Vertical Soak Diffusion

FOR BAMBOO PRESERVATION

Environmental Bamboo Foundation
YAYASAN BAMBU LESTARI

bamboo_foundation
EnvironmentalBambooFoundation
linkedin.com/company/1000bamboovillage

The Environmental Bamboo Foundation (EBF) is an Indonesian non-profit organization started in 1993 by designer and environmentalist, LINDA GARLAND.

The EBF strives to protect tropical forests by promoting and demonstrating the many conservation and development opportunities that bamboo offers. The mission of the Environmental Bamboo Foundation is to encourage, through research and education, the sustainable planting and utilization of bamboo in an effort to promote its many environmental benefits and protect the world's remaining tropical forests and mangroves. Based in Bali, Indonesia, the EBF has affiliate non-profit organizations in the United States and in Holland.

ACKNOWLEDGEMENTS

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We thank Ben Brown of Mangrove Action Project for providing valuable help and insight during the testing period and providing translation services for the Indonesian edition.

We appreciate the advise/comments made by Prof.Liese along the development of the VSD treatment.

Many thanks to Emerald Starr of Sacred Mountain Sanctuary in Sideman, Bali, who used a high percentage of experimental VSD treated bamboo timbers when building his resort. Seven years later, the bamboo he used is still in excellent condition

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Every effort has been made to ensure that all the information in this booklet is accurate. However, due to differing conditions, kind and age of the bamboos, tools, and individual skills, the publisher cannot be responsible for any injuries, losses, and other damages that may result from the use of the information of this booklet.

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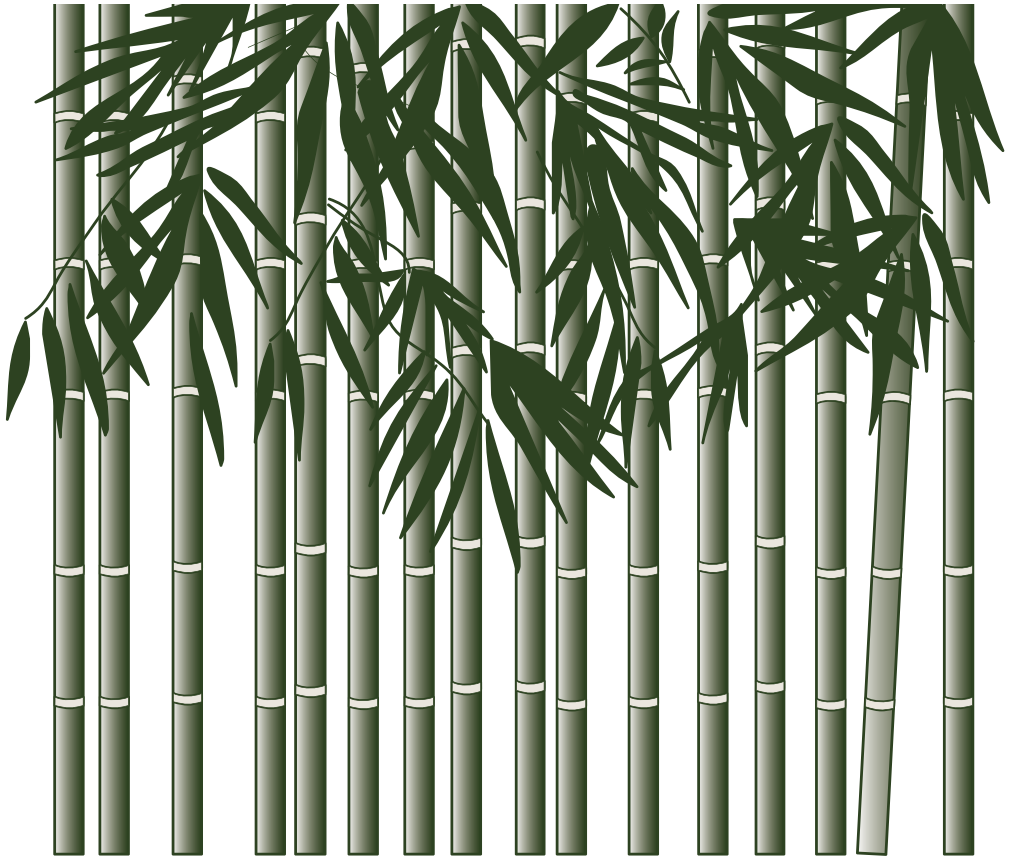
PREFACE

The use of bamboo products requires often its protection against biodegradation by chemical treatment. Its application is hindered by the structure of the culm, the need for larger technical installations and the danger of environmental side-effects. The VSD method developed by EBF is obviously an efficient method to obtain well treated culms, safe to be handled. Its wider application, also to other species, will strengthen its base.

Walter Liese
Universität Hamburg, Germany



INTRODUCTION

Bamboo culms are a natural material susceptible to insect and fungal attack. Without treatment products made from bamboo can be expected to last for only up to 3 years.

There are many different techniques for curing and treating bamboo culms in order to prevent splitting,insect infection and fungal growth. In this booklet we present the Vertical Soak Diffusion (VSD) method which uses minimally toxic borates as preservatives. The method has been tested in Indonesia using three species of bamboo:

Dendrocalamus asper
Gigantochloa apus
Gigantochloa atter

see local names in Appendices.

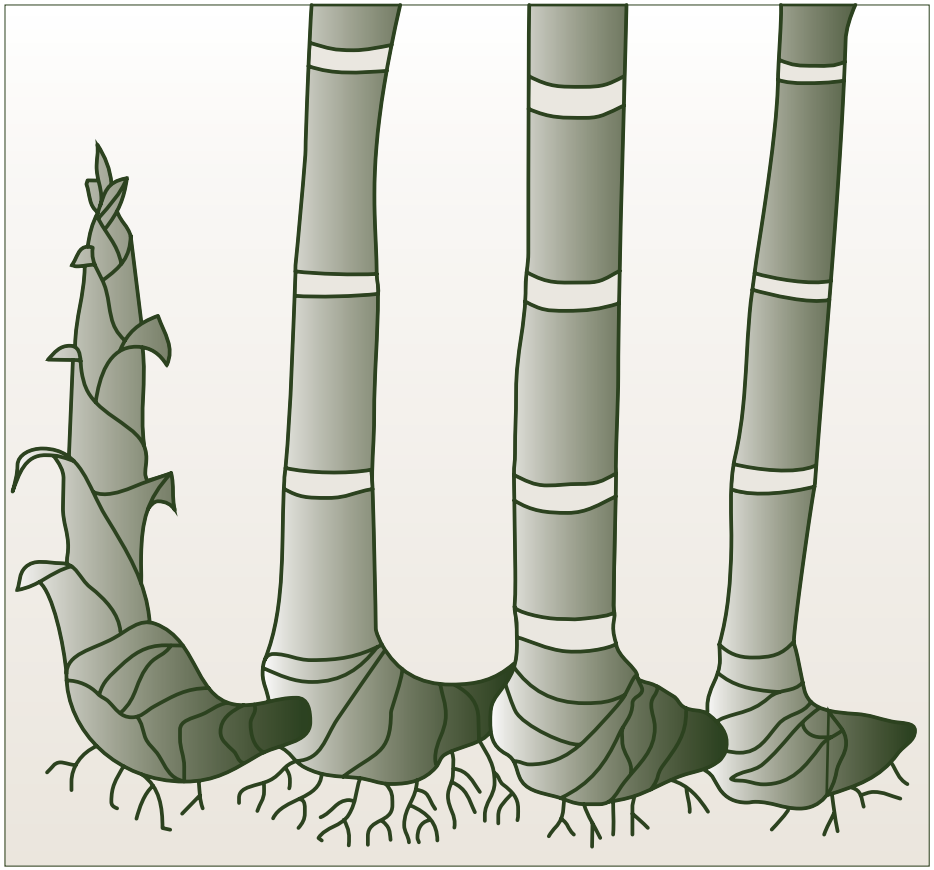
If you are intending to use other species of bamboo, follow the methodology in this booklet to treat a small section (1-2 internodes) and observe insect attact.

Whereas bamboo treated by the modified boucherie system (a pressure system introduced by Prof. Dr. Liese, Hamburg, Germany) is appropriate for large scale plantations growing bamboo for construction timber, furniture and some crafts the VSD system works well with small-plantation situations and community development work in rural villages.

MANAGING BAMBOO

CLUMPING BAMBOO

Clumping bamboos are noninvasive. They do not ruin buildings, they grow very fast when young and the culms are larger than those of the running bamboo. They require little maintenance, although simple clump management will benefit both the grower and the bamboos.



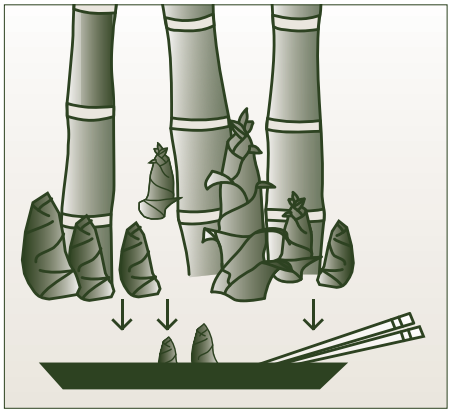
RUNNING BAMBOO

Running bamboo is more prelevant in temperate climates, can be extremely invasive, great for erosion control.

In the dry season, almost all culms that are 3 years or older can be removed from a clump by cutting them just above a node about 20cm above the ground. Some of the younger ones should remain for further nourishment of the rhizome.

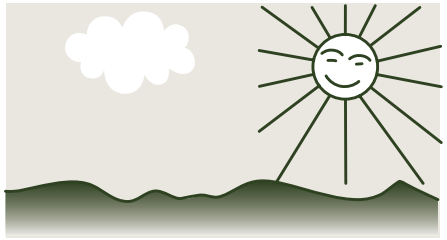
Use a marking pen to date young culms when they first appear, that way you will know when they are at least 3-4 years old without having to guess.

In the shooting season, remove any shoots that are going to create overcrowding (many species are edible, cooked). Leave only the shoots of good diameter which have potential to produce straight strong poles for timber use.



HARVESTING BAMBOO

WET SEASON



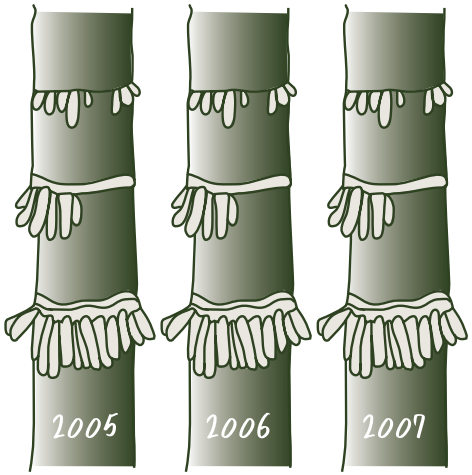
DRY SEASON

HARVEST BAMBOO DURING THE DRY SEASON

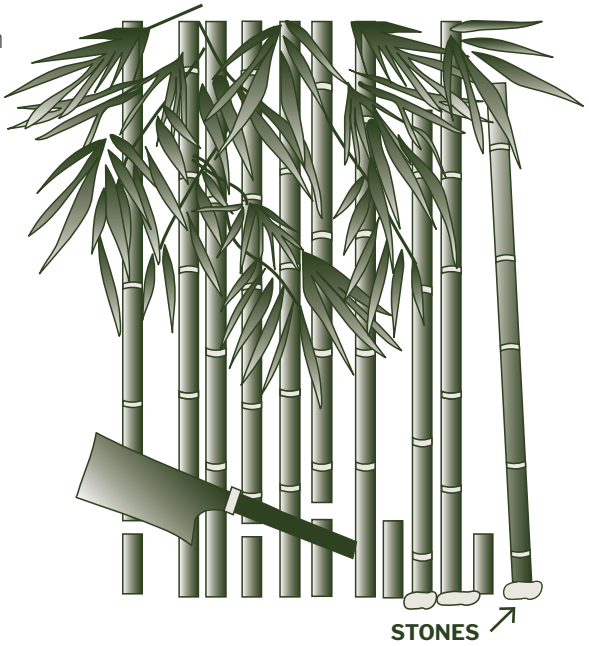
The best season for harvesting is after the rainy season when starch content in the bamboo sap is low. Starch is the favorite food for pests. Don't harvest during shooting season! Cut bamboo that is 3-5 years old. Bamboo older than 5 years is harder and the inner culm wall becomes impermeable to the treatment solution. If the poles are not regularly harvested, they push each other and this causes the development of bent poles.

There are 3 different ways to tell the age of bamboo culms:

1. Mostly, culms at the inside of a clump are the oldest.
1. Label the new shoots; this is the safest method.
1. If you are an experienced bamboo harvester you will know the age by knocking on the culm and observe the different sounds.



The culms should be treated soon after having been cut, but can be left for a few days standing upright, placed on a stone. Due to the ongoing transpiration by the leaves the culm will loose some of its moisture and also starch, which is the food for the pest. But don't wait too long, since moisture is required for the following diffusion process. If your bamboo is very dry you can soak it in water for a few days to reopen the vessels for treatment. In case of split culms cut the cracked pieces off, treat them in the horizontal basin.

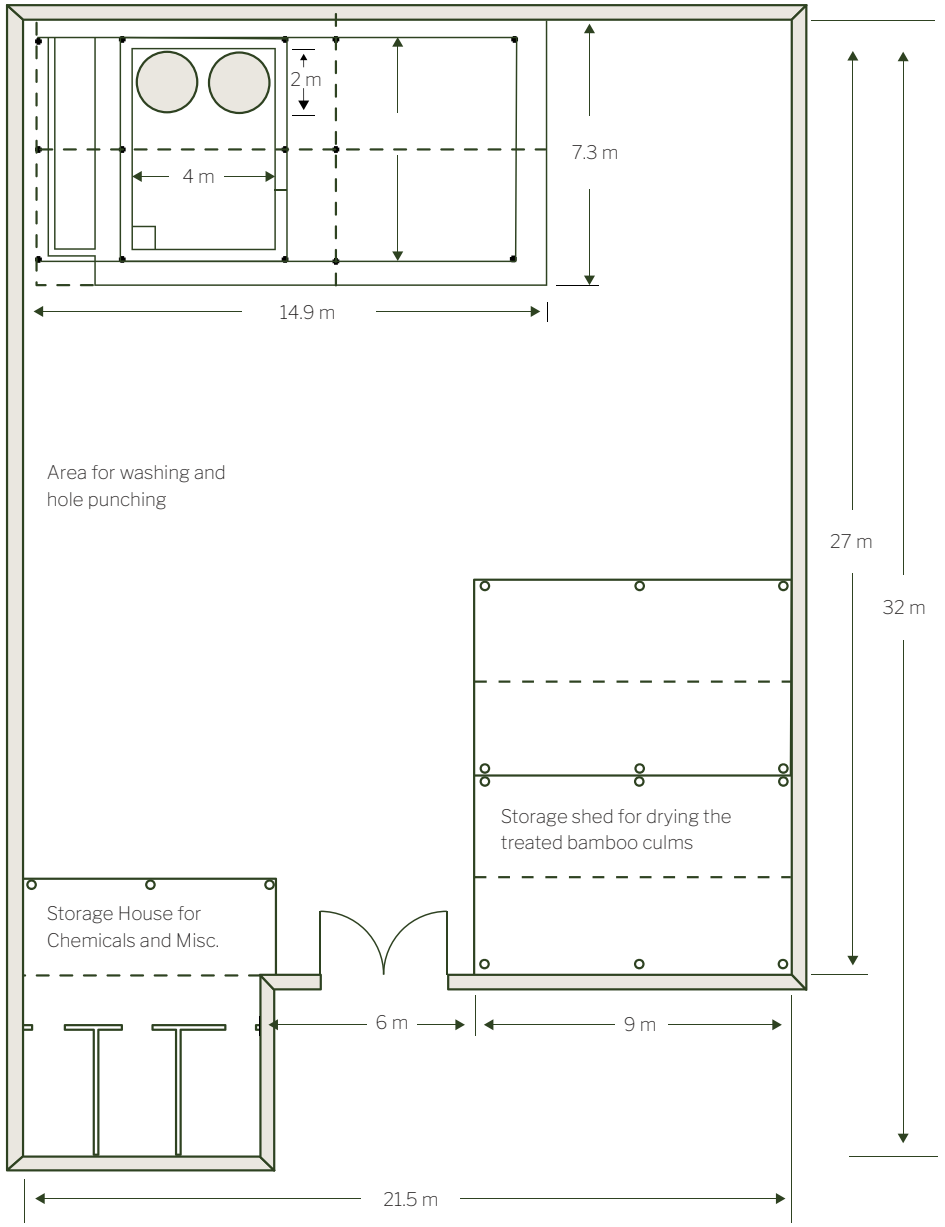


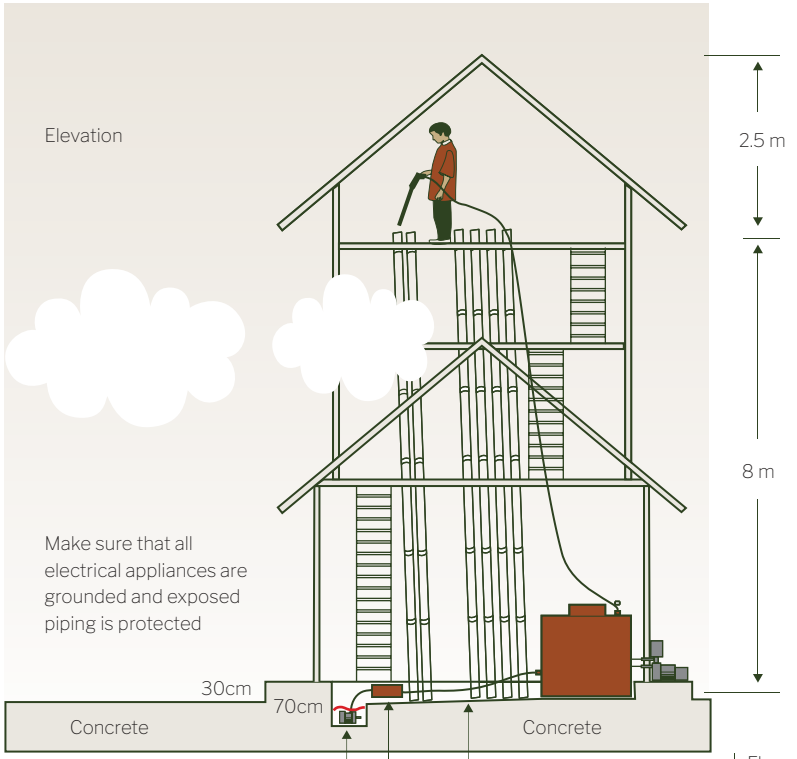
THE POWDERPOST BEETLE

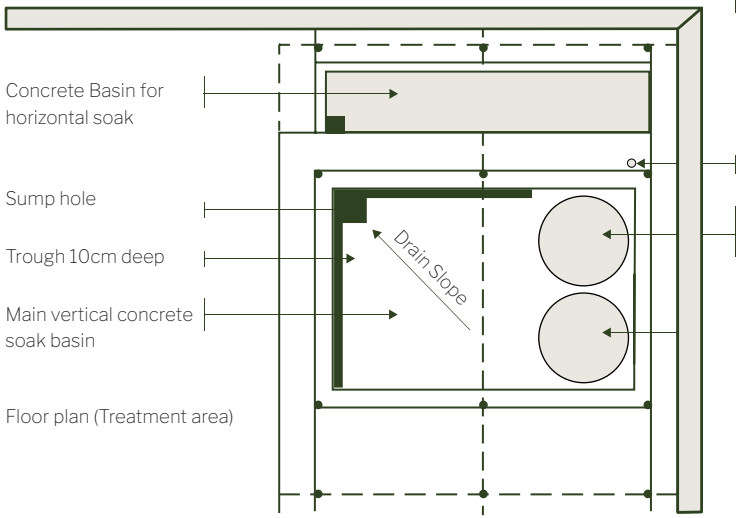
Stored bamboo is endangered by beetle infestation which can be recognized in the form of a talcum-like yellowish powder and small holes in the area of the nodes and along the internodes.

PLANNING A TREATMENT CENTER

FLOORPLAN







Using the here displayed principles in simpler and more economic versions is of course acceptable

LIST OF TOOLS AND MATERIALS

EYE PROTECTION

RUBBER GLOVES

RUBBER BOOTS

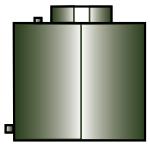
TIM-BOR
SEE APPENDICE PAGE 23

RED DYE

PLASTICS CONTAINERS FOR MIXING & MEASURING

WATER

FILTER

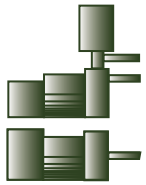


PLASTIC CONTAINERS FOR SOLUTION

HANDSAW

T-BAR WITH ATTACHED SPEAR HEAD (WELDED, LENGTH DEPENDING ON THE CULM TO BE TREATED)

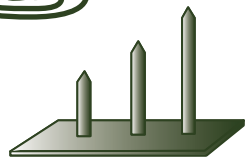
FLAT, BROAD BAMBOO OR WOODEN STICK FOR MIXING



PUMP, PLASTIC AND/OR STAINLESS STEEL

SMALL SUM PUMP

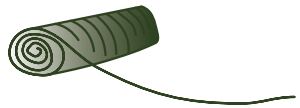
PLASTIC OR RUBBER HOSE



BAMBOO NODE PUNCH

HYDROMETER
(CAN BE FOUND IN AQUARIUM STORES)

BRUSH FOR CLEANING OR COCONUT HUSKS



ROPE (FOR TYING CULMS)

MIXING THE TIM-BOR SOLUTION

STEP 1

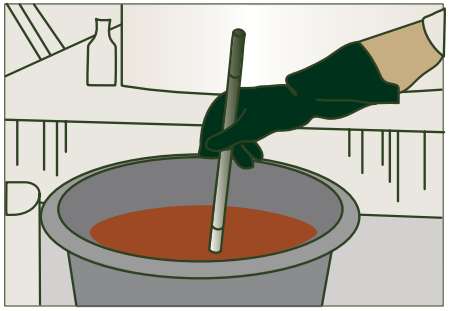
Figure out the internal volume of the culms.Fill one punctured culm with water and simply measure how many liters it takes to fill it up. Multiply by the number of culms.

STEP 2

Mix 1 bag of Tim-bor (25kg) with 225 liters of water. This gives a 9 to 1 or 10% weight for weight solution. Keep in mind though that the total quantity of Tim-bor solution is not 250 liters but about 5% less because when 25 kg of Tim-bor are dissolved in water its volume will be reduced.

STEP 3

Add red dye and mix well. This is done for the purpose of later identifying the treated bamboo poles.



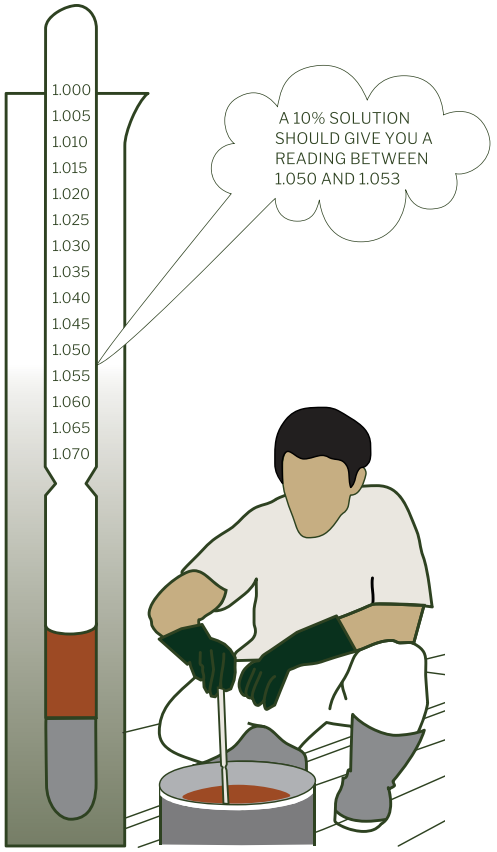
STEP 4

Slowly add water stirring constantly until Tim-bor and dye are completely dissolved and no more crystals are at bottom of container.

STEP 5

Test the solution with a salt measuring hydrometer under normal temperatures of your region. Fill a small test container with the Tim-bor solution slowly, so as to not form air bubbles.

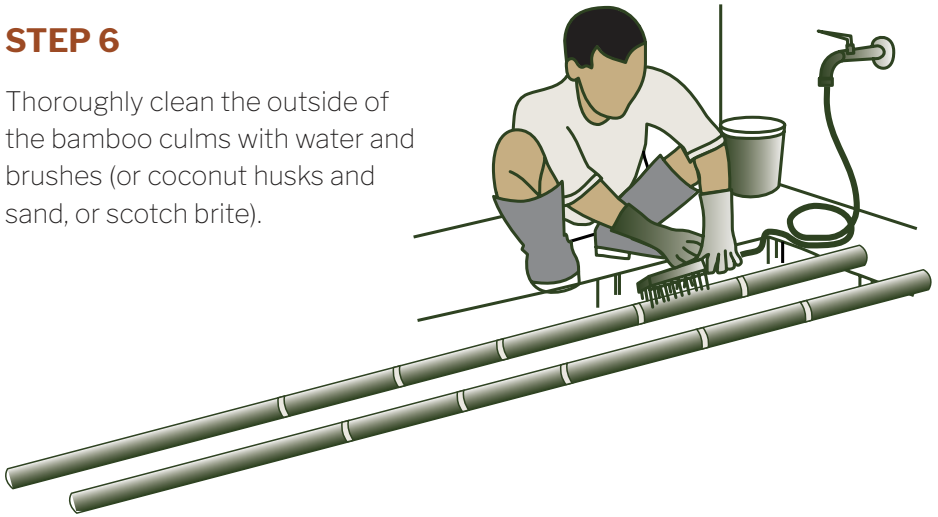
Lower the Hydrometer into the container and give it a quick twirl, spinning the top. This will get rid of air bubbles that might have accumulated on the hydrometer. Then read the number where the solution crosses the scale like reading a thermometer: 1.052 should be reading on an well-calibrated hydrometer. If this not available make sure you measure the ingredients correctly.

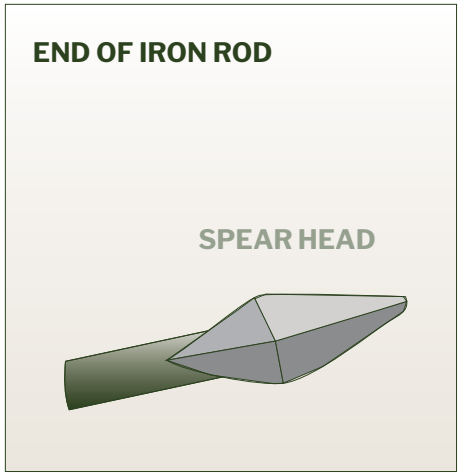


TREATMENT

STEP 6

Thoroughly clean the outside of the bamboo culms with water and brushes (or coconut husks and sand, or scotch brite).



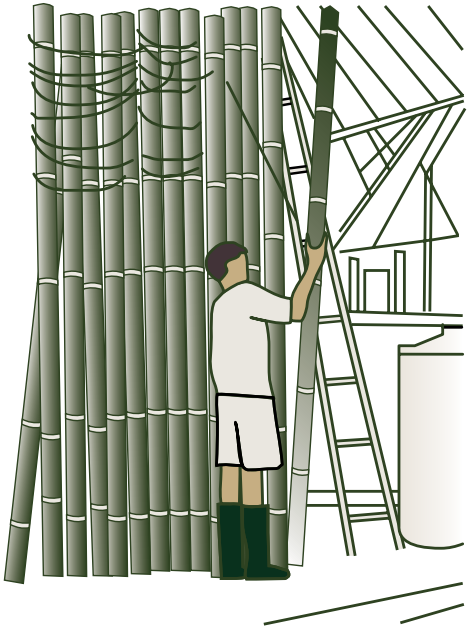


STEP 7

Weld a spear head to one end of iron rod. With this you can punch holes easily through the diaphragms and pieces of the diaphragms don't clog the inside of the culm. Larger diameter holes will prevent air bubbles from forming during the filling procedure. The holes will not diminish the strength of the culm (Prof. Liese).

STEP 8

Place the bamboo against a wall. Insert the iron rod and punch holes through the nodes. Make sure the last node is not punctured.



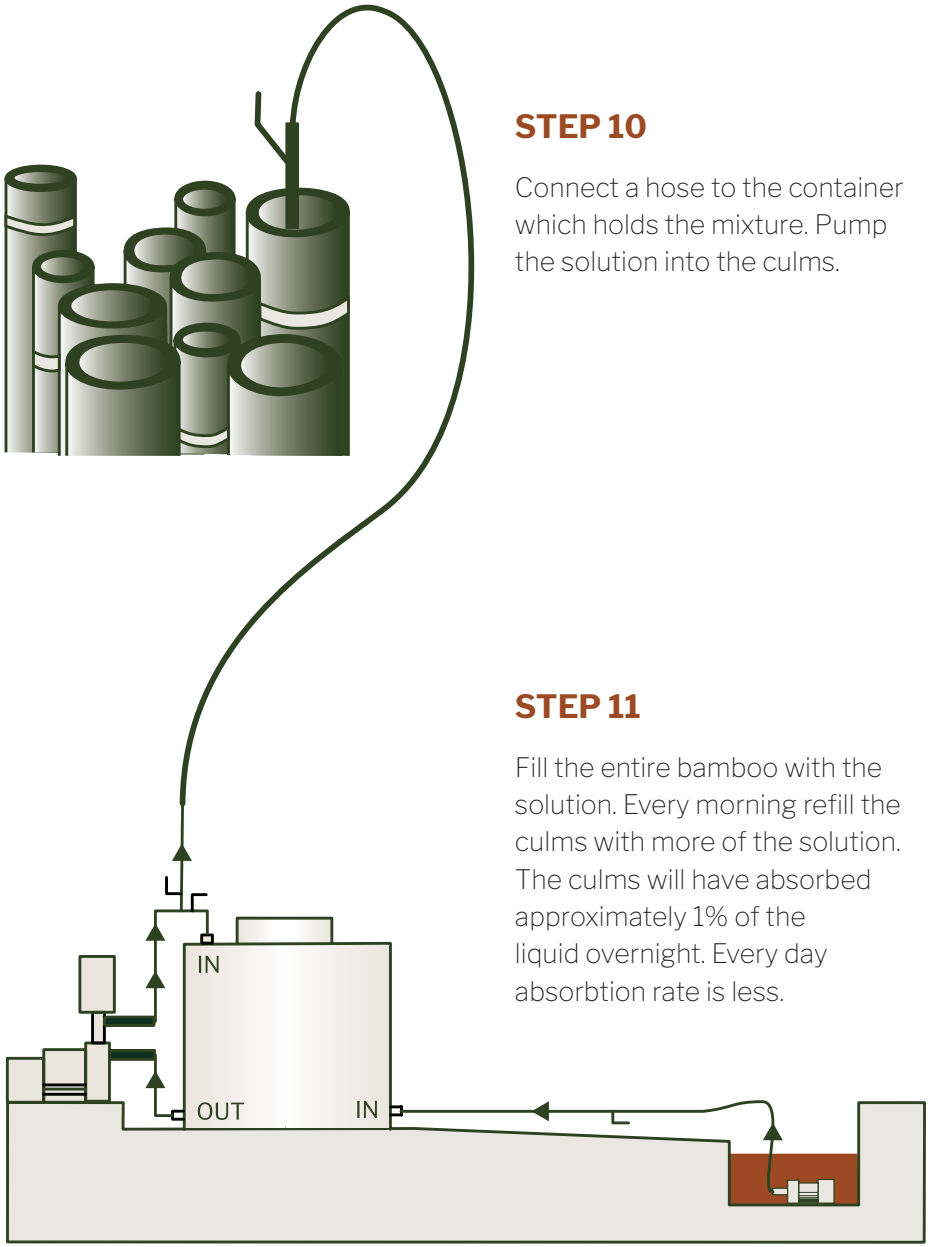
STEP 9

Move the bamboo to the concrete basin. Stand up vertically. Tie culms securely together so that they cannot move when they are being filled with the solution. Culms become very heavy when filled.

TREATMENT

STEP 10

Connect a hose to the container which holds the mixture. Pump the solution into the culms.



STEP 11

Fill the entire bamboo with the solution. Every morning refill the culms with more of the solution. The culms will have absorbed approximately 1% of the liquid overnight. Every day absorbtion rate is less.

STEP 12

On Day 13 don't add more solution. Allow the level to go down to avoid overflow when the last node is broken.

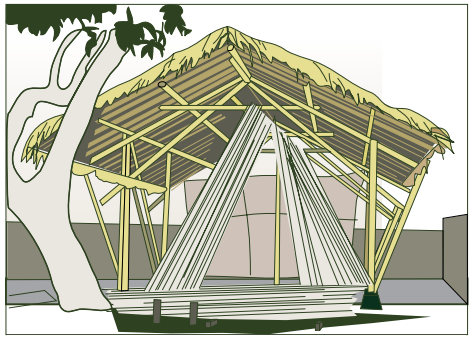
STEP 13

On Day 14 break the last node using a metal punch. Make sure you wear face protection. The diaphragms of large culms should be punctured by using the iron rod. The solution will now flow on the sloped basin floor into the sump hole.

TREATMENT

STEP 15

Dry the bamboo for 4-6 weeks depending on humidity conditions in a well ventilated, covered area. It must be in the shade; hot sun splits the culms. Make sure that they are not exposed to rain which could wash out the preservative.



STEP 14

Leave the bamboo for a minimum of one hour in the basin for the solution to fully drain out of culms into the sump hole. Pump leftover solution back into container **through a filter** for re-use. The filter should be regularly changed. Hydrometer testing of the re-use solution will be will be inaccurate because of the added bamboo sugar content (see appendix page 23). Wipe down the whole culm to remove excess solution.

NOTES

APPENDICES

GENERAL INFORMATION ABOUT TIM-BOR

Tim-bor, Disodium octaborate tetrahydrate, Na2B8O13 x 4 H2O, is more environmentally friendly than other wood preservatives currently used. It is a white, odorless, powdered substance that is not flammable, cumbustible, or explosive and has acute low and dermal toxicity. The product is itself fire retardent and shows no hazardous decomposition,

Tim-bor is superior to BORIC ACID because it diffuses and penetrates bamboo or wood better and faster. Stirring the solution will cause Tim-bor to completely dissolve into the water, resulting in a clear solution which is very stable. Do not use Fertibor (Na2B4O7x5H2O).

SOLUBILITY

Substance	Solubility at 20 C	Solubility at 30 C
Tim-bor ($Na_2B_8O_{13}x4H_2O$)	9.7%	21.9%
Boric Acid (H_3BO_3)	5.5%	6.3%

REUSE GUIDELINES

The Tim-bor solution can be used more than once for treating bamboo. Keep in mind that, as the bamboo sap gets partially drained out of the culm, the starch/sugar from the sap will move into the treatment solution. This leads to inaccurate hydrometer readings. After the 3rd or 4th use add more Tim-bor. At the point when the drained solution foams significantly and/or mold is forming on the surface of the solution and on the bamboo culm it is time for the solution to be disposed of. For more info, visit www.borax.com

EBF is currently researching sap content percentages in re-used solutions and will develop more accurate procedures to deal with this issue.

HOW TO MIX YOUR OWN TIM-BOR IN CASE YOU DON'T FIND A SUPPLIER IN YOUR COUNTRY

Our chemist David Kueper, MSc (Organic Technical Chemistry), MBA, from Switzerland has tested this:

Tim-bor can be made by slowly adding 50KG of Boric Acid and 75KG of Borax to 700 liters of water while stirring the solution. When all crystals are dissolved, you will have the equivalent of a 10% Timbor solution.

DISPOSAL GUIDELINES

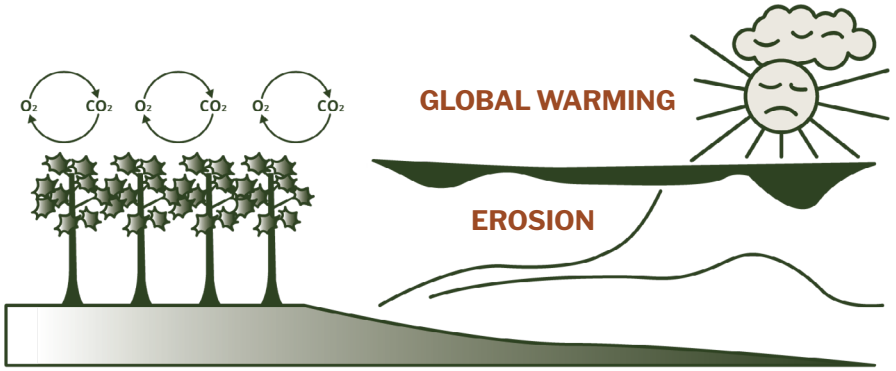
Tim-bor is non toxic to the environment, but is highly saline. When a moderate amount of it is absorbed into the ground, the ground filters out the salt to the point where it does not pollute the ground water. However, it is advisable to dispose of it safely and out of reach of children.

When diluted with more water the discarded solution could be used as a herbicide on terraces and walkways.

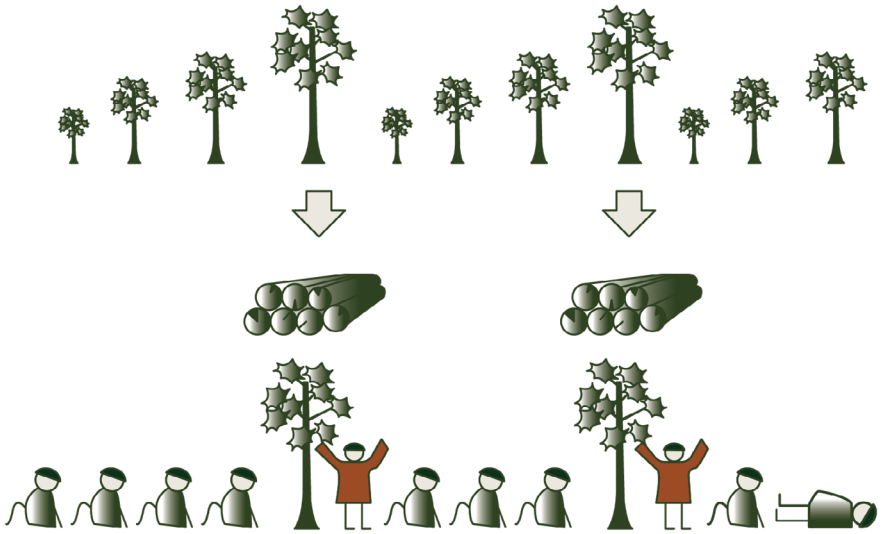
WHERE TO BUY TIM-BOR OR BORAX/BORIC ACID IN ASIA

- Pt Chimifin Jaya Utama, Jakarta
  Tel 021-424-0202, 424-7141, 425-5563
  Fax 420-5588
- UD. Saba Kimia, Denpasar,
  Tel/Fax 0361-410662
- Tim-bor distributor in Thailand 22/2 Moo2, Soi Jadsarntaharnrua Chalermprakiet Rama 9 Rd Dokmai, Praves, Bangkok 10250, Thailand
  66 2-726-7300 / 7350, contact: Numchai L.

WOOD



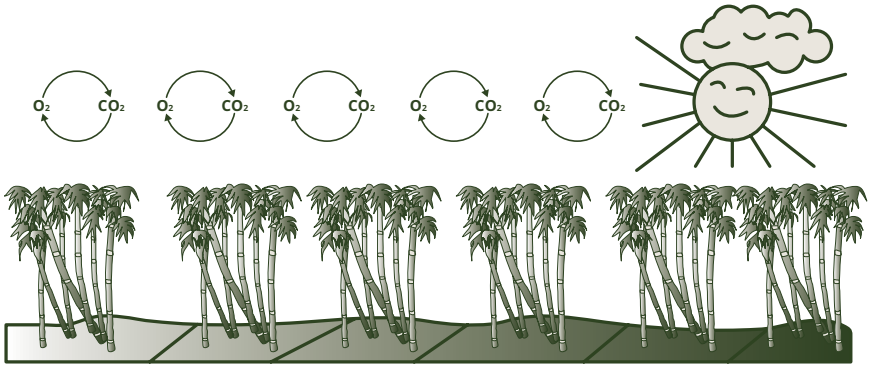
HARVEST ONCE EVERY TEN YEARS



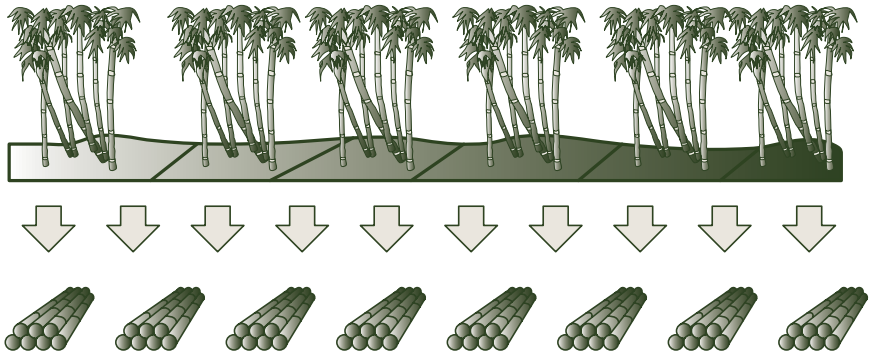
IRREGULAR EMPLOYMENT

IRREGULAR INCOME

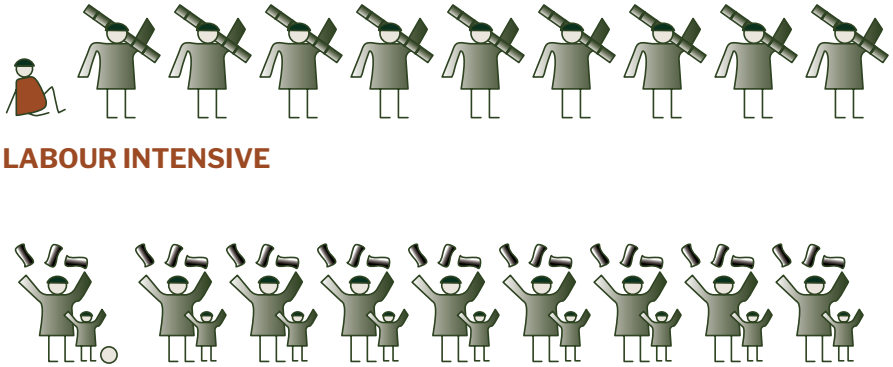
BAMBOO



ANNUAL CROP



LABOUR INTENSIVE



REGULAR INCOME

JOB SHEET

Customer Name				
Customer Tel. No.				
Bamboo Species				
Date arrived				
Date treatment started				
Date treatment finished				
Quantity of culms				
Length of Culms				
Average inside diameter				
Average outside diameter				
New liters added			Liters of used solution in tank	
Day 1				
Day 2				
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				
Day 8				
Day 9				
Day 10				
Day 12				
Day 13				
Total liters added			Liters of solution left in tank	
			Total liters used	
Day 14	Drying period			
Day 15	Drying period		Total borax used	
Day 16	Drying period		Total boric acid used	

LOCAL BAMBOO NAMES

COUNTRIES	LANGUAGES	DENDOCALAMUS ASPER	GIGANTOCHLOA ATTER	GIGANTOCHLOA APUS
INDONESIA	Indonesian Balinese Madurese Javanese Sundanese Batak Manado Eastern Indon,	Bambu Betung Pring Betung Awi Bitung Bulu Batung Bulu Jawa	Bambu Ater Peres Keles Pring Legi Awi Tenen Bulu Cina Bulu Jawa	Bambu Tali Pring Tali Pring Apus Awi Tali Bulu Pagar
MALAYSIA	Malayu	Buloh Beting Buloh Betong Buloh Panching		Bambu Tali
PHILIPINES	Tagalog Bikol Visaya	Bukawe Botong Butong		
SINGAPORE		Rebong China		
LAOS		Hok		
THAILAND		Phai-tong		Pai Dtakwang
VIETNAM		Manh Tong	Tre-tau (cochinchinensis)	
E.TIMOR	Tetun	Patung	Au Ora	

BAMBOO USES

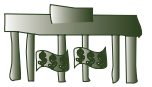
UPPER CULM (LEAVES & BRANCHES):
Arts & Crafts
Medicinal CO2

MID-CULM:
Houses
Furniture

BASE:
Construction
Charcoal Furniture

ROOT SYSTEM:
Food
Water Shed
Erosion control
Toxic Cleanup
Charcoal Medicinal

FINANCING



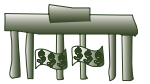
Loans are given

Bamboo forests are planted

Houses are built

Products are made and consumed

Products are sold



Banks get loans back plus interes)

Village is happy