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the oil palm



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Twenty-six titles have been published in this series, designed as handbooks for a two-year intermediate level agricultural education and training course. They may be purchased as a set or as individual documents.

FIRST YEAR

1. The plant: the living plant; the root
2. The plant: the stem; the buds; the leaves
3. The plant: the flower
4. The soil: how the soil is made up
5. The soil: how to conserve the soil
6. The soil: how to improve the soil
7. Crop farming
8. Animal husbandry: feeding and care of animals
9. Animal husbandry: animal diseases; how animals reproduce

SECOND YEAR

10. The farm business survey
11. Cattle breeding
12. Sheep and goat breeding
13. Keeping chickens
14. Farming with animal power
15. Cereals
16. Roots and tubers
17. Groundnuts
18. Bananas
19. Market gardening
20. Upland rice
21. Wet paddy or swamp rice
22. Cocoa
23. Coffee
24. The oil palm
25. The rubber tree
26. The modern farm business

the oil palm

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PREFACE

This manual is a translation and adaptation of "Le palmier à huile," 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 acknowledgement 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.

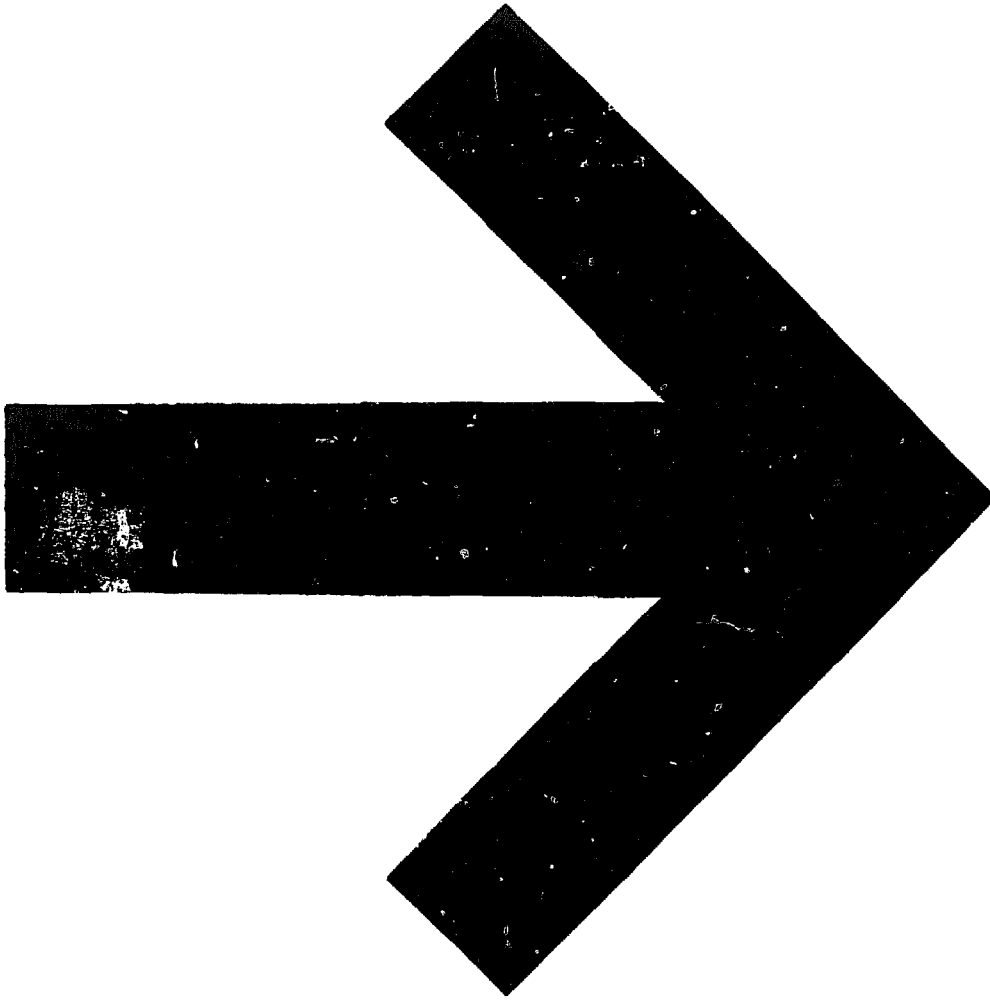
It should be noted that the original texts were prepared for an African environment and this is naturally reflected in the English version. However, it is expected that many of the manuals of the series — a list of which will be found on the inside front cover — will also be of value for training in 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 cover illustrations were prepared by Asuni Balzola.



An oil palm



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MODERN OIL PALM CULTIVATION

1. A modern oil palm plantation needs a grower who has learned how to cultivate oil palms.

Growing selected oil palms is not just a matter of picking the fruit; it is a modern crop.

The grower must learn how to do his work well.

The grower should ask for advice, so that he learns to do better and better.

The grower must think about his work and plan it, so that he can always do his work at the right time.

Selected oil palms give the grower much more work than the natural trees, but they yield much more.

An oil palm grower is a modern farmer.

With the money he earns he can buy for his family what they need, and he can modernize his farm.

BEFORE STARTING THINK THINGS OVER CAREFULLY

An oil palm begins to produce 3 or 4 years after it has been planted.

During that time the grower must spend money and work hard, without harvesting any fruit or earning any money.

2. To make a modern oil palm plantation takes money.

Most often you will have to pay workmen for clearing the site of the plantation and removing tree stumps.

Then you must buy seedlings and fertilizers.

Unless you apply fertilizers to the oil palms when they are still young, they will not grow well and you will have to wait a longer time before you can begin to harvest.

You may also have to pay workers to help you look after the young plantation. Weeds must not be allowed to get in the way of the oil palms, and the trees must be protected from damage by rats and agoutis.

All this work takes a lot of time, and this means that you may not have enough time to look after large fields of food crops.

You may have to buy food for your family.

Before you start an oil palm plantation, you must calculate carefully whether you will be able to pay all these expenses.

3. To grow oil palms takes a lot of work.

Before planting your oil palms, you have to clear the forest and remove the tree stumps.

Then it takes a lot of time to sow the cover crop, dig holes in the plantation, take the seedlings out of the nursery, carry them to the plantation and plant them.

All this work needs to be carefully done: you must take your time.

Never hurry if you want to be successful with your plantation.

Once the oil palms are planted, you must put wire netting around the young trees, you must spread fertilizer and keep watch over the plantation.

Young oil palms need a lot of care. It is better to make a smaller plantation, but look after it carefully.

Once the oil palms have begun to produce, the fruit must be harvested at the right moment.

If you cannot pick the fruit at the right moment, it becomes too ripe, many clusters will drop and the quality of the fruit will be less good.

4. To grow oil palms takes much time and much care.

Do not try to cultivate too large an area, or the work will be badly done.

It is better to cultivate a small plantation and to do the work well.

A small plantation that is well looked after can yield more than a large plantation that is badly looked after.

LIFE OF THE OIL PALM

5. The oil palm may have a very long life.

It is important to know about the life of the oil palm. If you know all about the life of the oil palm, you will understand better how to cultivate them.

If you do not take care of the seeds, they will germinate only after several years.

At the research stations, the seeds are kept in a room where it is always very hot.

This makes the seeds germinate sooner, after 90 to 100 days.

6. Each seed germinated is planted in a small plastic container.

A new leaf grows every month.

The young seedling stays in the container for 4 to 5 months.

When you see a leaf with two points (**bilid leaf**) coming up, transplant the seedling out into the nursery.

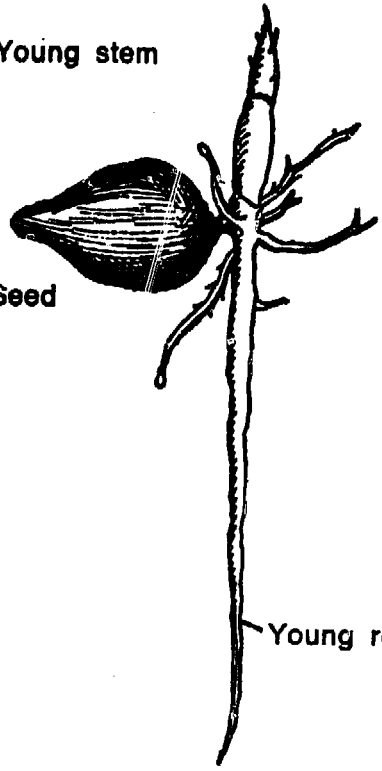
7. The seedling stays in the nursery for 1 year. When it has about 15 green leaves, it is planted in the palm grove.

The seedling is therefore 15 to 18 months old when it is ready to be planted in the palm grove.

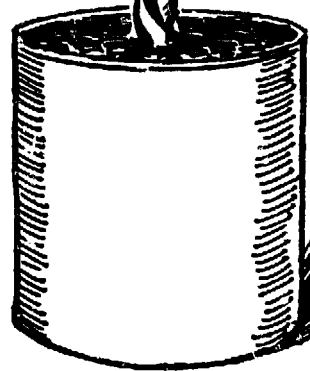
Young stem

Seed

Young root

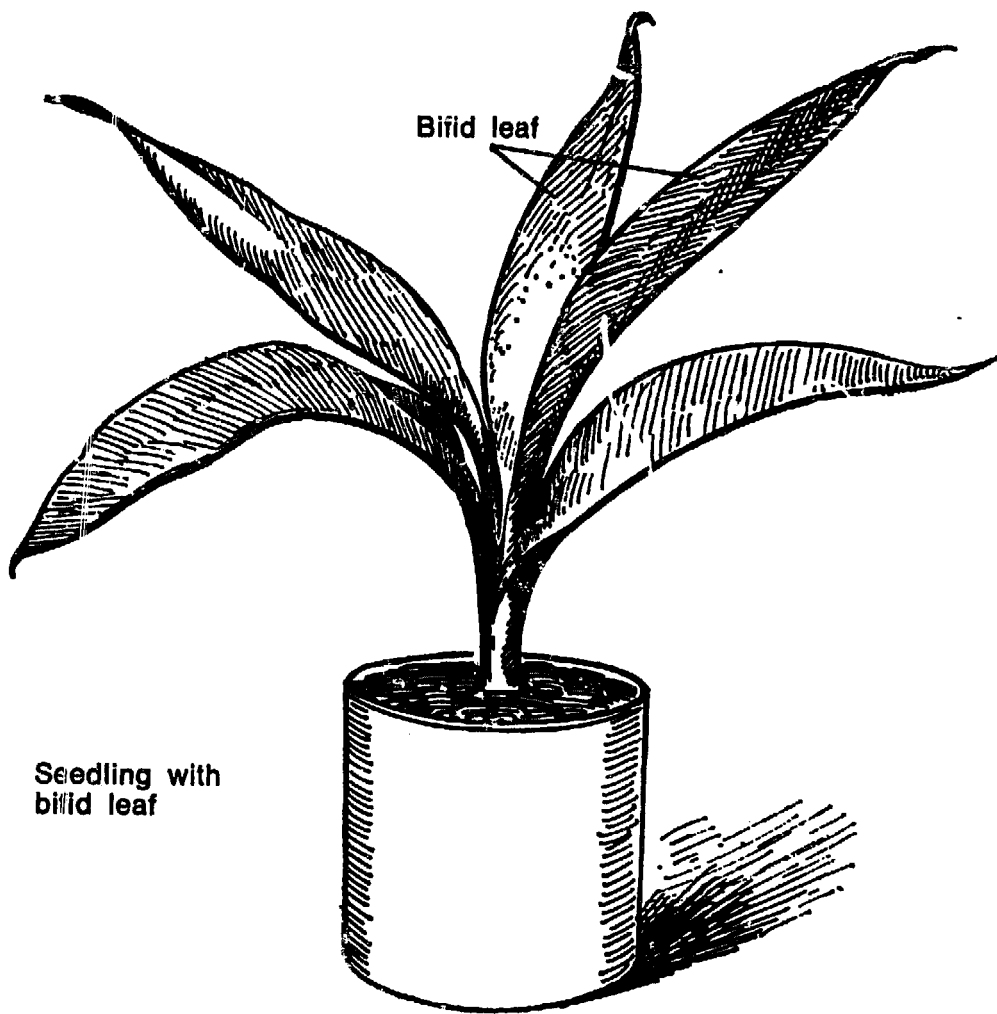


Seedling with two leaves



Bifid leaf

Seedling with bifid leaf

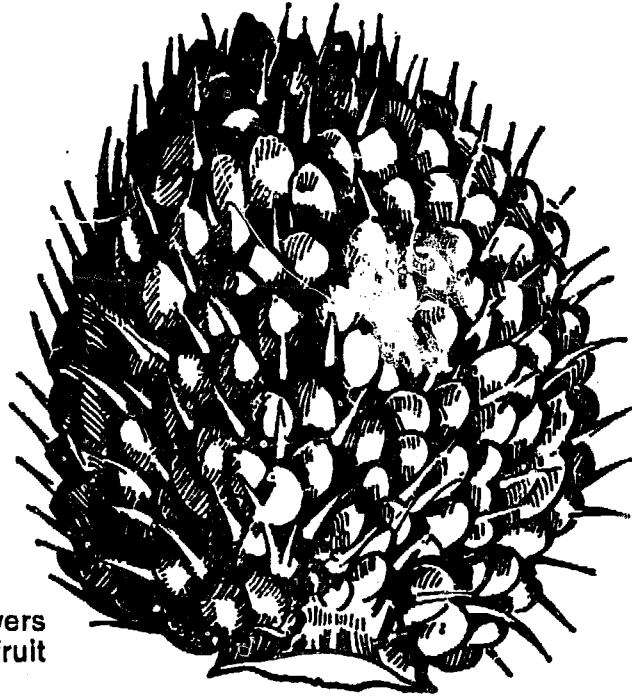




Spikes of male flowers

8. When the young oil palm has been planted in the palm grove, it produces male flowers. The flowers form at the base of each leaf. For several months, the oil palm produces only male flowers. After that, for several months, it produces only female flowers.

The male flowers are grouped in spikes.
The female flowers form other spikes.
The male flowers fertilize the female flowers.
Fertilized female flowers turn into a cluster of fruit.



Fertilized female flowers
turn into a cluster of fruit

9. The oil palm has no branches.

it has a trunk and leaves. The trunk, sometimes called a **stipe**, is the stem of the palm.

At the tip of the stem there is **one bud - one only**:
This is the growing point, which makes the oil palm live and grow.

If the growing point dies, the tree dies as well.

The growing point of the adult oil palm produces 20 to 25 leaves every year.

It is most important that the growing point should produce many leaves, because there will be a flower at the base of each leaf.

If there are many leaves, there will be many flowers. And if there are many flowers, there will be many clusters of fruit.

The oil palm grows well and produces a lot in regions where it is very hot, where the sun is very strong, and where it rains a great deal.

THE FRUITS OF THE OIL PALM YIELD OIL

10. The clusters consist of spikelets.

The spikelets contain the fruit.

Before getting the oil out of the fruit, the fruit must be separated from the spikelets.

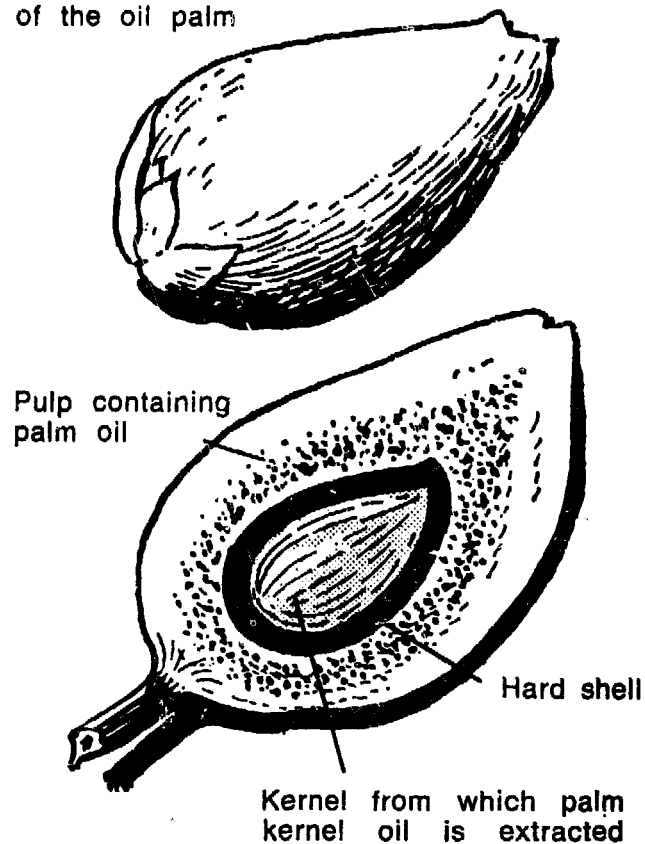
11. The fruits of the oil palm consist of the following parts:

Pulp: the pulp is yellow; when the pulp is crushed it yields palm oil.

Seed: inside the shell of the seed is the kernel; when the kernel is crushed, it yields palm kernel oil.

The kernel also contains the germ.

Fruit of the oil palm

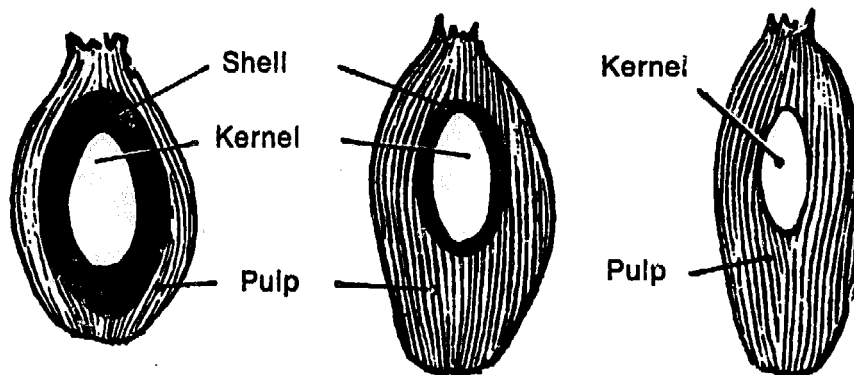


12. The fruits of all oil palms are not the same.

- They are not all of the same size.
- The pulp is not equally thick in all of them.
- The shell is not equally thick.
- Some kernels have no shell at all.

There are different varieties of oil palm:

- **dura** palms have kernels with a **thick shell**;
- **pisifera** palms have kernels with **no shell**;
- **tenera** palms have kernels with a **thin shell**.



Dura palm fruit

Thick shell

Tenera palm fruit

Less thick shell

Pisifera palm fruit

No shell

13. When oil palms bear many and large fruit clusters, they yield a lot of oil.

But to get a lot of oil, each fruit must also contain a lot of pulp, a shell that is not very thick, and a big kernel.

Research stations have developed varieties of oil palm which produce many large clusters with fruits that have a lot of pulp, a thin shell and a big kernel.
These are selected oil palms.

In order to get a lot of oil, the female flowers of a **dura** palm are fertilized with the pollen from a **pisifera** palm.
Once they are fertilized, the female flowers turn into fruits.
These fruits are of the **tenera** variety.

The fruits of the tenera palm have a lot of pulp, a thin shell and a big kernel.

WHY CULTIVATE OIL PALMS?

14. In traditional farming, nobody cultivates oil palms.

People simply pick the clusters of fruit from the oil palms that grow in the forest.

But these oil palms produce little.

The oil is extracted by traditional methods, and a lot of oil is left in the pulp and the kernel.

But nowadays oil palms are grown on modern plantations.

These contain selected oil palms with big yields.

The clusters of fruit are sold to mills which extract all the oil from the pulp and the kernels.

These oil palm plantations bring in money

- for the growers who sell the fruit,
- for the workers who work in the mills,
- for the government which can sell the oil to foreign countries.

15. The growers can also earn money by raising beef cattle.

Beef cattle can be fed with the green fodder from the cover crop grown in the palm groves.

The grower can also feed his cattle with palm-kernel oil cake, that is, what is left over after extraction of the palm kernel oil.

Palm-kernel oil cake is a protein-rich food.

WHERE TO CULTIVATE OIL PALMS

Oil palms are cultivated in the regions where they grow well and where there are oil mills.

To repay the grower the oil palm needs a region:

16. Where it is hot all the year round

The oil palm grows well where it is hot all the year round: between 25 and 28 degrees C.

If the temperature drops, the oil palm produces fewer leaves and is more often attacked by diseases. It therefore yields less.

A hot temperature enables the oil palm to make many leaves and to produce many clusters of fruit.

A lot of sunshine

Where there is a lot of sunshine, there will be strong photosynthesis, provided the oil palm is in soil which gives it water and mineral salts.

The leaves grow large, the fruit ripens well, and there is more oil in the fruits.

Plentiful rain

If it does not rain much, or if it does not rain for several months, the leaves do not grow well.

If there are few new leaves, there are few flowers and few clusters of fruit.

There is less yield.

17. Where the soil is flat, deep, permeable and rich.

The oil palm needs a flat soil.

If the soil is not flat, transport is difficult and costs a lot.

Erosion is severe; the water carries away the earth.

The oil palm needs a deep soil.

The roots of the oil palm cannot develop if they meet a hard layer.

They cannot take up water and mineral salts that are deep down.

If the oil palm does not have enough water, yields are low.

The oil palm needs a permeable soil.

The oil palm does not grow well if water remains around its roots for too long.

The oil palm needs a rich soil.

In order to produce many large clusters of fruit, the oil palm needs a lot of mineral salts.

If the soil is poor, mineral salts can be added by applying fertilizers.

18. Where there are oil mills.

With traditional methods, a lot of oil is left in the pulp and the kernels.

The machines of the oil mills extract all the oil contained in the pulp and the kernels.

Selected oil palms produce many clusters of fruit.

To get all the oil out of these clusters yourself, you would have to spend a lot of time.

Before planting selected oil palms, make sure you can sell the fruit clusters to a mill.

19. Where business companies or extension services can give the grower advice.

It takes much money and work to make an oil palm plantation.

The grower must use modern methods in order to pay for his expenses and earn money. He will need advice on:

- how to choose the site for his plantation
- how densely to plant it
- how to look after the plantation
- how to apply fertilizers
- how to protect the oil palms against disease

THE OIL PALM NURSERY

20. It is difficult for a grower to make the seeds of oil palms germinate.

Growers buy young seedlings which already have four or five leaves. Seedlings can be bought from research stations or extension services.

The young seedlings are then put into a nursery. The nursery is a small plot in which the young oil palms develop.

When the oil palms are big enough, they are planted out in the palm grove.

Nurseries cause a lot of expense and need much care.

It would be very expensive for one grower alone to make a nursery; it is better to make the nursery jointly with other growers.

It is very important to make a success of the nursery, so as to get fine young plants.

A seedling that has not grown well in the nursery will make a poor oil palm.

To have fine seedlings in the nursery you must:

- choose a good site and prepare it well,
- choose the finest seedlings,
- water them, protect them against erosion and weeds, give them fertilizers, protect them against insects and diseases.

HOW TO MAKE A NURSERY

21. Choosing the site

The soil should be fairly rich and well prepared. It is best to clear a bit of forest for the nursery plot. If you clear a forest site for the nursery, pull out all the trees and burn them. Burning all the wood helps to control certain diseases which might attack the roots of the oil palms, and it also makes the soil more fertile. Spread the ashes all over the plot.

If you put the nursery on a field which is already cultivated, pull up all the old crops: cocoa trees, coffee trees, oil palms.
Burn all the wood.

When the site is well cleared, it needs deep tilling. You should till 40 centimetres deep with a hoe or a tractor.

To improve the soil structure, you can then sow a green-manure crop, like **Centrosema** or **Crotalaria**. When these crops have grown, work them into the soil by tilling again.
Then apply fertilizers: 500 kilogrammes of dicalcium phosphate per hectare.

LAYOUT OF PATHS AND NURSERY BEDS

22. Nursery bed is the name for the strip of soil where the oil palm seedlings are planted.

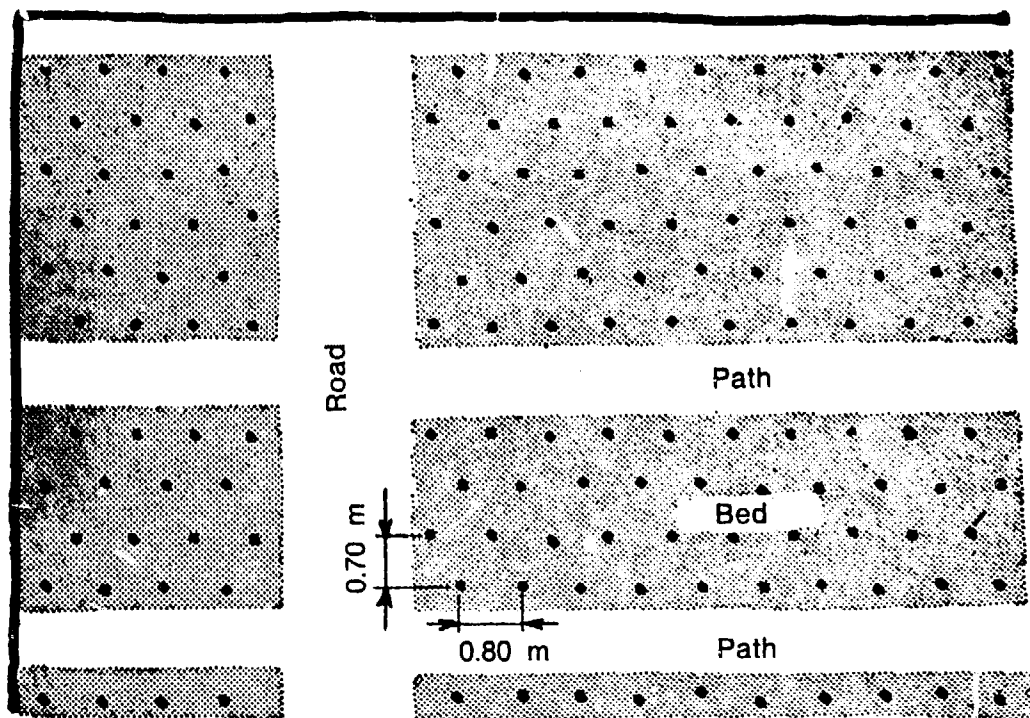
It is best to make the nursery on flat ground.

But, if the ground slopes, the beds must lie across the slope.

The beds should be 45 metres long and 3.5 metres wide.

The soil of the beds should be well worked to make it quite flat.

After that, apply a dressing of fertilizer. For instance, at La Mé, Ivory Coast, 250 kilogrammes of 10:10:20 fertilizer are applied per hectare.



23. Making holes for seedlings and transplanting

To know where to make the holes for your seedlings, make a pattern.

At the places where you have put your little pegs, make a hole with a Richard plant setter.

Then put a seedling with its ball of earth into each hole.

You must give the seedlings a lot of water. But do not water when it is hot; it is best to water in the evening and the morning.

To protect the soil against erosion, mulch it.

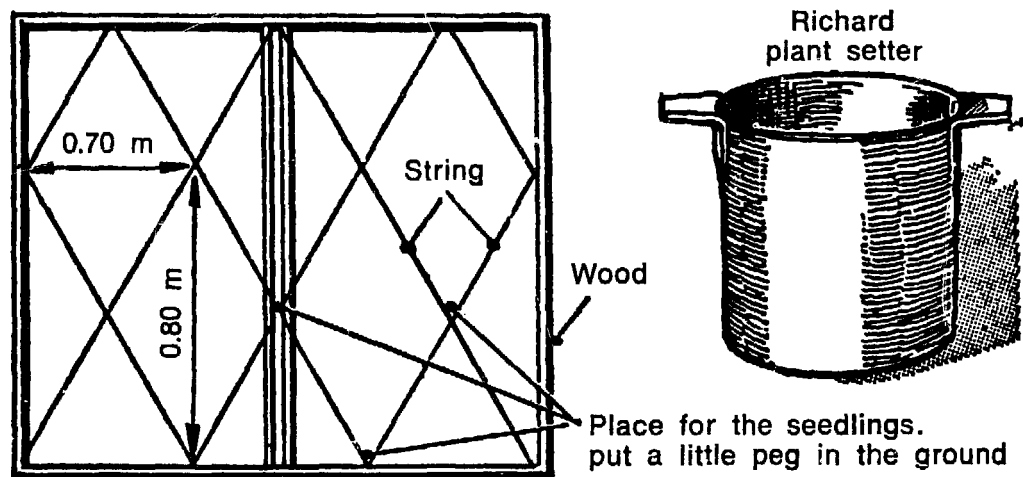
Cover the ground with herbage or cluster residues. Leave a ring of 20 centimetres of unmulched ground around each seedling.

If you mulch with cluster residues, put them down only three months after transplanting, so that the insects do not attack the young leaves.

If you mulch with herbage, you must replace the herbage when it rots. Then hoe the soil.

If you cannot get enough water for the seedlings, transplant them into the nursery at the beginning of the rainy season.

At the end of the rainy season, the seedlings will be strong enough to get through the drought.



Pattern for nursery planting

PUTTING UP SHELTERS

24. In certain regions shelter has to be put up over the nursery.
This protects the young seedlings from a disease called blast.

These shelters are made with posts and bamboo sticks.

To make the shelters more solid, put two posts together.

The posts should be 2.5 metres high. The bamboo sticks are tied to the posts with lianas.

Finally, put palm fronds over the bamboo sticks.

In Benin, shade for the young oil palms is provided by planting castor-oil plants in the nursery.

If you make a shelter, you need not mulch, but you must hoe very often.

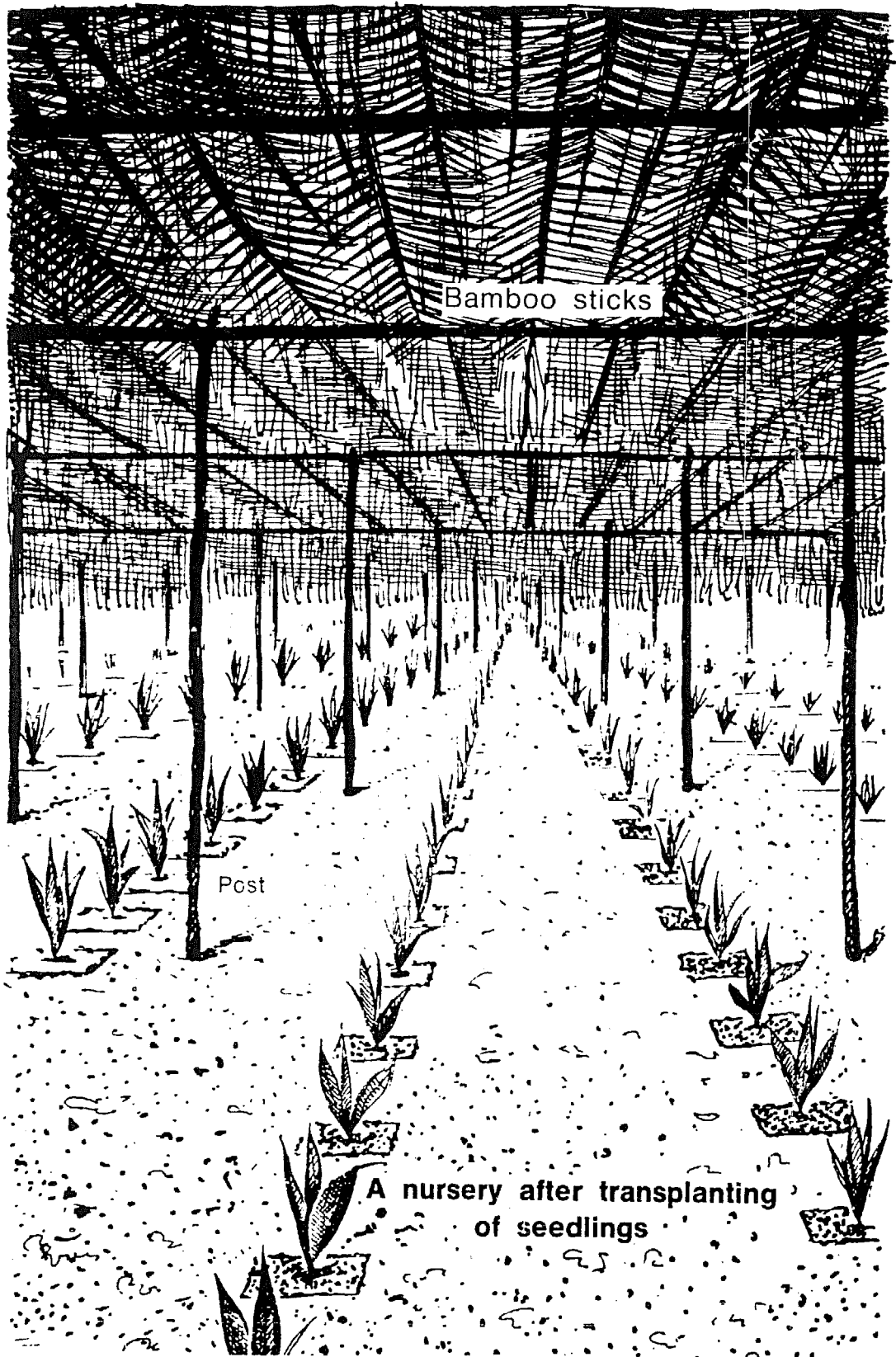
Get rid of all the weeds, and always keep the soil loose.

Three months after transplanting, if the seedlings have grown well, apply monthly to each plant 15 to 20 grammes of a mixture of ammonium sulfate and potassium chloride.

Spread the fertilizer mixture in a ring 10 centimetres from the seedling and water.

Hoe to work the fertilizer into the ground.

The seedlings stay in the nursery for about 1 year. You must plan, therefore, to make the nursery about 1 year before you want to plant your palm grove.



Bamboo sticks

Post

A nursery after transplanting of seedlings

THE PLANTATION

PREPARING THE SITE

- 25.** In big plantations the forest trees are pulled up with the help of big machines.
But often the grower cannot use these machines.

Begin by marking out the boundaries of the plantation.

Next, cut down as many trees as you can around the plantation and take all the trees away, so that the fire cannot burn down the whole forest.

This is called making a **firebreak**.

Then set fire to the plantation site.

When the fire is over, the soil is bare.

You must protect the soil against the sun, for the sun burns the soil and destroys the humus.

At the beginning of the rainy season, sow a cover crop;
a mixture of **Pueraria javanica**

Centrosema pubescens, and
Calopogonium muconoides.

Sow 4 to 6 kilogrammes of seed per hectare.

PEGGING THE PLANTING PATTERN

26. When the soil of the plantation has been well cleared by fire, peg out the places where you will plant your seedlings.

To be sure to plant at the right density, you must peg out carefully before planting.

Then you will be sure of having always the same distance between rows and in each row the same distance between oil palms.

To get a good yield, you must plant the oil palms at the right density.

If the oil palms are planted too close together, the roots get in each other's way, and the leaves do not have enough air and sun: the yield will be low.

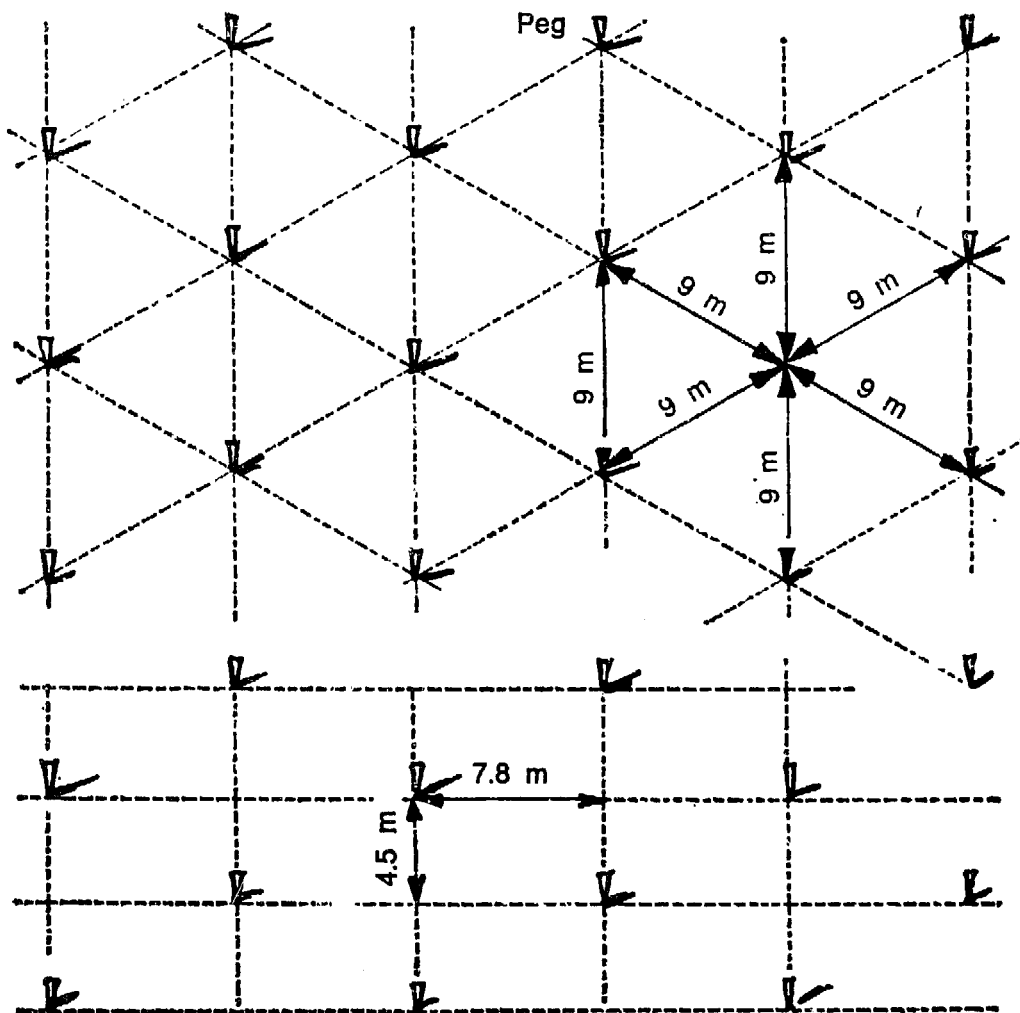
If the oil palms are not planted close enough together, each separate tree produces much, but the roots do not use all the soil: the yield per hectare will be low.

27. How to peg out the planting pattern

Trace lines across the slope and **put in your pegs in straight lines**; leave 7.8 metres between rows and 9 metres between pegs.

In this way you can plant 143 oil palms per hectare; this is the best density.

Pull out tree stumps and remove fallen trees close to the pegs, because these stumps and trees would interfere with the oil palms.



Planting pattern for a plantation

PLANTING OUT THE OIL PALM SEEDLINGS

28. One month before planting, dig a hole at each place where you have put a peg.

The hole should be 0.60 metre long and wide, and 0.80 metre deep.

When you are digging the holes, cut any roots that you find in the soil.

Do not mix the soil from above and the soil from below.



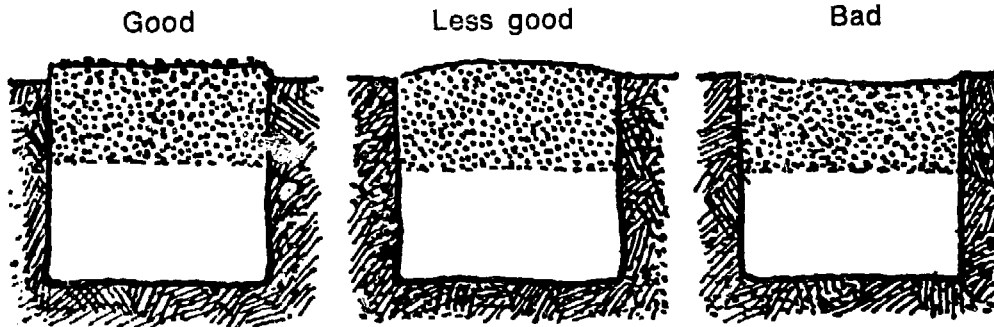
Soil from the top in one heap

Soil from the bottom in another heap

A few days later fill in the holes with the earth you have dug out.

At the bottom of the hole, put the soil you have dug out from the top, and at the top put the soil you have dug out from below.

Fill the hole well, so that no saucer shape forms on top.



Bottom soil now on top,
top soil now at the bottom.

- 29. Lifting the seedlings from the nursery**
The right time to plant is the beginning of the rainy season.

In this way the young plants can develop their root system before the dry season arrives.

Choose the biggest and the best-grown seedlings.
Leave in the nursery any seedlings that are small or badly grown.

Cut away all the dry leaves and the tip of leaves that are too long.

Put grease over the cut ends where you have removed leaf tips.

Tie the leaves together.

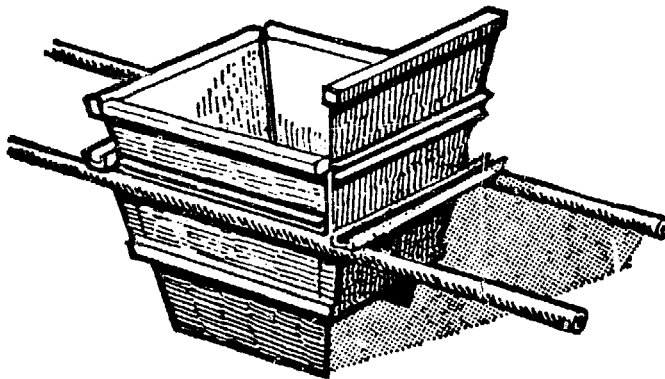
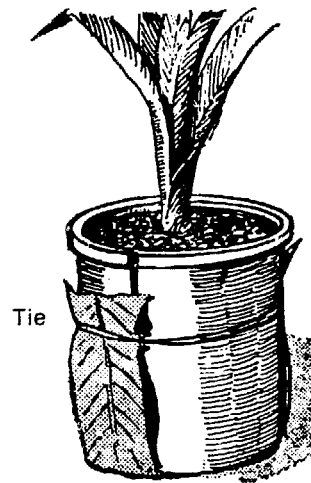
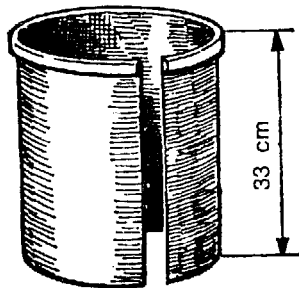
- 30. Do not lift the seedlings long before you plant them.**
Lift and plant them in the course of a single day.

In order to keep a big ball of earth around the roots, lift and plant the palm oil seedlings with a plant setter.

31. If you use a Socfin plant setter, place the seedlings after lifting into a wooden box in order to carry them to the plantation.

32. If you use a Java plant setter, leave the seedling inside the plant setter when you carry it to the plantation.
The seedling is tied into the plant setter.

Java plant setter



Socfin plant setter

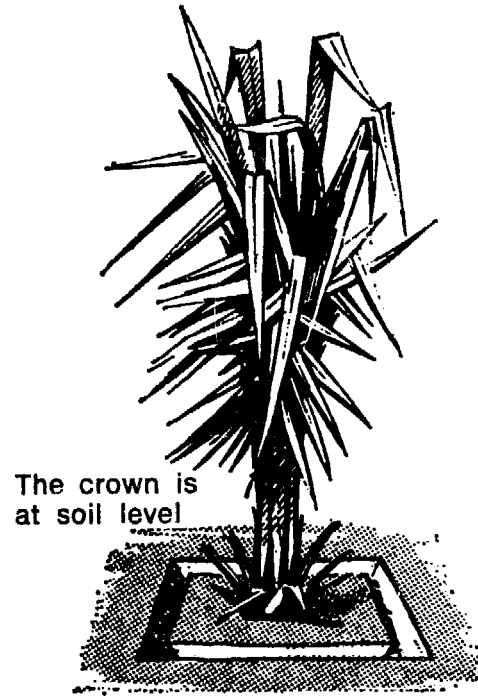
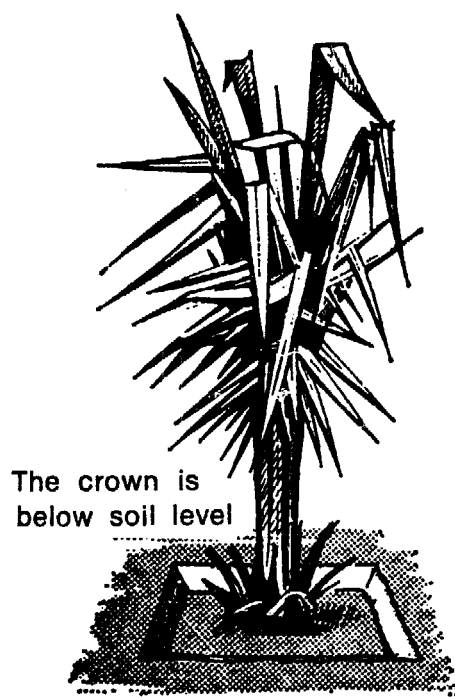


Seedling in wooden box

- 33.** Make the holes for planting in the plantation, with the plant setter you use for lifting the seedlings from the nursery beds.

Do not make the holes several days before planting. If you make the holes too long before planting, the rain may wash earth from the sides into the hole, or the sun may dry out the earth on the sides. The ball of earth around the roots must be level with the soil of the plantation.

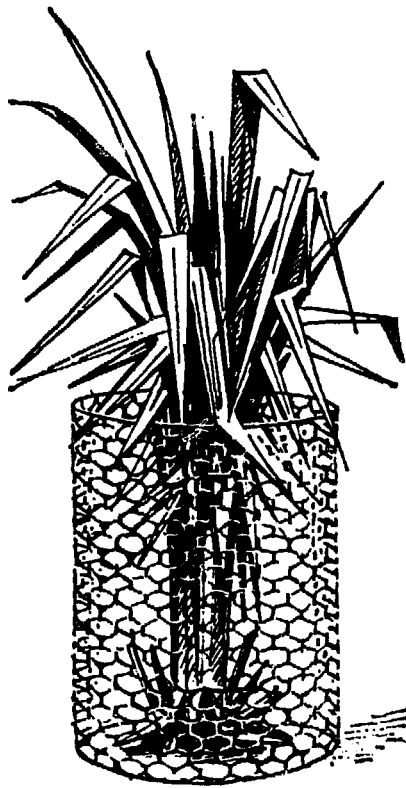
The earth must not form a hollow around the crown. Fill in with earth the space between the sides of the hole and the root ball. Remove with a little stick all the earth that has fallen on the leaves.



PUTTING WIRE NETTING AROUND SEEDLINGS

- 34. Certain animals may eat the young oil palm seedlings. To protect the seedlings, surround them with wire netting.**

Leave the wire netting in place for about 18 months. When you have put your wire netting in place, spread a mulch 20 centimetres thick around the seedlings. This mulch prevents the soil from drying out, and prevents weeds from growing. Use dry herbage, and spread it 15 to 20 centimetres thick at a distance of 30 to 40 centimetres around the crown.



Wire netting in place

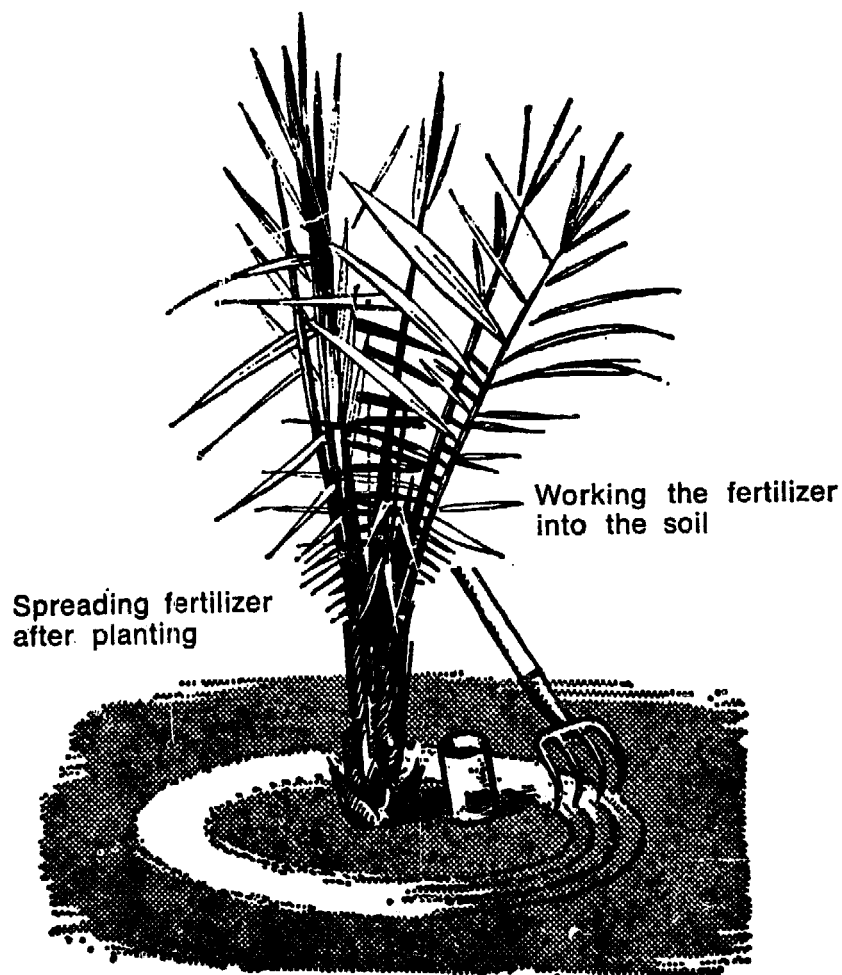
35. A few months after planting, apply fertilizers.

The right time to apply fertilizers is near the end of the rainy season.

The recommended dose of fertilizers for each plant is: 250 to 500 grammes of ammonium sulfate and 250 grammes of potassium chloride.

Spread the fertilizers in a ring underneath the longest leaves.

After you have spread the fertilizer, cover it with a little earth. If there is a mulch around the seedlings, remove the mulch before applying the fertilizer. Afterwards spread a fresh mulch of dry herbage.



LOOKING AFTER THE PLANTATION

36. Cultivation

You must remove the weeds around the young oil palms.

This work is done with a hoe or a machete.

During the first year, cultivate 6 times.

Remove all the weeds for 2 metres around each stem. During the first months, the weeds between rows have to be cut.

If you leave the weeds, the cover crop will not grow well.

37. Trimming the plants

You must always cut away the dry leaves of the oil palm.

In order to cut the leaves without damage to the oil palm, your tools must be well sharpened.

Cut the leaves very close to the stem, so that no other plants can grow in the axil of the cut-off leaves.

Remove from the trunk any plants (ferns) that may grow in the axils of the leaves.

Remove also the male flowers.

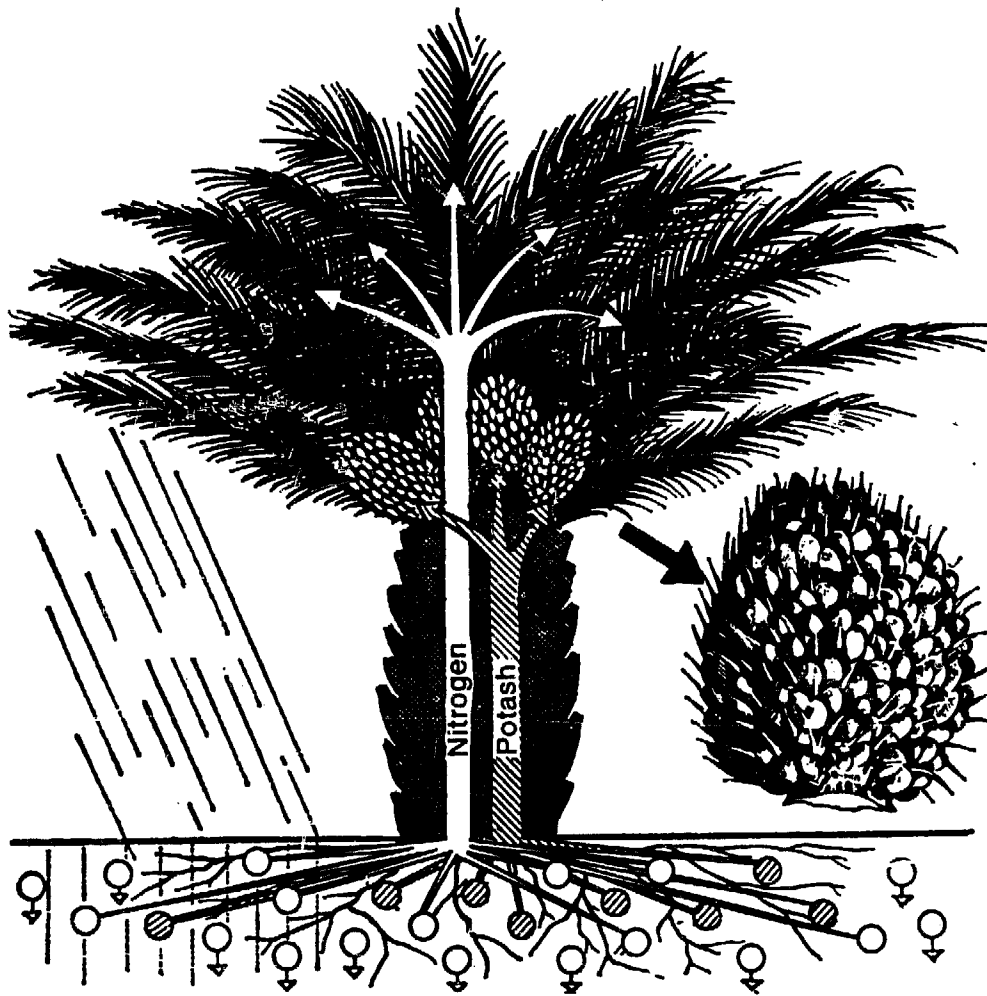
38. Applying fertilizer

The oil palm needs a lot of mineral salts to form its leaves and fruit clusters.

When the oil palm is young, it needs above all nitrogen.

When the oil palm has begun to produce, it needs a lot of potash.

Potash increases the number of fruit clusters, and makes them bigger.



HOW MUCH FERTILIZER TO APPLY

Example: Ivory Coast

On plantations (per tree per year)

Age of oil palm	Savanna		Forest	
	Grammes	Fertilizer	Grammes	Fertilizer
Year of planting	500	Ammonium sulfate	250	Ammonium sulfate
	500	Potassium chloride	250	Potassium chloride
1 year	750	Ammonium sulfate	500	Ammonium sulfate
	750	Potassium chloride	300	Potassium chloride
2 years	750	Ammonium sulfate	750	Potassium chloride
	750	Potassium chloride	to 1 500	
3 and 4 years and afterwards	1 000	Potassium chloride	750	
	to 1 500		to 1 500	

On natural palm groves (per tree per year):
1 000 grammes of potassium chloride

Example: Benin

On plantations (per tree per year)

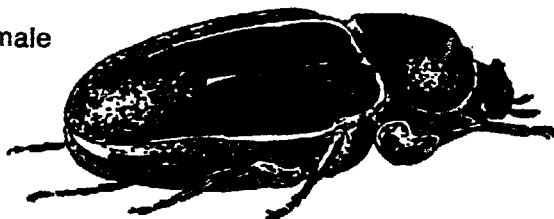
Age of oil palm	Ammonium sulfate	Potassium chloride
	Grammes	Grammes
Year of planting	250	200
1 year	350	200
2 years	500	500
3 years	600	750
4 years	600	1 000

PROTECT AGAINST INSECTS

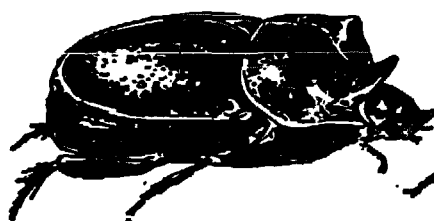
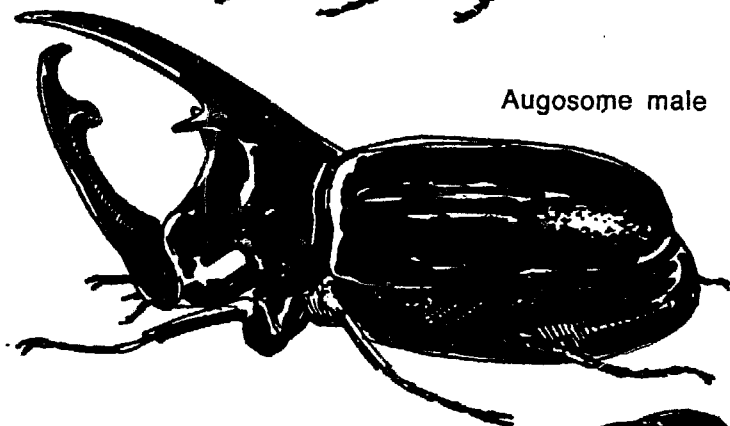
39. Rhinoceros and augosome beetles Strategus beetle

To protect the young trees, put in the axil of the leaves a mixture of sawdust and BHC.

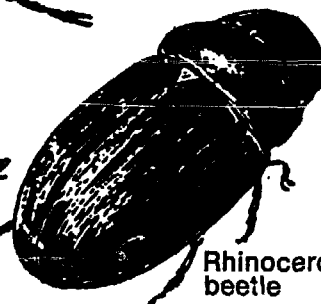
Augosome female



Augosome male



Strategus beetle



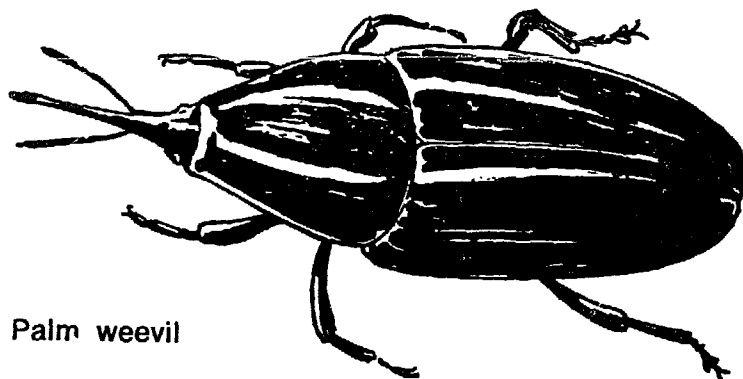
Rhinoceros beetle

Palm weevil (Rhynchophora)

To avoid dangerous attacks, be very careful not to wound the trees.

The insects may lay their eggs in the wounds of the oil palm.

There are other insects, but it is difficult for the grower to control them.



Palm weevil

Oil palms may also be attacked by rats and agoutis.

Rats and agoutis can eat young oil palms.
Protect your young oil palms against agoutis by wire netting round each tree.

As a protection against rats, you can place little bags with poisoned maize near the oil palms.

Diseases

Oil palms may be attacked by several diseases.
If you see distorted leaves or leaves that break, ask for advice from the extension service.

HARVESTING

- 40. Harvesting needs much time and much care, because only those fruit clusters which are cut at the right moment yield a lot of good-quality oil.**

You must go through the plantation many times to pick the ripe clusters.

A cluster is ripe for harvesting when the fruits begin to turn red, and when 5 or 6 fruits drop to the ground. If you wait too long before harvesting the clusters, harvesting takes much more time, because you must pick up all the fruits that have dropped to the ground. The fruits will also yield less oil, and the oil will be of less good quality.

If you do not wait long enough before harvesting the clusters, the fruit will not be ripe enough. It will be more difficult to separate the fruits from the clusters and the clusters will yield less oil.

41. The clusters can be cut off with different tools.

For oil palms 4 to 7 years old

Cut the clusters with a chisel.

Slip the chisel between the stem and the leaf; in this way you can cut off the cluster without cutting the leaf below it.

For oil palms 7 to 12 years old

Cut the clusters with a machete.

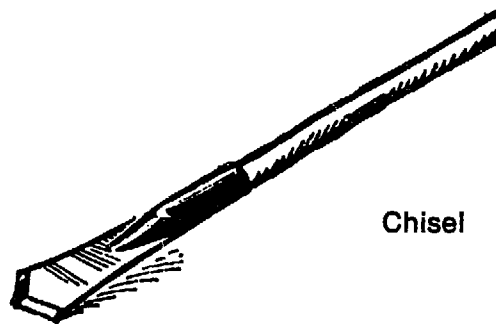
If the clusters are too high up, climb up the tree by putting your feet on the base of the leaves.

For oil palms older than 12 years

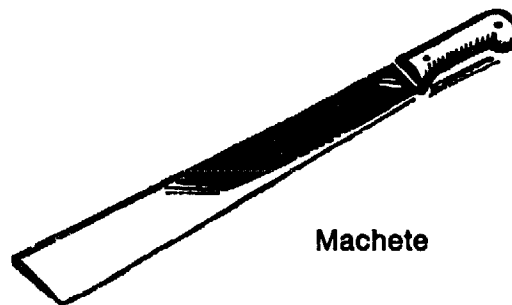
Cut the clusters with a long-armed sickle.



Long-armed sickle



Chisel



Machete



If the clusters are too high up to be cut with the long-armed sickle, use bamboo ladders, or else climb up the tree with a belt; you can also wear spiked shoes.

Any clusters that have dropped to the ground should be collected in a basket.

Fruits that have come loose must also be picked up.

SUGGESTED QUESTION PAPER

FILL IN THE MISSING WORDS:

The female flowers, after they are fertilized, turn into a

Inside the pulp of the oil palm fruit there is a

Before planting oil palms in a plantation, they are grown for about a year in a

The best density is oil palms per hectare.

When the oil palm is young, it needs, especially in fertilizers.

ANSWER THE FOLLOWING QUESTIONS:

Describe the fruit of an oil palm.

What varieties of oil palm are there?

What tools are used to harvest the fruit clusters?

What cover crops have you sown in your oil palm plantation?

What insects attack the oil palm?

In what regions can oil palms be cultivated?

Why must fertilizers be applied to an oil palm plantation?

Why must the fruit clusters be harvested at the right moment?

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