Better Farming Series No. 2, The Plant: The Stem; the Buds; the Leaves

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better farming series 2

the plant

the stem
the buds
the leaves

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

BETTER FARMING SERIES

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.

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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
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21. Wet paddy or swamp rice
22. Cocoa
23. Coffee
24. The oil palm
25. The rubber tree
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better farming series 2

The plant

The stem

The buds

The leaves

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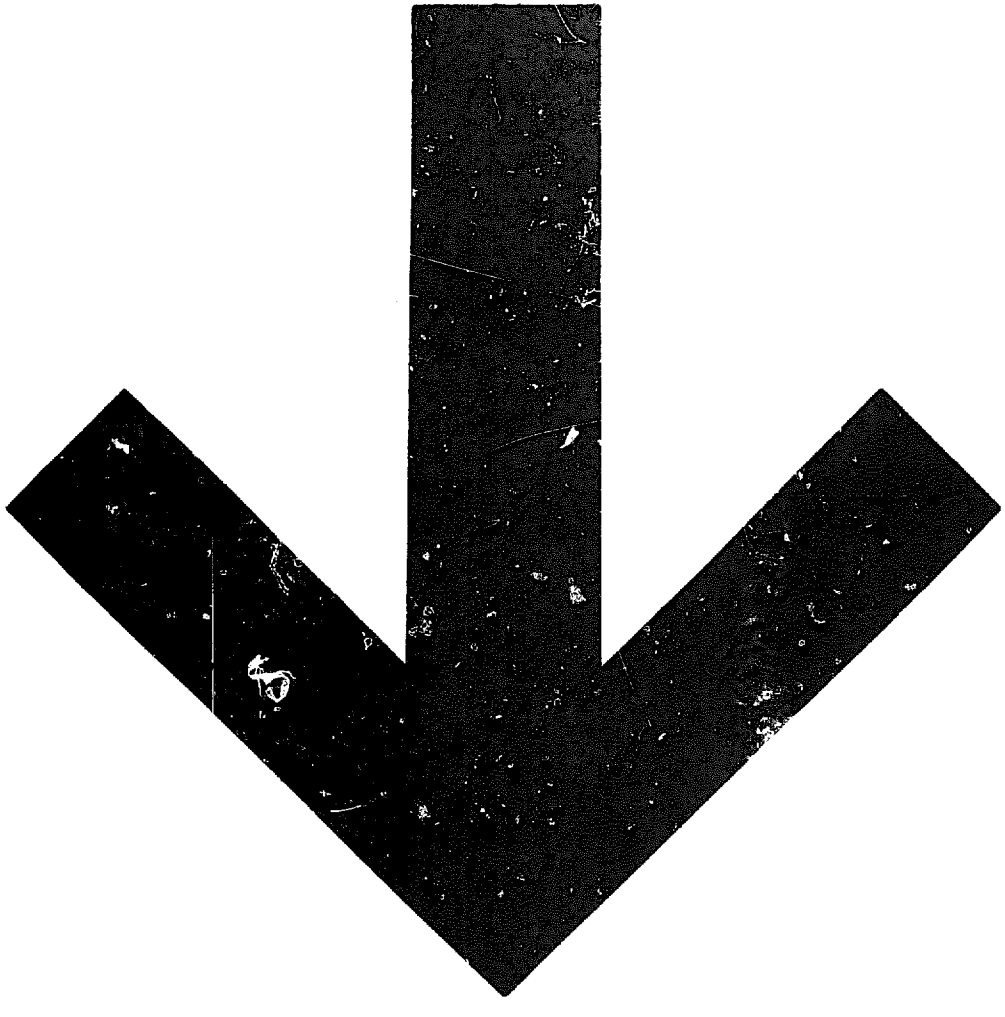
PREFACE

This manual is a translation and adaptation of "La plante — la tige, les bourgeons, les feuilles," 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.

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.



OUTLINE OF COURSE

PLAN OF WORK

FIRST WEEK

The stem.

Read pages 4 to 11.

- You must look at each stem.
  For example, on page 7 it says:
  "Let us look at a yam plant."

  Go to the field,
  and look at the stem of a yam.

  If there are no yams in your village,
  look carefully at the drawing.

- You must take good note
  of how one stem differs from another
  or is like another.

Make sure you understand what the stem does.

SECOND WEEK

The buds. How a leaf is made.

Read pages 12 to 18.

- To help your memory, read again pages 4 to 11.
- Look carefully at buds.
- Take a good look at the leaves you have picked.
  Look carefully, you will see the veins.
- Learn the new words, such as vein, midrib, leaf-stalk.

THIRD WEEK

What the leaves do.

Read pages 19 to 23.

- Read again pages 12 to 18.
- Leaves change raw sap into elaborated sap.
- Leaves breathe.
- Leaves transpire.

This week's work is more difficult.
You must take longer to study it.
Don't forget to look up the other pages mentioned.
For instance, where it says,
"See Booklet No. 1, page 17."

FOURTH WEEK

Some practical applications.

Read pages 24 to 29.
This is easy work, and not long.

Read again the whole course, especially the work for the third week.

THE STEM

Where is the stem?

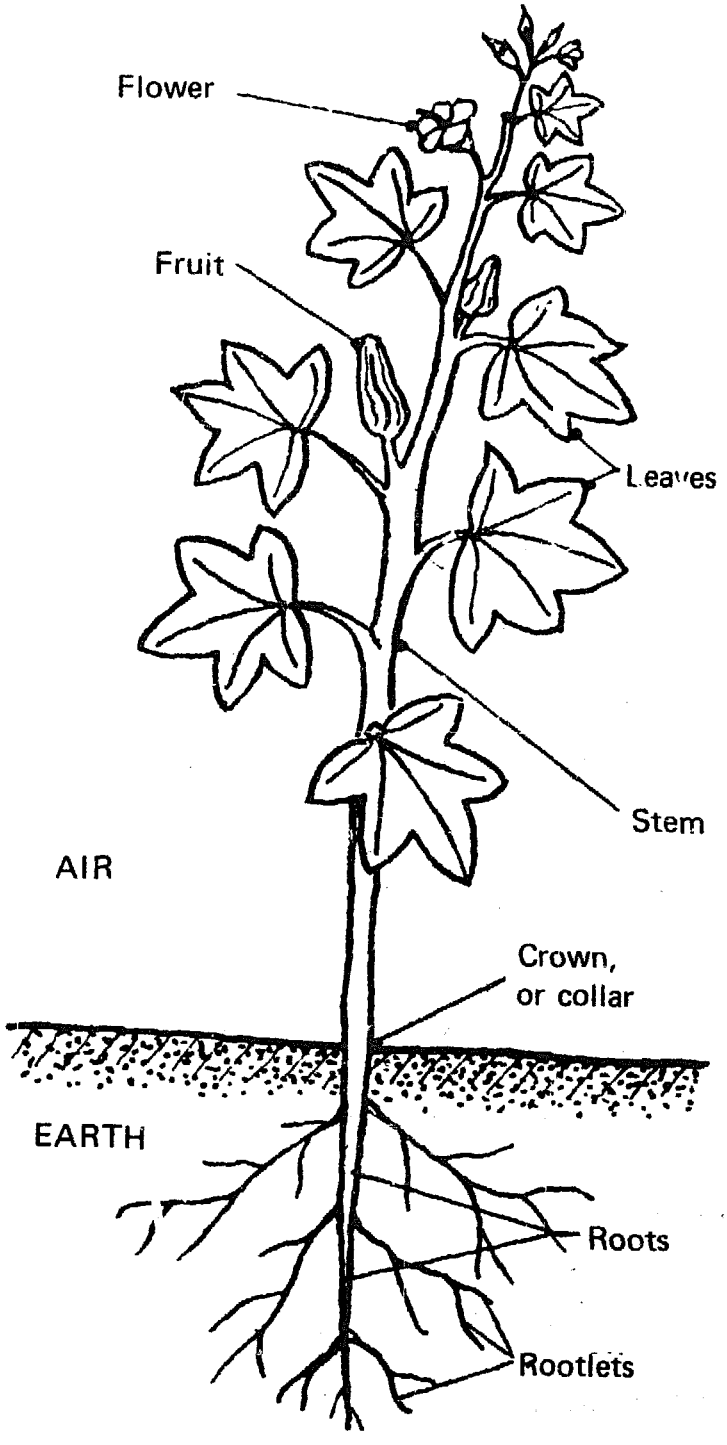
- **The root** is the part of the plant
  that lives in the soil.

- **The stem** is the part of the plant
  that lives in the air, above the soil.

- **The crown**, or collar, joins the root and the stem.

- **The stem bears** leaves, flowers, fruits.

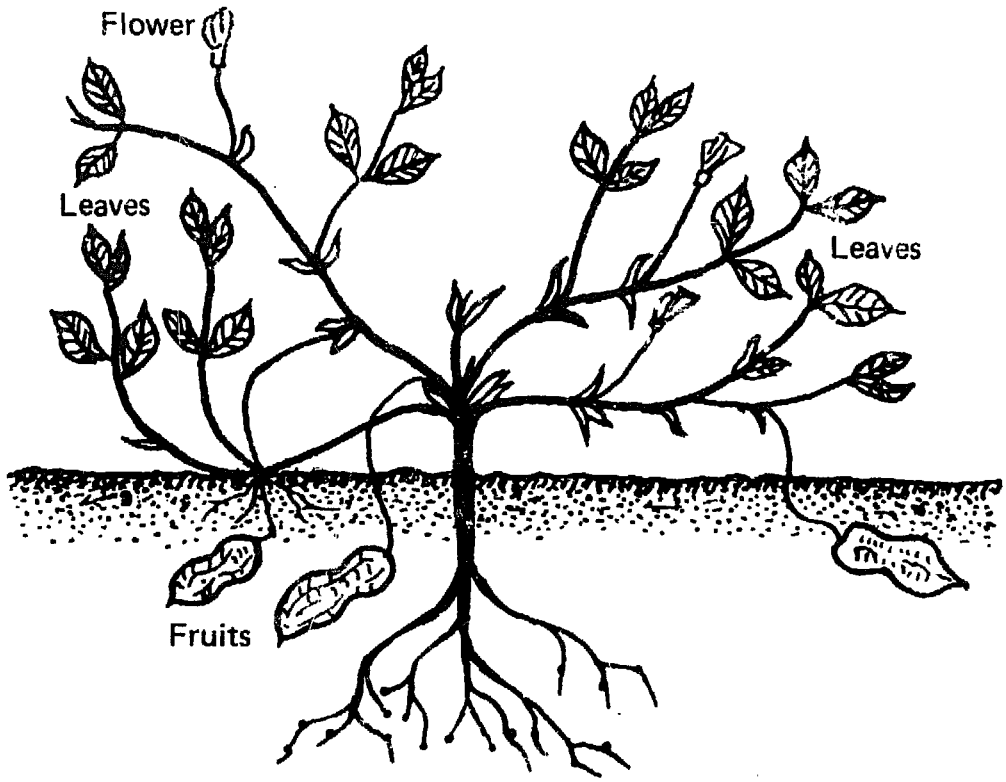
- Leaves,
  flowers,
  fruits, all grow on the stem.


Flower
Fruit
Leaves
Stem
AIR
Crown,
or collar
EARTH
Roots
Rootlets

How a stem is made

- The stem can be **trailing,**
  for example,
  that of a groundnut plant,
  or of a marrow, cucumber or melon.

Let us look at a groundnut plant.
What do we see?



A groundnut plant

A groundnut plant has **several stems.**

They are easy to cut
or crush between the fingers.

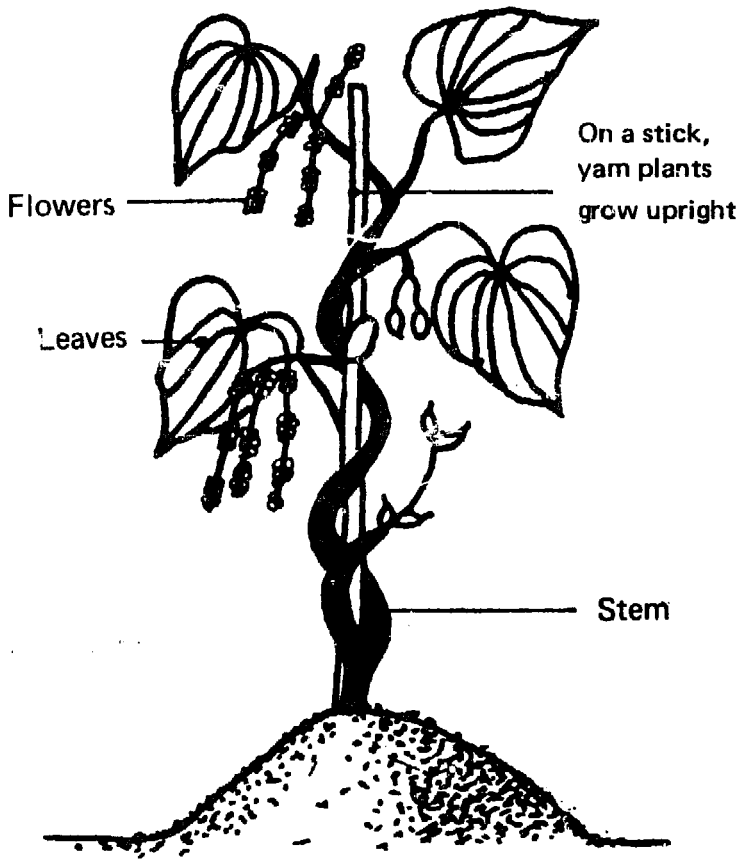
They are not hard.

The stems **lie on the ground or are upright.**

- The stem can be **climbing,**
  for example,
  that of the yam, bean, pea,
  and all the creepers.

Let us look at a yam plant.

What do we see?



A yam plant

- A yam plant may have **several stems.**

  The stems **lie on the soil.**

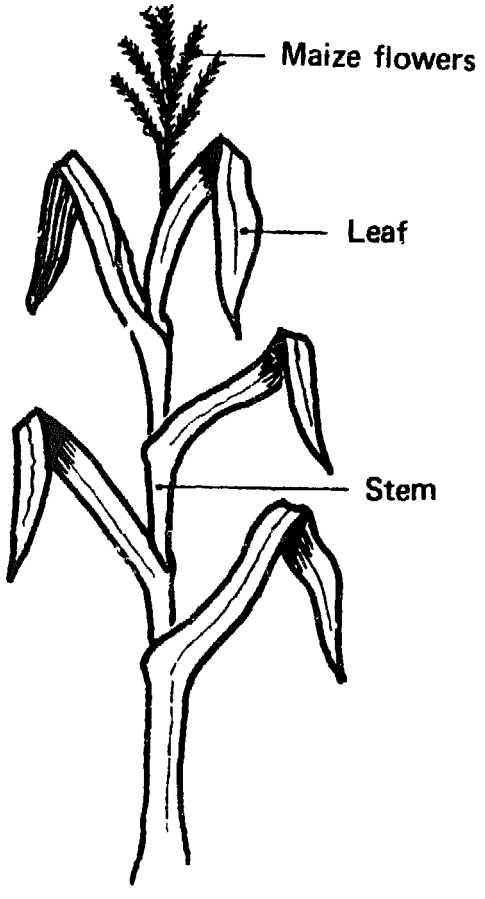
  If you push a stick into the ground beside a yam
  the stems **can be held upright,**
  because they hold on to the stick.
  The stem winds round the stick and climbs.

- The stems bear
  rather large green leaves
  and clusters of little flowers.

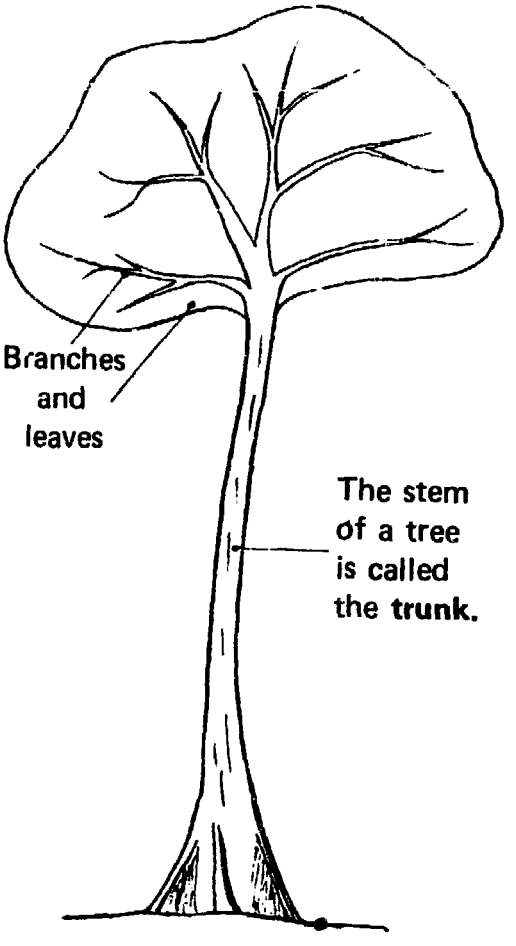
- The stem can be **upright**, for example,

  that of millet, maize, sorghum, cassava

  cotton,
  kapok tree or baobab.



Maize plant



Kapok tree

Maize has **only one stem.**

The stem is **upright.**

It is harder than the stem of groundnuts or yams.

Trees:
The stem is **upright,**
very tall,
very thick,
hard.

It is called the trunk.

The trunk of a tree is its stem.

- The stem can be **underground,**
  for example
  that of garlic or onion.

Let us look at an onion.

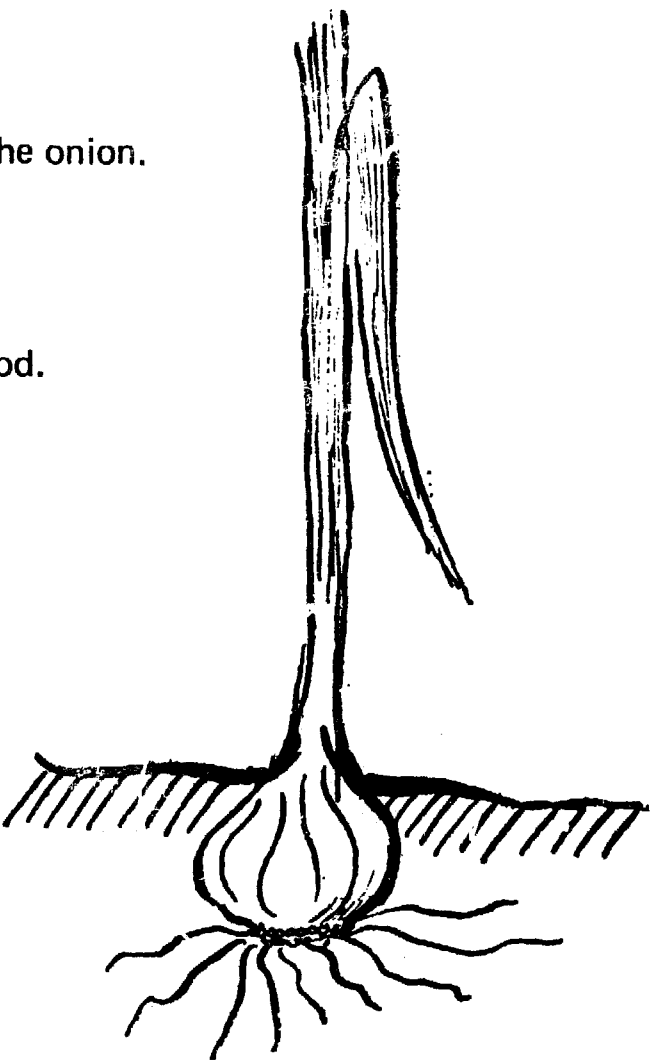
What do we see?

- A **very thick stem,**
  in the ground;
  this is the onion.

- Long leaves
  come out of the stem.

- Roots grow in a ring
  at the base
  of the stem,
  at the base of the onion.

- These stems
  hold a lot of food.



An onion

HERBACEOUS STEMS AND WOODY STEMS

- The stems of groundnuts, yams, maize,
  millet, tomato and okra
  are **green and pliable.**

  They can be bent without breaking.
  They are like grasses.
  They are called **herbaceous stems.**

- The stems of cotton, kapok trees, coffee,
  cocoa, of all trees,
  are **hard.**

  They break if you try to bend them.
  You have to strike hard to cut them with a machete.
  They are called **woody stems.**

ANNUAL STEMS AND PERENNIAL STEMS

- The stems of groundnuts, maize, millet,
  tomato and okra
  last for **only one year.**
  They are called **annual stems.**

- The stems of the kapok tree, coffee, cocoa,
  the underground stem of yams,
  last for **many years.**
  They are called **perennial stems.**

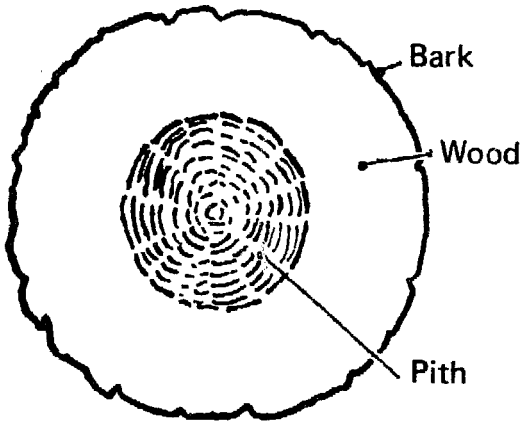
What the stem does

- It **supports** leaves and flowers.
- It **circulates** sap.

THE CIRCULATION OF SAP

Cut through the stem of a coffee tree or of a lemon tree.
What do we see?

- First of all, **on the outside of the stem, there is the bark.**
  This is the skin of the tree.
  Skin protects a man or an animal.
  The bark protects a tree stem.
  If a goat eats the bark, or you cut it with a hoe,
  the plant is no longer protected. It is injured.
  Many diseases can get in through this injury.
  You must not injure the bark.
- **Under the bark is the wood.**
  When the tree is old, the wood is thick,
  the stem is hard.
  Wood makes the stem hard.



Cut stem of a lemon tree

In the wood you can see
many little holes.

These are little tubes
or **vessels.**

In a man's body
the blood is carried
by blood vessels.

In a plant,
vessels carry the sap.

- **In the centre of the stem is the pith.**
  If you cut a cotton stem
  you can see the pith very easily.
  It is less hard than the wood.
  Often it is not the same colour.

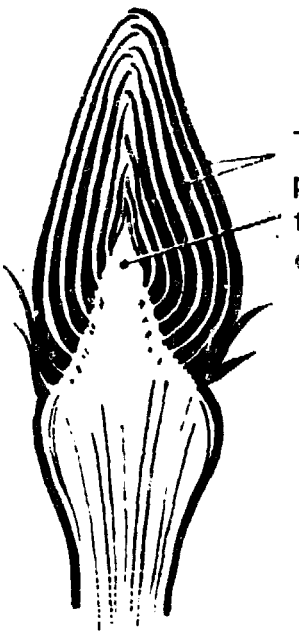
THE BUDS

How buds are made

A bud is made of
little leaves;
they are hard
and very closely packed
and called **scales.**

These scales
are stuck together.

They protect
the inside of the bud.



The scales protect the inside of the bud.

What are buds for?

Flowers come out of certain buds.
These are called **flower buds.**

Leaves or shoots come out of certain buds.
These are called **leaf buds.**

Where are the buds?

They are at the tip of the stem and on the stem.

- Those at the tip of the stem
  enable the stem and shoots to grow.

- Those at the base of the leaves
  produce shoots, leaves and flowers.

THE LEAVES

Where are the leaves found?

- Leaves grow
  from **leaf buds.**

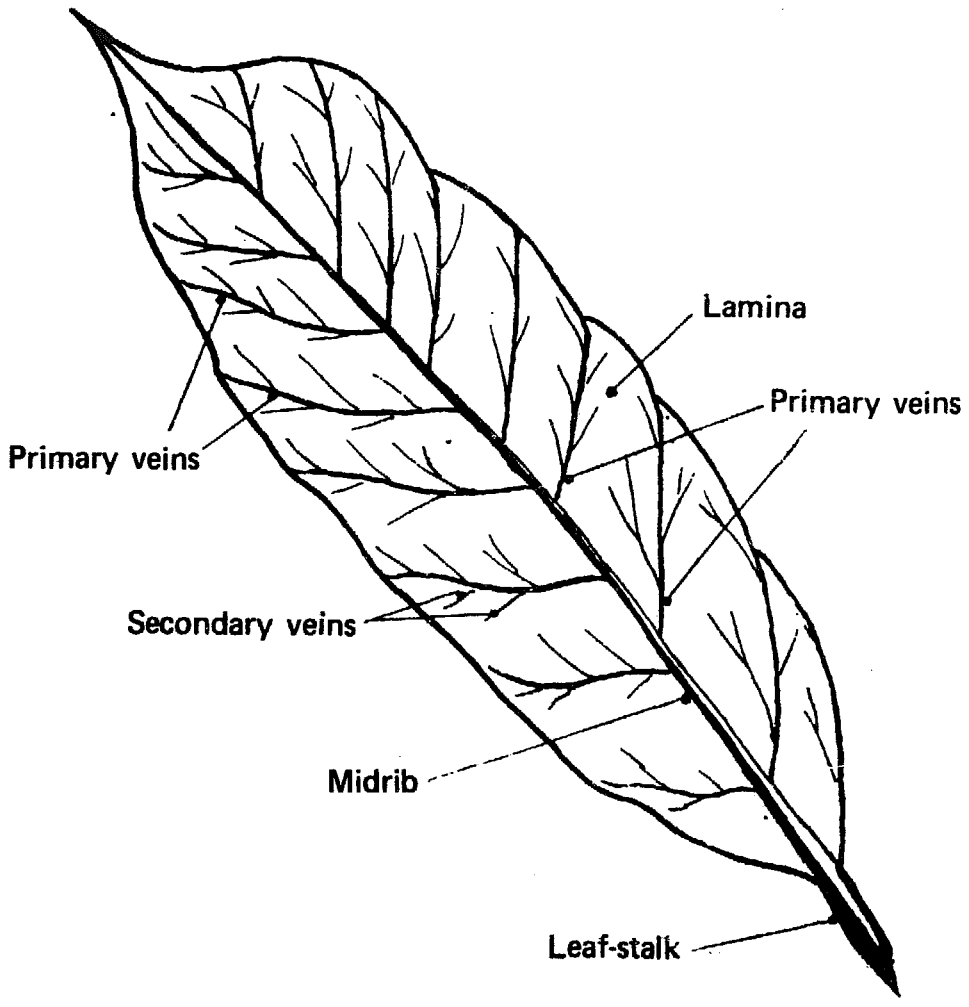
- Leaves are found
  on **stems**
  and side shoots or branches.

- They are joined to the branches
  by the **leaf-stalk.**

How a leaf is made

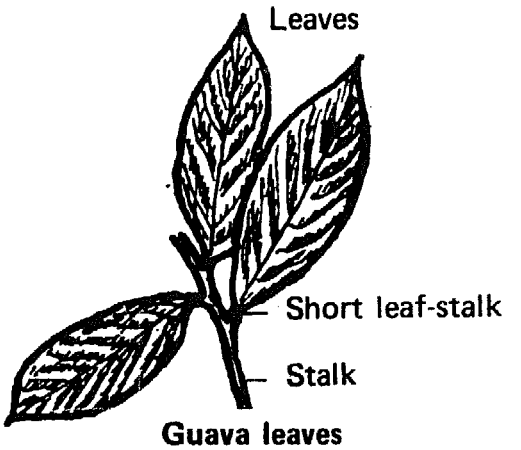
Pick up some leaves of a mango tree or coffee tree.
Let us look at them.

- Leaves are usually of a **green colour,** more or less dark.
- They are joined to the stem by a stalk called the **leaf-stalk.**
- The leaf-stalk is continued into the leaf by the **midrib.**
- Other smaller veins branch out from the midrib. These are the **primary and secondary veins.**
- The whole flat part of the leaf is called the leaf blade or **lamina.**



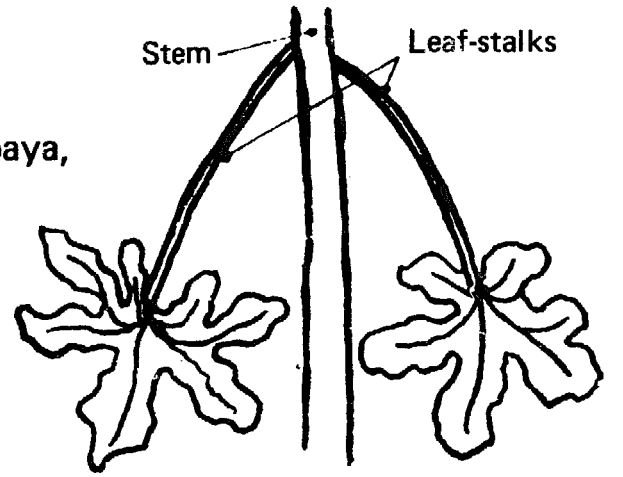
THE LEAF-STALK

Some plants have
a **short leaf-stalk.**
For example,
coffee,
orange,
hibiscus,
guava.



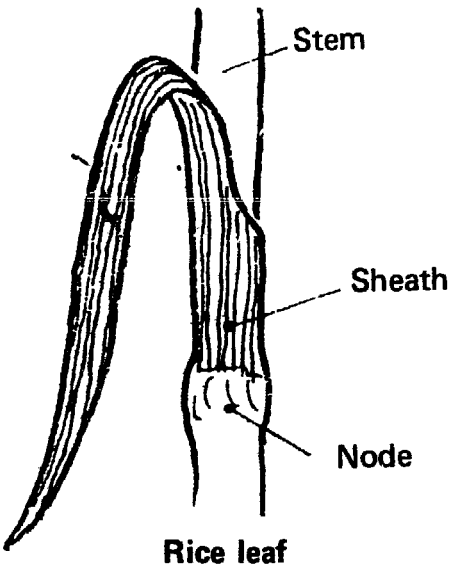
Guava leaves

Some plants have
a **long leaf-stalk.**
For example,
papaw or papaya,
sweet potato



Papaya leaves

Some plants
do not have a leaf-stalk.
The leaves of maize,
millet or rice
surround the stem.
There is no leaf-stalk.



Rice leaf

THE VEINS

In the middle of the leaf there is the midrib.

On each side of the midrib
other veins branch off.

These are the **primary veins.**

They are smaller. These primary veins
divide into many still smaller veins.

Perhaps you have seen a leaf
that has been eaten by insects.
The leaf tissue has gone and only the veins are left.
It is like a spider's web.

What are the veins for?

They carry the sap.

The sap passes along the stem vessels.

Then it enters the vein vessels.

Cut a palm frond and you will see the sap flow.
The vessels of the palm frond
carry the sap.

In a man's body, the vessels carry the blood.

In a plant, the vessels carry the sap.

Sap is the blood of plants.

The shape of leaves

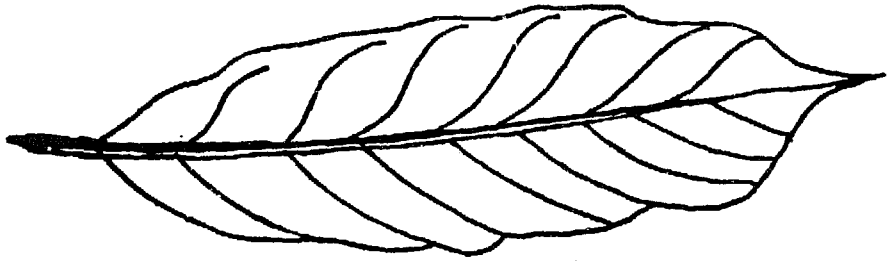
The leaves of yam are not like those of cassava.

You can recognize a plant by looking at the leaves.

Leaves are simple or compound.

- **Simple leaf**

  The simple leaf can be entire or lobed.



Entire simple leaf

Examples: yam
millet
okra
hibiscus
maize
cocoa
teak
coffee

Lobed simple leaf

Examples: cassava
cotton

• Compound leaf

Look carefully at the drawing of a groundnut leaf.

What it shows is not four groundnut leaves.

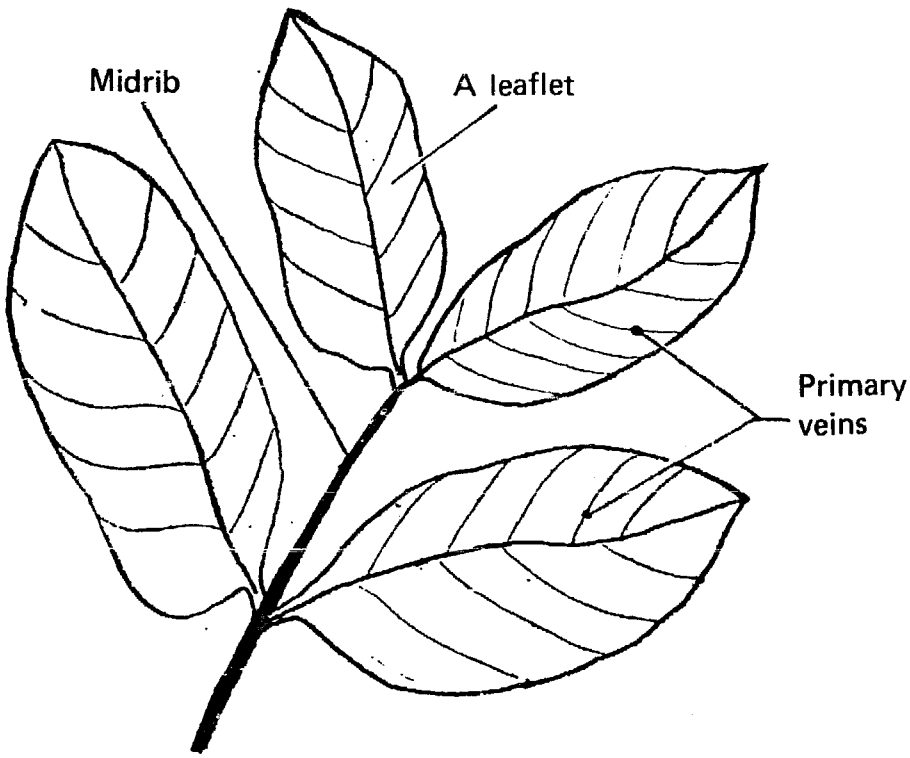
It is a single leaf.

But this leaf is made up of
a midrib bearing
four little leaves.

These little leaves are called **leaflets.**

The midrib of a compound leaf is not a stem.

So there is never a bud between the midrib and the leaflets.



A groundnut leaf

What are leaves for?

To live, a man feeds
and breathes.

To live, a plant also feeds
and breathes.

THE PLANT FEEDS

- The plant takes up food from the soil
through its roots.
It takes water and mineral salts from the soil
(see Booklet No. 1, page 17).
But it has to **change** the water and mineral salts.

A baby drinks only milk.
Its hair grows
and so do its arms and legs.
It becomes strong and heavy.
The baby has changed
the milk in its stomach
into hair, fat, muscles, etc.

- The leaf changes the water and mineral salts
taken from the soil by the roots.
Water and mineral salts make up the **raw sap**
(see Booklet No. 1, page 19, and Booklet No. 2,
page 21).

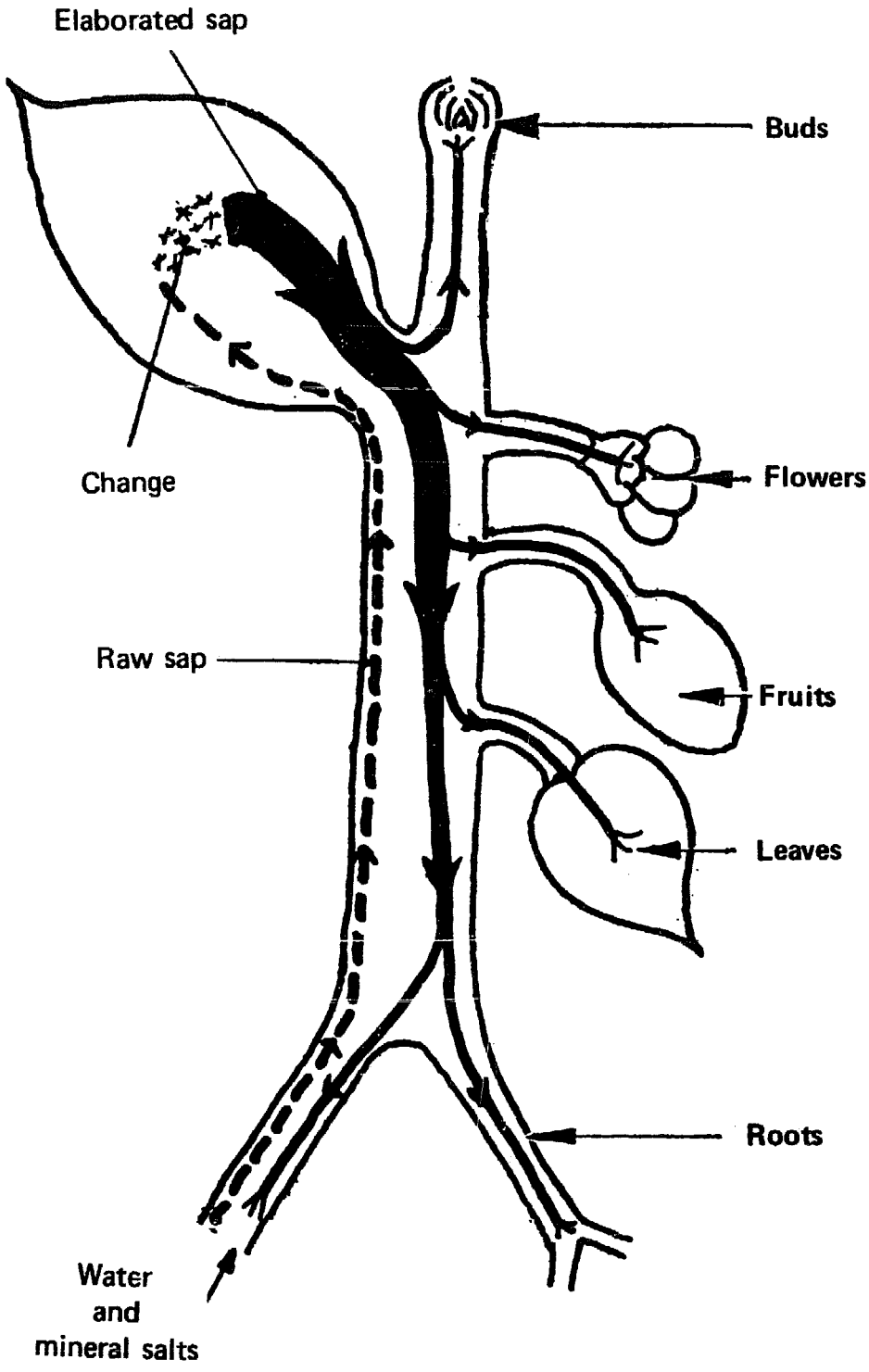
The leaf changes the raw sap into **elaborated sap.**

The leaf sends the elaborated sap into the buds,
flowers, fruits, stem and roots.

The elaborated sap feeds the whole plant.

- **The leaf changes the raw sap into elaborated sap.**

The elaborated sap FEEDS: ⟶



HOW THE LEAF CHANGES RAW SAP INTO ELABORATED SAP

- **The leaf feeds the plant.**

  It receives the raw sap;
  it changes the raw sap into elaborated sap.
  This change is called
  plant material synthesis.

What is plant material synthesis?

- Heaps of sand, wood and bricks
  are not a house.
  To build a house
  you have to put them together.
  You join them with cement.
  The cement changes the wood, sand and bricks
  into a house.

- Water and mineral salts
  cannot feed the plant.
  They have to be put together,
  they have to be joined.

How are water and mineral salts joined together?

- The leaves live in the air.
  The air contains **carbon dioxide gas.**
  The carbon dioxide gas
  is made of oxygen and carbon.
  The leaf keeps the carbon
  and gives off oxygen.

- **The carbon joins the mineral salts and the water.**
  The mineral salts and water
  are changed into elaborated sap.
  The elaborated sap can then feed the plant.

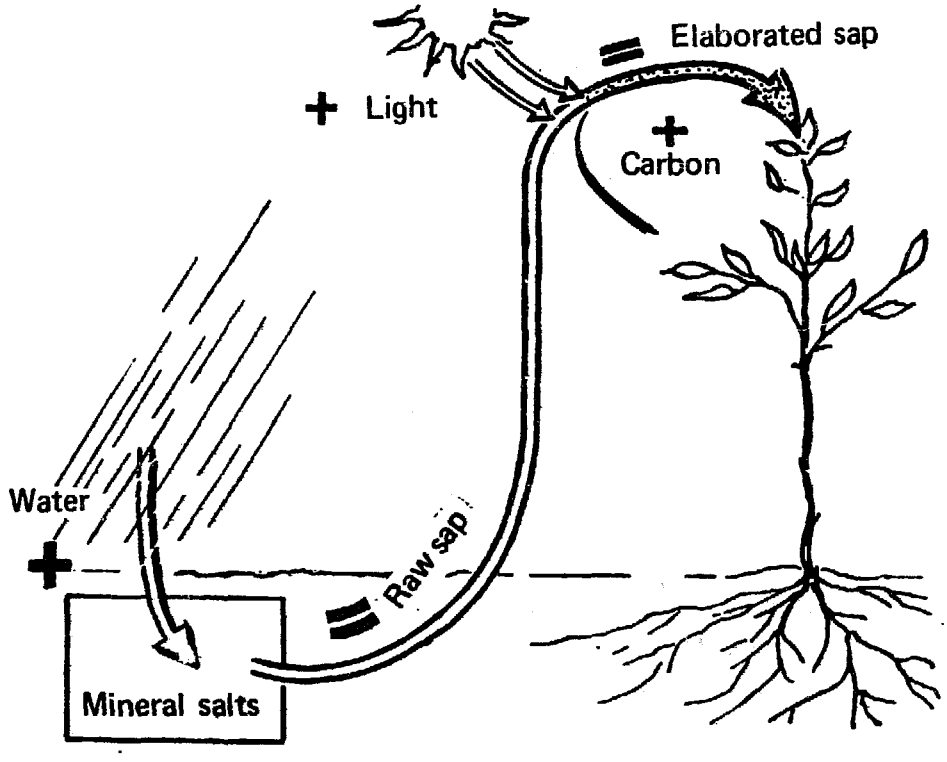
The carbon changes
the raw sap into elaborated sap.
This is **plant material synthesis.**

To join sand, wood and bricks with cement
requires **work.**
You can't have a house
without men's work, men's energy.
To join water and mineral salts with carbon
also requires work and energy.

- **Light** gives the leaf this energy.

Light enables the leaf
to change raw sap into elaborated sap.

At night there is no light,
and the raw sap is not changed.



ORGANIC MATTER IN THE PLANT

The plant gets water and mineral salts
from the soil.
This is **inorganic matter.**

This inorganic matter is changed
by light and carbon
and becomes elaborated sap.

The elaborated sap feeds the plant.
Just as blood enables a man
to make his muscles, hair, bones,
so elaborated sap enables a plant
to make leaves, wood, fruits.
The leaves, the wood, the fruits
are **organic matter.**

Inorganic matter has become organic matter.

The plant breathes.

To live,
a man feeds and breathes.

To live,
a plant also feeds and breathes.

A plant breathes through its leaves.

The plant transpires.

When it is hot,
a man sweats, he transpires.

A plant also transpires.
The water in the sap evaporates,
the leaf gets dry.

The plant is thirsty.

SOME PRACTICAL APPLICATIONS

The plant needs air and light

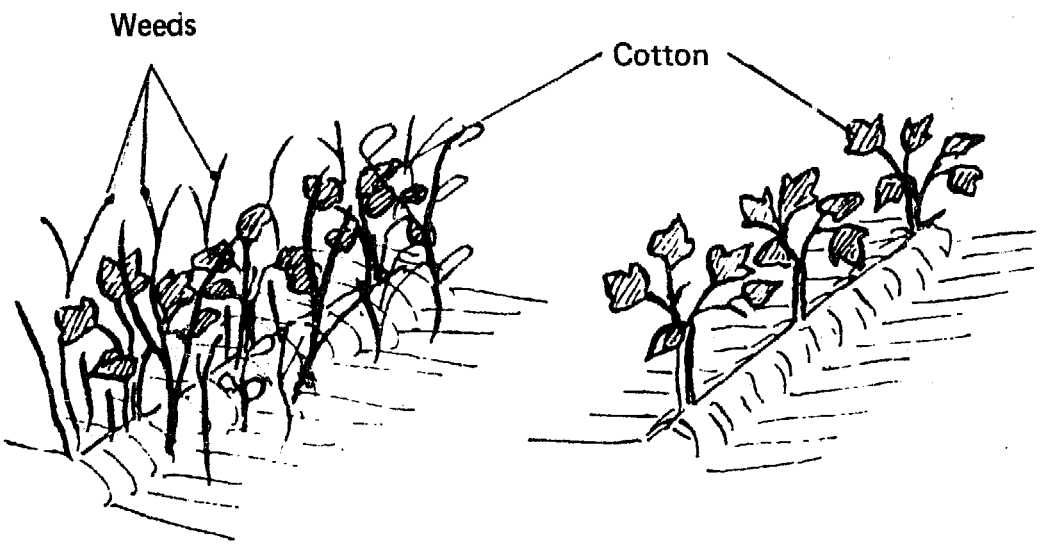
If a plant is not in the light,
it does not grow well.

Light does not come through the leaves
of a dense mango tree,
and almost nothing grows under it.

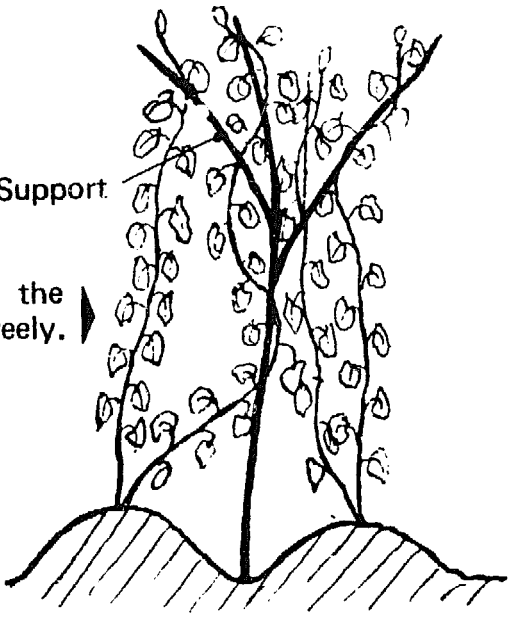
Grass needs light to grow.

Plants get most good from air and light:

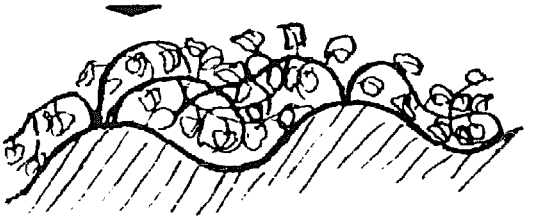
- if you pull out weeds;
- if you prune trees such as coffee, cocoa.
- if you grow crops on fairly high ridges,
  as with groundnuts, cotton, salad plants.
- if you make stems climb on sticks or branches,
  for instance, cowpeas,
  tomatoes,
  yams.



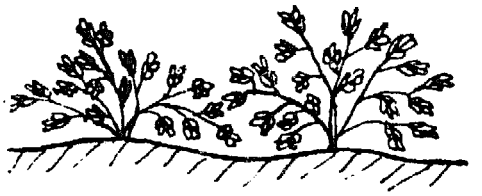
With good air circulation,
there is less disease.
Well ventilated plants
resist disease better.



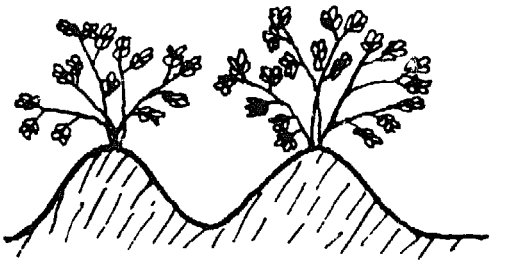
Yam trails on the ground.
Air does not circulate.

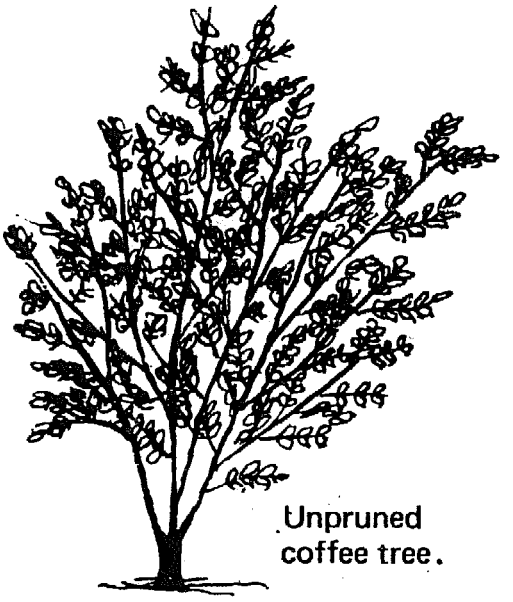


Groundnuts not earthed up.
Air does not circulate freely.



Groundnuts on ridges





Unpruned coffee tree.

Pruned coffee tree. Air circulates freely.

The plant needs water

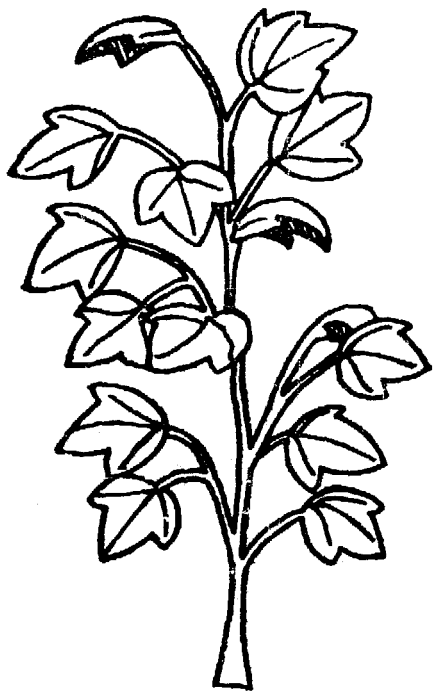
When there is not enough rain,
the roots cannot find water,
the leaves wilt,
the plant grows badly.

If there is a great lack of water,
the harvest is very poor.

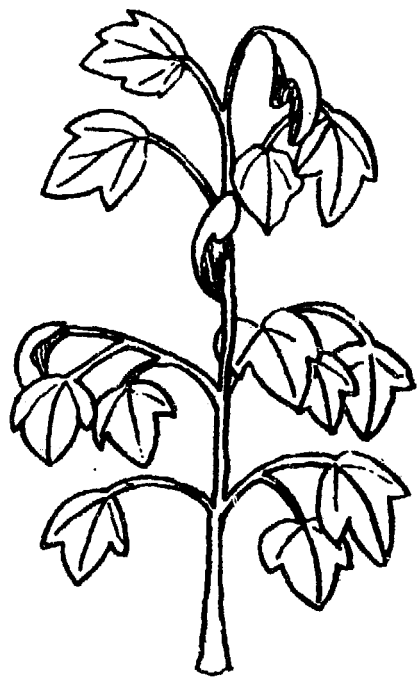
The plant feeds badly.
It does not produce many fruits or seeds.
It may die.

You understand now why you have to give the plant water.

When there is enough water, the plant grows well;
it produces plenty of seeds or fruits.

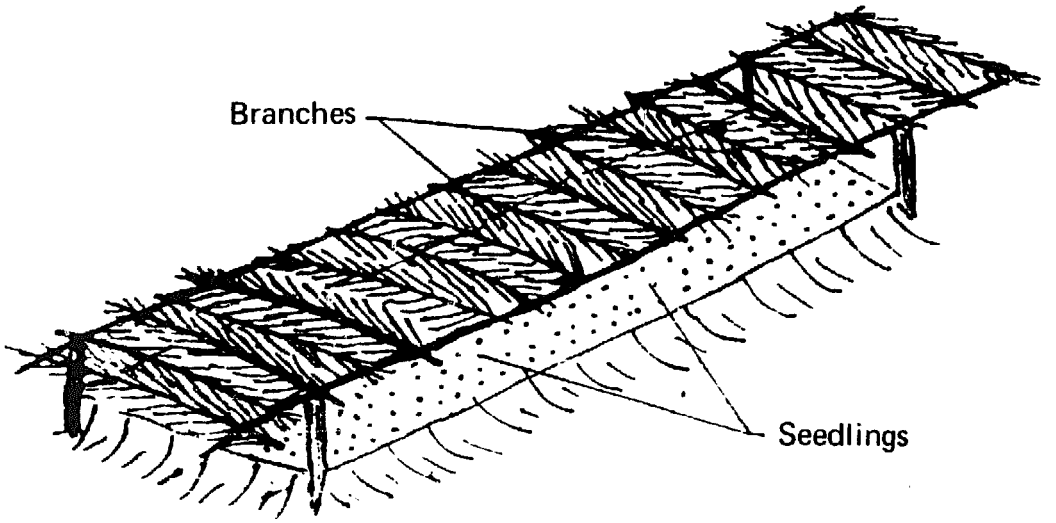


The plant has plenty of water.
It grows well.



The plant lacks water.
The leaves wilt.
The plant grows badly.

Young plants do not have many roots.
They cannot seek out water that lies very deep.
They wilt quickly if they are left in the sun.
Seedlings must be protected by covering them,
for instance, with branches.
Seedlings must be well watered.



The plant needs its leaves

If a plant has many big leaves,
the harvest will be good.

If a plant has few, small leaves,
the harvest will be less good.

Plants sown at the best density
(see Booklet No. 1, page 26)
will have the best leaves.

The roots will find enough food,
and the leaves will change this food into organic matter,
and the harvest will be good.

When plants of cotton or maize
are too close together,
the surplus plants are removed.

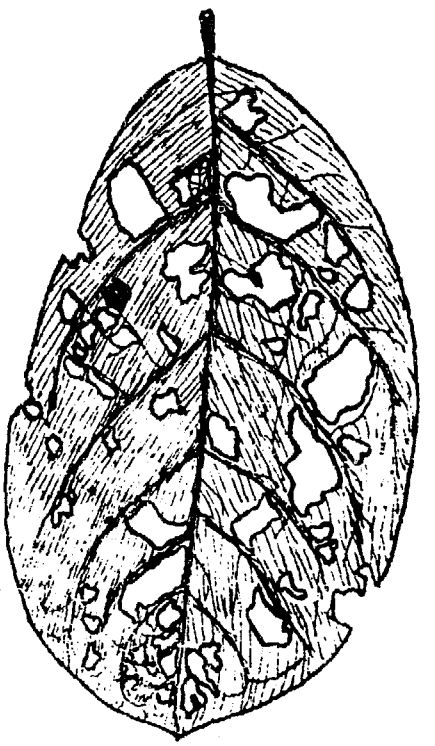
- **Some insects eat leaves and buds.**

Young leaves are eaten first,
because they are not hard.

When the insects are born,
the plants should already be strong.

The leaves, being harder,
will be less attacked.

Plants sown at the right time
will be strong
when the insects appear.



Leaf eaten
by insects

- **Insects and diseases can be destroyed.**

You should pull out diseased plants.

Let them dry.

Burn them.

Insects and diseases are killed by fire.

Certain seeds produce strong plants.

These strong plants
resist diseases and insects better

Sow seeds
which resist diseases and insects.

To kill insects or to prevent diseases,
pesticides can be used.
These pesticides are poisons.
You cover the leaves with them and the insects are killed.
Often you need a sprayer,
so that the pesticide covers
the whole plant.

These pesticides can be dangerous
to men and animals.
You have to be very careful.

You must use exactly the quantity written on the containers,
no more and no less.

- **Animals also eat leaves.**

Leaves and plants must also be protected against animals,
such as goats, cows, agoutis, monkeys.

Put fences round the fields,
keep a watch on cows and goats;
put them in a paddock.

SUGGESTED QUESTION PAPER

FILL IN THE MISSING WORDS

The stem

The part of the plant that lives in the air is called .....

It bears .....flowers and fruits.

The leaves

Leaves change the ..... sap into ..... sap.

Leaves take ..... from the air.

Carbon joins the ..... and the water of the raw sap.

The raw sap ..... elaborated sap, and it can then ..... the plant.

A good farmer protects his plants. He destroys the ..... which attack crops.

He does not leave ..... at liberty.

Animals at liberty ..... leaves; they ..... crops.

ANSWER THE FOLLOWING QUESTIONS

How is a groundnut stem made?

How is a cotton stem made?

What is the stem for?

What can you do so that a plant gets the most good from the air and light?

Where are the buds?

Explain to a friend what leaves are for.

What is elaborated sap?

What can you do to protect your plants from insects and animals?

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