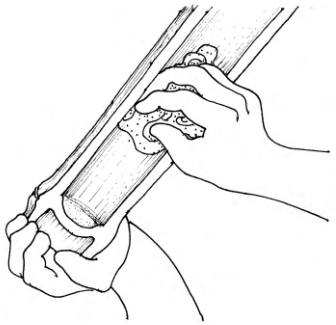
- Choose a cleaned and treated bamboo culm with an internodal length of at least 12 inches and diameter of at least 4 inches. The wall thickness should be a maximum of 1/8 inch. Cut a section 9 inches long with one node end present.

- Place the bamboo piece vertically on the node end, on a piece of board. This is the base of the container and the open end it its mouth. Using a file, scrape and smoothen the base so that it is totally flat and the container is stable when at rest.

- To make a lid for the open mouth of the container, select another piece of bamboo with one node end present, 3 inches long and of diameter marginally less than of the container. De-skin the bamboo piece and sand with No. 80 ALO coated cloth and then No 100 emery paper to ensure smoothness and a good fit. Slip the lid into the mouth of the container with the node end on top.

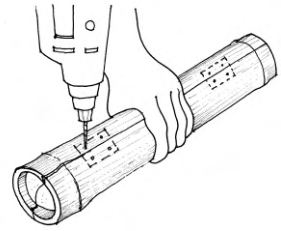
- De-skin the container and apply any of the following finishes: natural oil finish, clear polymer finish, enamel paint or metallic finish.

Horizontal Lidded Container



- Choose a cleaned and treated bamboo culm with an internodal length of at least 8 inches and diameter of at least 4 inches. The wall thickness should be a maximum of 1/8 inch. Take a section with both node ends present.

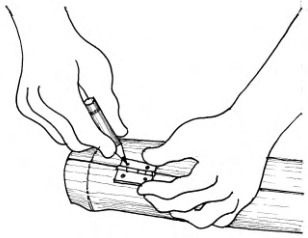
- Using a machete, split the bamboo into half along its length. Clean and smoothen the cut edges by sanding them with No. 80 ALO coated cloth and then No. 100 emery paper. Remove any dirt from inside the segments by inverting the cut halves and rubbing the inside with an old rag.



- De-skin the outer surface of both halves of the container.

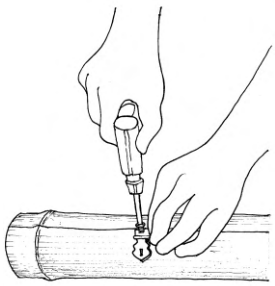
- Lay one half horizontally on a piece of board. To ensure that it rests stably, sand the bottom of the container with No. 80 ALO coated cloth and then No. 100 emery paper. This is the base of the container. The top of the container is the other half.

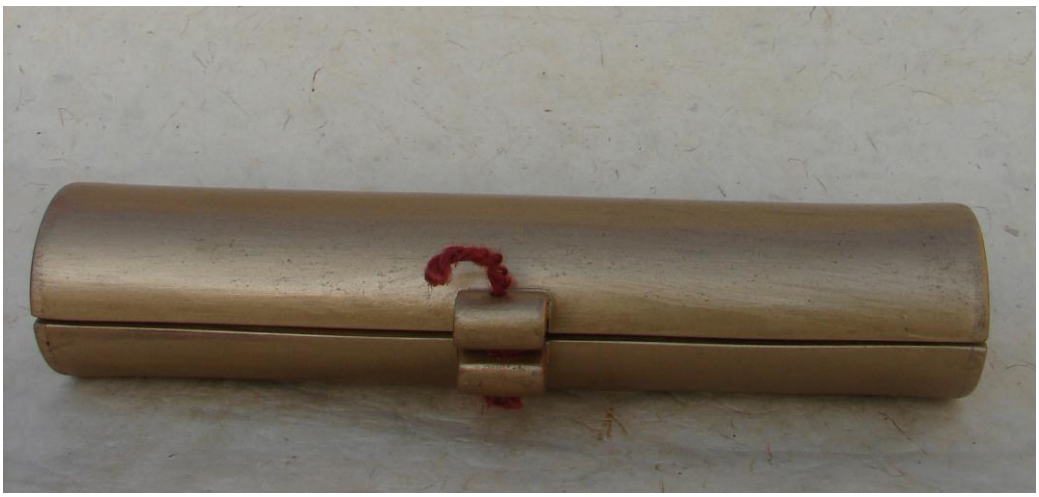
- Attach the two halves to each other by screwing in two small metal hinges on one side along the length of the container. To fix the screws, make holes with a drill machine using a fine bit. Take care to align the two segments before fixing the hinge. This hinged side is the back of the container and the opposite side with no hinges is the fron.



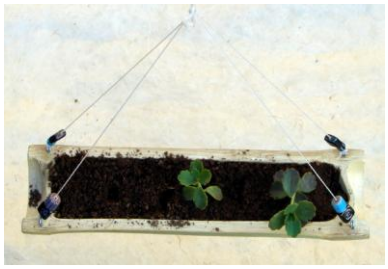
- Mark out the centre of the front of the container on both halves. Screw in a metal clasp to the top half close to the cut edge, and the corresponding hook to the bottom half. The container now has a perfect locking device.

- Finish the surface of the bamboo container with any of the following finishes: clear polymer finish, enamel paint or metallic finish.





BAMBOO PLANTERS

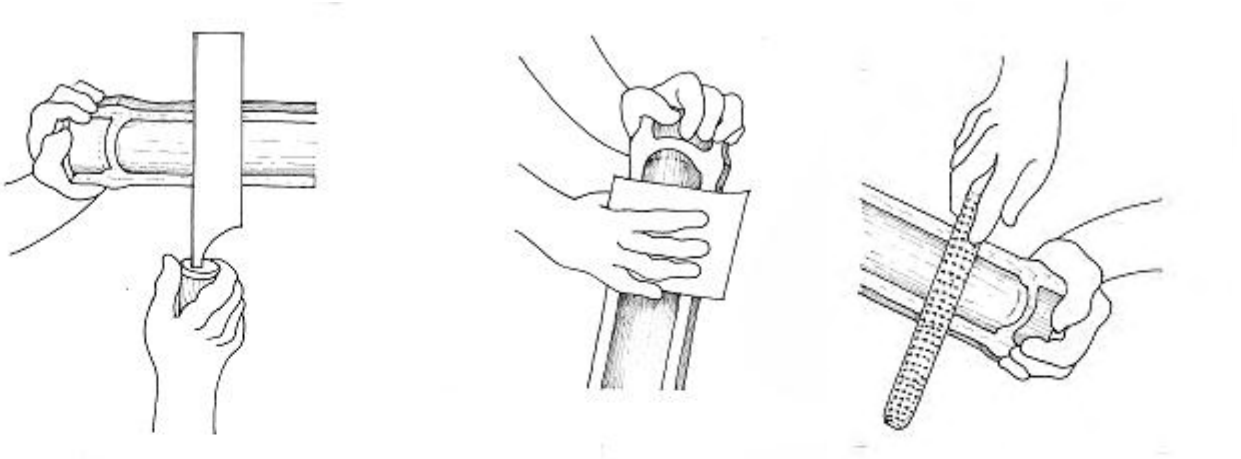


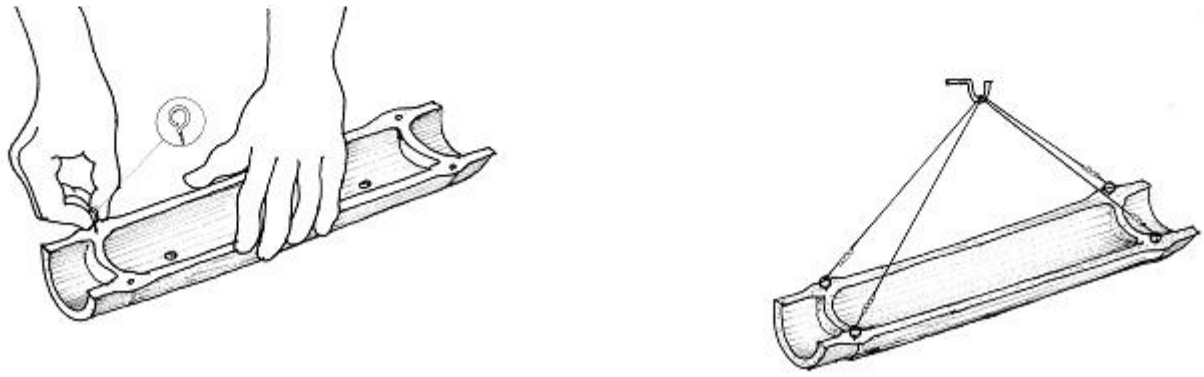
A hanging bamboo planter is an attractive way of decorating the garden or an interior space. It is also an example of good utilisation of a bamboo internode, as two planters can be made from one internodal length.

Since bamboo can tolerate water, wet soil in a bamboo planter poses no problem, with excess water draining out through the specially created drainage holes at the box of the planter. The thicker the bamboo culm, the bigger the planter.

- Choose a cleaned and treated bamboo culm with an internodal length of at least 12 inches and diameter of at least 6 inches. The wall thickness should be a maximum of 1/8 inch. Cut a section with both node ends present.

- Using a machete, split the bamboo into half along its length. Each half of the bamboo node can be used as a planter.





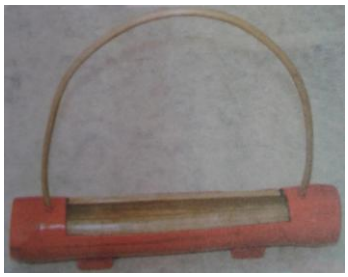
- Clean the cut edges by sanding them with No. 80 ALO coated cloth and then No. 100 emery paper. Remove any dirt from inside the segments by inverting the cut halves and rubbing with a piece of old rag.

- Create two drainage holes at the bottom of the container with a drill.

- At all four corners of the planter, screw in a metal fish-eye hook. To hang the planter, attach a length of thin-gauge wire between the two hooks at either end.

- Do not de-skin the planter.

CANDY BASKETS



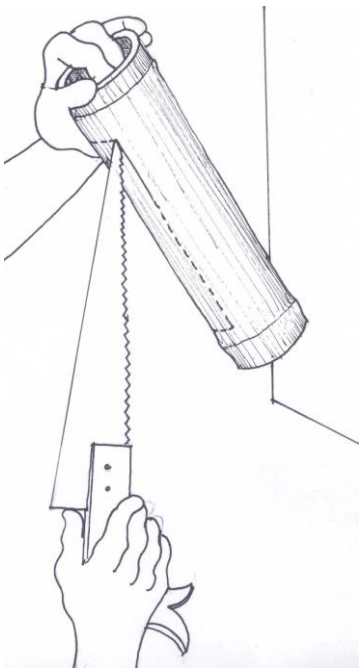
This is a multi-purpose container with an elegant cane-handle and rests on two bamboo feet. It is ideal for packaging sweets and dry fruit and makes for an attractive packaging option for the festive season. It is reusable and can be used to store pens or office stationery as a desk-top accessory.

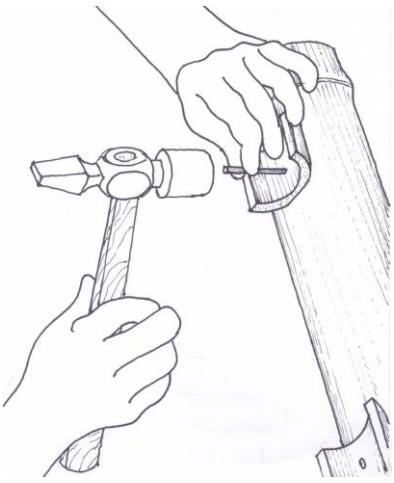
- Choose a cleaned and treated bamboo culm with an internodal length of at least 12 inches and diameter of at least 3 inches. The wall thickness should be a maximum of 1/8 inch. Cut a section with both node ends present.

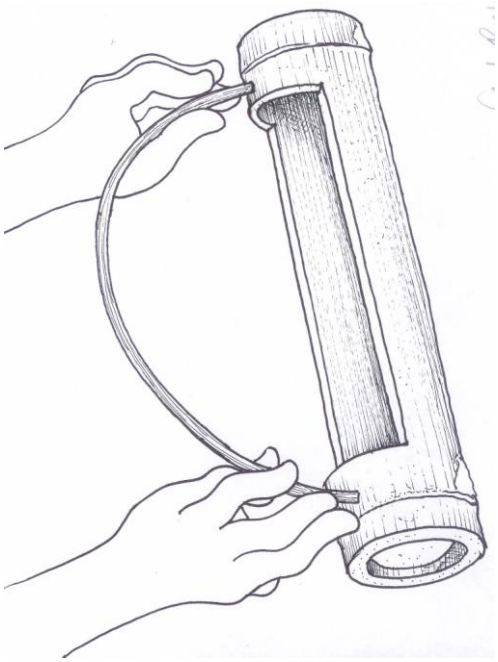
- Keeping a gap of 2 inches from the edge on either node end, mark out a rectangle on the top surface of the bamboo section. The rectangle should have minimum dimensions of 8 inches length and 3 inches width. Use a fine-toothed hacksaw to cut out the rectangle from the bamboo. This open portion is the top of the container. The uncut side it its base.

- To make feet for the container, use the portion cut out from the top of the bamboo. Cut out two sections (of width 2 inches) and smoothen the edges.

- To fix the feet, first invert the container so that the base is on top. Mark out two spots on the bottom, each 4 inches away from the edge of the node. At each spot, place the feet, with its length parallel to the container and its top flush with the base. Drill two holes through the feet and the bottom of the container. Using water-proof adhesive, fix a bamboo nail into each hole. Leave to dry. Use a chisel to cut off extra nail length.







- To make a handle for the basket, take a length (at least 24 inches) of thin-diameter rattan/cane. Soak the cane for an hour and then bend it over the flame of a blow-torch to get a wide curve (like the letter C). On the top of the container, mark out two spots 1.5 inches from the edge on either end. Drill two holes at these spots and using water-proof adhesive, fix the ends of the curved cane into these holes. Leave to dry.

- De-skin in the outer surface of the container with a small knife.

- Finish the surface of the bamboo container as per choice with any of the following finishes: clear polymer finish, enamel paint or metallic finish.

TRIPLE VASES

This is an attractive flower vase. It takes the concept of the bamboo pen stand further by combining a variety of pen stands in different sizes to make attractive containers for flowers, pens or spoons.

- Take three sections of cleaned and treated bamboo of length 10 inches, 8 inches and 6 inches, with a minimum diameter of 2.5 inches. Each section must have one node end present and be open from the other end.

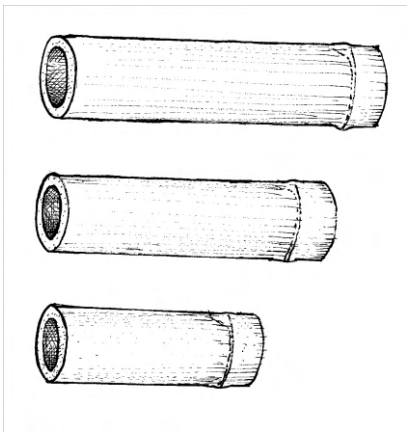
- Rest each piece of bamboo on its closed node end and make sure it is stable when at rest. File, scrape and sand if required to ensure a stable base.

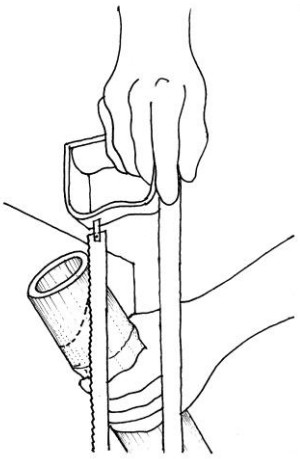
- From the top open end of each piece, cut a taper of 2 inches to make the end slanted.

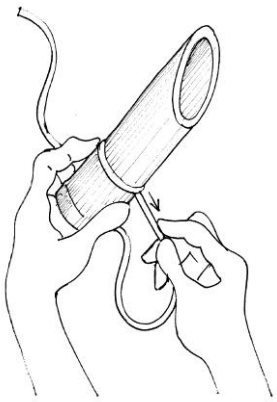
- De-skin each piece with a small knife, then rub with No. 80 ALO paper and No. 100 emery paper. Paint of polish as per choice with any of the following finishes: natural oil finish, clear polymer finish, enamel paint or metallic finish. Let the pieces dry completely.

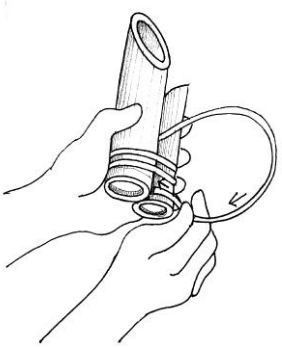
- Using a length of cane or rope or twine, bind the three containers together, weaving the cane/rope around the three.

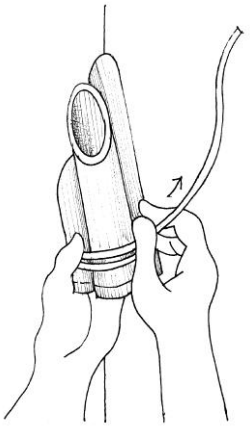
    - Soak the length of cane in water, to make it more pliable. Strip the cane with a small knife to make it thin.
    - Wrap the cane around the long piece and tie a knot.
    - Holding two pieces together, wrap the cane around both twice.
    - Take the free end of the cane under the wrapped portion; make a knot.
    - Add the third piece and wrap the cane arount it.
    - Slip the free end of the cane through the gap between the containers and take it out at the other end – make a knot at this point too by slipping it under the wrapped portion. Cut off the extra length of cane.

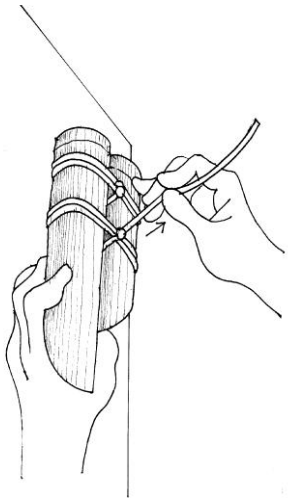


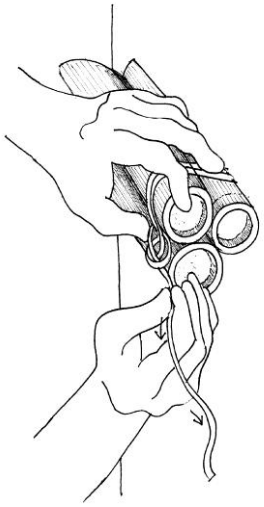


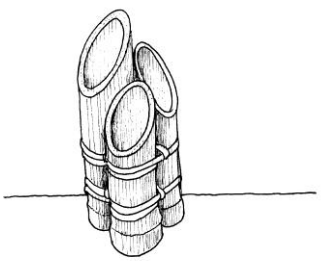












CD RACKS

This CD rack uses the rounded form of whole bamboo to make slots to hold CDs. Depending on the length of the internode, a CD rack can hold 6 or 12 CDs

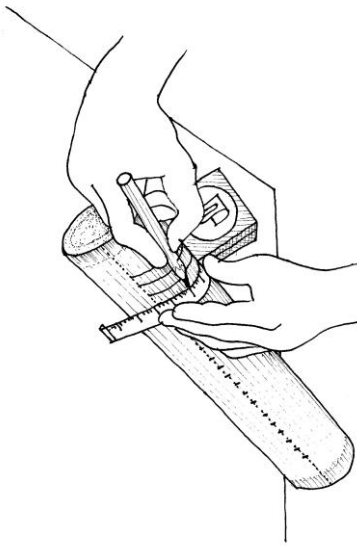
- Choose a cleaned and treated bamboo culm with an internodal length of at least 15 inches and diameter of at least 3 inches. The wall thickness should be a maximum of 1/8 inch. Cut a section with both node ends present. The CD rack made using this length will hold 12 CDs.

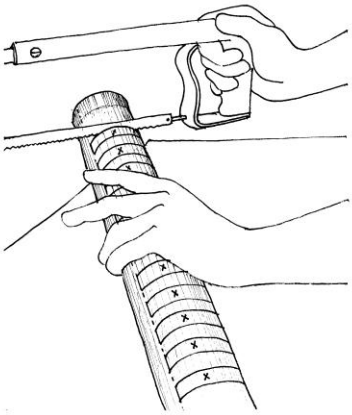
- Keeping a gap of 1 inch from the node end on either side, mark out 12 slots of 1/2-inch width across the bamboo section, leaving a gap of 1/2 inch between each slot.

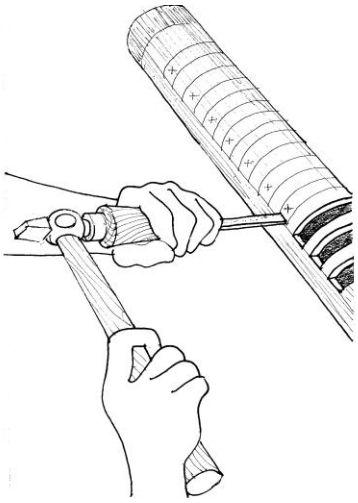
- Using a fine-toothed hacksaw, neatly cut out the market slots to half the diameter of the bamboo, leaving the other half intact to hold the CDs in place. Use a chisel to remove the cut portions. This is the top of the CD rack. The opposite side where the slots have not been cut is its base.

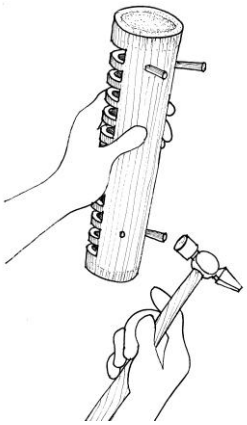
- To make the feet the CD rack, take a radial section of bamboo and make four dowels of 3/8-inch diameter and 3-inch length.

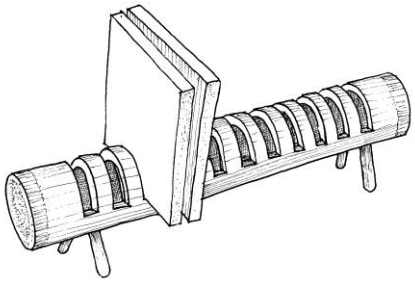
- To fix the feet to the base of the CD rack, invert the rack so that the base is on top. Mark out a spot 2 inches from the edge on both sides and make two holes on each side, keeping a gap of 1 inch between them. Dip one end of the feet into adhesive and hammer into the holes.











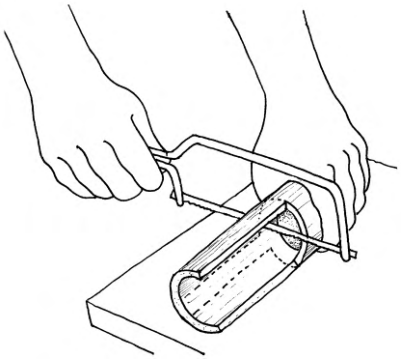
- Balance the CD rack on all four feet to ensure that each foot has been hammered in enough to ensure stability. In case any of the feet are protruding, hammer lightly. Allow the adhesive to dry completely. Place a piece of ALO No. 80 paper flat on a piece of board and rub the feet of the rack. Leave to dry.

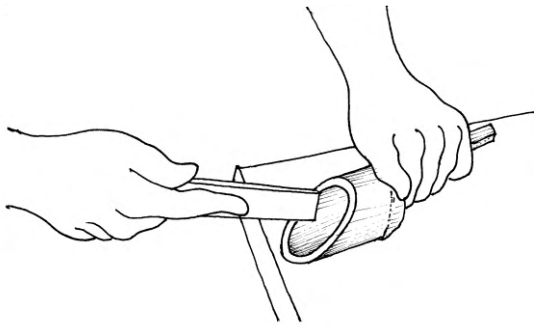
- De-skin with a small knife, and finish with any of the following finishes: natural oil finish or clear polymer finish.

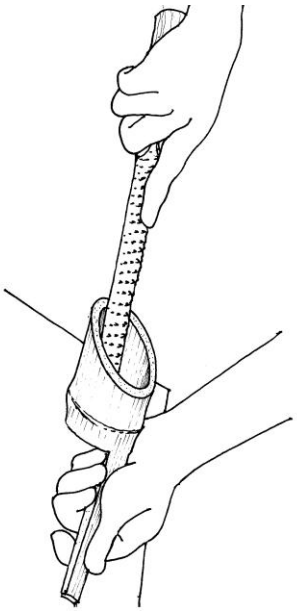
BAMBOO SCOOPS

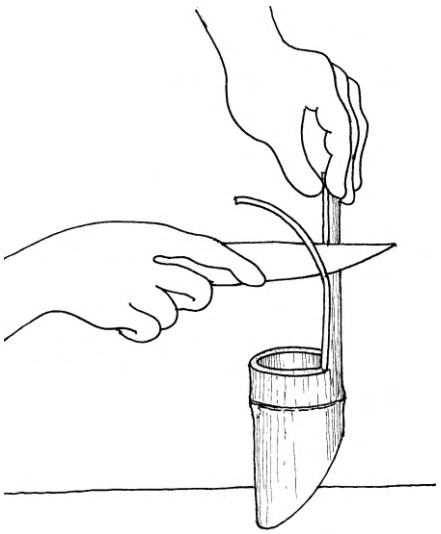
Bamboo scoops are a stylish addition to kitchens and dining tables, adding a rustic touch. Scoops of different sizes and lengths can be made from bamboo, particularly from sections with one node end intact.

- Take a section of cleaned and treated whole bamboo with the node in the center and both ends open. Make sure that the bamboo has been treated with boric–borax and not any toxic chemical preservative. The length of the section must be a minimum of 4 inches on one side and 6 inches on the other side. The bamboo should preferably be thin-walled with a minimum diameter of 2 inches. The longer side of the node will be used to make the handle and the shorter side will be the scoop,





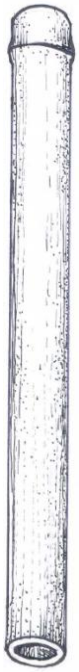




- To make the scoop, on the shorter side, on the top surface, mark out a point 1.5 inches away from the node. On the bottom surface mark a point 3.5 inches from the node cut a taper between these points. Using a chisel and file, scrape the inner wall to make a thin rim for the scoop.

- To make the handle, on the other side of the node, on the top surface, mark out a long rectangle (1 inch wide and 6 inches long). Leaving a gap of 1/2 inch from the node wall, cut along the node leaving the handle intact. Cut along the length of the handle.

- De-skin with a small knife and smoothen the scoop by rubbing it, particularly along the cut edges with 80 ALO paper and NO 100 emery paper. Apply linseed oil finish.



BAMBOO TONGS

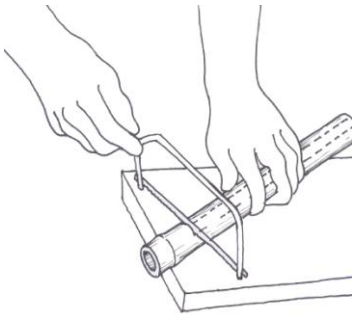
Whole bamboo tongs capitalize on the length & hollowness of bamboo culm. These are a trendy addition to any kitchen or table. They are useful while serving snacks and salads.

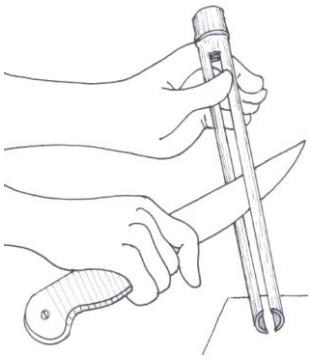
- Take a cleaned and treated whole bamboo section of 18 inches length with the node present on one side. Make sure that the bamboo has been treated with boric–borax and not any toxic chemical preservative. Behind the node there should be at least one inch of inch of bamboo. This will be the handle of the tong.

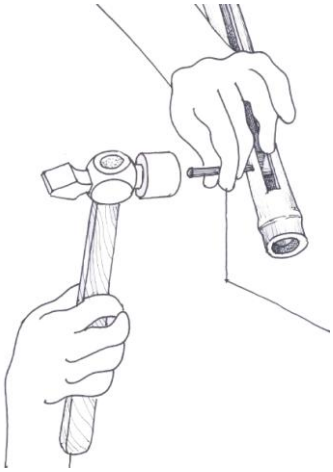
- On the remaining length of bamboo, leave a gap of 2 inches from the node wall and mark out a rectangle on the top and bottom surface. The rectangle should be 16 inches in length and 3/4 inch in width.

- Using a fine-toothed hacksaw, cut along the width of the rectangle close the node wall. Using a knife, split along the length of the rectangle on both sides. Remove the cut out rectangular sections on both sides.

- Using a radial section of 1/2 inch by 1/2 inch, make a bamboo dowel of length 1 inch. Push the dowel between the side walls of the tongs towards the nodal end. Ensure that adequate tension is achieved to







pick up objects with the tongs. Fix the dowel at this point by drilling holes on both side walls and inserting bamboo nails coated with adhesive.

- Wrap the handle with a thin strip of cane – begin from the top part by sticking one end of the cane length to the bamboo and wrapping the other free end till where the bamboo has been cut. Cut off extra cane length and stick the end to the bamboo surface. Leave to dry.

- Once dry, scrape the skin off, round the cut edges and smoothen with ALO No. 80 and No. 100 emery paper. Finish with linseed oil.

PROBLEM-SOLVING

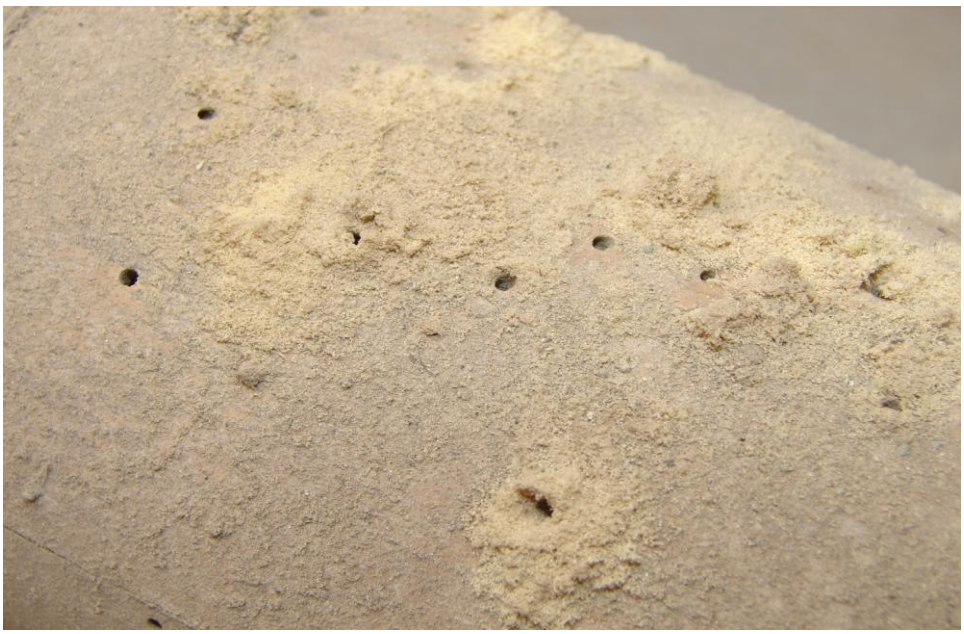
Certain problems can arise with bamboo products even when great care has been taken while making them. Some of the common problems and their solutions are listed below.

Splitting of the Finished Products

Examine the piece carefully to see the extent of damage. It the split it visible throughout the length of the container, the product has to be disposed of. However, if the split is small and or superficial, it can be filled with a mixture of bamboo dust and glue. Once the filling is dry the piece can be refinished and sold.

Appearance of Borer Holes

Examine the piece to see the number of borer holes. If there are too many, the piece may have been badly damaged on the inside and may need to be thrown away. However, if there are very few borer holes and the piece seems structurally strong, treat the product with a chemical preservative (solvent-based proprietary preservatives), and fill the holes with a mixture of bamboo dust and glue. Once the filling is dry the piece can be refinished and sold.



10 Finishing

FINISHING OF ANY product is extremely important. Good finishing makes for good quality, and a long lasting and attractive product.

Finishing adds value and enables a higher price to be obtained.

Finishing is a two-part process.

The first stage is preparation of the surface. The second stage is application of a protective and decorative coat.

Good finishing starts with a good beginning.

- Rub clean with a dry cloth the bamboo section before beginning to make the product. In some cases a slightly moist cloth will be needed. Make sure that dirt and grime are removed from the surface of the section, including the cut ends. In the case of single nodded sections, clean the hollow cavity as well.
- Make sure there are no surface imperfections such as small holes or abrasions on the surface. Fill the abrasions and cavities with a mixture of glue and bamboo dust.
- Make sure all edges and surfaces are smoothened and rounded, using first a rough grade NO. 80 ALO coated cloth and then a fine grade emery paper (NO. 100/NO. 120). For large volumes, use a sanding machine.
- Apply the varnish/enamel paint in even, smooth strokes so that the finish is uniform on all parts of the product. Also, this will ensure that no lumps are formed due to excess of point/varnish.
- Allow each coat of paint/varnish to dry completely before applying the next coat.
- The painted/varnished product must be allowed to dry in a dust-free room as dust/dirt sticks to freshly painted/varnished surfaces and ruins the finish of the product.

PROCEDURE FOR APPLYING FINISHES

For bamboo pen stands/mugs/any other vertical container, place your hand inside the container and hold it upside down. Apply the finish to the bottom base and then to the outer walls of the container using a brush. Leave inverted on a piece of board to dry.

For horizontal containers, rest the container vertically on one of its node ends and then apply the finish to the node end on the opposite side and the outer walls of the container. Leave to dry resting on the unpainted end. Once the coat of finish is dry, invert the piece and paint the unpainted node end.

APPLICATION OF PROTECTIVE AND DECORATIVE FINISHES

Natural Oil Finish

This finish effectively creates a 'natural' look on the bamboo product. It is a simple but very effective and tasteful finish. This finish is recommended for bamboo mugs, bamboo scoops, bamboo tongs, bamboo planters, bamboo pen stands and bamboo CD racks.

Materials required (for a batch of 12 mugs)

- 150–175 ml of linseed oil
- clean soft cloth pieces (one small piece for applying oil, one large piece to buff).

Procedure

- Roll up a piece of cloth into a ball and soak in the linseed oil.
- Squeeze out extra oil and apply to the surface of a pre-finished bamboo product (which has been cleaned and smoothened).
- Rub the linseed oil gently on the exterior surface, dipping the rag into more oil as required. Use ling even strokes so that the oil is applied uniformly across the product.
- Allow to dry completely.
- Using a soft cloth, rub the surface to buff.

Clear Polymer Finish

This gives a very polished and glossy natural look to the bamboo product. It is applied to the outer surface with a brush. This finish is recommended for products such as the bamboo CD racks, bamboo triple vases, bamboo candy baskets, horizontal and vertical lidded containers. Clear polymer finishes are available in most point shops and one can choose between a glass and matt finish. They are convenient since they are ready-to-apply.

Materials required (for a batch of 12 horizontal/vertical containers)

- 200–250 ml branded polyurethane finish like Touchwood (available in both glossy and matt finishes)
- brush or clean rag
- turpentine to clean brushes.

Procedure

- Apply the finish on to the pieces in smooth even strokes, taking care not to leave any area unpainted.
- Be careful not to let the polymer stain the inside of the container as it will spoil the final look.
- Hold the piece carefully to avoid any finger marks on the paint.
- Place the pieces carefully on a sheet of clean plywood to dry in a dust free room
- Allow the coat of finish to dry completely.
- A second coat may be applied after the first coat is fully dry but it is advisable to finely sand the first coat with No. 150 emery paper to get an even second coat.

Enamel Paint Finish

This finish imparts a bright and colourful look to the bamboo product and it ideal for products for children's rooms or for gift products. This finish is suitable for products such as bamboo pen stands, bamboo candy baskets, bamboo triple vase, and bamboo horizontal or vertical lidded containers.

Materials required (for a batch of 12 bamboo candy baskets)

- 250–300 enamel paint
- brush or clean rag
- 40 ml of turpentine to thin the paint and to clean brushes.

Procedure

- Thin the paint with turpentine so that brush can move smoothly.
- Apply the paint on to the product in smooth even strokes, taking care not to leave any are unpainted.
- Be careful not to let the paint stain the inside of the container as it will spoil the final look.
- Hold the product carefully to avoid any finger marks on the paint.
- Place the containers carefully on a sheet of clean plywood to dry in a dust-free room.
- Once a base colour has been applied, products can be painted in contrast colours to create a beautiful effect & has dried completely.

Metallic Finish

This finish is ideal to create a rich and luxurious look, as the end-result can be golden, silver or copper-tinted. This finish is recommended for horizontal and vertical lidded containers, pen stands and candy baskets.

Materials required (for a batch of 12 pen stands)

- 150–200 ml clear varnish
- 1–2 tsp metallic colour powders (gold/sliver/copper)
- brush or clean rag
- 20 ml of turpentine to thin the polish and to clean the brushes.

Procedure

- Mix together the clear varnish, metallic powder and turpentine. Stir the mixture with a spoon or stick so that a uniform mixture is formed.
- Apply the mixture on to the product in smooth even strokes, taking care not to leave any area unpainted.
- Be careful not to let the paint stain the inside of the container as it will spoil the final look
- Hold the product carefully to avoid any finger marks on the paint.
- Place the containers carefully on a sheet of clean plywood to dry in a dust-free room.
- Allow the coast of paint to dry completely.

11 Storage and Packing

PROPER PACKAGING AND storage is of utmost importance to ensure minimal damage to the finished whole bamboo containers. Many handicraft producers suffer losses due to improper packaging and storage of products, which results in the goods being broken or dented or scratched.

STORAGE

Many handicraft products are spoiled due to bad storage practices such as dumping products on dirty floors, storing in damp and dark rooms, etc. To ensure proper storage:

- Make sure the storage space is clean and dry with no chance for rain, water or dust to enter.
- Store the products in a room or in a large cupboard.
- If the products are stored on the floor, make sure it is clean, dry and dust free.
- Make sure the storage space is free of water products or degradable items which encourage the presence of insects, pests and rats.
- Store the products systematically, taking care to keep space between each item to avoid scraching or other surface abrasion.
- Do not keep products one on top on the other in a haphazard heap.

PACKING

Packaging is necessary both as an aid to marketing as well as to prevent damage to the finished whole bamboo containers. As a marketing tool, the packaging has to attractive with signage that provides information about the product. Proper packaging is essential that the whole bamboo

containers can be transported and stored over a long period without any breakage or scratches.

Depending on the size, shape and fragility of the bamboo containers, they can be packaged in a variety of materials. It is recommended to that delicate items in wrapped plastic bubble sheets before placing from in to a cardboard box, which should be made to the size of the product.

Sturdier items may be erapped in plain plastic sheets or paper and then boxed.

Clear plastic bags with self-sealing closures can be used too.

When the goods are being packed in a large carton for transportation to other sites, care must be taken to see that:

- The products are individually well wrapped and stacked systematically.
- The products are not dumped in to the box haphazardly as this can result in tremendous damage.
- Between two layers of products, sheets of newspaper on paddy straw are placed for cushioning.
- Empty spaces in the carton are filled with crumpled newspaper or paper shreds.

12 Waste Utilisation

WHEN A LENGTH of bamboo is used to make containers or any other handicraft products, usually the entire length is not fully utilized.

The bamboo or bamboo dust left over after the containers are made may be considered “waste”. Such waste may be generated at the following stages:

- *Selection stage*. The upper-most portion of the culms, the lowest portions, irregular or bent sections is not used.
- *Cutting stage*. For containers such as planters where both node ends are required, only alternate internode sections can be used, alternating segmentswill not be need.
- *Preparation stage*. While making the containers, cut and unused portions of the culm will be left over.
- Bamboo dust also is generated throughtout the process, whenever a bamboo section is cut through.

Waste can be utilized in various ways:

- Bamboo piece can be cut in to thick and thin slats and used for making other handcraft products such as tablemats, coasters and candle stands.
- Small pieces of bamboo can be used to accessories the bamboo containers, as handles for bamboo mugs or as lids and knobs for bamboo boxes.
- Bamboo dust should be collected and stored as it can be used to make a paste to fill in any surface pits and abrasions.

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