



# Training Manual for Bamboo Craft

Module I:  
Bamboo, Tools &  
Processes



Published by

Commonwealth Educational Media Centre for Asia  
7/8 Sarv Priya Vihar  
New Delhi - 110016

Foundation for MSME Clusters,  
USO House, 2nd Floor, USO Road,  
6 Special Institutional Area,  
Off Shaheed Jeet Singh Marg, New Delhi - 110067



This publication is made available under Creative Commons Attribution-Share Alike 4.0 License (international):

<http://creativecommons.org/licenses/by-sa/4.0/> by CEMCA with permission of authors

# Training Manual for Bamboo Craft

Module I:

## Bamboo, Tools & Processes

## Preface

Bamboo is an ancient woody grass widely distributed in tropical, subtropical and mild temperate zones. Traditionally seen as the “poor man’s tree”, in recent years bamboo has risen to become a high-tech, industrial raw material and substitute for wood. Although the commercialization of planted bamboo has been slow, bamboo is becoming an increasingly important economic asset for poverty eradication, economic and environmental development.

Bamboo is a group of perennial evergreens in the true grass family Poaceae and includes the largest members of the grass family. There are more than 70 genera and about 1,450 species of bamboo of which only around 50 species are routinely cultivated. Native bamboo grows in many parts of the world, including East Asia, Sub-Saharan Africa and the Americas. Bamboo is not limited to tropical climates, with some species able to withstand frost and survive in Northern Europe. Bamboo is an extremely fast growing plant, with some species obtaining growth surges of 100cm per 24 hour period. Most bamboo species grow to their full height within a single growing season. Over the following seasons the walls of each culm (or stem) dry and harden, reaching maturity within 3 to 5 years.

Bamboo has traditionally been used for basic construction and scaffolding, woven mats,

basketry, incense sticks, and a wide variety of other handcrafted items. The utilization and trade of bamboo sector is dominated by a large informal sector comprising farmers, artisans, and family owned cottage industries located in remote villages. Bamboo has been used as the primary raw material of the pulp and paper industry for many years. It is increasingly being exploited as a wood substitute for a range of industrial products including particleboard, bamboo mat boards, and bamboo mat corrugated sheets. Bamboo is cultivated in a small scale in homesteads but most of the material that is processed into finished products is extracted from state owned forests.

## How to use the manuals

In order to promote vocational skill development through the use of technology enhanced learning, and open educational resources, training contents have been developed for training artisans / workers to enhance the quality and introduce new line of products with higher value addition that has acceptance in high-end markets.

Module 1 is designed to provide information on the various post harvesting processes of bamboo such as treatment, storage, basic processing and finishing. This manual can be used as a reference material for trainers, trainees and artisans while learning or working with bamboo. An audio-visual guide has also been developed for the manual in order to enhance understanding. It is advisable to use both resources to derive the most of the manual.

# Contents

- Preface ----- 00
- 1. Introduction to Bamboo ----- 01
- 2. Various Bamboo species ----- 02
- 3. Harvesting, Grading and storage --- 03
- 4. Treatment Methods -----04
- 5. Workshop Safety ----- 05
- 6. Tools and equipment ----- 06
- 7. Basic Bamboo Working Methods -- 07
- 8. Dying -----09
- 9. Finishing Methods ----- 09
- Foundation for MSME Clusters ----- 10
- Acknowledgements ----- 11

# 1. Introduction to Bamboo

Bamboo, the giant grass, with more than 70 genera and about 1450 species, occur in a wide variety of soil and climatic conditions around the globe and play a critical role in providing ecological, livelihood and food security to mankind. In India, although bamboos occur throughout the country, the largest area under bamboo is in the North-Eastern India followed by the Western Ghats. There are about 1500 traditional uses of bamboo broadly classified under household, industry, weapons, energy, transportation, fisheries, agriculture, medicine and construction. Recently, in East and Southeast Asia, especially in China there has been a rapid growth of bamboo industries. The major reasons may be ascribed to the development of new products like laminated bamboo, parquet flooring, ply bamboo, bamboo composites and bamboo charcoal. Mechanization of the traditional sectors like bamboo shoots for food, chopsticks, toothpicks and bamboo handicrafts are other possible reasons.

Considering the large bamboo resources of India, which is second only to China, the potential for developing bamboo sector appears to be very high. In India, 136 species of bamboos in 36 genera are found to exist. The North East India holds the largest stock and diversity of bamboos. It is estimated that 8 million artisans depend on bamboo craft for their livelihood. The annual turnover of the bamboo sector in India is estimated to be around Rs.

2400 crores. By and large, this is a totally unorganized sector and bamboo has always been considered either from the craft point of view or for making pulp only. This craft has been practiced by the North Eastern States for centuries as their prime income source and, in the process, the weaving skills of the artisans have evolved to levels comparable with the craftsperson from more affluent societies like Japan, China etc.

## 2. Bamboo Glossary

India, home to 125 indigenous and 11 exotic species of bamboos spread across 23 genera, has the second largest genetic resources in the world. Except for the Kashmir region, bamboo is found growing in all part of the country. However, more than 50 per cent of the bamboo species are found in Easter India (Arunachal Pradesh, Assam, Manipur, Mizoram, Meghalaya, Nagaland, Sikkim, Tripura and West Bengal). They are also found abundantly in the Western Ghats. The total bamboo bearing area in India is estimated to be at 13.96 million hectares. Out of the 138 species found in India, only around 12-13 are considered economical beneficial in.

### Common Terminology

**Culm** is the stem of bamboo plant which is hollow except at the nodes

**Culm Sheath:** the plant casing (similar to a leaf) that protects the young bamboo shoot during growth, attached at each node of culm. Useful for identification of the species.

**Node:** the joint between hollow segments of a culm, branch, or rhizome

**Rhizome** is the underground part of the plant that stores food

**Soundness** is a quality measurement of bamboo; they are classified as green sound, dry sound and decayed

**Bamboo Brake** is dense thicket of bamboo plants

**Monopodial:** describes the growth habit of the rhizomes where the main rhizome continues to grow underground, with some buds producing side shoots (new rhizomes) and others producing aerial shoots (new culms).

**Sympodial:** describes the growth habit of the rhizomes where rhizomes emerge from the lateral buds of other rhizomes, while the terminal buds produce new culms. Here the bamboo grows in clumps that may be loosely or closely spaced depending on species.

### 3. Harvesting, Grading & Storage

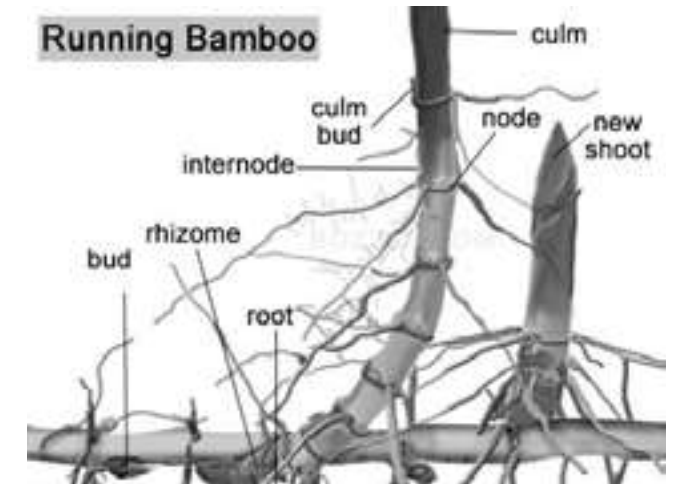
#### The Bamboo Plant

Bamboo is not a tree and it belongs to the grass family. The most common bamboo species are tree-like timber species. All bamboo plants share the biological feature of grasses especially the nodes that are obvious in bamboo culms.

Bamboo can be propagated in two ways. One by reproductive method through seeds and the other is by vegetative methods by using vegetative parts of bamboo plants such as rhizomes, culms and branches. Seed propagation methods are seldom used because of the irregular flowering of most of the bamboos, poor viability of seeds (between one and six months) and non-availability of seeds around the year. Therefore, vegetative propagation is the most popular and effective of the methods.



Seed propagation methods



When a bamboo seed grows or a young bamboo plant cultivated, the rhizomes produce new buds that either become a new shoot or another rhizome. Each new shoot develops into a culm. A swollen segment of the culm where the culm sheath, foliage leaves and branches originate is the node. The nodes provide the connection from one side of the culm to another.

Buds appear on the nodes and develop into branches. The hollow section of the culm between nodes are called internodes. The length of the internodes varies from plant to plant and species. Individual culm undergoes a gradual process of development. As it matures, it becomes harder.

### **Bamboo Selection and harvesting**

The selection of bamboo is very important for making high quality products. The main criteria for selecting bamboo is culm size, age and the growing environment. The bamboo raw material required depends on the intended application and characteristics of the product that will be manufactured. For example, culms younger than 1 year old, can be used as finishing strips for weaving because they have soft and flexible fibers and culms that are 3-4 years old can be used for furniture making.

Finding the right age of bamboo is key in the selection process. There are two methods to identify the age of culms.

### **Colour of the Culm**

Identifying the age of the bamboo by colour of the culm is challenging. Young bamboo culms that are a year old or less are dark green in colour. However, mature culms have similar girth, length and nodal structure. Therefore this is not a reliable method of selection.

### **Marking Culms**

Maturity marking of culms is a reliable method for selecting bamboo. The simplest way is to paint a colored band around the each culm with a specific colour for every year. Five colors one for each year of a 5-year cycle can be used. This will also help remove culms that are more than 5 years as they become brittle and are expected to die within a span of a year.



Bamboo plant ready for harvesting

### **Bamboo Harvesting**

Bamboo harvesting depends on the application. It is important to keep in mind the intended application before selecting. Young, one year old bamboo culm is suitable for weaving because of soft and flexible fibers properties. The thickness of the culm wall determines the number of layers and strips. If the culm aged more than three years, it will be too hard to strip.

Select culms that are 3-4 years old for making bamboo furniture as they have medium diameter (3 cm) and thick walls of at least 5 mm. Thick walls provide strength and a higher tolerance for nailing and drilling. At this age they combine strength with low moisture content and low shrinkage.

Harvesting should not be done during the rainy season as during this time bamboos grow well and have high moisture and starch content which makes them susceptible to fungal and insect attacks. Also, as harvesting will damage delicate new shoots that emerge during rains will be damaged, hindering re-generation. Therefore, dry season is the ideal time for bamboo harvesting.

New culms are produced towards the periphery of the clump, therefore harvesting of bamboo should be from center. Only 70% of the all the mature culms in a clump should be harvested in order to ensure regeneration. Clear felling (100% cutting) of culms causes

the regenerated clump to form into bushy, unmanageable

Culms should be cut at a height as low as possible, between the first or second node above the ground, leaving only one internode above the ground. After harvesting all branches of culm should be removed cautiously without damaging the culm. For making bamboo poles into different sections, use knife or saw and cut parallel to the node in order to facilitate transport to work area. After cutting culms, post-harvest treatment should be done.

Insert horseshoe and cross tunnel diagram





### Storing

After post-harvest treatment is done, bamboo poles should be stored in a ventilated shelter and not in a closed area. The poles should be piled in stacks of different diameters with distance splits to allow air flow. Sort and classify the preserved culms based on their size, diameter and quality. An ideal way of storing treated bamboo culms is in horizontal racks.



Treated bamboo poles stacked for further process.

Treated bamboo poles brought to the work area.

## 4. Treatment Methods

Bamboo is a giant grass which contains high percentages of cellulose, which makes it a source of food for many organisms, especially fungi and insects such as borer beetles. Therefore, bamboo is prone to insect attacks. In order to prevent these kinds of attack, the bamboo pole has to be treated to increase its durability. If the bamboo is not treated properly, the products made out of bamboo will not last long. Treatment and seasoning protects them from different kinds of insects, borers and fungal attacks.

Preservation treatment method of bamboo are of two types: 1) traditional treatment (non-chemical method 2) chemical treatment. The choice between these two methods depends on the type of bamboo and its status, whether it is green or dry or split, the future use of bamboo, quantity to be treated and the time available.

### 1) Traditional treatment

The traditional methods have been widely used by artisans and villagers in India as well as other parts of the world. The most commonly used methods are smoking, white washing and soaking in water.

#### Smoking

Smoking is one of the oldest treatment methods followed in our country. The bamboo materials are arranged on top of the fire place and are smoked. Exposure to smoke reduces moisture content and reduces chances of and forms a protective layer of tar is formed on the outer surface. Smoking also reduces splitting.

#### Lime Washing

Culms can also be painted with a mixture of tar and sand, or plaster, cow dung and lime. This prevent water absorption and makes the surface alkaline thereby preventing fungal and insect attack.

#### Soaking in water

Newly cut bamboo materials are stored either in water ponds or in running water for 3-4 months to leach out starch. Lack of starch makes the bamboo less attractive to insects and other fungal attacks. One can also store bamboo materials in water basins but in this case, the water must be changed frequently.

### 2) Chemical treatment

Bamboo in its natural state is quite durable. However, we can greatly increase the durability by preserving it with safe, environment-friendly chemicals. There are a number of methods. However we will look at commonly used non-pressure and pressure ones such as open tank, boucherie and butt treatment methods using some of the common chemicals such as borix and borax.

Treating bamboo with borax and boric acid is the most popular bamboo preservation method, because it is very effective and more environmentally friendly than other preservatives.

#### Open tank method- non pressure

Open tank method is best suited for round bamboo, splits and slivers. The boric acid/borax (5-8%) mix put into an open tank that has an outlet for draining. For round bamboo is holes should be made through diaphragms for better penetration. The bamboo is bundled and tied down with a weight to keep them submerged in the preservative.



Bamboo poles are placed in the open tank.

Cover the tank to avoid evaporation. In case sludge is formed, do not disturb it as it will deposit on the bamboo, preventing absorption. The round bamboo material should be immersed for 15-20 days and 7-10 days for splits and slivers. Check and top up the solution if required. This requires a large number of tanks to treat culms in the scale of 100 /month/

After soaking, the bamboo has to be stacked horizontally to further encourage diffusion and should be covered and air-dried.

### Boucherie treatment

Pressure treatment method is appropriate for dry bamboo for quick and uniform penetration of the preservative deep inside. The main aim of the pressure treatment method is to force the preservative into the bamboo tissue. This is done either by removing the air inside the culm or by giving increased pressure upon the preservative in a pressurized cylinder. Bamboo poles treated using this method will have long durability.

In this method, the preservative is forced under pressure through the entire length of the fresh culm, so that the sap is replaced by the preservative. As this method is applied on freshly cut culms, they should be stored in water overnight before treatment. You will need a bicycle pump, strong thick steel tank/pipe that can withstand pressure, metallic clamps and a rubber hose.

Cut a few centimeters off both ends of the culm, join them together and attach the base ends to the steel treatment tank. Secure them with clamps to avoid leaks. Fill two-thirds of the tank with preservative solution. Fit the tank with an airtight screw with a car tyre valve so pressure can be applied. Bleed the air out of the system and develop a pressure of 1.0 to 1.4 Kg/cm<sup>2</sup> in the tank. Open the valves to start the preservation process. The preservative will start dripping out of the other end of the bamboo in 30 minutes.

When the concentration of preservative exiting is close to, the initial concentration,

the procedure can be stopped.

Steel tank with preservative connected to base end of bamboo. The other end has a tray to collect the preservative after sap replacement



### Butt treatment method

The newly cut fresh bamboo culms are put immediately at the bottom ends into a drum containing preservative vertically. Water-borne preservative chemicals used here boric acid and borax. The solution penetrates the vessels by capillary action and subsequently by diffusion. The leaves on the culm act as a pump because of the process of transpiration. The time for treatment one or two weeks but it will depend upon the moisture content and length of the culm. After treatment place the culm in an empty drum to drain the excess preservative. This method can be used instead of boucherie method when only few culms are to be treated.



# 5. Workshop Safety

**W**orkshop is the place where various kinds of machineries are being used and it contains many potential safety hazards. The purpose of safety measure is to prevent fatal accidents and provide emergency help. Therefore, it is very important that the rules and guidelines are followed.

It is not possible for this section to cover every conceivable situation and therefore staff who have management or supervisory responsibilities must also establish and enforce safety rules to cover specific hazards in their workshops. The laws that govern occupational health and safety in a bamboo processing workplace are very important to each and every learner. The learner should be able to identify typical workplace hazards and follow procedures that will control the risks associated with those hazards to prevent injury, illness and death. The knowledge of workshop safety measures will enable the learners to respond correctly and safely in an emergency situation that may arise in a bamboo processing workplace and to take appropriate safety measures.

The trainer should explain the warning or reporting procedures of unsafe situations in the workplace. In case of an emergency situation, the trainer or the trainee should inform the nearest hospital for treatment.

There are various safety measures followed in bamboo processing working environment. The following are some of the important safety clothing and equipment one should strictly wear while working with bamboo in the workshop. They are a) safety glass b) mask c) apron d) hand gloves e) first aid kit.

#### **a) Safety glass**

Safety glass is a glass which has safety features to protect eyes while working in the workshop. There are many types of glasses available in the market like toughened glass, laminated glass and wire mesh glass for workshop safety.

#### **b) Mask**

When working in the bamboo workshop, you can breathe in lot of dusts that can cause serious lung diseases. In such conditions, it is advised to use dust mask to protect oneself. A dust mask is a pad held over the nose and mouth by elastic or rubber straps to protect against dusts encountered during workshop activities.

#### **c) Apron**

An apron is an outer protective garment that covers primarily the front of the body. It is worn for various safety reasons in the workshop to protect oneself from many hazards. Aprons are available in different materials and the learner should wear a thick cloth apron for bamboo activities in the workshop.

#### **d) Hand gloves**

Hand gloves are worn to protect hands from cuts and abrasions, chemicals, heat and most of the work environments. Hand gloves are made from leather, cotton, synthetics, nitrile, latex etc. to offer maximum protection and comfort.

#### **e) First aid kit**

A first aid kit consists of equipment for treating minor injuries by an individual. Typical contents include adhesive bandages, crepe bandage, finger bandage, scissors, hypo allergic tape, disposable gloves, regular pain medication, gauze and disinfectant. It is important to keep all kits in a clean condition and waterproof container to keep them safe and aseptic. The contents of the kit should be checked regularly and stocked if any items are damaged or expired out of date. Other than the above mentioned safety measures one should keep in mind the following strictly.

- No casual attitude in the workshop premise.
- Wear suitable personal clothing to the workshop conditions.
- Appropriate footwear should be worn.
- Never run in the workshop.
- Label safety equipment and maintain in good condition.
- Keep all fire-escape routes completely clear at all times.
- Ensure that all safety equipment remains accessible to the workshop personnel at all times.

#### **Artificial Respiration**

Artificial respiration is a procedure used to restore or maintain respiration in a person who has stopped breathing due to drowning, electric shock, choking, gas or smoke inhalation,

Safety glass

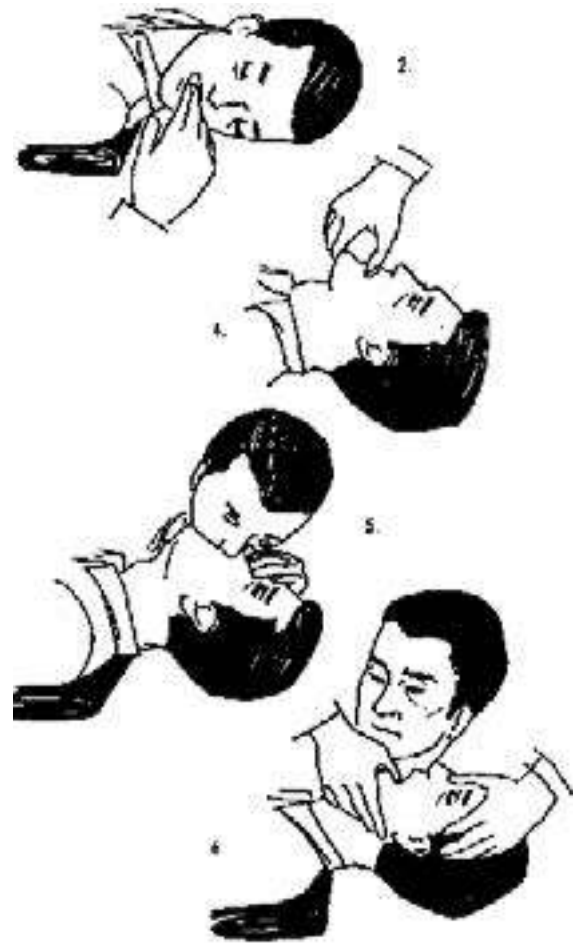
Mask

Apron

Hand Gloves

or poisoning. This method uses mechanical or manual means to force air into and out of the lungs in a rhythmic fashion. In emergency situations, however when no professional help is available rescuers undertake the natural method mouth-to-mouth or nose-to-nose for artificial respiration.

In the first place to perform this method, any foreign material is swept out of the mouth with the hand. The patient is placed on his/her back with the head tilted backward and chin pointing upward just to avoid the tongue blocking the throat. The rescuer's mouth is then placed tightly over the victim's mouth or nose with the victim's mouth or nostrils shut. The rescuer then takes a deep breath and blows into the victim's mouth, nose or both. The breathing should be vigorous at the rate of 12 breaths per minute. Breathing exercise should be continued until natural breathing resumes or until professional help arrives.



## 6. Tools and Equipment



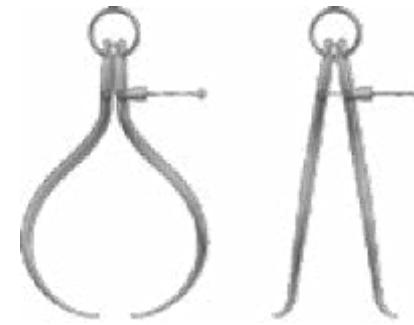
Inch Steel Rule

Used for measuring and marking in inch and in millimetre.



Right Angle

Used for marking right angle in various materials.

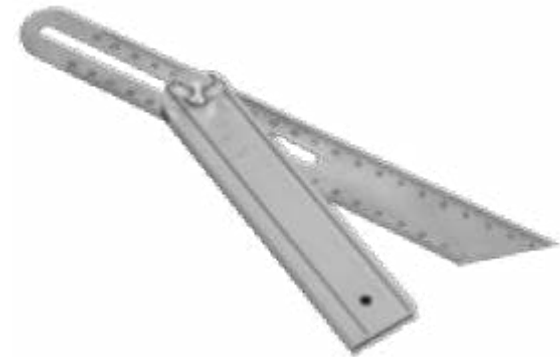


Calipers

Used for measuring inside and outside dimensions of various material and pipes.

Bench vice-1

Used to hold various material tightly for tooling.



Angle Rule

Used for measuring and marking various angles on the materials.



Measuring Tape

Used for measuring longer length in various materials.



Compass

Used to draw the circle on the surface so f various materials.



Bench Vice-2

Used to hold wood and plywood tightly for tooling.



Vernier Caliper

Used to measure the inner and outer dimensions of various materials and pipes.



Marking Gauge

Used for marking on various materials.



Hand Saw

Used to cut wood/bamboo based material along or across the grains.



Hand Planer

Used to level the surface of wood/bamboo etc. to make surface smooth and straight.





Cutting pliers

Used for cutting & twisting wire, opening and tightening nuts & bolts etc.



Fret saw

Used for cutting various intricate shapes from flat sheets.



Flat file

Used for shaping and levelling the surface.



Wire cutter

Used for cutting wire of various diameters.



Chisels

Used for carving out the surface of wood/ Bamboo for making the joints, shapes etc.



Mortise Chisels

Used for making any grooves for joints etc.



Hand saw

Used for cross cutting the bamboo across the grains.



Noose Pliers

Used for cutting, bending & twisting wire, opening and tightening nuts & bolts.



Half round rasp file

Used for shaping and levelling the surface.



Work Bench

A sturdy table with vice used for working with various materials and tools.



'C' Clamp

Used to hold the bamboo tightly while working, joining etc.



**Hammer**  
Used to hit on bamboo, chisel or knives while working with bamboo.



**Marking chisel**  
Sharp pointed chisel used for marking the material.



**Center punch**  
Sharp pointed rod for marking on metal or other materials.



**Screw Driver - flat**  
Used for driving the screws to the material.



**Screw Driver - star**  
Used for driving the screws to the material.



**Brushes**  
Used for painting or polishing on various material.



**Bending Stand**  
Used as a supporting jig while bending the solid bamboo.



**Hand Drill**  
Used for creating a hole on the surface of any material.



**Hand held sander**  
Used for smoothening the surface of any material.



**Hot air gun**  
Used for heating to bend bamboo splits.



**Jig saw**  
Used for cutting bamboo or wood material in any shapes.



Sabre saw  
Used for cutting the bamboo pole or wood planks.



Hand held grinder  
Used to grind the surfaces of various materials.



Bench top table saw  
This helps to cut the bamboo and wood along the fibre in length.



Bench top horizontal band saw  
Used for cross cutting the bamboo in any angle required.



Bamboo radial splitter  
This machine is used to split the bamboo radially to various numbers as required.



Table Saw  
This helps to cut the bamboo and wood along the fibre in length.



Bench top jig saw  
Used for cutting bamboo or wood material in any shapes.



Surface planer  
Used for levelling the surface of wood or bamboo splits.



Pillar Drill  
Used for drilling on the surface of wood, bamboo, metal etc.



Node removing machine  
After splitting in radial splitter this machine is used to remove the nodes.



Cross cut saw  
Used for cutting wood and bamboo across the grains in any angle.



Vertical sand saw  
Used for cutting wood or bamboo along with grains and in any shapes.



Slivering machine  
This machine makes thick sliver suitable for making furniture and lifestyle products.



Cross cut saw  
This machine is used for cutting the length of bamboo.

Slivering machine  
This machine is used to make thin slivers.



Parallel blade saw

This machine has parallel blades which cuts the bamboo to straight splits.



Four side planer

This machine makes four side planed slivers for furniture and other products



The closer view of the parallel blade



Pressure treatment tank

This machine is used for treating bamboo by impregnating chemicals by pressure.



Slivering machine

This machine makes thin slivers for mat weaving.

## 7. Basic Bamboo Working Methods



Various bamboo species are used according to the requirement of what products to be made.



Thin green bamboo can be cut with knife itself.



Cutting the bamboo with sabre saw.



Use the bench vice to hold the bamboo tightly while cutting drilling or any machining.



Cutting bamboo with hacksaw.

Adjusting the cross cut saw angle.



Cutting bamboo with cross cut saw

Cross cut saw can be used to cut the bamboo in any angle required.



Always branches should be removed from the bottom part of the branch.





Using a knife and a hammer/mallet to split the bamboo into half.



Further splitting of half bamboo to the required width.



Reducing the thickness of the bamboo by using the knife.



Knife and chisel used with hammer for splitting the bamboo into half



Bending the bamboo.



Bending the bamboo split using hot air gun. Start bending by heating the surface.



Bend the bamboo slowly by adding more pressure.



If required (wet or green bamboo) also heat behind the curve on the skin.



After bending apply water or dip it in the water for cooling the bamboo which helps to retain the shape.

Always keep excess length of bamboo for proper grip during bending and this extra length can be cut after the process.



Hold the material tightly while sanding on the sanding machine.



A hand held power drill can be used for drilling on the splits or smaller size objects.



Remove the burned skin by a knife after the bending process is done.



A power drill can be used for drilling on the bigger sized bamboo or products.



For further finishing a sander can be used to smoothen the surface.

## 8. Dying



Dried bamboo is often pale yellow or yellow ochre in colour. Thus, we often need to add colors to make it look attractive. So one of the common method used is dyeing. Dyeing is a simple process that adds colour to any cellulose material like cotton, jute, bamboo, or any other natural fibre.

There are two types of dyeing. One is by using natural dyes which are made of flowers, leaves, barks, minerals etc. which are available naturally. The other is by using chemical/fast colours for dyeing. Bamboo's natural cellulose material and offwhite natural shade can absorb colour well and improve adds to its attractiveness. Preferably green or non-dried bamboos in sliver form are good for better absorption of dyes. The bamboo skin does not allow dyes to be absorbed in the grains.



Various colours of dyes.



Adding salt to the water.



Adding dye to the water as required.



Heating the water in a tub.



Stir well to mix the dye in water.



Place the bamboo sliver in the prepared mix.



Boil the dye with bamboo sliver in it.



After about 15-20 min. take out the slivers.



Wash the dyed sliver and dry it before using.

Dyed bamboo is mostly used for making woven products like baskets, mats, window blinds etc.



Clean the tub every time after dyeing before using it for another colour.

## 9. Finishing Methods

Bamboo tends to absorb moisture even after making a product using it. This causes fungus growth, expansion of material, which change the dimension of products, change of shape etc. Thus a surface coating is required to protect the products from moisture especially during the rainy season.

There are various types of coating available which are commonly used for wood products.



Mellamine is one of the best material that can be applied on bamboo surface, which is normally available in glossy and mat finish. Mat finish makes it look like natural while glossy adds a shine to the surface. They are sometimes mixed together in 1:1 proportion which gives another unique look. Various stainers can be added with mellamine to get an attractive colour on finished products.



Take 100 ml of mellamine in a container.



Add 200 ml of NC thinner in mellamine.



Add 10 ml of hardener with the mixture.



Pour the mixture in the container of airbrush.



Spray it on the surface of products.

The surface of the products has to be smooth and dust free before the spraying is done. There should not be any moisture content on the products. Wear a mask and an eye guard during the spray to avoid any accident.

## Foundation for MSME Clusters

FMC is a non-government, not-for-profit Public Charitable Trust, registered under India Trust Act set up in the year 2005. It was conceived in the year 2004 at the suggestion of the then Ministry of Small Scale Industries (SSI) and now renamed as Ministry of MSME, Govt. of India. United Nations Industrial Development Organisation (UNIDO) helped to draw up its business plan and Entrepreneurship Development Institute of India (EDII) gave legal birth to FMC. The Foundation is an apex national body known worldwide as a pioneer organization for the development of MSMEs through cluster development approach. FMC has rich experience of working with MSMEs and has provided services in the areas of advocacy, implementation and coordination, training and research to more than 150 clusters nationally and globally across 10 countries. It has its head office located in New Delhi and regional/project offices in Hyderabad, Phagwara, Ludhiana, Jaipur and Kolkata

## Acknowledgement

This manual development is sponsored by CEMCA

The team:

Mr. Kamesh Salam

Mr. Susanth C S

Mr. Antony William

Mr. Nibu George

Mr. Arjun N J

Mr. Prajeesh Kumar T. K

Mr. Ranjit Debbarma

Mr. Shridhar H

For further information and feedback:

Ms. Sangeeta Agasty,  
General Manager  
USO House, 2nd Floor, USO Road,  
6 Special Institutional Area,  
Off Shaheed Jeet Singh Marg, New Delhi - 110067  
Ph: +91-11-26602886, 40563324/2  
Fax: +91-11-41688589/90  
Website: [www.fmc.org.in](http://www.fmc.org.in) | [www.clusterobservatory.in](http://www.clusterobservatory.in),

Contact: +91-99100-47811



Foundation for MSME Clusters (FMC)  
© 2003-2006. 2006 Certified Organization