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market gardening



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.

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

market gardening

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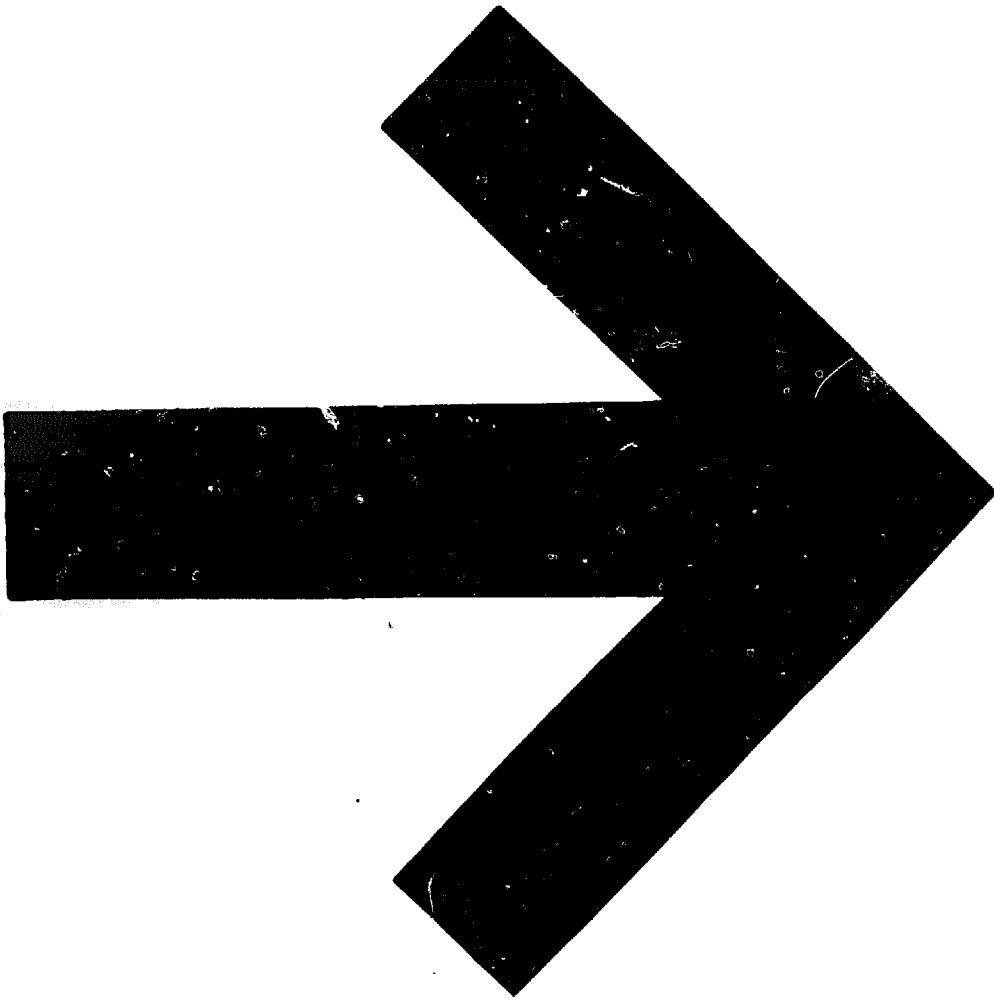
PREFACE

This manual is a translation and adaptation of "La culture maraîchère," 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 Asun Balzola.



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MARKET GARDENING

When a lot of vegetables are grown for sale at the markets in towns, this is called **market gardening**.

Kitchen gardening means growing vegetables for the family to eat.

The field where these vegetables are grown is called a kitchen garden.

Why vegetables are grown

- 1. Vegetables add to the diet a lot of mineral salts and vitamins.** People need vitamins for good health.

If you eat a lot of vegetables, you supply your body with vitamins and a lot of mineral salts. If you want to keep your good health, you must often eat vegetables.

- 2. Vegetables can be sold at a good price.**

By doing your work well, you can produce enough vegetables for the family, and you can sell those vegetables which you produce in excess of what the family needs.

To grow vegetables gives no more work than to grow other crops, but, to be successful, you must know thoroughly how to do it.

The man who produces vegetables is called a market gardener.

Not all the parts of the vegetables that are grown are used as food for people.

Some vegetables are grown c for

3. Leaves and stems

Examples are spinach, lettuce, onions, leeks.

4. Roots

Examples are carrots, turnips.

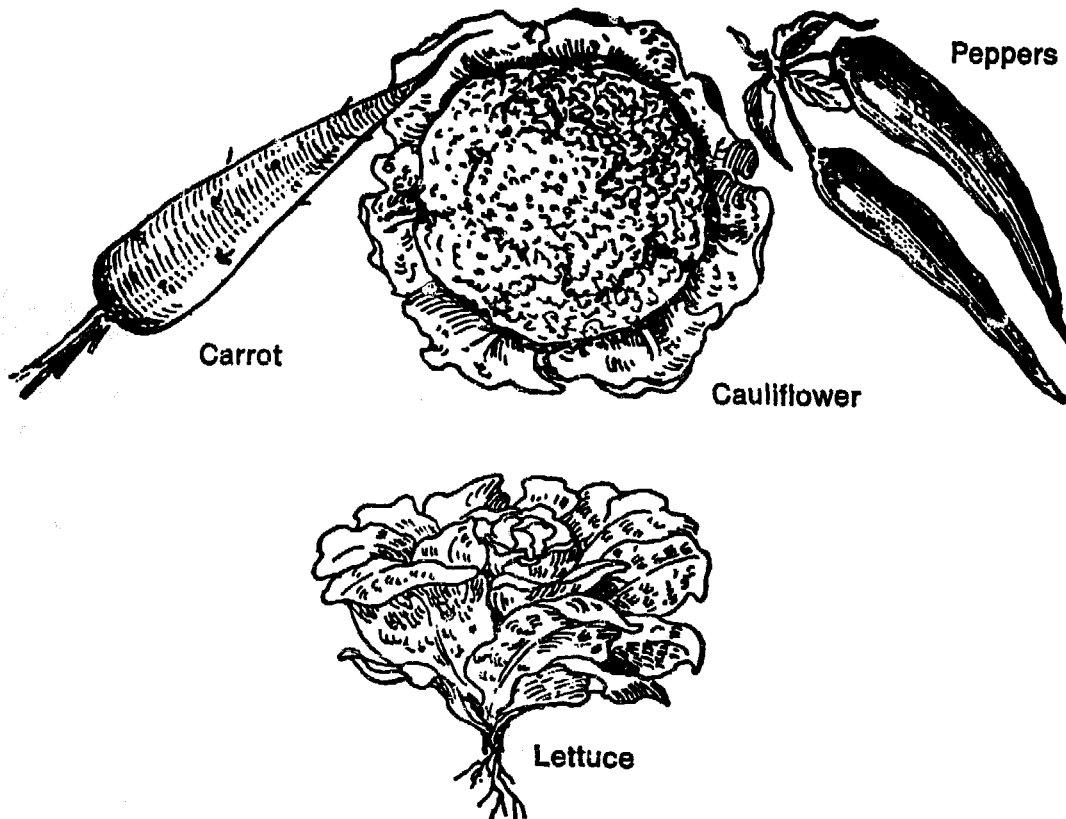
5. Flower heads

An example is the cauliflower.

6. Fruits

Examples are tomatoes, green peppers, beans, okra.

In this booklet you will learn how to grow vegetables successfully.



CHOOSING THE SITE

The kitchen garden should be situated

7. as near as possible to the house

If you want to harvest a lot of vegetables of good quality, you will have to look after them very well. You will have to go often into your kitchen garden. If the kitchen garden is near the house, you lose less time.

8. as near as possible to a source of water

This may be a spring, river, little stream, well or artificial reservoir.

The soil must always be damp.

It will have to be watered often even during the rainy season.

9. protected against wind, sun and heavy rain

It is well to put up a fence of millet stems or palm fronds around your vegetable garden so as to protect it better.

But vegetables do not grow well if you leave too many trees on the field or if you plant small trees to fence off the vegetable garden.

The roots of the trees take nourishment out of the soil, so that the vegetables have less.

WHAT TOOLS TO USE

10. The tools used for vegetable crops can often be made in the village, and so they cost less. There are many different tools that can be used. If you have these tools, you can do your work better and more quickly.

Tools can get damaged and are easily lost. When you have finished working, clean them and put them away tidily so that they will keep better.

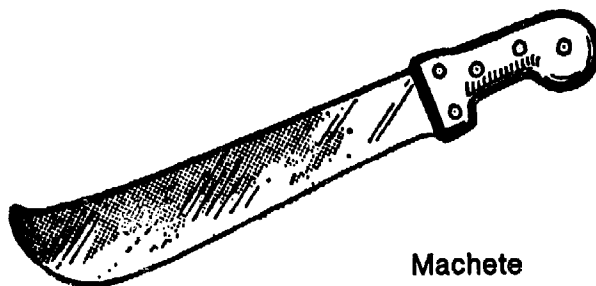
11. **The main tools used in vegetable growing.**

The machete is used for clearing the field, for cutting and for trimming.

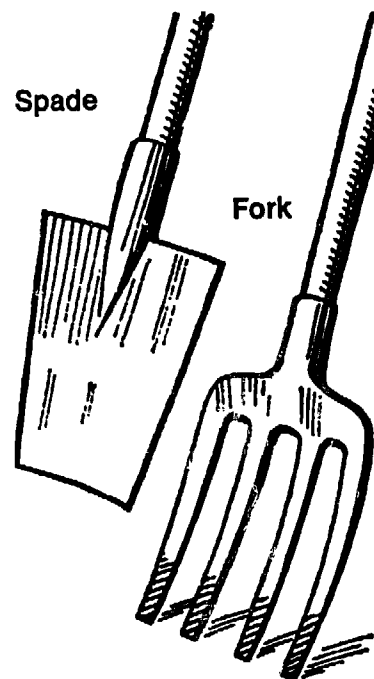
The spade is used for working the soil.

When the soil is clayey or contains a lot of stones, it is better to use the **digging fork**.

The digging fork is also used for applying manure.



Machete



Spade

Fork

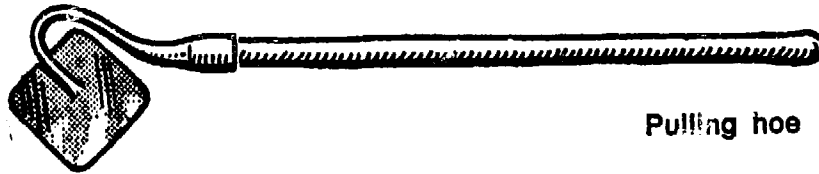
The digging hoe is used for many purposes: to break up lumps of earth when the soil is dry, to prepare the beds and earth up the plants.

For removing stones, you can use a **forked hoe**.

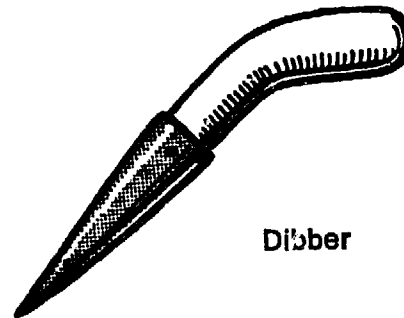
The pulling hoe is used for weeding and intercultivating between the rows.

The dibber is used for transplanting seedlings.

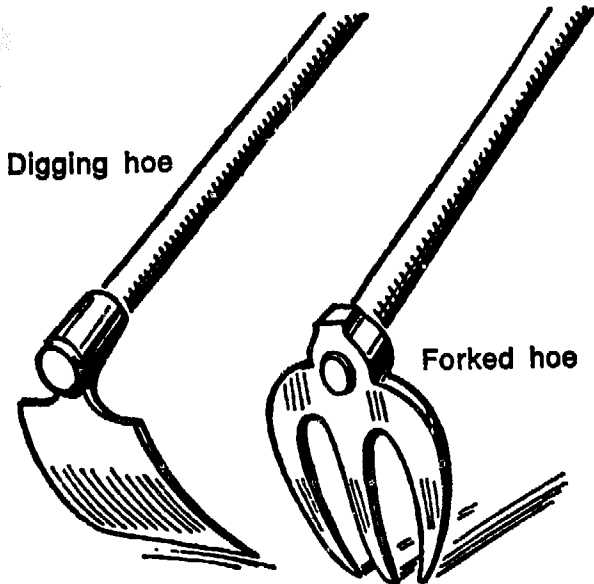
The watering can is used for watering vegetables without damaging them. The watering can has to be fitted with a rose.



Pulling hoe

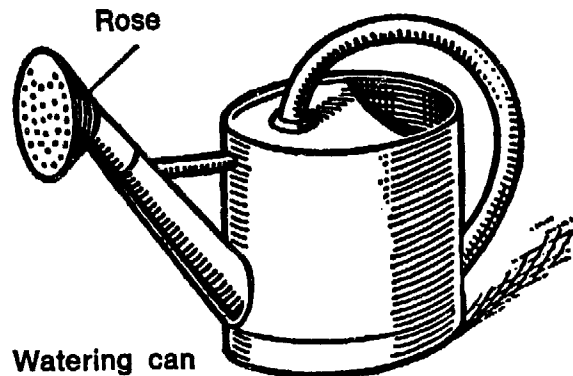


Dibber



Digging hoe

Forked hoe



Watering can

There are other tools which may be very useful.

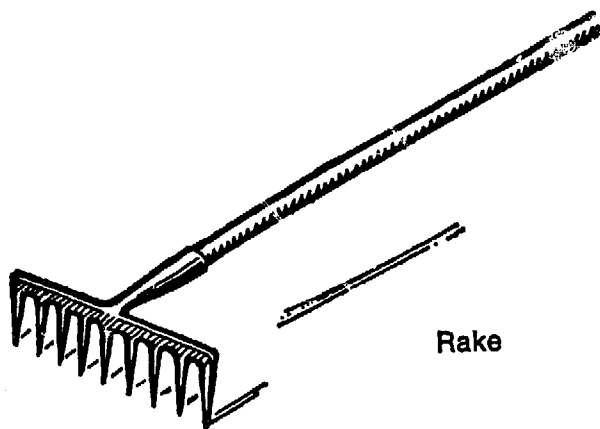
The rake is used to break up clods, to level the beds, to cover up seeds after sowing.

The tamper is a wooden board used for firming the soil after sowing.

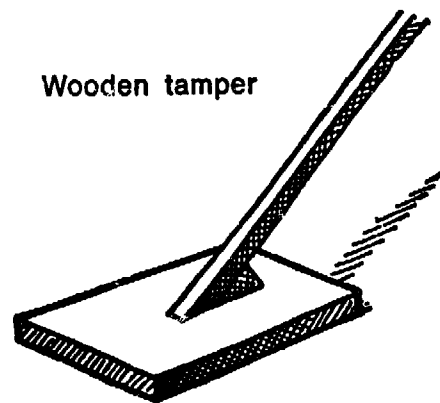
Length of cord is used for tracing straight lines for sowing and transplanting.

The wheelbarrow is used for carrying manure, compost, fertilizers, etc.

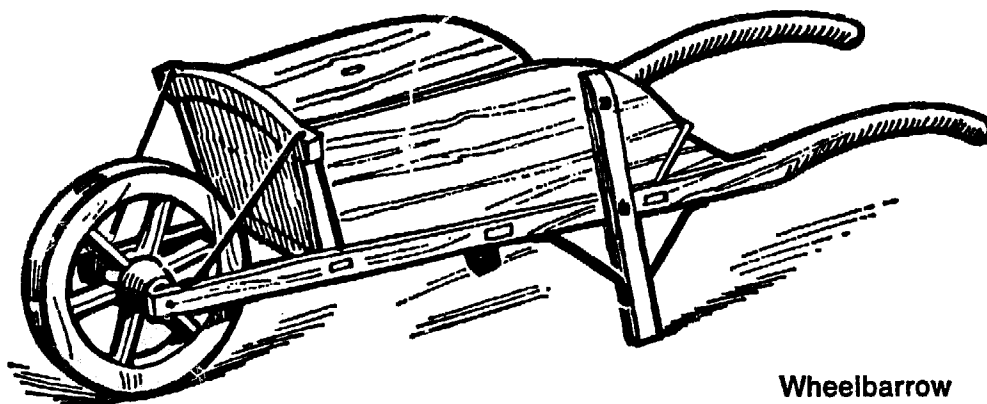
The powder duster is used for applying dusts for pest control.



Rake



Wooden tamper



Wheelbarrow

CLEARING THE PLOT

- 12.** Before sowing, remove all the plants and trees on the plot. Shade and the roots of trees prevent vegetables from growing well.

Roots of trees take out of the soil mineral salts which should feed the vegetables.

Trees also harbour insects which may eat the vegetables.

TILLING

- 13.** Before sowing, you must also work the soil with the spade or the hoe.

But do not turn over the soil. If you turn over the soil, you put on the top those layers of the soil that contain less humus and are of less good structure.

If you till deeply, you must put manure into the soil so as to improve the poorer layers underneath.

Working the soil well means that you let air and water into the earth, mix in manure (see paragraphs 33 and 34) and destroy weeds.

If the soil is too wet, you must wait a little before tilling.

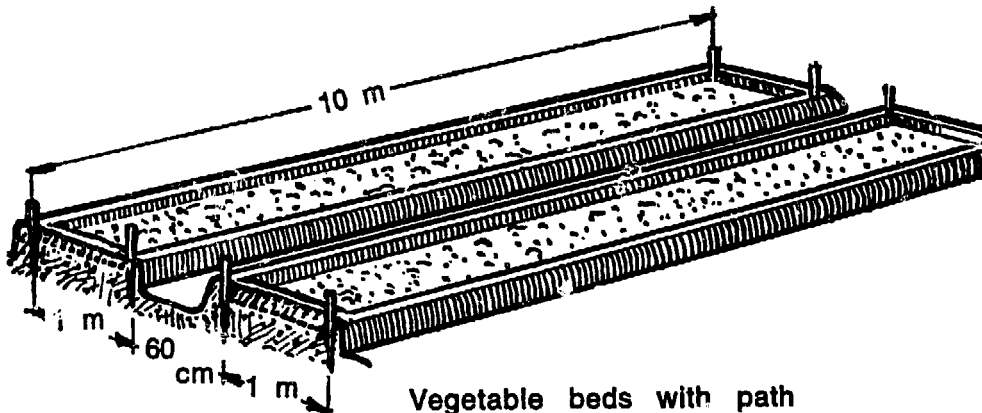
PREPARING THE BEDS

- 14. A bed is the name for one of the small plots on which vegetables are grown.**

Use a length of cord to trace out the beds and put pegs in the earth at the four corners of each bed. Each bed should be 1 metre wide.

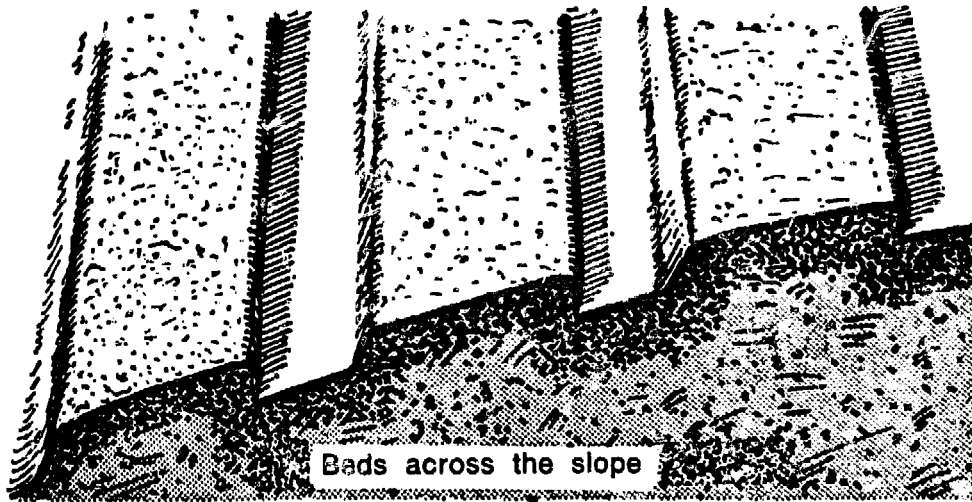
In this way you can sow and look after the plants in the middle of the bed without damaging your vegetables.

Between the beds, leave room for a path. For example, leave 60 centimetres so that you can get through with the wheelbarrow.



If the plot is large and flat enough, make your beds 10 metres long. Then you will have beds 1 metre wide and 10 metres long; that is, 10 square metres (m^2). For each bed of $10 m^2$, add 30 kilogrammes of manure to the soil (roughly the contents of a wheelbarrow).

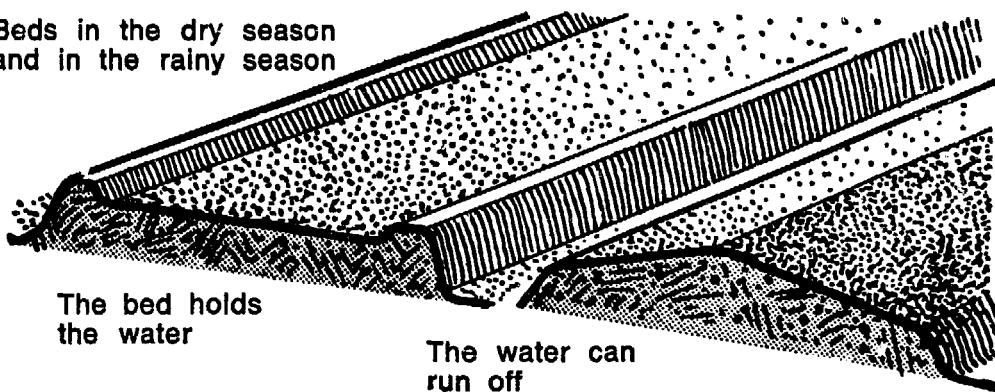
If the plot is on a slope, make the beds across the slope.



When you have marked out your vegetable beds, remove the stones, break up the clods of earth with the forked hoe or the rake, so that the surface is quite flat.

Then firm down the earth, for example with the tamper.

Beds in the dry season
and in the rainy season

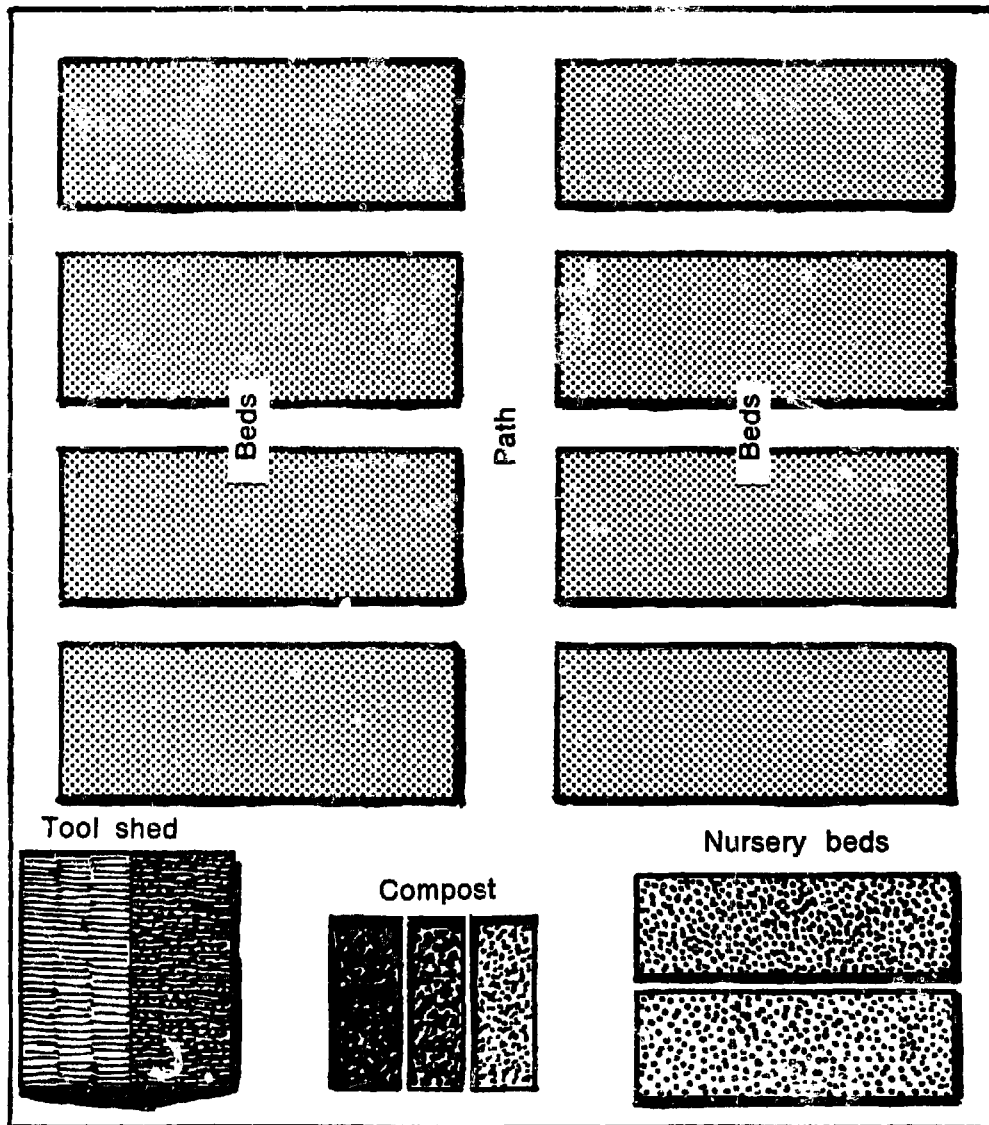


15. Decide where in your garden you will place:

- nursery beds,
- compost pits,
- tool shed.

Put up a fence.

This can be made with posts, millet stems, maize stems, palm fronds.



Layout of a kitchen garden

SOWING

- 16.** With traditional methods, market gardeners use the seeds of their own harvests.
With modern methods you buy selected seeds every year.

Like that, you can produce better vegetables that can be sold more easily.
The seeds are sown either directly in the open beds or in a nursery bed.

17. Sowing in open beds

Certain vegetables do not need to be transplanted. They are sown, they grow and ripen, and are harvested all at the same place. Examples are carrots, beans, okra, radishes.

18. Sowing in a nursery bed

The nursery bed is a bed set aside for sowing seeds. When the seeds have grown into young seedlings, these seedlings are transplanted into another bed.

Examples are green or sweet peppers, lettuces, tomatoes, leeks, cabbages.

Push the big seeds deeper into the soil than the small ones.

For example, push the seeds of okra and beans 3 centimetres deep into the soil, and the seeds of lettuces and leeks 0.5 centimetre.

Then firm the soil well over the seeds.

**19. Seeds can be broadcast,
sown in rows,
sown in seed holes.**

● **Broadcasting**

The seeds are thrown and fall just anywhere in a haphazard way.

Sometimes the plants are too close and get in each other's way when they grow.

Sometimes the plants are not close enough. They do not use all the soil.

If you broadcast your seed, you may not get the right density, and you cannot weed and hoe well.

● **Sowing in rows**

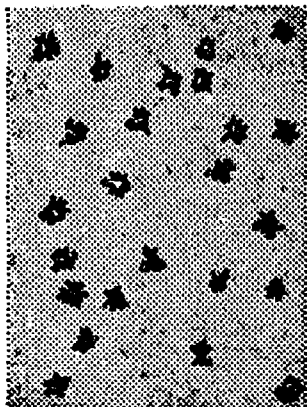
Lines are traced with the cord and the seeds sown along the lines.

The distance between rows varies according to the size of the vegetables.

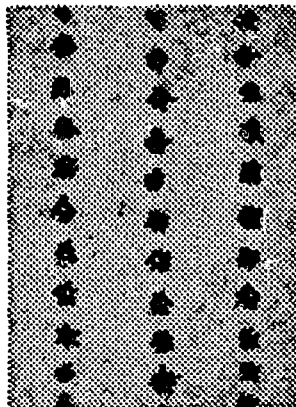
● **Sowing in seed holes**

Little holes are made along the lines, and one or several seeds are placed in each hole.

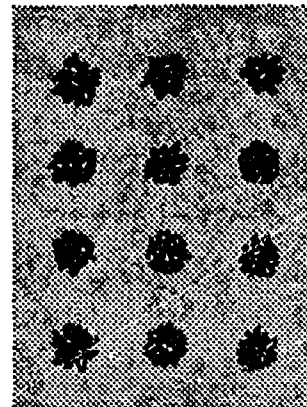
The distance between holes is different according to the size of the vegetables.



Broadcast seeds



Sowing in rows



Sowing in rows
and seed holes

TRANSPLANTING

- 20. Transplanting means taking a seedling out of the nursery bed and planting it elsewhere.**

Certain vegetables are generally transplanted; for example, tomatoes, cabbages.

The purpose of transplanting is to give each plant more space.

Then the plant can develop its roots and leaves better. The distance left between plants varies according to their size.

The best way to transplant seedlings is to:

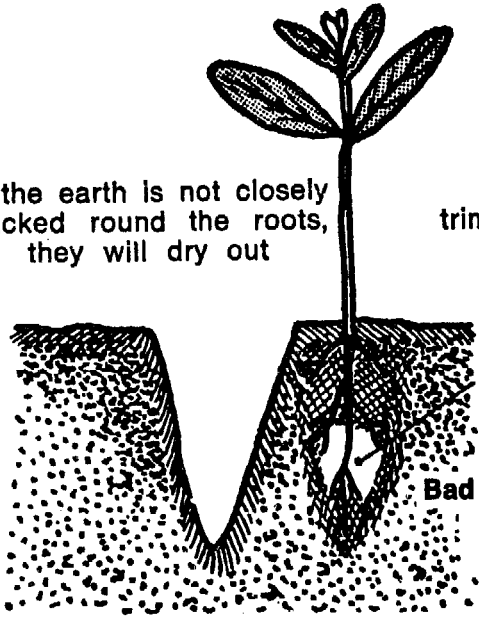
- thoroughly water the nursery bed, so that you can lift the seedlings more easily
- be very careful not to break the roots of the seedlings when you lift them
- choose only those seedlings that have grown best
- prepare the seedling by trimming off part of the roots and leaves
- transplant the seedlings into holes made with the dibber, and bury the roots up to the crown
- pack the earth down well around the plant
- water the transplanted seedling thoroughly.

Make a little shelter to protect your transplanted seedlings against rain and sun.

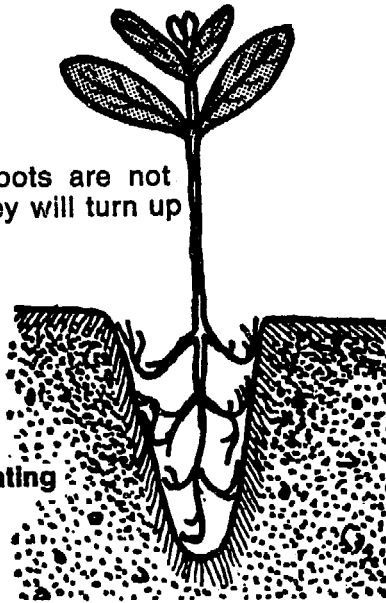
The seedlings you have not transplanted should be kept in the nursery bed for replacing any transplanted seedlings which do not grow.

It is best to transplant late in the day, when not so hot.

If the earth is not closely packed round the roots, they will dry out



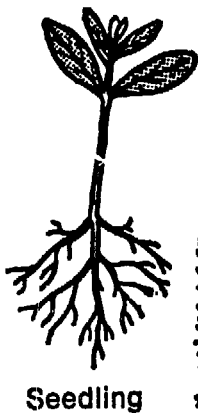
If the roots are not trimmed, they will turn up



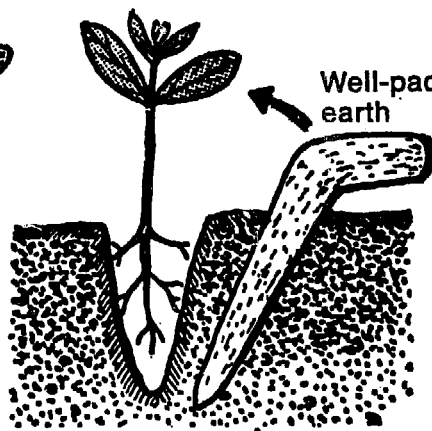
Hole

Bad transplanting

Good transplanting

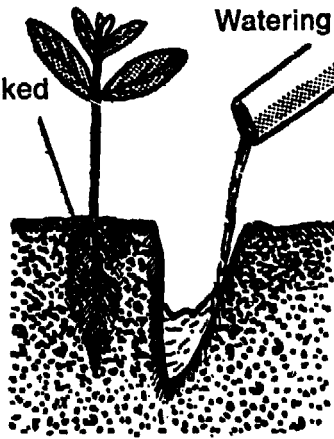


Seedling



Well-packed earth

Roots are trimmed a little, so that they fit more easily into the hole



Watering

Well-transplanted seedling

TAKING CARE OF THE VEGETABLE CROP

21. Watering

Vegetables need plenty of water to develop their roots and leaves.

Vegetables do not grow well in dry soil; the soil of the beds must always be moist.

In the dry season, each bed of 10 square metres needs about 7 watering cans full of water every day.

Watering can be done either with a watering can or by irrigation.

Your watering can should have a rose with very fine holes.

Like that, you can get the water everywhere onto the leaves, the plant will be well watered and you use less water.

The seedlings in the nursery bed, which are delicate, will not be damaged.

If you have a lot of water, you can also water by irrigation.

The water flows along ditches dug between the beds. This is a very good way of watering for vegetables whose fruits are eaten, for example, tomatoes.

22. Weeding and earthing up

Watering a lot means that weeds will grow. Furthermore, the water compacts the soil and a hard layer of earth may form.

Weeds take the nourishment (mineral salts) of the vegetables out of the soil. Weeds must be removed often.

This is what cultivating is for. Cultivating is done with the pulling hoe.

By cultivating you break up the layer of dry earth that keeps air out of the soil.

23. Earthing up means heaping up soil around the base of the plant.

Like that, the roots of tomatoes and beans, as well as tubers, like potatoes, can grow well.

With certain plants, for example leeks, covering up part of the plant with earth keeps the plants white and prevents them from becoming tough.

Cultivate often, so as to remove all weeds and loosen the soil.

24. Mulching

In order to protect the soil from the sun and to enrich it with organic matter, cover the soil with straw or herbage. This is called **mulching**.

When you water, the soil will stay damp and the herbage will rot.

25. Tying

Certain vegetables are softer and sell at a better price when they are blanched.

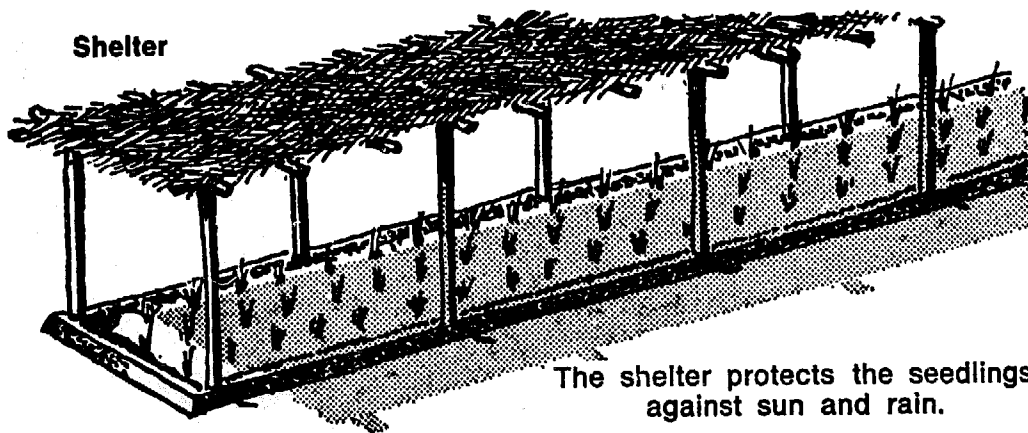
You can prevent them turning green by tying together the leaves — for example, endives; or by covering the base of the plant with earth — for example, leeks.

This is discussed in paragraph 53.

26. Putting up shelters

In regions where the sun is very hot, or the rain very heavy, the young plants must be protected.

Over every vegetable bed, put up a shelter made of palm fronds or matting.



The shelter protects the seedlings against sun and rain.

27. Thinning

When the young seedlings are too close to each other, they do not grow well. They do not find enough nourishment in the soil and their leaves do not have enough room to develop.

Leave only the strongest plants and remove the others. This is called thinning.

When you take out the seedlings that are small, diseased or misshapen, be very careful not to damage the seedlings which remain in the beds.

At the end, pack down the earth around the base of the plants and water them.

28. Staking

Vegetables with long and weak stems, for example beans and tomatoes, need stakes.

A stake is a stick firmly embedded in the earth. It is best to use hard wood, which does not rot.

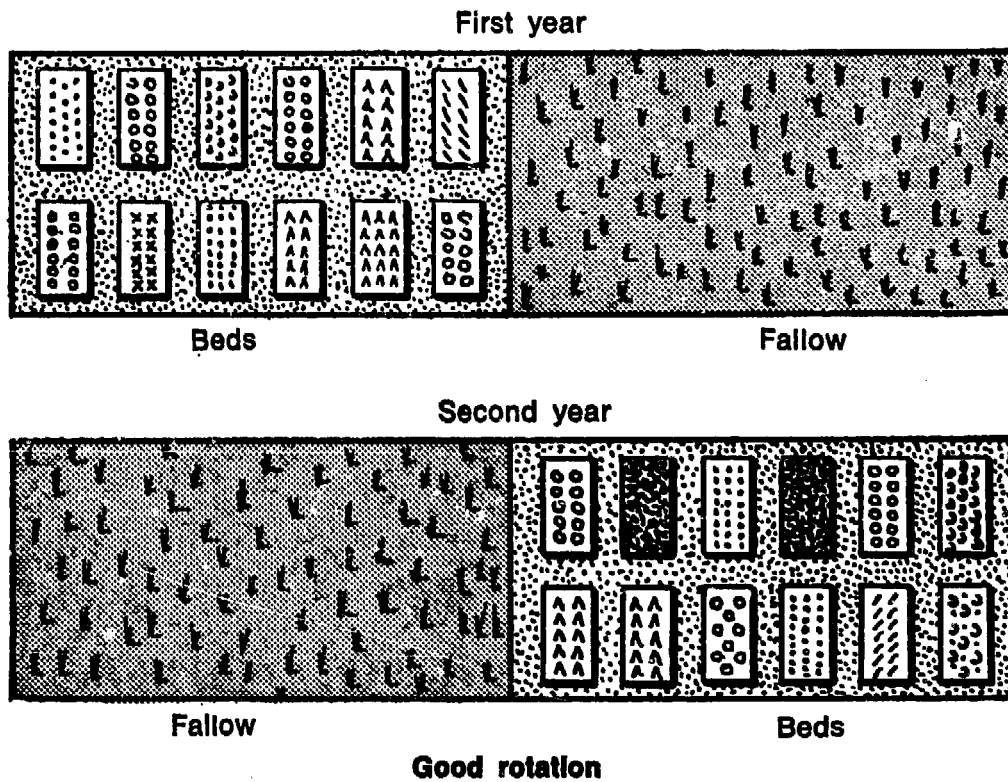
29. Pruning

Certain vegetables, like tomatoes, beans, eggplant, need pruning.

Nip off surplus buds. Then there will be more fruits and they will be bigger.

IMPROVING SOIL FERTILITY

30. A market gardener who does not have much money for buying fertilizers can still improve the fertility of the soil by a good crop rotation. If the rotation is not good, the fertilizers are wasted.
31. If your vegetable garden is large enough, divide it into two parts, and every year grow vegetables only on one part, leaving the other part fallow or sowing it with cover crops.
- Like that, each part of your vegetable garden produces one year and rests the next year, so that the soil is enriched.
32. Even on the beds where you do grow vegetables, you can still make a good rotation. **Rotation means to grow different vegetables one after another on the same bed.**



THE ADVANTAGES OF ROTATION

Making better use of all parts of the soil

For example, plants with tap-roots, like carrots, take their nourishment deep down in the soil.

Plants with fibrous roots, like lettuces, take their nourishment near the surface.

By rotating your crops, you make the plants use all parts of the soil.

Making better use of mineral salts

For example, lettuces use a lot of nitrogen; tomatoes and onions use a lot of potash.

By rotating your crops, you make the plants use all the mineral salts in the soil.

Controlling insects and diseases

For example, when you grow onions, the insects and diseases which attack onions will develop. If you again grow onions after an onion crop, these insects and diseases remain on the field and develop further. But if you grow lettuce after an onion crop, the insects and diseases which attack onions do no harm to lettuce; they will just disappear.

APPLYING MANURE AND FERTILIZERS

33. Vegetables are plants that grow fast. They need a soil with plenty of mineral salts. Mineral salts are added to the soil by organic manures and chemical fertilizers.

34. Organic manures

These provide humus which improves the soil structure.

- **Animal manure**

This is the best organic manure. It has to be well mixed with the soil.

- **Compost**

This can always be made by the market gardener himself. It is used instead of animal manure.

35. Chemical fertilizers

These are the commercial fertilizers you can buy.

Simple fertilizers add to the soil only one mineral salt. Nitrogenous fertilizers add only nitrogen. Phosphatic fertilizers add only phosphorus. Potassic fertilizers add only potassium.

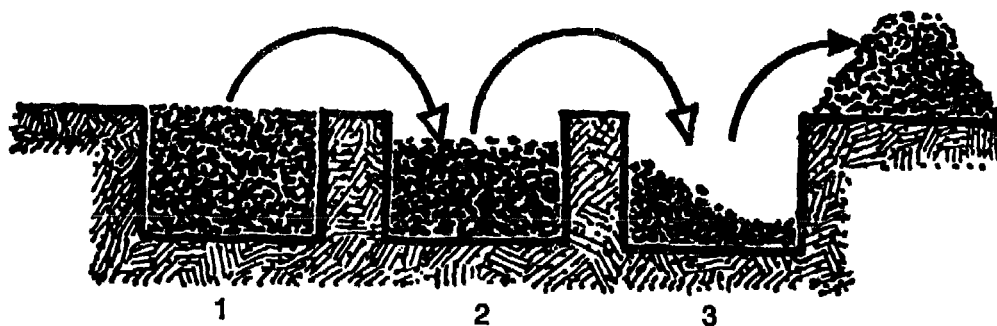
There are also mixed or compound fertilizers, which add to the soil a mixture of mineral salts (nitrogen, phosphorus, potassium).

Different vegetables need different quantities of each fertilizer.

HOW TO MAKE COMPOST

36. Dig three pits.

- Into pit 1 put herbage, leaves, small twigs, crop residues and food remnants. Pour on water fairly often to encourage rotting. Leave the contents of the pit to rot for about 1 month.
- After a month, move the contents of pit 1 into pit 2. What was at the top of pit 1 now goes to the bottom of pit 2. When pit 1 is empty, begin to fill it again as before.
- After another month, move the contents of pit 2 to pit 3. Fill up pit 2 with the contents of pit 1.
- At the end of the third month, put the compost from pit 3 on the fields. Continue, as before, to fill and empty the pits.



It takes about three months to make good compost.

THE MAIN FERTILIZERS

37. Nitrogen (N)

Nitrogen makes plants grow, especially the leaves. Apply nitrogen when you cultivate or transplant. In this way the fertilizer will be well used.

The chief nitrogen fertilizers are:

- ammonium sulfate,
- ammonium nitrate.

Phosphorus (P)

Plants need phosphorus to help them make their flowers and fruit.

Phosphorus is used mainly for vegetables of which the fruits are eaten, like beans and tomatoes, and those of which the roots are eaten, like carrots.

Phosphate fertilizers are best applied shortly before sowing or transplanting.

The chief phosphate fertilizers are:

- ordinary phosphates,
- superphosphates.

Potassium (K)

Potassium helps plants to resist drought and diseases, and to build up reserves.

It is used mainly for carrots, onions and tomatoes. Apply potassium fertilizers shortly before sowing or transplanting, at the same time as phosphates.

The chief potassium fertilizers are:

- sylvinite,
- potassium chloride,
- potassium sulfate.

CONTROL OF INSECTS AND DISEASES

- 38.** Many different vegetables may be attacked by insects and diseases.

Often you may not be able to recognize these insects and diseases.

Ask advice from the extension services about what pesticides to use.

The seeds you have bought must also be protected from insects and diseases. When they have been dried, keep them in a dry place, in tightly closed tins or bottles.

39. Insects

Remove and burn all fruits, leaves and plants attacked by insects.

Soil pests (cockchafers, wireworms and mole crickets) can be very injurious and can be controlled by various soil insecticides. Details should be obtained from your extension agent.

40. Diseases

Pull up and burn all diseased plants.

If you do not burn the diseased plants, the disease will attack all the plants in your vegetable garden.

Bean rust and tomato blight can be controlled with Bordeaux mixture. Ask the extension services how to use Bordeaux mixture.

DISINFECTING THE SOIL

41. You can disinfect the soil with hot water.

Pour boiling water on the vegetable beds before sowing.

For a bed of 10 square metres (m²), you will need about 10 watering cans of boiling water. Afterwards, cover the soil with sacks or matting.

You can also disinfect the soil with Vapam.

Vapam is a soil disinfectant. Three or four weeks before sowing, when a bed has been prepared for seeds or for transplanting, water the bed with Vapam. For a bed of 10 m², you will need about 20 litres of water with 1 litre of Vapam mixed in it.

Afterwards water plentifully with clear water, without Vapam.

Firm down the earth and leave it to rest for a few days.

Before sowing, stir the soil well.

HARVEST AND SALE

- 42.** If you want to sell your vegetables at a good price, you must be very careful not to spoil the vegetables when you harvest and transport them.

Well-packed vegetables are easier to sell and fetch a better price.

Foreign countries only buy vegetables of good quality that are well packed.

When you harvest, be careful not to damage the vegetables.

- Do not pick vegetables with dirty hands.
- Do not break or tear the leaves of salad plants, spinach or cabbage.
- Do not drop fruits like tomatoes, eggplant, green peppers.
- Do not pick fruits when they are wet, because in that case they can easily rot.
- Do not wash certain fruits like eggplant, tomatoes and green peppers, but merely wipe them with a cloth.

43. When you have plucked your vegetables, sort them.

- Do not put together spoiled or damaged vegetables and good-quality ones.
- Put together vegetables of the same kind and the same size.
- Pack each vegetable carefully: remove all leaves that are black or dirty. For example, with cabbage, leave only 2 or 3 leaves to protect the heart; with eggplant, leave only a short piece of stem; with carrots, leave only a few green leaves. Make small bundles of carrots, turnips and radishes.

44. Vegetables must not be damaged in transport.

- Do not put too many vegetables together. When too many fruits are heaped one on top of the other, they get crushed and rot.
- Do not drop them. A fruit that is dropped rots very quickly.

A market gardener who harvests and packs his vegetables well can sell them at a better price.

SALAD PLANTS

SALAD PLANTS ARE LEAF VEGETABLES

45. There are many other leaf vegetables, for example spinach or cabbage, which are looked after in the same way.

What varieties are most grown in Africa?

46. **Head lettuce**

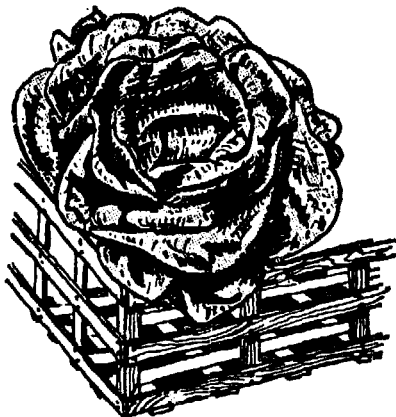
Head lettuce grows very fast and produces a lot. Its leaves are soft. It is very nice to eat, but is easily attacked by snails and little worms (eelworms), and it does not stand up well to transport.

Curled endive

Endive grows less fast; it is picked 12 weeks after transplanting. Its leaves are bitter and hard; it is not easily attacked by snails and eelworms. It stands up well to transport, but rots easily.

Batavia lettuce

Batavia lettuce produces a lot. It is picked 10 weeks after transplanting. Its leaves are a little hard, but it is resistant to diseases and stands up well to transport.



Head of lettuce



Curled endive

HOW TO GROW SALAD PLANTS

47. Leaf vegetables are grown for picking and eating the leaves.

So it is important to produce a lot of leaves of good quality, leaves that are soft and nice to eat, leaves that are not spoilt by diseases, snails or eelworms.

To produce these leaves, the soil must be well prepared

48. Salad plants do not have a large root system, so they need a fine and rich soil.

For this reason it is best to grow salad plants at the beginning of the rotation.

Then the roots can take their nourishment from the mineral salts added by manure.

If the soil has been well prepared, salad plants can make better use of fertilizers and water, and grow faster.

Salad seeds must be sown in nursery beds

49. Disinfect the soil of the nursery beds with boiling water.

When you buy seeds, be careful not to buy old seeds. You can mix the seeds with a little sand, but in that case the sand must also be disinfected.

Do not push the seed deeply into the soil.

Firm the soil well with the tamper.

Water.

Five days after sowing, the seedlings come up.

Salad plants must be transplanted

50. Lift the seedlings from the nursery bed when they have 3 or 4 leaves, about three weeks after sowing. When you take them out of the earth, be very careful not to damage the roots; the roots are very delicate.

Transplant at once; the plants must not dry out in the sun.

It is best to transplant in the evening, when the air is not hot any more.

Leave 30 centimetres between rows, and 30 centimetres between seedlings.

For salad plant varieties that grow to a large size, leave greater distances.

Pack the earth down well around each plant, and water it.

Salad plants must be well cared for

- 51. Leaf vegetables need above all water and shade.**

Water your salad plants often — every morning and every evening.

Do not water when the sun is hot.

Do your watering gently, so as not to damage the leaves.

It is best to pour the water on the ground between the salad plants.

Shade.

Make a shelter over the salad plant beds (see paragraph 26), so that the sun does not burn the leaves and the heavy rain does not tear them.

When the plants are bigger, give them less shade.

Hoeling.

It is very important to remove the weeds often. They take the nourishment of the plants out of the soil. Hoe twice a week.

At the same time, remove any snails and eelworms and take out and burn diseased plants.

Salad plants must be protected against snails and eelworms

- 52. Snails eat the leaves of salad plants; they must be picked up and removed.**

Eelworms are tiny worms which attack the roots, and then the young salad plants die very quickly.

To control eelworms you must use a good rotation of crops.

Before sowing, disinfect the soil with boiling water.

Once a year, cover the beds with straw and burn the straw.

HARVESTING

- 53.** A few days before picking, tie the leaves of each plant of curled endive together with raffia. Like that the leaves remain white and soft.

Do not tie up the leaves when they are wet, because in that case they may rot. If it rains when the plants are already tied up, take off the raffia and begin again.

Do not pour water on salad plants once they are tied up; water only on the ground between the plants.

Pick salad plants in the morning or the evening, when the sun is not hot.

Do not pick salad plants when they are too wet, because in that case they may rot during transport.

Remember

- **Salad plants have to be picked at the right time. When they start to bolt — that is, when they grow a stem from their base — they are not fit to eat.**



Salad plant that has bolted



Curled endive tied up

TOMATOES

HOW TO GROW TOMATOES

54. Tomatoes grow well in a hot and dry climate.

Damp air and rain encourage diseases, especially blight.

In regions where the air is very damp, it is best to grow tomatoes in the dry season.

Some varieties widely grown in Africa are shown in the picture.

Prepare the soil well

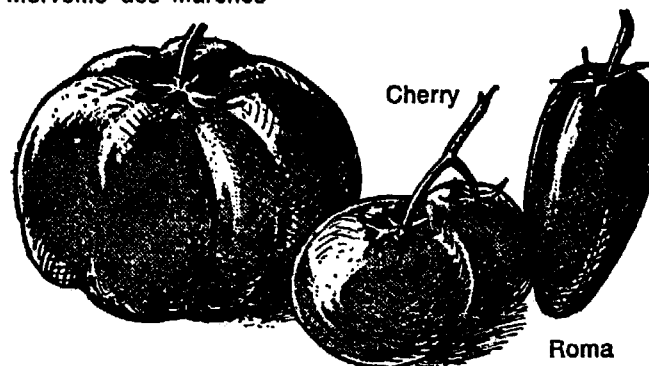
55. Tomato roots go deep down into the soil. Tomatoes therefore need a deep soil. If you want to grow tomatoes, you must first till fairly deeply.

But this deep soil must not retain water. If there is too much water, the roots cannot breathe and they rot. When tilling, mix manure and fertilizers into the soil. The manure must be well decomposed. Apply especially potassium and phosphate fertilizers.

Ask the extension services how much fertilizer to apply.

Merveille des Marchés

Varieties of tomato



Tomatoes must be sown in nursery beds

- 56. Buy selected seeds.** In most cases, these seeds have already been disinfected. Seeds that are not disinfected are more easily attacked by certain diseases.

If the seeds you buy have not yet been disinfected, mix the seeds with a powder. Ask the extension services which powder to use.

- 57. Disinfect the soil of the nursery beds with boiling water.**

The soil must be very fine and well firmed in depth.

- 58. Sow the seeds in rows,** leaving 10 centimetres between rows.

Do not push the seeds into the soil, merely cover them up with a little earth.

Water twice a day.

Make a shelter like the one shown on page 19.

When the seedlings have come up and begin to grow, **remove surplus seedlings.**

If the plants are to grow well, they must not get in each other's way and must not be too close together. At the same time, remove weeds.

59. Transplanting

Prepare the soil of the tomato beds several weeks before transplanting.

Work manure into the earth.

Put stakes in the beds. The stakes should be fairly strong and about 1.5 metres high.

Leave 50 centimetres between rows and 40 centimetres between plants.

Transplant your tomato seedlings 5 or 6 weeks after sowing.

Water the soil of the nursery beds so as to get the seedlings out more easily. Then the roots will not be damaged.

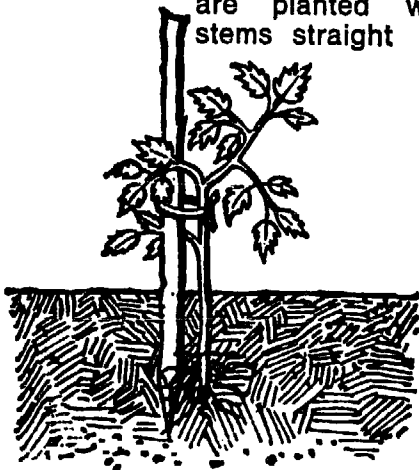
It is very important not to damage the roots.

Transplant the seedlings at once; they must not dry out in the sun.

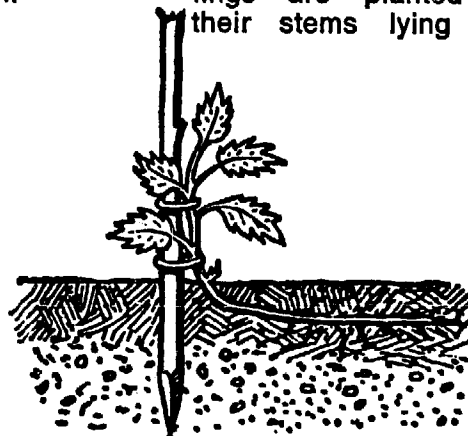
It is best to transplant in the evening, when the sun is not hot.

Dig a hole at the base of each stake. Lean the seedlings a little sideways, so that you can cover the roots well with earth. Then many adventitious roots will grow.

In deep soil, the seedlings are planted with their stems straight



In shallow soil, the seedlings are planted with their stems lying down

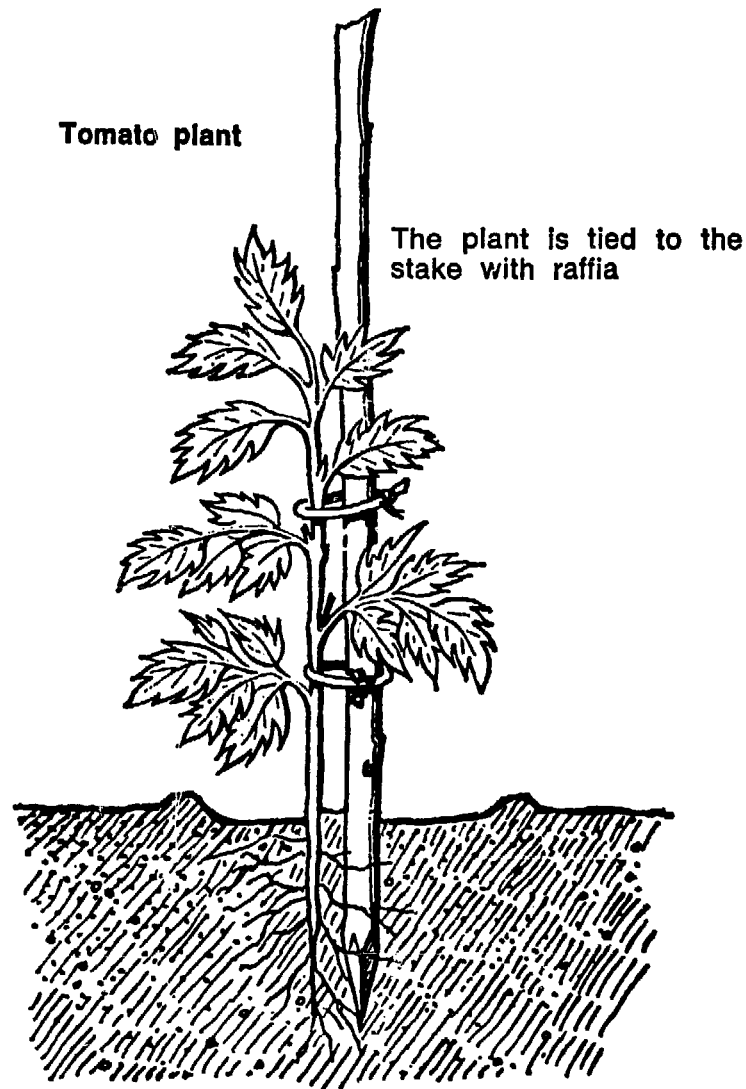


Pack the earth down well around each tomato seedling, and water it.

Make a shelter.

When the plant has grown to a height of 40 centimetres, tie it to the stake with raffia.

Keep some seedlings in the nursery bed to replace any seedlings you have transplanted which do not grow.



TOMATOES MUST BE WELL TENDED

60. Watering

Water very often.

Be careful not to pour water on the leaves and fruit; then, tomato blight will develop less easily.

Mulching

Cover the soil between the plants with cut herbage or leaves.

Like that the soil remains fresh and loose, and the weeds grow less easily.

When you water, the earth does not make the leaves and fruits so dirty.

But the mulch must not be too thick, otherwise it might prevent the soil from breathing.

Weeding

Remove weeds very often. Weeds take the nourishment of the tomatoes out of the soil.

When you are cultivating, remove snails and insects.

Take out and burn plants that are diseased or have been spoilt by pests.

Replace the diseased plants you remove by seedlings from the nursery beds.

Pruning



Tomato plant with shoots

The shoots are removed

- 61.** Tomato plants grow very quickly. They put up many branches, and then the fruits come late and are small. The leaves and fruits are easily attacked by diseases.

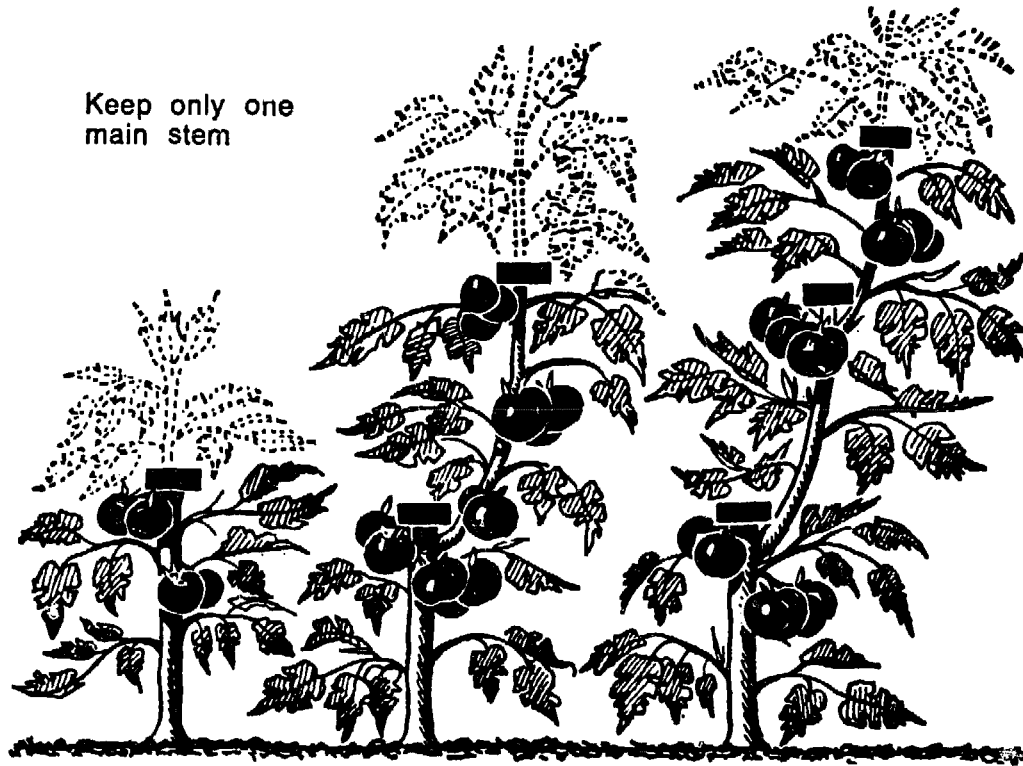
Remove the buds which show between the leaf and the stem.

Keep only one or two main stems with their leaves and flowers.

Prune once or twice a month. If you do not prune often enough, the fruits grow more slowly and are smaller.

With quick-growing varieties, keep only one main stem.

Keep only one
main stem



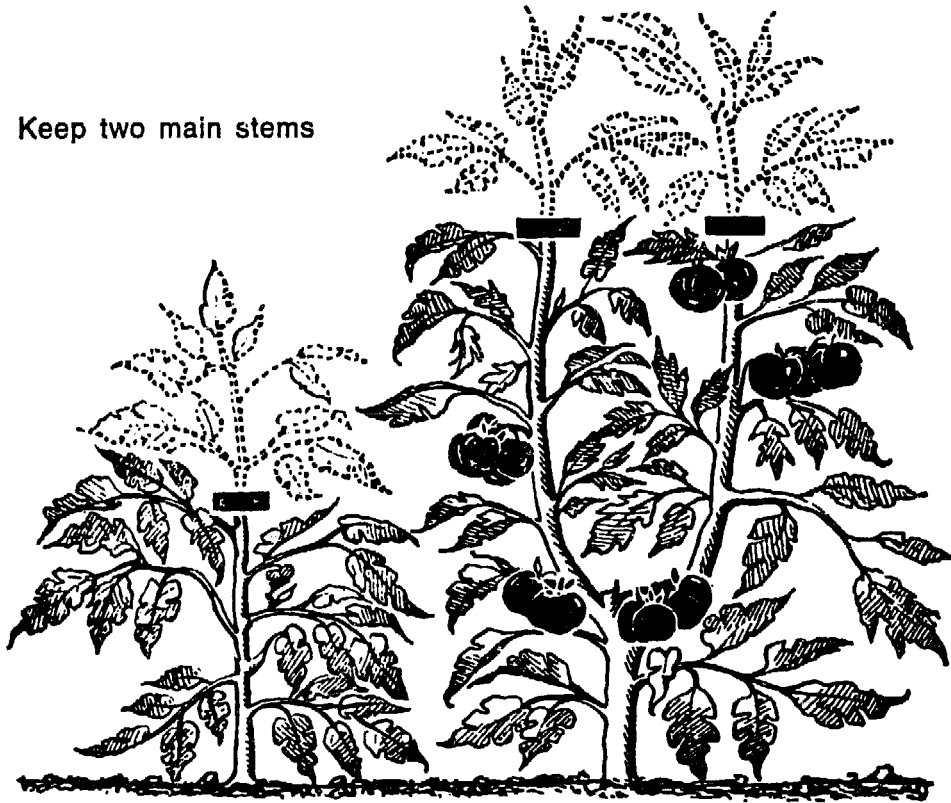
Do not prune before the tomato plant has two flowers and one leaf above the second flower.

Cut the top of the stem above the leaf.
Two shoots will form: leave only one of them.

The bud develops into a new stem.
Wait until two flowers form on that stem, and then cut it back in the same way as the first stem.

With slow-growing varieties, keep two main stems.

Keep two main stems



Do not prune before the tomato plant has two flowers and one leaf above the second flower.

Cut the top of the stem above the leaf.
Two shoots will form: leave them both.

The two shoots develop into two main stems; cut them both back in the same way as the first stem.

GUARD AGAINST SNAILS, INSECTS AND DISEASES

62. Snails eat the stems and leaves of tomato plants. Pick them up and remove them often.

Tomatoes are attacked by many diseases on all parts of the plant — on the roots, stems, leaves and fruits. Ask advice from the extension services on how to recognize and treat tomato diseases.

Some diseases of tomatoes

Disease and symptoms	Treatment
Alternaria: Brown or black spots on fruits and leaves	Treat seedlings when young, after transplanting, with copper-based products, or Maneb or Zineb.
Bacterial canker	Always disinfect soil and seeds, pull up and burn diseased plants.
Fusarium wilt	Good rotation.
Tomato blight: Grey or black spots on leaves and fruits	Treat plants every day with products based on copper, Maneb or Zineb.
Verticillium wilt	Good rotation.
Mosaic	Do not grow tomatoes next to cucumbers, potatoes or tobacco, which may have the same diseases.

HARVESTING

63. Pick your tomatoes only when they are quite ripe, red all over.

Tomatoes that are picked only when they are quite ripe are heavier and sweeter, and sell at a good price.

Tomatoes are very delicate fruits:

- Do not drop them.
- Do not bruise them by handling them roughly.
- Do not pile too many of them on top of each other.

It is best to pick tomatoes during the day, when they are not wet. Wet tomatoes do not keep well.

Sort your tomatoes: do not leave perfect tomatoes next to damaged tomatoes.

If you grow your tomatoes well, you can produce 20 to 40 kilogrammes for every bed of 10 square metres.



BEANS

64. Beans are worth growing, because:

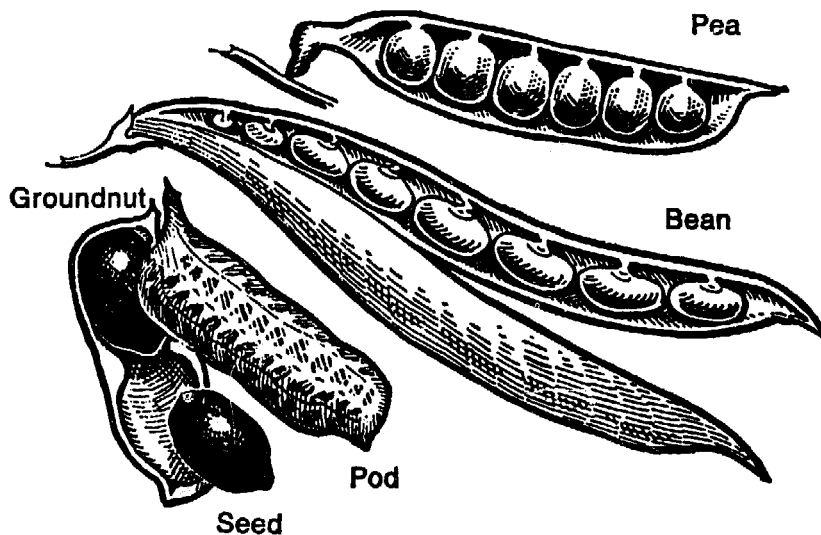
Beans are food for people; they are rich in proteins.

Beans do not need a very rich soil. They grow in light soils and soils rich in humus, but they can also be grown in fairly poor soils.

Beans enrich the soil. They can be sown as a cover crop during the year of fallow, at the end of the rotation.

Peas, broad beans, and groundnuts are grown in much the same way as beans.

They are all legumes of which the fruits are eaten.



Some bean varieties

65. There are many varieties of beans.

Cowpeas and Kissi are African varieties. Both grow slowly.

Harvesting begins two months after sowing. Production may continue for a month. Both are disease-resistant.

Some foreign varieties grow faster.

Harvesting begins 30 to 40 days after sowing.

But they are easily attacked by diseases, and new seeds have to be bought every year.

Certain varieties have very long stems (1.8 to 3 metres) and have to be staked. These are called pole beans. Other dwarf varieties have short stems (from 20 to 40 centimetres) and do not need staking.



PREPARE THE SOIL WELL

66. Beans are best grown at the end of the rotation.

In that way they use up the mineral salts which still remain in the soil.

It is not necessary to spread manure before sowing beans.

Fertilizers may be used, especially potassium and phosphorus ones. Ask advice from the extension services. Till the soil fairly deeply so that the soil will hold its moisture and the roots can go down more deeply to take up nourishment.

SOWING

67. Buy new seeds every year.

- Sow directly into the open beds, in seed holes and rows.
- Put three seeds in each seed hole.
- Push the seeds 3 or 4 centimetres deep into the soil.
- For pole varieties, leave 1 metre between rows, and along the rows 70 to 125 centimetres between seed holes.
- For dwarf varieties, leave 50 centimetres between rows, and, along the rows 60 to 70 centimetres between seed holes.
- Water.

BEANS MUST BE WELL TENDED

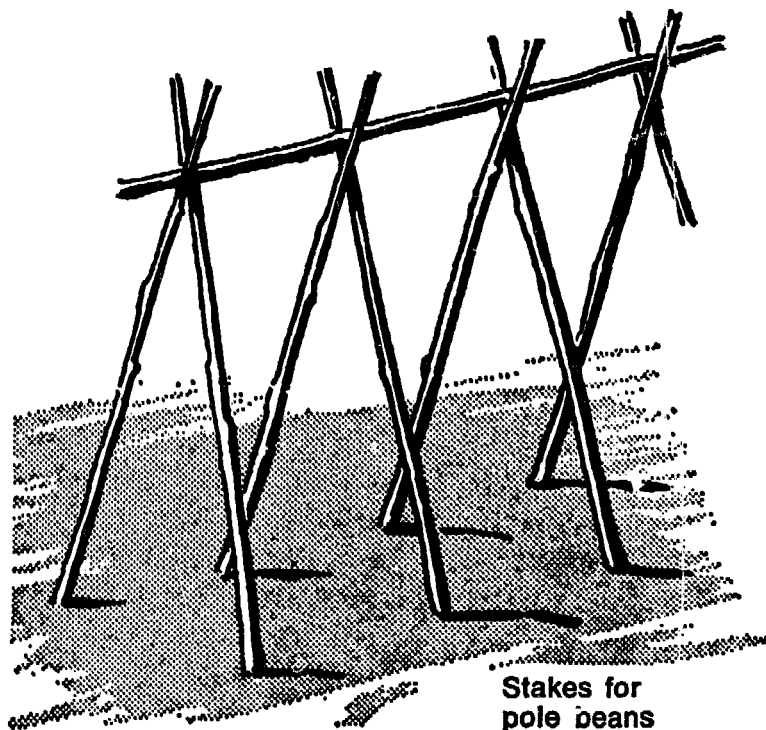
68. Cultivating

A few days after sowing, when the seedlings have come up, remove weeds.

Two or three weeks after the first cultivation, earth up the plants by heaping soil around their base. At the same time weed for the second and last time.

When you cultivate be careful not to damage the roots. If a very hard crust of earth has formed, for example after heavy rain, break up the crust without disturbing the soil in depth so that the soil is aerated without damaging the roots.

Put in stakes only for pole varieties. The stakes should be 1.8 to 2 metres high. Tie the stakes together.



PROTECT AGAINST INSECTS AND DISEASES

69. Insects

The main insect pests attacking beans are yellow spiders, bean weevils and aphids.

Insect	Treatment
Yellow spider: Attacks leaves and young bean plants	Apply Phosdrin especially on the underside of the leaves
Bean weevil	Treat seeds with Lindane, DDT and Aldrin.
Aphid	Treat with Phosdrin.

70. Diseases

Disease	Treatment
Bean anthracnose: Shows brown spots, and leaves and pods wither	Good rotation and deep tilling. Treat seeds, possibly more than once, with mercury-based prod- ucts, with Dithane or Thiram.
White mould	Treat with Karathane.
Halo blight	Pull up and burn diseased plants. Good rotation.
Rust	Disease can be prevented by treating with 1 percent Bor- deaux mixture or with syn- thetic fungicides.

HARVESTING

- 71.** Some beans are picked when they are green, and both pods and seeds are eaten.

The first green beans are ready for picking about 11 weeks after sowing. Picking green beans means a lot of work.

The pods must be picked every day. If you do not pick the ripe pods every day, they become hard and are not nice to eat.

If you do not pick the ripe pods every day, no new pods will form, and the harvest will be less plentiful.



Green beans

Green beans can be picked for about a month. It is best to pick green beans early in the morning, or late in the evening. When picking the ripe pods be careful not to damage the young pods which are forming.

Green beans do not keep. They must be either eaten or sold the same day you pick them or the day after.

72. Some beans are picked when the seeds have grown quite large, but the pods are still green. These are called fresh beans.

Only the seeds are eaten, not the pods.
Fresh beans are ready for picking about three months after sowing.

Pick fresh beans once a week.
Do not wait too long, otherwise the seeds become too hard.
Fresh beans do not keep long. They must be eaten or sold shortly after picking.

73. Some beans are picked dry.

Only the seeds are eaten.

Dry beans are picked only when the pods are quite yellow.
But do not wait for the pods to open, otherwise the seeds drop.

Picking dry beans is easy. Pull up the whole plant by hand.
Pile the plants in little heaps on the beds. Leave them to dry in the sun. When they are quite dry, put them in the barn.

The beans keep better if you leave them in the pods.
Take the beans out of the pods only at the moment when you want to eat or sell them.

ONIONS

- 74.** This is a vegetable which sells well. But onions do not grow very well in moist regions; they grow better in a dry and hot climate. Leeks, garlic, and shallots are grown in much the same way as onions. They are attacked by the same diseases. They need the same soil and the same care.

PREPARE THE SOIL WELL

- 75.** Onions develop the end of their stems underground. This part of the stem which fattens in the earth is called the bulb. The bulb grows quickly and becomes large if the soil is light, not too moist, rich in humus and free from weeds.

- 76. The soil must not be too moist.**

If the soil is very moist, the bulb may rot. In a well-tilled soil, the water goes down deep and air can get in.

So till the soil deeply.

- 77. The soil must be rich in humus.**

It is best to grow onions after salad plants. Salad plants do not use all the mineral salts in the soil. Onions use up the salts that remain from the manure you put down for the first crop.

Apply fertilizers. Onions need above all potassium and phosphorus. Sulfur is often very useful too.

Ask the supplier or the extension services how much fertilizer to apply.

Do not apply too much nitrogen, otherwise the leaves will develop more than the bulbs.

Never grow two crops of onions one after the other, because of diseases.

SOW IN NURSERY BEDS AND TRANSPLANT

- 78.** Some market gardeners have large onion fields. To sow in nursery beds and to transplant later means a lot of work. These market gardeners do better to sow their onions in open beds.
Many market gardeners have small onion fields. For these people it is better to sow the onions in nursery beds and to transplant them.

Do not sow seeds which are more than one year old.

Sowing in open beds

- 79.** Leave 25 to 30 centimetres between rows and, along the rows, 6 to 8 centimetres between plants. You will need 4 kilogrammes of seed for 1 hectare.

Sowing in nursery beds and transplanting

- 80.** Disinfect the soil of the nursery beds. The soil should have a fine tilth and be firm in depth. Leave 10 to 15 centimetres between rows.
Make a shelter and water the beds twice a day.
Thin out surplus seedlings and weed.
When the seedlings have grown to a height of 15 to 20 centimetres, take them out of the nursery beds and transplant them into new beds. Leave 20 to 30 centimetres between rows and, along the rows, 10 to 15 centimetres between plants. Set the plants only 2 or 3 centimetres deep in the soil.

Pack the earth down well around each plant. Water. If any plants do not grow, replace them with seedlings you have kept in the nursery beds.
Do not earth up the onion plants when you cultivate; if you cover the bulb with earth, the bulb does not grow well.

PROTECT AGAINST INSECTS AND DISEASES

81. Insects

Insect	Treatment
Onion eelworms: Tiny worms which attack the roots and the base of onion plants	Pull up and burn infested plants. Disinfect the soil with boiling water, or with Vapam or Nemagon. Good crop rotation.
Onion fly: Its maggots eat the bulbs, and the bulbs rot	Control the maggots by treating the plants with Aldrin or DDT.

82. Diseases

Disease	Treatment
Onion smut: Seedlings do not grow well; black or grey lines appear on the leaves	Disinfect the seeds. Disinfect the soil with Formol or Thiram.
Downy mildew: Yellow spots appear on the leaves. The whole plant becomes yellow and dies	When the mildew appears, treat onion plants with copper-based products, or with Thiram, Zineb, or Ziram.
Rots: These are due to funguses which attack onion seeds, destroy the roots and bulbs of seedlings, cause the leaves to wither and kill the onion plant	Control rots by disinfecting the soil with boiling water, or with Formol. Later, treat onion plants with copper-based products, or with Thiram, Zineb or Ziram.

HARVESTING

Onions should be harvested only when they are quite ripe.

- 83.** An onion is ripe when the leaves are dry.
An onion harvested before it is quite ripe does not keep well.

Lift onions only when the leaves are quite dry.
It is best to lift your onions when it is not raining, so that they will not rot.

Leave the onions lying on the field for a few days, so as to dry them well. It is best to cover them up with a little grass or straw. If it rains, dry the onions under a shelter.

To keep onions well, store them in a dry, airy place, well protected against rats and other animals.

SUGGESTED QUESTION PAPER

UNDERLINE THE RIGHT ANSWER

Pimento and gumbo are leaf vegetables	Yes or No
The market gardener should buy selected seeds every year	Yes or No
The vegetable garden should be as far as possible from the house	Yes or No
Thinning out weakens the vegetables	Yes or No
A good market gardener should add well-decomposed manure to the soil of his vegetable garden	Yes or No
Well-packed vegetables do not sell well	Yes or No

FILL IN THE MISSING WORDS

When somebody grows mainly for his family to eat, this is called

Vegetables add to the diet many and above all many

If the field is on a slope, lay out the across the slope.

To prevent a disease attacking all the plants in the vegetable garden, the farmer must and all the diseased plants.

Snails the stems and leaves of vegetables: they must be often.

ANSWER THE FOLLOWING QUESTIONS

What is the purpose of crop rotation?

Why must the soil be well tilled before sowing?

What is a nursery bed? Name two vegetables which have to be sown first in nursery beds.

Why is frequent cultivating necessary?

Why is it necessary to mulch the soil and to make shelters for the vegetables in the vegetable garden?

Describe how to disinfect the soil of a vegetable bed.

What should you do when you see snails and insects on the vegetables in your vegetable garden?

By what means can you improve the fertility of the soil in your vegetable garden?

Have you tried to make compost for enriching the soil of your vegetable garden? Describe how you did it.

Make drawings to explain better.

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