



## 49 • Production of Trees

### Introduction

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New trees can be produced using the following methods:

1. in a tree nursery in polythene pots,
2. in a nursery using seedbeds,
3. by planting seeds where you want trees,
4. by planting wild seedlings found under mature trees in nature,
5. with plant cuttings.

### Growing seedlings

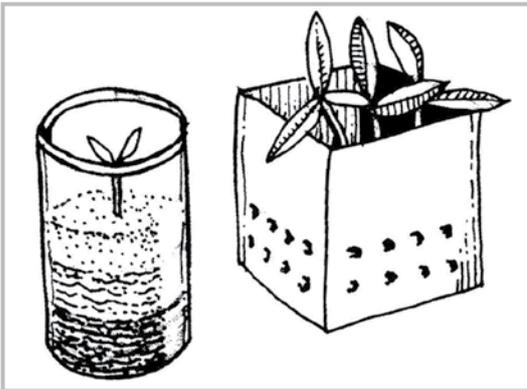
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#### Site selection

A nursery should be located near a water source, on flat land. It should also have a wind break, some shade trees, and not be waterlogged.

#### Fencing

The nursery must be fenced in order to protect the tree seedlings from animals and chickens. Use grass and poles, thorny bushes, or plant live trees to serve as a fence at the start of the rainy season.



*Production of seedlings in cans (tins) or juice/milk cartons*

#### Nursery beds

The beds should be one m wide and should be separated by walkways 60 cm wide. A bed 1 m x 5 m can accommodate from 500 to 1000 seedlings. So 10 m x 10 m will be sufficient for at least 10,000 seedlings.

#### Type of soil to use

The polythene pots or the seed beds can be filled with a good layer of topsoil. The best soil is found under big trees (acacias) or near dams/rivers. If the soil contains much clay (it can be easily formed into a ball when wet), you should mix the soil with sand. If the soil is not very fertile, then you should mix it with manure. Never mix more than one part of manure to ten parts of soil because the manure can burn the tree seedlings.

#### How to fill the pots

The bottom layer must be pressed hard, the middle layer should be slightly pressed and the top layer quite loose. The soil is pressed hard at the bottom in order for the soil not to fall out during transplantation. If you have no polythene pots you can use any available container, such as cans (tins) or milk cartons. Remember to make several small holes in the base so that excess water can run out.

#### Sowing the seeds

Seeds can be sown directly into pots or seedbeds. If you are using pots, it is best to sow at least three seeds per pot. Seeds sown in seed beds can later be transplanted to pots or even directly to the field (bare root planting). Cover the seeds with a layer of soil that is as twice as thick as the seed itself. This means that the bigger the seeds are, the more soil will be needed for covering.

#### Shading (protection from the sun)

The seed bed or pots should be covered with a thin layer of grass after sowing to protect against the sun and heavy rain storms. A thick layer of grass is bad for germination (the stage where seeds start growing into tiny plants). When the seedlings have germinated you should build



a shade at a height of 60 cm above the seedlings to protect them from the sun and strong rains.

### **Seed collection**

Many seeds can be collected locally from existing trees. It is best to collect seeds from good and healthy trees. Seeds from any ripe fruit can be washed and then sown fresh or dried in the shade.

### **Seed treatment**

It is important that the seeds are treated correctly before sowing, or they may take a long time to germinate or germinate poorly. There are basically two different treatments:

#### **Cold water treatment:**

Leave the seeds in cold water overnight before sowing. This applies to most fruit tree seeds and some other soft seeds.

#### **Hot water treatment:**

Heat some water close to boiling (the volume of the water must be twice the volume of the seeds). Put the seeds in the hot water and leave them to soak overnight.

### **Watering**

While the seeds are germinating and the seedlings are small, they must be watered daily. After this phase watering every other day is sufficient. Use a water can or sprinkler made from a plastic container with small holes in it. Do not over-water as this can cause fungal diseases. Keep the pots or seed beds free from weeds at all times.

### **Transplanting**

Seedlings can be transplanted from seed beds when they are 3-5 cm tall. Transplant them to pots or another seed bed for bare root planting, keeping a distance of 5 cm x 5 cm between each plant. Water the seedlings and water the pots. Lift the seedling and make sure that the root will not be dis-

turbed. Make a planting hole with a finger or a stick. Make sure the hole is bigger than the root. Press the soil firmly around the

plant. Water again and give full shade to the seedlings for three days.

It is good to separate pots by size to make correct watering easier. Take away the empty pots where seeds did not germinate or where transplanted seedlings died. Re-sow or plant in these pots.

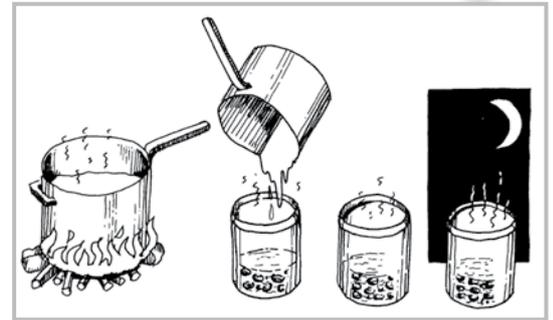
### **Root pruning**

Eliminate small roots protruding from the pots by simply

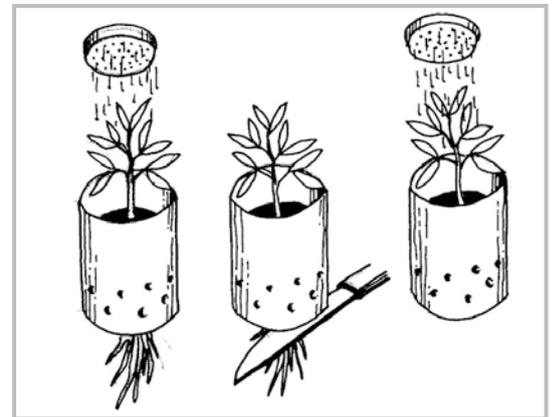
lifting the pots and breaking the roots by turning the pot around or by cutting the roots with a knife. This will give the seedling a denser root system that can better survive being moved. Without pruning, the roots

will grow under the pots. This can cause difficulties during transplanting, as roots may be damaged or break. Before and after root pruning, the

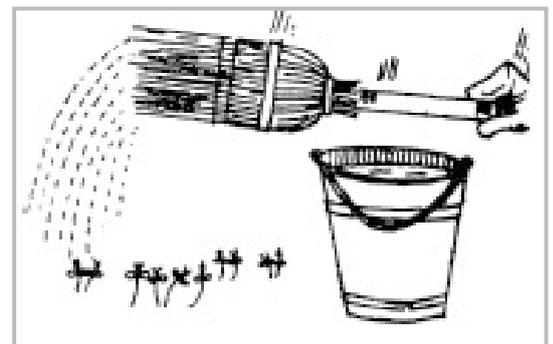
seedlings must be well irrigated. Give full shade to the seedlings for 2-3 days.



*Hot water seed treatment*



*Pruning of seedling roots*



*Watering seedlings with a broom*



# 50 • Agroforestry Systems

## Environmental advantages of trees

Trees:

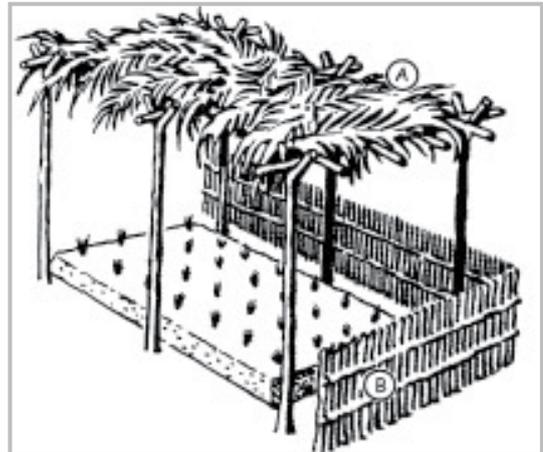


- improve the local climate (micro-climate), by forming a barrier against wind, regulating the temperature and increasing humidity levels,
- protect the soil against erosion caused by wind and water, while at the same time improving the absorption of water into the soil,

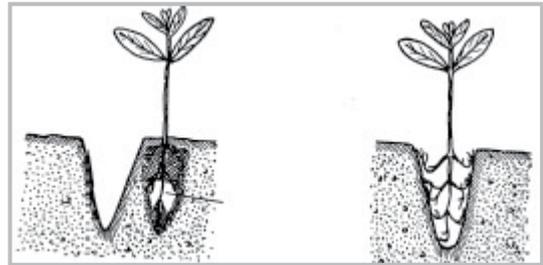
*Mounds and covering to preserve the soil's humidity*

- support nearby crops indirectly by influencing the micro-climate and the soil, and directly by supplying shade and shelter or protection, and by bringing up nutrients from deeper soil layers,
- diversify the landscape and enrich the environment - where would the birds make nests if there were no trees?

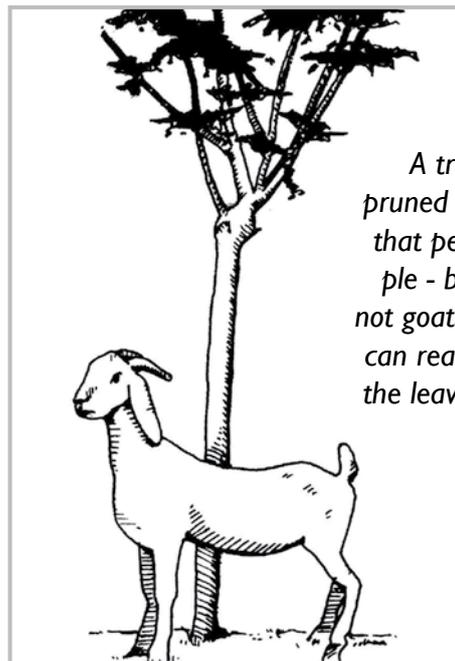
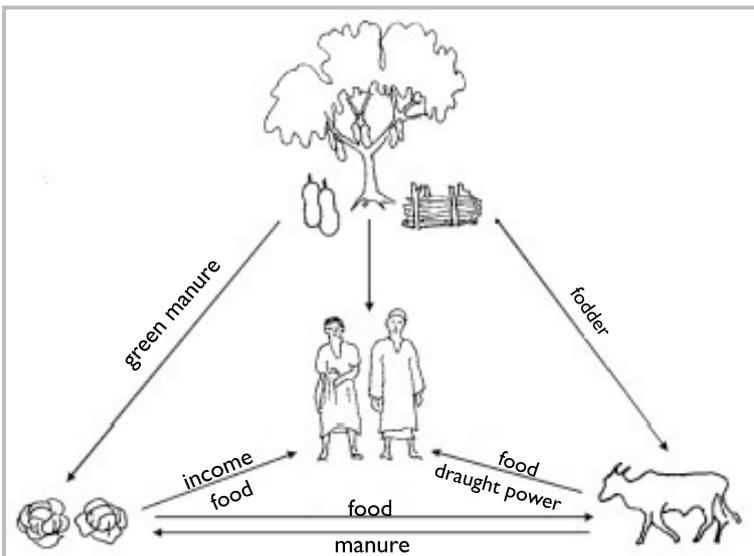
*Advantages of trees*



*A well-covered nursery*



*Incorrect planting - with air pockets or bent roots*



*A tree pruned so that people - but not goats - can reach the leaves*



Legumes - including trees, bushes and herbs - are capable of converting the air's nitrogen into nitrogen that the plants can use by means of bacteria that live in their roots. The trees have the great advantage of fixing nitrogen throughout the entire year. Many nutrients such as nitrogen are easily drained out of the topsoil and they often end up out of reach of the crop plants with smaller roots. Only plants with deep roots such as trees are capable of using these nutrients and are thus able to "pump" the nutrients back to the topsoil, when the leaves of the trees drop and decompose.

An agroforestry system is a farming system that integrates crop and livestock production with growing trees and shrubs. Read more about agroforestry systems in section 21 - "Improved fallowing".

### The Msangu - *Faidherbia albida*

Msangu (also known as *Acacia albida* and *Mussadze* in Central Mozambique), is used in some regions of Africa in an agroforestry system together with cultures of maize and many others. Msangu loses leaves at the start of the rainy season. It is therefore possible to plant crops beneath it since there is enough sunlight. Msangu is a legume tree that fixes nitrogen, with the result that the farmers get better harvests underneath the trees. The ability of msangu to improve soil fertility has long been known in Senegal, for example, and in many areas the trees are protected and may reach a density of 40 to 50 trees per hectare of agricultural fields.

Msangu also supplies plant fodder for domestic animals during the dry season. Msangu has many long roots and grows well where groundwater is not deeper than 30-40 metres.

Msangus can be grown from seedlings that grow naturally in the fields. The farmer

must then select and nurture the seedlings until the leaves are above the reach of livestock - about 1.5 m - after 2 rainy seasons.

The msangu can also easily be grown from seeds. The seeds should be soaked in warm water overnight.

Direct seeding of pre-germinated seeds has shown to be successful and cheap in Senegal. This requires careful weeding in the while the plants are young, to avoid competition for water.

It has been shown than millet yields under msangu are, on average, 2.5 times higher than when millet is

grown away from the trees, and the protein content of the millet increases by a factor of 3 or 4 when it is grown near the trees.

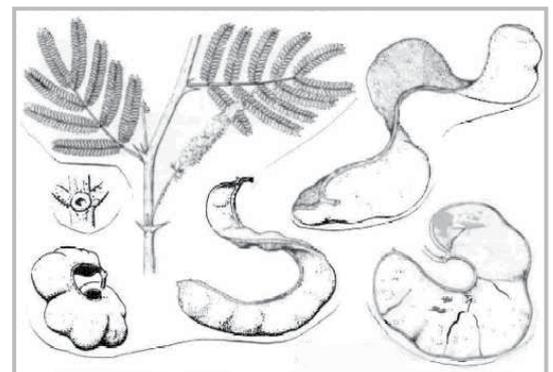
A similar system using the *Prosopis cineraria* tree in Rajasthan, India, produces the same good results.



Trees pruned so that branches and leaves can be used



Msangu trees left to grow in fields in Zambia



Msangu leaves and fruits



# 51 • Bamboo Cultivation

## Introduction

Bamboo is a plant that offers many economic advantages:

### 1. Rapid growth

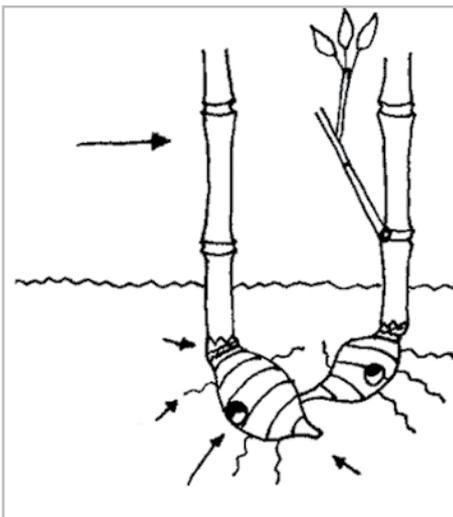


One billion people live in bamboo houses

Bamboo matures in three or four years, faster than the fastest growing tree. You can harvest shoots and sprouts. You can produce ten tons of bamboo per

hectare per year.

### 2. Ease of establishment, maintenance and collection



Most African bamboos have bulbs

Bamboo does not demand complex techniques in order to become established after planting. Harvesting strengthens the bamboo and is done with manual instruments. Transport is relatively easy due to the lighter weight of bamboo in comparison to other woods.

### 3. Adaptable uses

Bamboo has many uses. It can be used for firewood, paper, or as a construction material; its edible shoots can be eaten, etc.

### 4. Ecological importance

Bamboo is a material that can substitute for wood in many different ways and thus contribute to reducing deforestation. It can also be used to reduce soil erosion.

### 5. Cultural importance

About one billion people in the world live in bamboo houses. People use bamboo in many aspects of life, including music, ceremonies, food.

## Bamboo production

Bamboo is usually propagated through the growing of new plant shoots (vegetative propagation), not through seeds. Bamboo is a very resistant plant that can grow back after a bad year or season. The plants sprout again after fires.

The structure of bamboo includes an underground network of rhizomes ("roots"), the sprouts, and the shoots.

## Rhizome system

The bamboo has rhizomes, which are underground shoots. They grow and separate from the mother plant, so that the bamboo can spread to new territory. Each year, new shoots (sprouts) grow from the rhizomes to form the taller (above-ground) parts of the plant. After 3 years the rhizomes will not grow more sprouts.

The sprouts use the reserves from one part to grow and sprout again. The shoots from the centre of the group are the oldest and those at the outer circle are the youngest. The youngest are the most brilliant, most flexible, and are moist on the inside. The older bamboo will be dry and rotten.

The natural bamboos of Africa - the species *Oxytenanthera abyssinica* is the most common - have bulbs at the rhizomes.



Every year a new rhizome can be produced from the original. The growth of this type of bamboo is characterized by a group of bamboo shoots that are very dense.

## Shoots

The initial growth phase of the bamboo demonstrates the highest growth rates of any plant. Certain species can grow 40 cm within 24 hours!

In the dry season the shoots are drier, and are less likely to be attacked by pests.

## Flowering

Bamboo does not have an annual cycle of flowering. Actually, bamboo flowering is still a mystery to botanists.

This species of African bamboo flowers every 70 years, and all the plants die afterwards.

## Planting

In order to establish bamboo successfully, you need an open place close to a water source. This helps the bamboo spread more rapidly. Bamboo prevents the soil from becoming dry. When it is planted in sloping land or at the edge of a river, it helps to reduce erosion.

The best time to plant bamboo is in the beginning of the rainy season, when the new sprouts come up, so they will have time to save energy and nutrients.

## Techniques

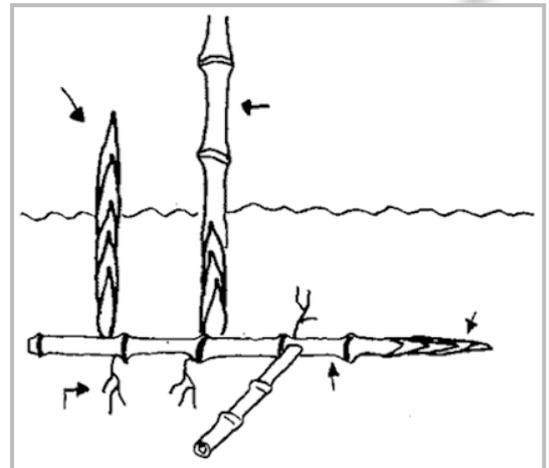
There are many ways to plant bamboo. Vegetative propagation can be done by using shoots, rhizomes or stems. For each of these three types, it is very important to ensure that the propagation parts have

intact buds that have not yet sprouted. They can be found in young bamboo parts up to one year of age.

### Separation of rhizome systems

You should choose rhi-

zomes that are a maximum of one year old. Cut the rhizomes at the neck where they are linked to the old rhizome and above the first knot of the young bud. Then plant it vertically with the bud above the soil or horizontally with the rhizome a few centimetres under the surface (3 - 5 cm) (see the drawings below).



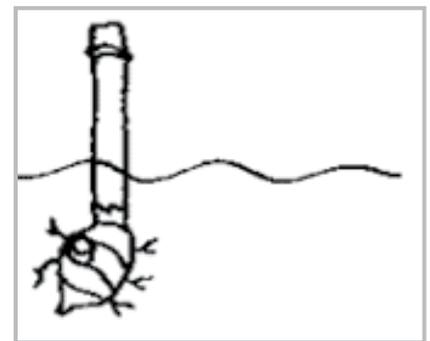
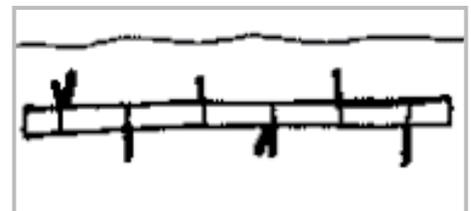
*The other type of bamboo - without bulbs*

### Separation of shoots

This technique involves using dormant seed buds (buds that haven't yet turned into sprouts) on the shoots to turn them into new rhizomes.

The shoot should be up to a year old. Leave the shoots that come out beside the buds at the joint of the shoot. On the drawings on next page you can see the two ways you can cut the shoot. Either cut just

around the joint, or cut a whole section of the shoot. If you use a whole bamboo section you can make a small hole and fill it partly with water. Plug the hole with cotton or cloth. Then bury it with the sprout on

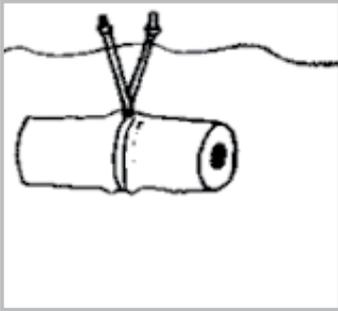


*Propagation with the rhizome in the soil*



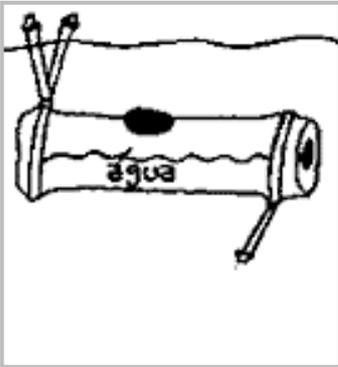
top. This method is more likely to work than the simpler methods.

### **Harvesting and pruning**



When pruning bamboo, one should leave the first section of the bamboo shoots. This is to avoid the rhizomes rotting when water is stored in the remaining shoot. After the first joint, cut as close to the soil as possible. It is important to make a clean, dry cut. This

reduces the chances of fungi and insects doing damage.



*Propaga-  
tion with  
one (top)  
and two  
joints.  
See text.*

A group of bamboo includes individuals of varying ages. Those older than 7 years should be removed so that the energy of the group is directed towards the newer sprouts and shoots. Also, rotten and dry bamboo should be removed. You should never have to remove more than 80

% of a group of mature bamboo, since this puts the plant under stress. Always leave some mature bamboo spread throughout the group so they can provide nutrients to the younger plants. The best time to harvest the bamboo material (for building, etc.) is in the dry season.

*Information and illustrations from the website:  
[www.bambubrasileiro.com](http://www.bambubrasileiro.com)*



*Bridge  
made of  
bamboo in  
Mozam-  
bique*