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# **the rubber tree**



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# **The rubber tree**

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## **PREFACE**

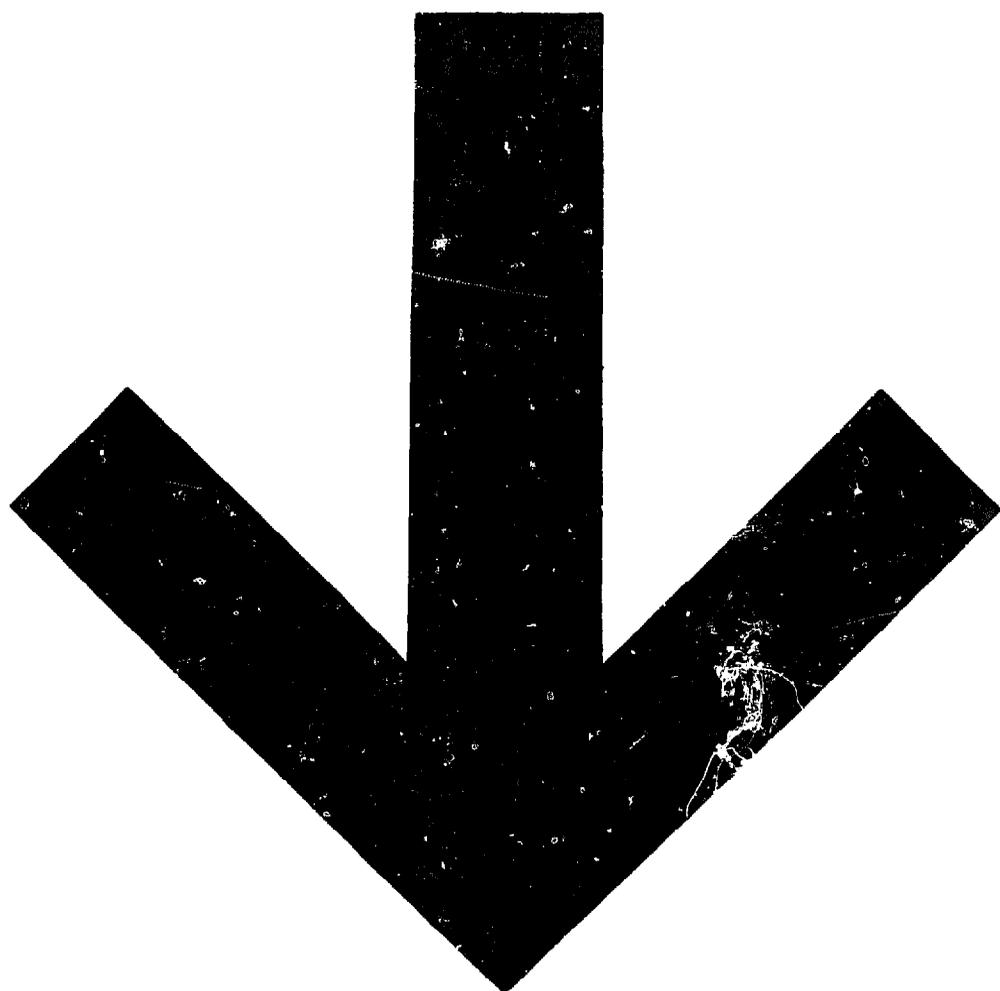
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This manual is a translation and adaptation of "L'hévéa," published by the Agri-Service-Afrique of the Institut africain pour le développement économique et social (INADES), and forms part of a series of 26 booklets. Grateful acknowledgment is made to the publishers for making available this text, which it is hoped will find widespread use at the intermediate level of agricultural education and training in English-speaking countries.

The original texts were prepared for an African environment and this is naturally reflected in the English version. However, it is expected that many of the manuals of the series — a list of which will be found on the inside front cover — will also be of value for training in many other parts of the world. Adaptations can be made to the text where necessary owing to different climatic and ecological conditions.

Applications for permission to issue this manual in other languages are welcomed. Such applications should be addressed to: Director, Publications Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.

The author of this English version is Mr. A.J. Henderson, former Chief of the FAO Editorial Branch.



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## **Why rubber trees are grown**

The rubber tree is grown  
because rubber is made from the latex in its bark.

The rubber tree has roots made up of  
a tap-root  
and creeping roots.

In the bark of the rubber tree  
there is a liquid called latex.

The latex is harvested  
by making a slit in the bark,  
that is, by cutting a piece of bark.

The latex makes the **rubber** that is used:

- in the tires of bicycles, motorcars and airplanes;
- for the soles of shoes;
- for many other things.

Rubber is in great demand all over the world;  
more and more of it is needed.

But it is very difficult  
to grow rubber trees well  
and to harvest the latex.

They cannot be grown everywhere.

They need:

- a high temperature;
- plenty of water;
- moist air, though they can withstand a dry season.

## Where rubber trees are grown

Rubber trees are grown in regions that are hot and moist, that is:

- in Africa (250 000 tons of natural rubber);
- in Central and South America (31 700 tons of natural rubber)
- in Asia, which is the chief producer (3 207 100 tons of natural rubber).

In Africa they are grown mainly in the forest regions.

In Africa the chief producers of natural rubber are:

Liberia	100 000 tons
Nigeria	80 000 tons
Zaire	35 675 tons
Ivory Coast	18 000 tons
Cameroon	12 000 tons
Central African Empire	1 250 tons
Ghana	1 700 tons
Mali	1 100 tons
Congo	160 tons

These production figures (for 1974) are from the *FAO Production Yearbook 1974*.

**To grow good rubber trees  
and harvest plenty of latex,**

**you must:**

- **prepare the seedlings well;**
- **make a good plantation;**
- **look after the plantation;**
- **harvest the latex well.**

# **PREPARING THE SEEDLINGS**

---

It takes a long time to get good rubber tree seedlings to put in the plantation.

It takes two years to get seedlings for putting in the plantation.

To raise seedlings for the plantation, you must:

- **make the seeds germinate in the germinator;**
- **put the germinated seeds in the nursery;**
- **look after the nursery;**
- **graft the young seedlings in the nursery.**

## **Germinating seeds in the germinator**

To do this, you have to:

- **make the germinator;**
- **choose the seeds;**
- **put the seeds in the germinator.**

## ● Making the germinator

### A germinator

is the place where you sow the seeds to make them germinate.

### To make a germinator

you must choose ground that is quite flat, that has no vegetable refuse on it; you must choose a spot that can be easily watered.

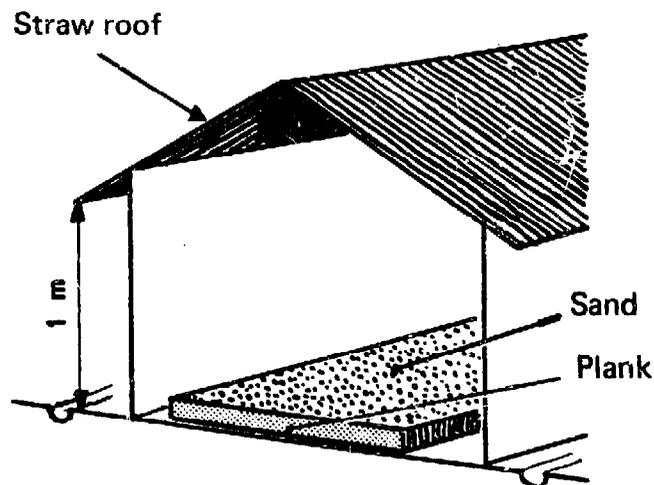
### Make beds 1 metre wide.

Each bed is edged with planks, so as to make a box.

Into each box put sand to a depth of 10 centimetres.

### Cover the germinator with a roof made of straw.

The roof must be at least 1 metre above ground, so that you can get underneath it to put the seeds to germinate.



- **Choosing the seeds**

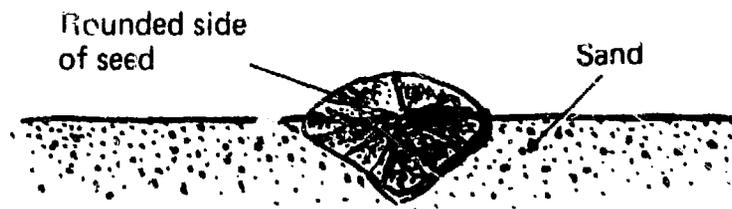
To get good seeds,  
it is best to ask for them at a **seed selection centre**.

The seeds must be put in the germinator  
as soon as they have been harvested  
for they very quickly become unable to germinate.

When you put the seeds in the germinator,  
you must look to see  
if each seed is shiny and bright.  
If is not, do not put it in,  
because it will not germinate.

- **Putting the seeds in the germinator**

Push the seed half way into the sand,  
with the rounded side of the seed uppermost.



Put the seeds close together, side by side,  
and water them.

To make a plantation of 1 hectare, with 625 trees,  
you must put 1 700 seeds to germinate.

So you must have a germinator  
1.7 metres long and 1 metre wide.

A week later the seed has germinated,  
and the rootlet is about 2 centimetres long.

This is the time to take the seeds out of the germinator  
and put them in the nursery.

## **Putting the germinated seeds in the nursery**

The nursery is the place  
where you put the germinated seeds  
so that they will grow into young rubber trees.

- **The soil of the nursery must be well prepared**

Choose a spot that is easy to water.

Grub up all trees.

A few days before planting the germinated seeds  
remove all vegetable refuse.

The soil must be tilled by hand very deeply,  
to at least 60 centimetres,  
with a hoe.

Then the soil must be levelled and harrowed  
to break up clods.

This is how the nursery is made ready  
for the germinated seeds.

- **Putting the germinated seeds in the nursery**

The germinated seeds are planted in rows.

In each row leave 40 centimetres between seeds.

Leave 30 centimetres between the rows.

Plant the seedlings (germinated seeds) in alternate spacing,  
as shown in the drawing on page 9.

Make four rows in each nursery bed.

Leave 60 centimetres between the nursery beds.

After every four beds, leave a space of 1.20 metres.

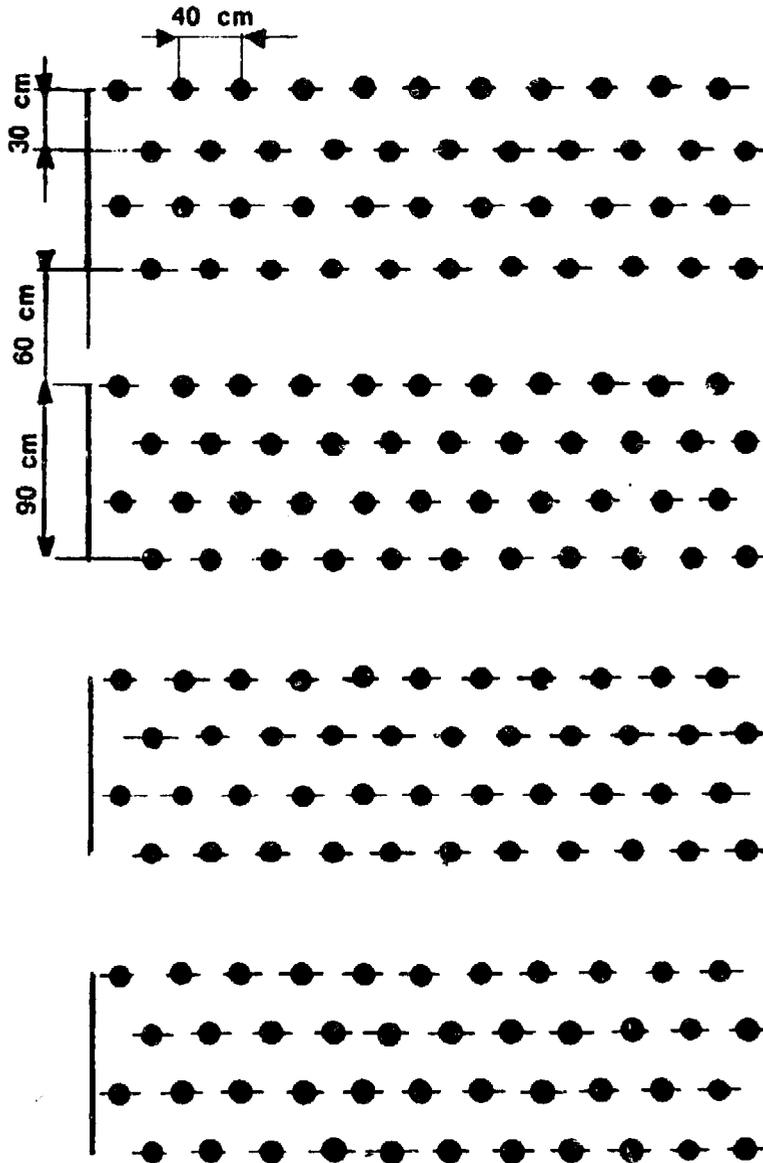
Thus 1 hectare will contain 58 000 seedlings.

To make a plantation of 1 hectare,  
you have to plant 1 500 germinated seeds;  
that means two nursery beds, each 70 metres long.

When transplanting the seedlings,  
press the soil well down round the tap-root and the rootlets,  
without damaging them.

Water the seedlings as soon as you have transplanted them.

# PLAN OF NURSERY



## **Looking after the nursery**

**You must hoe often**  
to get rid of weeds,  
and to keep the soil moist.

In the dry season **you must water** rather often.  
But do not water in the middle of the day.  
Water in the morning or in the evening.

If the soil is not very fertile, you can give it **fertilizer**,  
as follows:

- The first time, 2 months after transplanting,  
give 150 kilogrammes of ammonium phosphate  
to each hectare  
and 75 kilogrammes of potassium chloride  
to each hectare.  
This means that for a bed of 70 square metres  
you need 1 kilogramme of ammonium phosphate  
and 0.5 kilogramme of potassium chloride.
- The second time, 5 months after transplanting,  
give the same amounts.

But you must get advice from technical officers,  
because different soils have different needs.

Ten months after transplanting to the nursery,  
take out the young plants that have not grown well.

When the young plants are between 12 and 15 months old,  
during the short rainy season,  
**grafting** must be done.

Grafting is a difficult job.  
You must pay great attention to it.

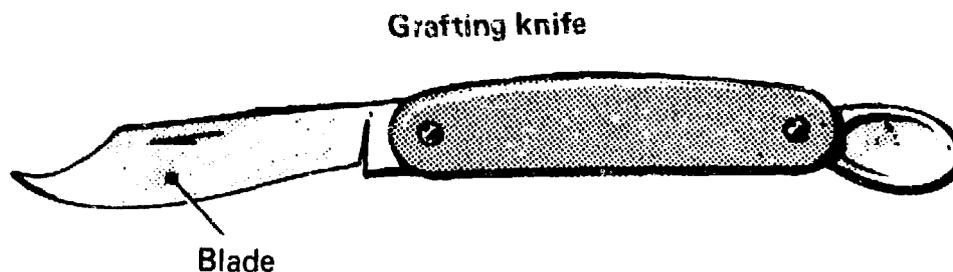
## Grafting young plants

Grafting means putting into a young plant (the stock) a little piece of a branch (the scion) taken from a tree of good quality.

The young plant in the nursery is the stock. It will provide the roots of the plant which is to be put into the plantation.

You take a piece of a branch from a tree that gives plenty of latex; this is called the scion. The scion will provide the stem of the plant that is to be put into the plantation.

To graft you use a grafting knife with a very sharp blade.



To do the grafting, you have to:

- prepare the young plant from the nursery (the stock);
- take the scion from a tree of good quality;
- place the scion in the stock.

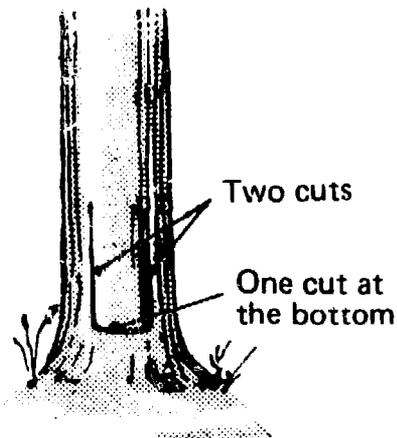
Afterwards look to see if the graft has succeeded.

### ● Preparing the stock

When the young plant in the nursery (the stock) is 3 or 3.5 centimetres thick, it can be grafted.

A few centimetres above the ground, make two cuts in the stock about 4 or 5 centimetres long and 2 centimetres apart.

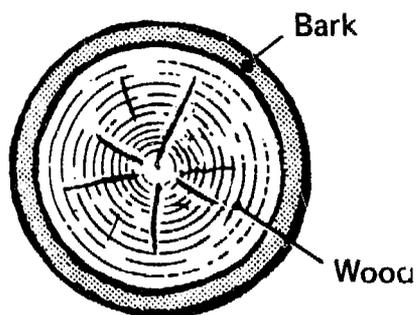
Then make one cut at the bottom to join the other two cuts at the lower end.



All these cuts are made in the bark only.  
You must not cut into the wood.

You will see, if you cut a stem right across, that

- outside is the bark;
- inside is the hard wood.



The cuts must be made so that the bark can be peeled back.

Make the cuts on 20 plants, one after the other.

You will see a white liquid flowing out.

This is the latex.

## ● Taking the scion

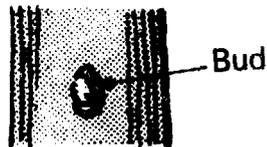
Ask at a selection centre  
for rubber tree branches for grafting.  
These branches have  
about the same thickness as the stock.  
They are called **grafting wood**.

These branches for grafting have no leaves;  
the leaves have been taken off  
10 days before cutting the branches.  
As soon as the selection centre  
has given you the grafting wood,  
the grafts must be done at once,  
during the next 24 hours.

In the first-year course  
we learned that on the stem there are buds  
below the leaves.

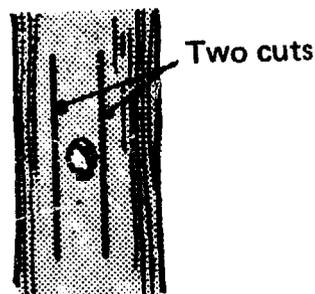
If you look closely just below a leaf,  
you will see that there is a bud.

This bud is called an eye.

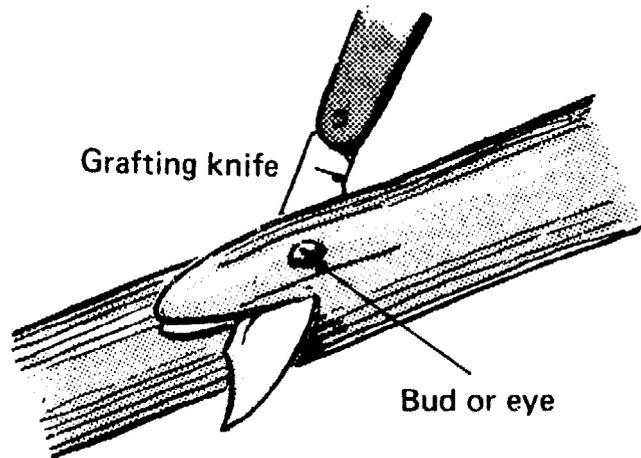


To get a scion, take an eye  
with a little piece of the bark round it.

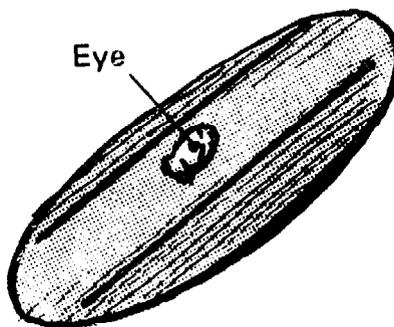
Take a branch of grafting wood  
in order to remove an eye from it.  
Round this eye make two cuts 5 or 6 centimetres long  
and 1 or 2 centimetres apart.  
You will see the latex flow out.



Remove the eye by cutting into the wood of the branch with the grafting knife.

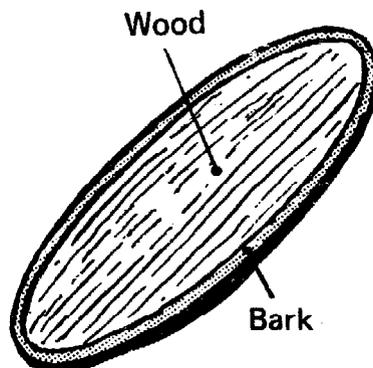


Now you have a piece of grafting wood with an eye in the centre of it.



If you look at the back of this piece of wood, you will see that:

- in the middle there is wood;
- round the outside is bark.

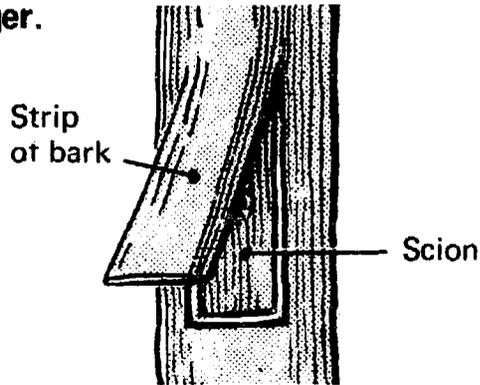


● **Putting the scion in the stock**

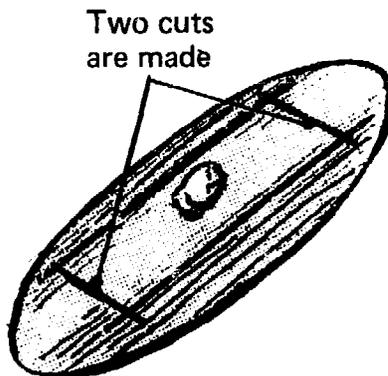
With a rag, wipe off the latex  
that has flowed out of the stock.

Peel back gently the strip of bark  
cut when preparing the stock.

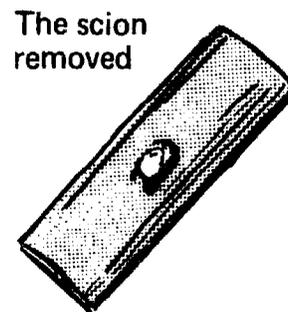
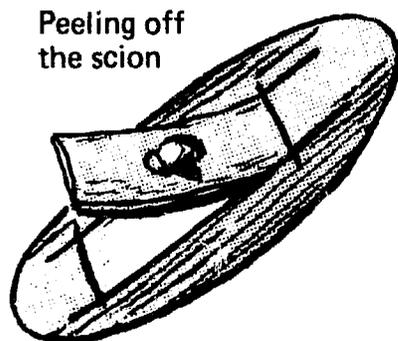
**You must not touch the underside of this strip  
with your finger.**



Take the piece removed from the grafting wood.  
Make two cuts, one on each side of the eye,  
so as to mark off the scion.

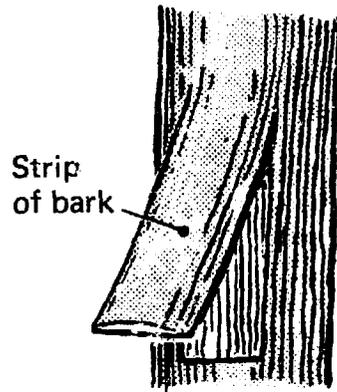


Peel off the piece of bark with the eye.  
**Do not take any wood  
and do not touch the underside of the scion.**



Now you have the scion by itself.

Next, put the scion  
under the strip of bark peeled back on the stock.  
**Do not touch the wood of the stock  
and the back of the scion.**



Put back the strip of bark over the scion  
and bind it to the trunk  
with a band 4 centimetres wide and 60 centimetres long.  
The graft is finished.

To plant 1 hectare, 1 400 plants must be grafted.

Three weeks after making the graft,  
take away the band and cut the strip of bark  
at the top of the vertical cuts.  
The graft has been successful  
if the scion is well joined to the stock,  
and if the graft is green when you scratch it a little.  
There should be at least 85% of successes.

The young plants are now left in the nursery  
until the next rainy season.  
Then the grafted plants will be put into final position  
in the plantation.

# **PREPARING THE GROUND AND MAKING THE PLANTATION**

---

To make a good plantation, you must:

- prepare the soil well;
- do the planting well.

## **Preparing the soil**

Choose deep soil that is never flooded.  
Then the tap-root of the rubber tree  
can go down well into the soil.

Once the site is chosen, you have to:

- clear the ground;
- stake out the rows;
- make terraces to control erosion.

### **● Clearing the ground**

Remove the trees by grubbing them.

Take the earth away round the base of each tree  
and cut the roots.

Then the tree will fall, pulling out its stump.

At the beginning of the dry season,  
do any burning that is necessary.

### **● Staking the rows**

This means putting stakes  
where the trees are to be planted.

If the ground slopes,  
the stakes must be placed along the contour lines.

Put the stakes 2 metres apart in each row.

Make the rows 8 metres apart.

This will give 625 plants on 1 hectare.

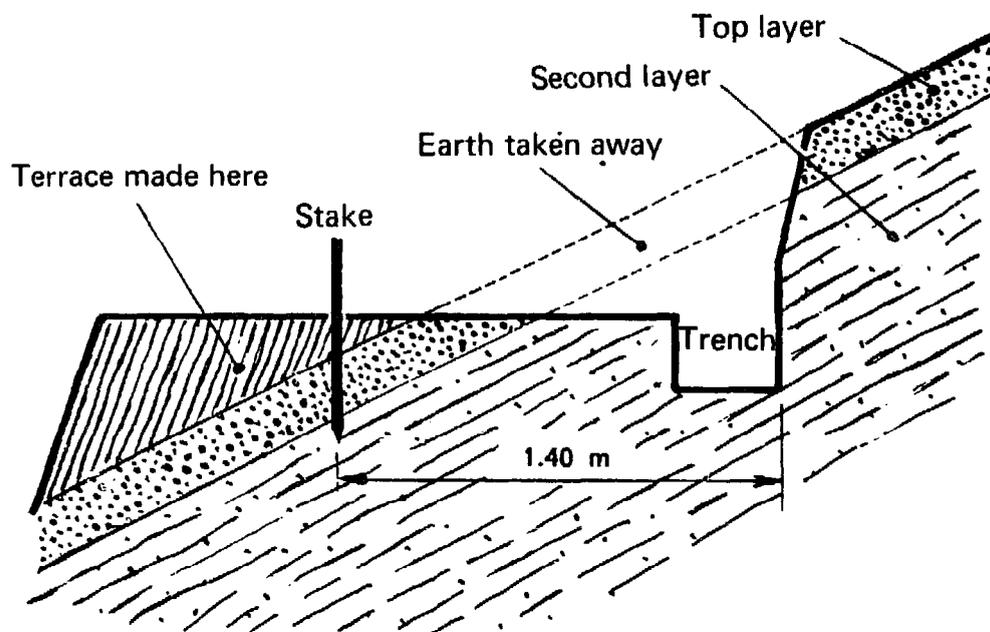
After this,

you must put the grubbed-out trees between the rows.

- **Making terraces on the contour lines**

When the ground slopes,  
terraces must be made along the contour lines  
to prevent erosion.

Take away the soil above the stake  
and put it lower down.  
The terrace should be 2 metres wide.  
Dig a trench 0.35 metre deep and 0.35 metre wide.  
Make the terrace slope  
a little against the slope of the land.  
The stake is 1.40 metres from the trench.



Everything must be finished  
by the beginning of the rainy season before planting.

At the beginning of the rainy season,  
sow cover crop plants between the terraces.  
In forested country use *Tithonia diversifolia*,  
in savanna, plant *Pueraria*.

The site is then ready for the plantation.

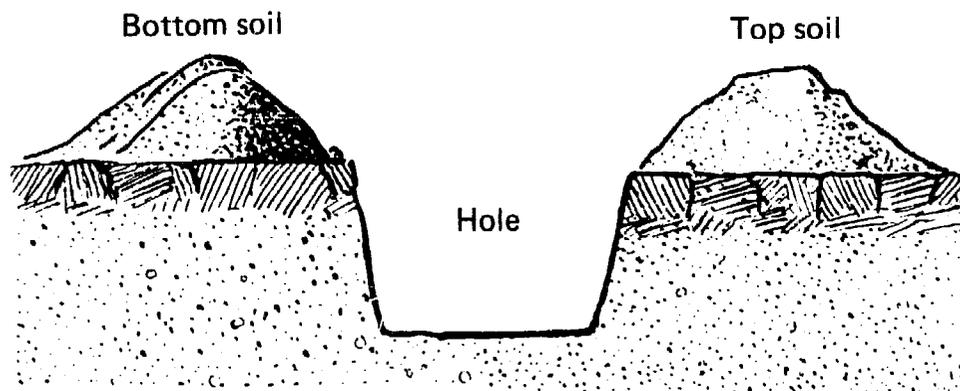
## Putting the young plants in the plantation

At the beginning of the rainy season,  
put the young plants in the plantation.

A month before planting,  
make holes at the points marked by the stakes.

The holes should be 60 centimetres deep,  
60 centimetres long and 60 centimetres wide.  
The bottom soil must be kept separate  
from the top soil.

Refill the hole 10 days before planting,  
putting the bottom soil down below.



Take out the young plants in the nursery  
by cutting the tap-root at a depth of 70 centimetres.

Then trim the plant as follows:

- cut the stem 5 centimetres above the graft;
- cut the tap-root 60 centimetres from the base of the stem;
- trim all side roots back to the tap-root.

Then make a hole with a dibber.

Push the tap-root into the soil at the bottom of the hole,  
and pack the soil well all round the tap-root.

The plant must stand upright.

Then fill up the hole,  
putting back a little soil and pressing it down well.  
You must put only a little soil at a time  
and press it well down as you go on.

# **LOOKING AFTER THE PLANTATION**

---

To have a good plantation that gives a lot of latex, the planter must:

- look after the plantation before tapping;
- look after the plantation after tapping;
- protect the rubber trees against diseases and insects.

## **Looking after the plantation before tapping**

To look after the plantation before tapping, you must:

- take good care of the trees;
- make clearings,  
that is, remove the less good trees,  
and those that have not grown well;
- look after the soil.
- **Taking care of the trees**  
The trees must be:
  - disbudded;
  - replaced where missing;
  - pruned.
- **Disbudding**  
Disbudding means to remove buds that have grown.  
When the scion grows, it forms a stem;  
on this stem shoots appear.  
All the shoots up to a height of 3 metres from the ground  
must be removed.  
There will then be a fine trunk  
with branches only above 3 metres  
that will form the crown of the tree.  
(The crown is all the branches  
that grow from the trunk.)
- **Replacing missing trees**  
During the first year after planting,  
trees that have not grown must be replaced.

- **Pruning the trees**

It may happen that a tree grows without forming a crown of branches at a height of 3 metres.

In that case, cut the stem at this height, so that a crown of branches will form.

If the crown is too dense, or if one part has more branches than another, it must be pruned 3 or 4 years after planting.

- **Making clearings**

As some trees will die, and some will be ill, extra trees have been planted.

When tapping begins (5 years after planting), there must be 500 trees to the hectare; the trees should be 50 centimetres in circumference at a height of 1 metre from the ground.

So from the second year after planting, some trees have to be removed.

Remove about 30 trees every year during the second, third, fourth and fifth years.

In choosing what trees to remove, take account of the following:

- disease: diseased trees are the first to be removed;
- growth: take out all those that have grown badly;
- close neighbours: removal of trees should leave a regular plantation.

- **Looking after the soil**

The rubber trees are planted in rows; between the rows of trees are ground cover plants. So you must look after the rows, and look after the ground between the rows.

- **Looking after the rows of trees**

They must be cultivated with the hoe, by hand, as follows:

- in the year after planting, carry out one cultivation every 3 weeks;
- in the second and third year, one cultivation every month;
- in the fourth year, one cultivation every 6 weeks;
- in the fifth year, one cultivation every 2 months;
- in the sixth year, one cultivation every 3 months.

If the dry season is very dry, the number of cultivations can be reduced.

Weed killers can also be used, making an application every 3 or 4 months.

- **Looking after the ground between the rows**

The ground cover plant must be cut 3 or 4 times a year to a height of 30 or 40 centimetres.

One cutting must be done before the dry season; the cut stems and leaves are used to mulch the rows.

You must remove weeds such as *Imperata* (a herbaceous plant with hard, long, straight leaves and very long roots).

You can pull up the *Imperata* by hand and then dig up the underground roots with a pick.

If the plantation is well looked after before tapping,

it will have fine trees when the time for tapping comes.

But you must also take care of the plantation after tapping begins.

## **Taking care of the plantation after tapping**

To keep the plantation in a good state after tapping has begun, you must:

- go on removing unwanted trees;
- take good care of the soil.

### **● Removing unwanted trees**

After about 12 years  
there should be about 350 trees to the hectare.  
(There were 450 when tapping began.)

Trees must be removed

- one year after tapping begins;
- three to four years after tapping begins;
- and in the twelfth year,  
so as to have 350 trees to the hectare.

### **● Care of the soil**

By this time the rubber tree is full grown  
and covers the soil well,  
so that few plants grow beneath it.  
All the same, the soil must be kept clear  
at the base of the trees.

The cover plants between the rows  
must be cut once a year.

The terraces must be kept up,  
so that they do not crumble away.

By looking after the plantation well,  
you will get fine trees.

But you must not let them be attacked by diseases.

## **Protection against disease and insects**

The most serious disease is root rot.

It destroys the roots and makes the tree die.

The rubber tree may also be attacked by insects;  
they do less serious damage.

- **Control of disease of the roots**

The tree may be attacked by white root rot (*Fomes*),  
which makes the roots rot.

Then the tree dies.

It is very important to see

if white root rot has attacked a tree,

because, by the time you see that the tree is ill,  
it is too late.

Control of white root rot is carried out in two stages:

- **First, detecting the disease**

During the first five years after planting,

twice a year, you must get freshly cut grass

and put it close up against the base of each tree.

A fortnight later, look to see

if there are little white threads on the trees  
underneath the dry grass.

If you see little white threads.

the tree is ill, it has white root rot.

So you must treat it.

- **Second, treatment of the disease**

Dig a hole to uncover the roots of the tree,  
without injuring them.

The hole should be 40 to 50 centimetres deep.

If the roots have been attacked,

the tree must be cut down and the roots taken out.

If the roots have not been attacked,

and there are only white threads on them,

you put a special product on the tap-root  
and the beginnings of the side roots.

This product is called quintozene.

- **Control of insects**

The most dangerous insects are mites  
and crickets.

The treatment for insects is to apply lindane.

# TAPPING

---

Tapping means

to make a cut in the bark of the rubber tree  
to harvest the latex.

Tapping is difficult to do well.

You must take care how you do it.

For a good tapping,  
you must:

- make a good cut;
- harvest the latex well;
- harvest the latex at the right time.

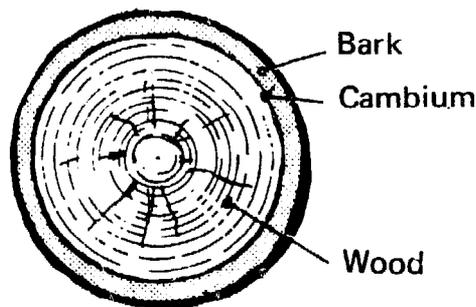
Before we see how to make the tapping,  
let us look back at what we learned  
in the course on plant stems.

Let us see how the trunk of the rubber tree is made.

## THE TRUNK OF THE RUBBER TREE

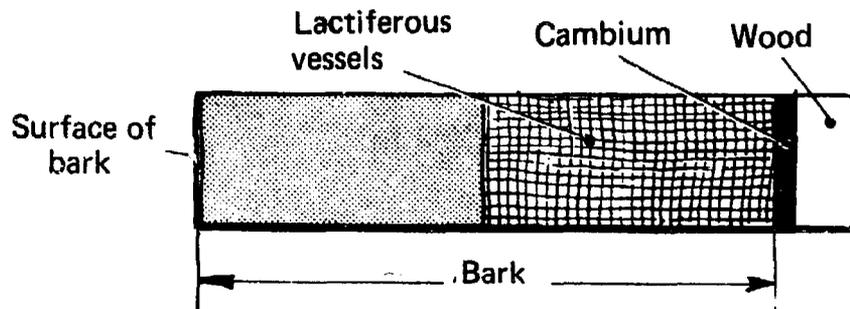
If you cut through a trunk, you see several layers.

- On the outside is the **bark**, which is about 6 millimetres thick.
- In the centre is the **wood**.
- Between the wood and the bark there is a layer which cannot be seen with the naked eye, because it is very thin. This is the **cambium** layer.



The cambium makes the tree grow, by producing wood and bark. So you must not damage it if you want the tree to grow normally.

If you look at rubber tree bark with a microscope, you will see several layers. One of these, the deepest, contains little channels called **lactiferous vessels** because they contain latex. This layer is next to the cambium.



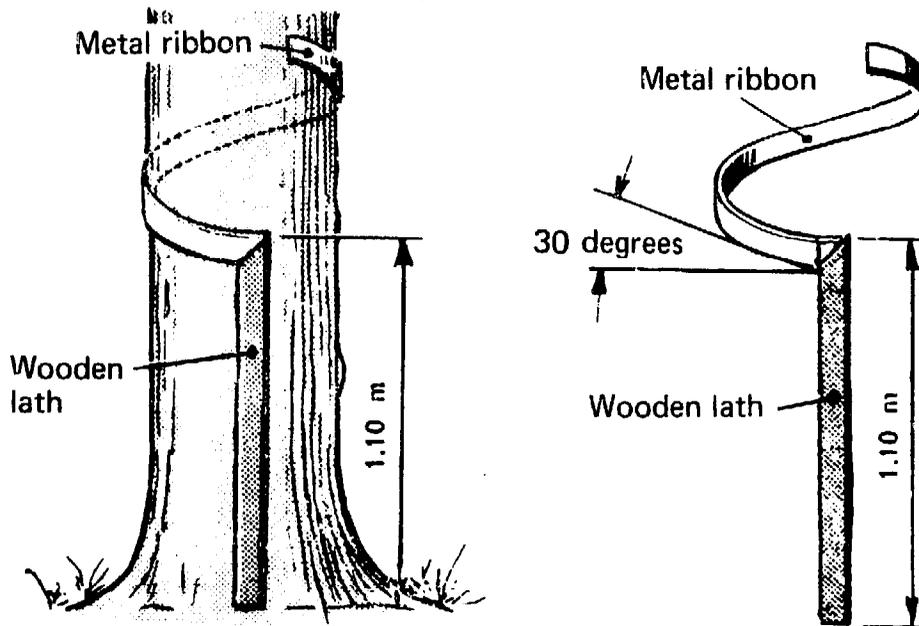
The **lactiferous vessels** are little tubes that produce latex.

In tapping, you cut these little tubes containing latex. But you must take care not to cut the cambium.

## Starting the tapping

When a tree is 50 centimetres in circumference at a height of 1 metre from the ground, that is, 5 years after it has been put in the plantation, you can begin to tap the tree.

To start the tapping, take a metal ribbon attached to a wooden lath 1.10 metres long. This metal ribbon is at an angle of 30 degrees to the horizontal.



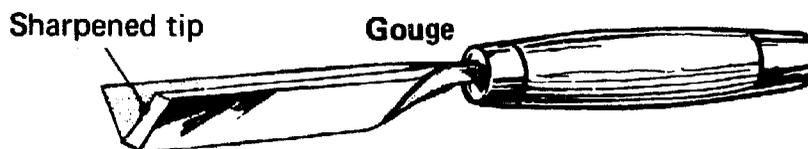
Roll the metal ribbon round the tree.

With an awl (an iron point), make a cut along the ribbon. The cut ends when you have gone right round the tree. The beginning of the cut and the end of the cut are on the same vertical line.

With the awl make a vertical channel from the lower edge of the cut.

The cut and the channel must be deepened.

This is done with a gouge, a tool that is used by pushing it so as to remove bark.

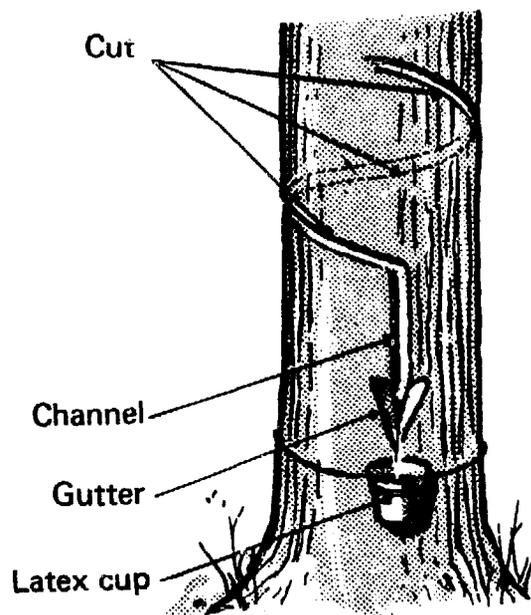


Push the gouge several times along the cut and the channel, taking away a very little bark at a time. You do this so as to cut the bark as close as possible to the cambium, but without damaging it.

As the bark is about 6 millimetres thick, the cut must be 4.5 millimetres deep.

The vertical channel is 25 centimetres long. At the lower end of this channel, put a gutter. Below that, put a cup called a latex cup. Tie it to the tree.

The latex flows along the cut, into the channel, and at last, through the gutter, it drops into the cup.



The latex that flows when you first make the cut is not good for harvesting, so for several days you do not harvest any latex, but all the same you must come and cut the bark.

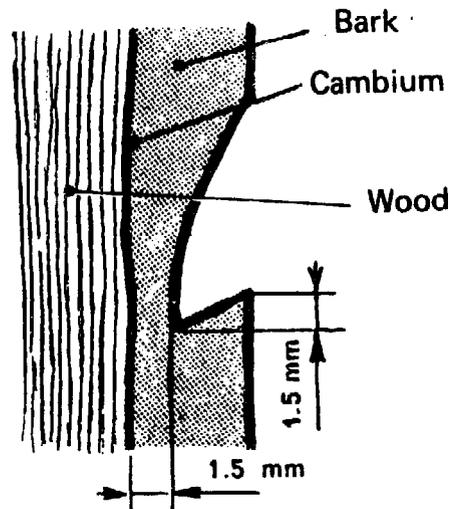
## Harvesting the latex

Early in the morning,  
go to the plantation to reopen the cut.

Begin by taking away the latex  
that has coagulated on the cut  
and put it in a basket.  
Take away also any latex  
that has flowed over the bark.

Then, with the gouge,  
take out a little piece of bark, 1.5 millimetres thick,  
without touching the cambium.

Make the cut as far as 1.5 millimetres from the cambium.



The latex flows along the cut, then down the channel,  
and through the gutter, it drops into the latex cup.

Then, 4 hours later,  
come again and collect what is in the cup.  
Two days afterwards, clean out the cup.

One man can tap 440 trees a day.  
The man who does the tapping is called the tapper.

If you make the cut badly, and if you touch the cambium,  
the bark closes up badly. It splits and turns brown.  
Then the tapping must be stopped.

There is a product for treating this browning of the bark.

## HARVESTING LATEX AT THE RIGHT TIME

The trees must be tapped  
very early in the morning,  
at daybreak,  
so as to harvest as much latex as possible.  
If you make the cuts late in the day,  
you harvest less latex, one third less.

But you must not tap the trees every day.

Each tree should be tapped on a fixed day.

Thus,

- one tree is tapped on Monday and Thursday;
- another, on Tuesday and Friday;
- a third on Wednesday and Saturday.

Each tapper can tap 440 trees.

So he will have 3 groups of 440 trees,  
since he will tap each tree only twice a week.

He will have:

- one group tapped on Monday and Thursday;
- one group tapped on Tuesday and Friday;
- one group tapped on Wednesday and Saturday.

Monday	Tuesday	Wednesday
Thursday	Friday	Saturday

He will stop tapping for two months, in the dry season,  
that is, at the time when the tree loses its leaves  
and makes new leaves.

When you have worked over the whole length of the tree,  
taking away the bark,  
that is, after 7 years,  
you can begin again,  
starting at 1.5 metres from the ground.

You can do this three times.

That means you can harvest latex for 28 years.  
After that, it is best to make a new plantation.

# **SUGGESTED QUESTION PAPER**

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## **FILL IN THE MISSING WORDS**

In the bark of the rubber tree there is a liquid called.....

The place where you sow the seeds to make them germinate is called .....

For grafting, you use a .....

The terraces must be made on the .....

To disbud means .....

The disease which makes the roots rot is called .....

Between the wood and the bark there is a layer which cannot be seen with the naked eye; it is called .....

The little tubes that produce latex are called .....

## **ANSWER THE FOLLOWING QUESTIONS**

Why are rubber trees grown?

How do you prepare the young plant (the stock) which is to take the scion? Make a drawing.

How do you take the scion? Make drawings.

How do you make the holes before planting the young trees in the plantation?

How do you protect the trees against white root rot?

How do you start the tapping?

How do you harvest the latex?

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