Better Farming Series No. 21, Wet Paddy or Swamp Rice

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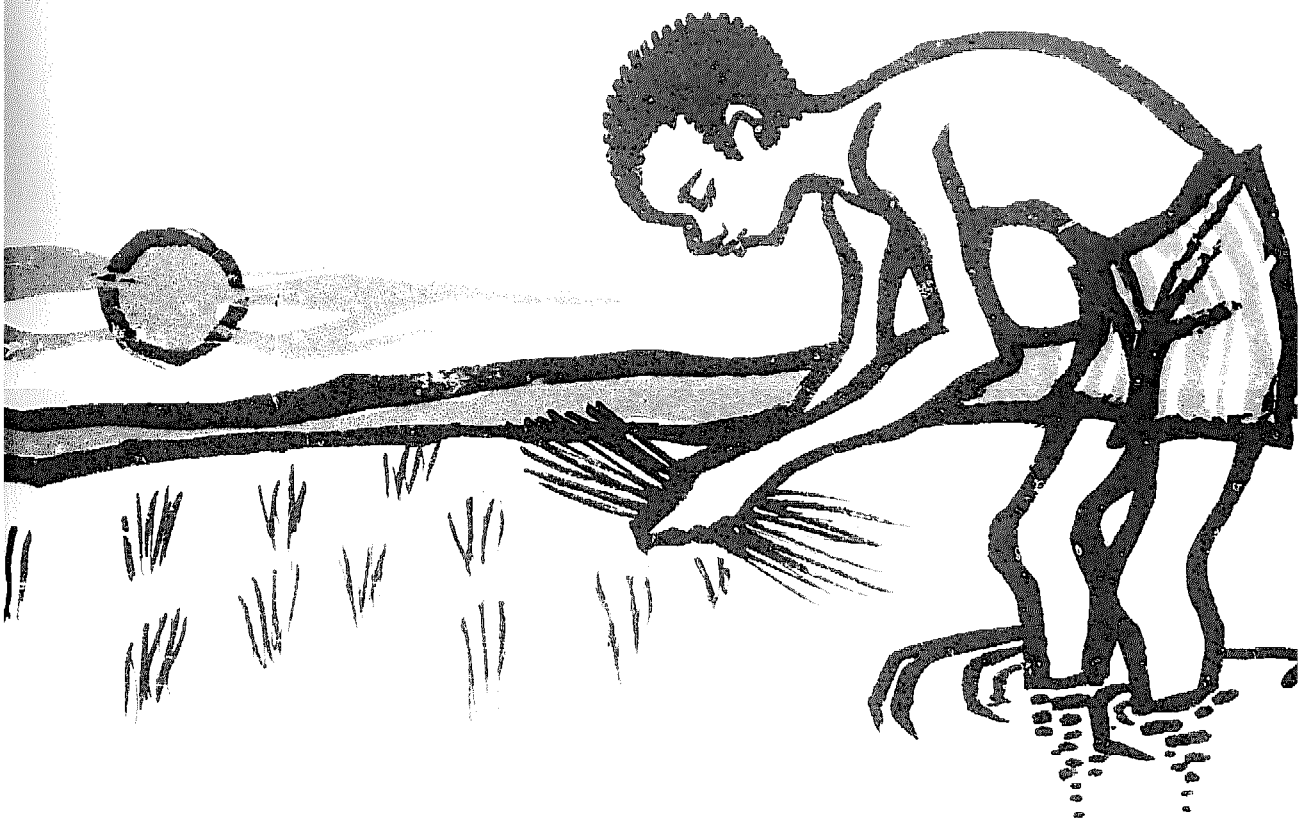
wet paddy or swamp rice



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8. The soil - the living soil - working the soil
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better farming series 21

wet paddy or swamp rice

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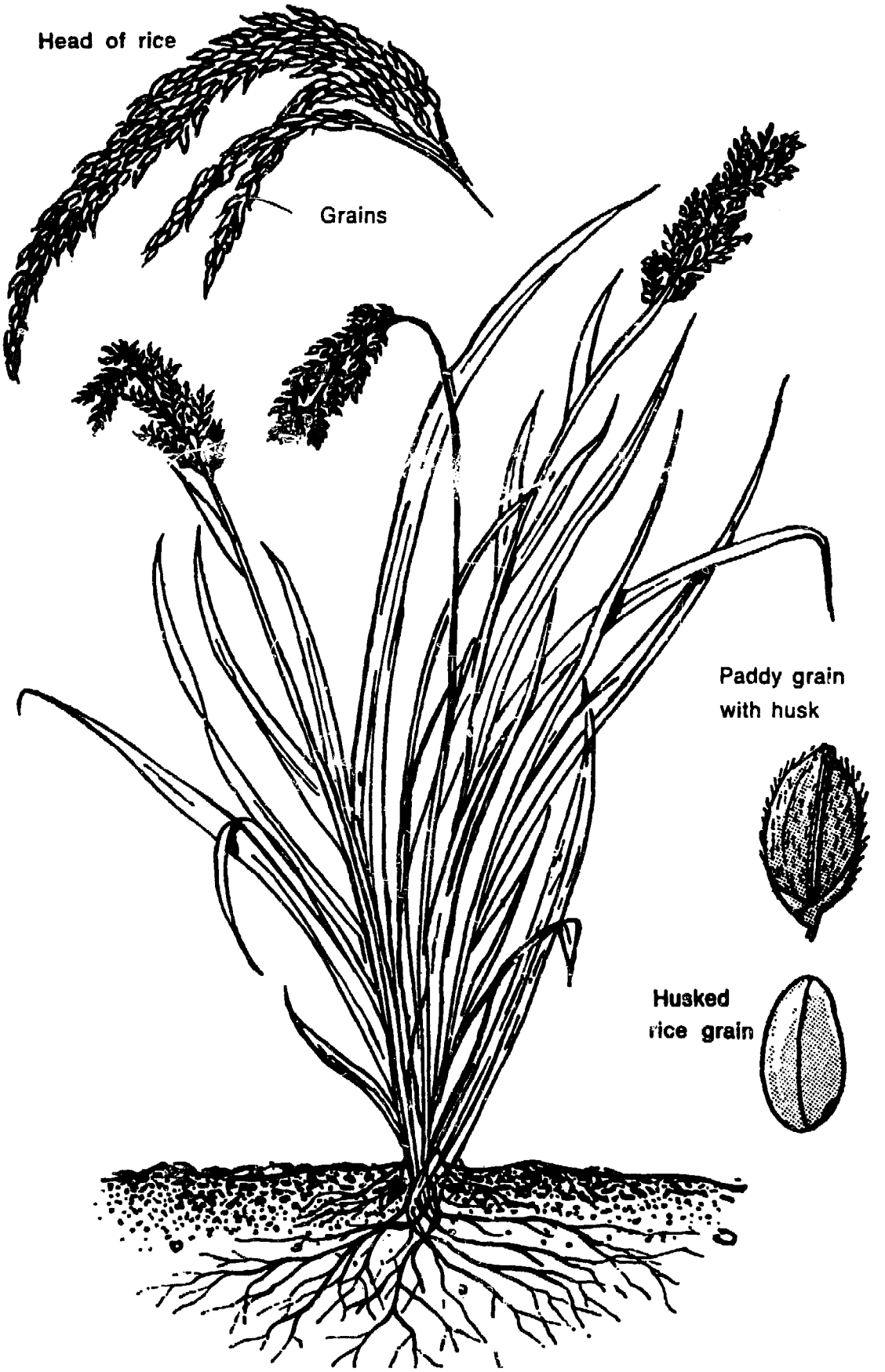
PREFACE

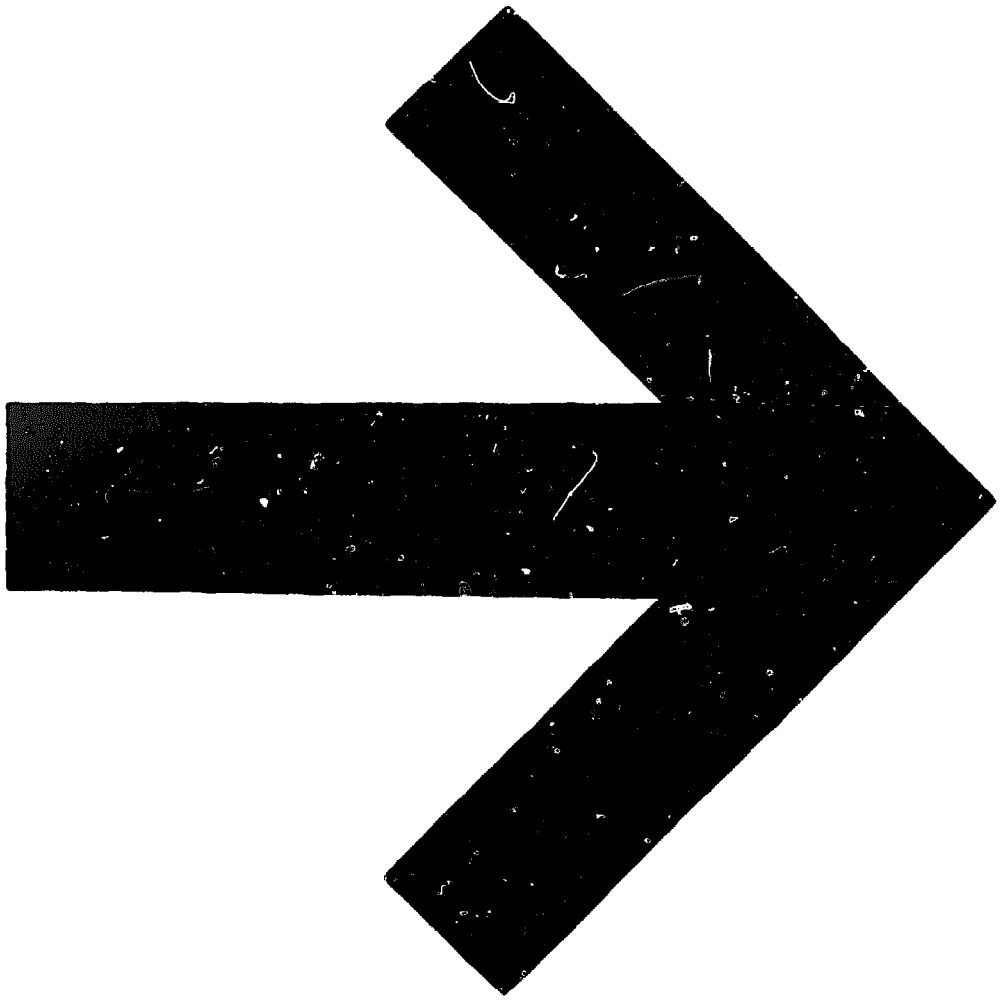
This manual is a translation and adaptation of "Le riz irrigué," published by the Agri-Service-Afrique of the Institut africain pour le développement économique et social (INADES), and forms part of a series of 23 booklets. Grateful acknowledgement is made to the publishers for making available this 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 author of this English version is Mr. A.J. Henderson, former Chief of the FAO Editorial Branch.


Head of rice
Grains
Paddy grain
with husk
Husked
rice grain



OUTLINE OF COURSE

PEOPLE NEED MORE RICE TO EAT

1. In many parts of the world people eat a lot of rice. But nowadays more people eat more rice than in the past.
Rice is a very good food.

In order to live, digest, work, resist the cold and the heat, people need foods that give them strength. These are called energy foods.
Rice is an excellent energy food.

Rice keeps well.
Cassava, yams and bananas rot quickly.
Rice does not rot if it is protected from damp.
Rice can be kept a very long time if it is protected from rats and insects.

2. **Some regions do not produce enough rice.**

Farmers do not produce enough rice.
For example, nearly all the countries of Africa have to buy rice abroad:
The countries of Africa spend on rice imports a lot of money that could be used in other ways.
If Africa produced more rice, it could sell rice to other countries with a large rice-eating population.
In this way Africa could earn more money.
Farmers must therefore produce more rice.

There are many regions of Africa where rice can be grown; along the banks of streams and rivers, around dams, and at the bottom of valleys.
But in order to increase rice production, it is necessary to adopt modern methods of wet paddy rice cultivation.

In this booklet, we shall speak only about wet paddy cultivation. In Booklet 20, we speak about upland rice cultivation.
The two methods of cultivation are quite different.

WET PADDY OR SWAMP RICE HAS BEEN GROWN FOR A LONG TIME IN AFRICA

3. **This rice is grown on land covered with water for most of the year.**

   - **Along banks of rivers and streams**
     When the water begins to rise at the beginning of the rainy season, and when the water begins to fall at the end of the rainy season.

   - **In lowland plains covered with water most of the year**
     Where these plains are covered with a very deep layer of water, people sow floating rice — the stems of floating rice grow longer when the water rises.

But yield varies very much according to how much it rains.

With traditional methods
it is impossible to give the rice at the right time the amount of water it needs. The farmer cannot make the water come when he needs it. **He is not in control of the water.**

It is impossible to make the water go away, to drain the land. The farmer cannot make the water go away when he does not need it. **He is not in control of the water.**

It is impossible to cover the land with the depth of water that the rice needs at any time in its life.
Rice does not need the same depth of water at all times in its life. **The farmer has no control over the depth of the water cover.**

HOW TO GET GOOD YIELDS

4. **To get good yields from wet paddy cultivation, the farmer must**

   - **Be in control of the water**
     have enough water when the rice is growing, add more water at the right time, take water away (drain) at the right time, have the right depth of water.

   - **Make good nurseries**
     so as to have fine seedlings for transplanting.

   - **Transplant at the right date, in rows**

   - **Prepare the soil of the rice field well by tillage and level it**

   - **Tend the rice field carefully**
     Cultivate whenever any weeds have grown.
     Apply fertilizers, flood the field, protect the rice from pests.

   - **Harvest with care, and dry the paddy grains well.**

LAYOUT OF A WATER CONTROL SYSTEM FOR A RICE FIELD

5. Laying out a water control system in a rice field means to arrange a tract of low-lying land so as to be in control of the water.

These arrangements are not the same

- when the water comes from a river, a spring or a small stream;
- when the rice field depends on a big river or when it depends on a small stream.

We shall see how the farmer can control the water for a small field.

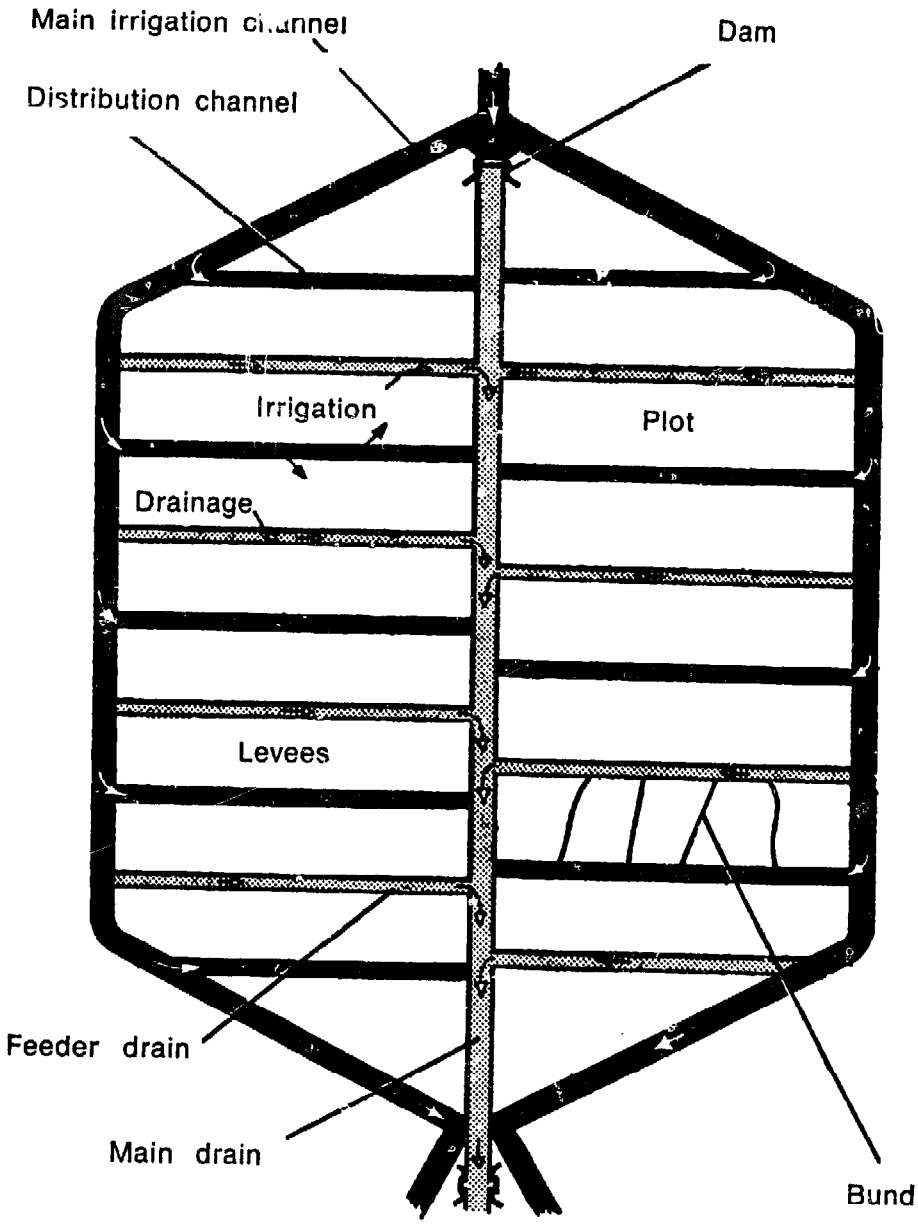
He can do a very large part of the work himself. He will not have to spend much money, but he will have to do a great deal of work.

We shall study the layout of a water control system for a rice field using a stream that carries water all the year round or during several months of the year. Before starting on the work, ask advice from the technicians.

A well-made water control system lasts a long time, and the work does not have to be done again in the following years.

6. Water control system for a rice field

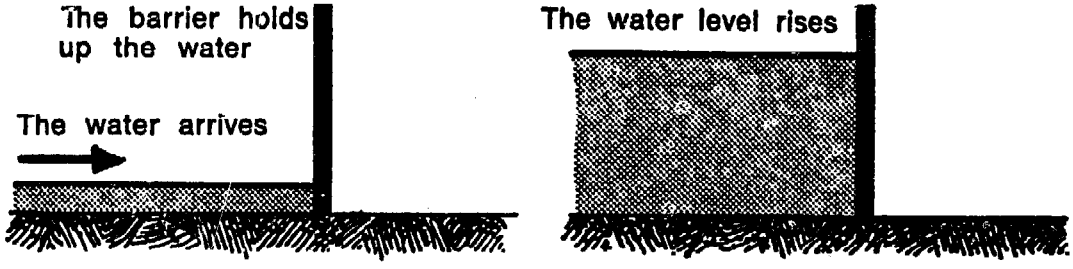
You will refer to this drawing frequently as you read the following pages.

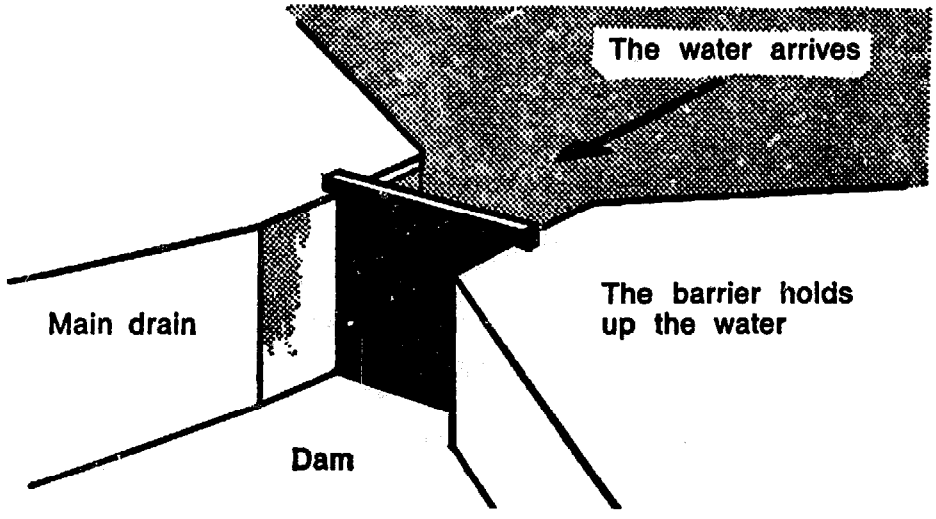


BUILDING THE DAMS

7. **Dams are small barriers across the stream.**
Dams hold up the water, so that the water of the stream rises.
In this way, the water of the stream overflows into the low-lying land.

It is best to have concrete dams.
They cost more, but they last longer.
The good harvests of the following years will pay for the dams.
The technician will tell you where to build your dams.

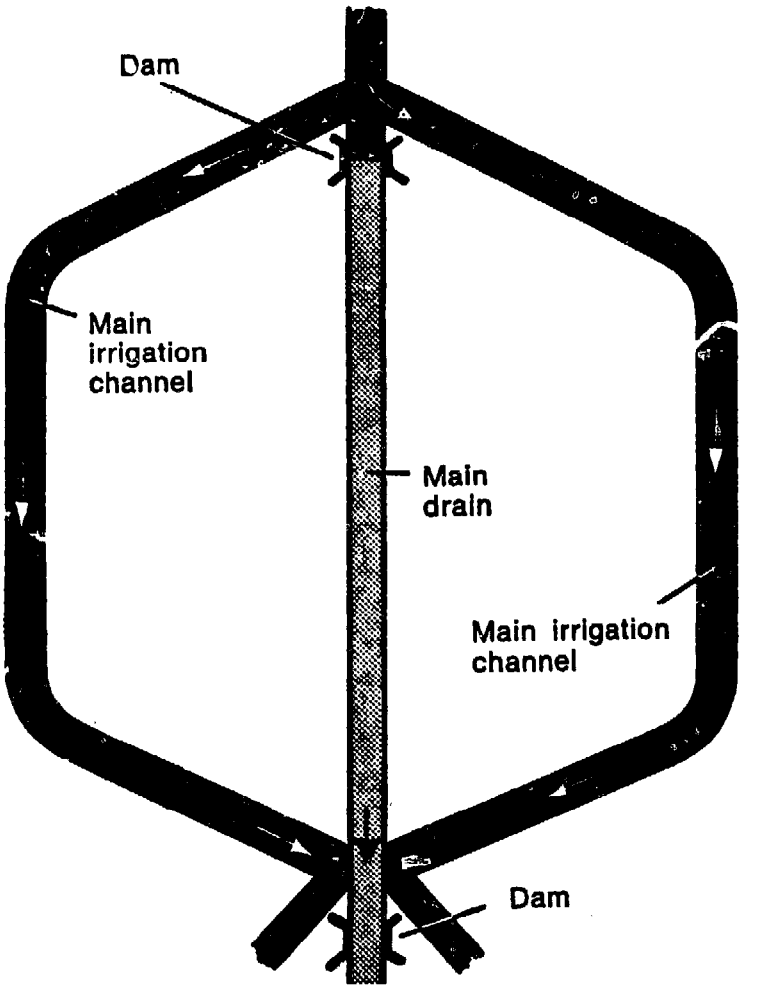




8. When the dam is built, dig irrigation channels **around the edges of the field.**

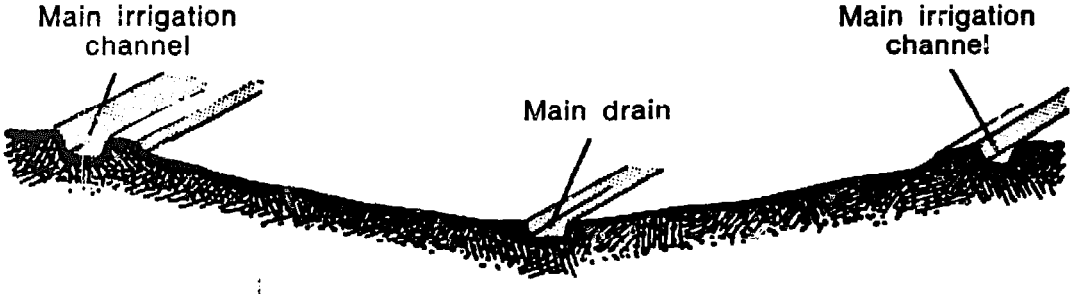
These are called **main irrigation channels.**
Dig also, right **through the middle of the field, the main drain.**

The water flow starts from the dam.
It goes into the main irrigation channels.
It floods the rice field.
It goes out of the rice field into the main drain, which is the channel for the outflow of the water.

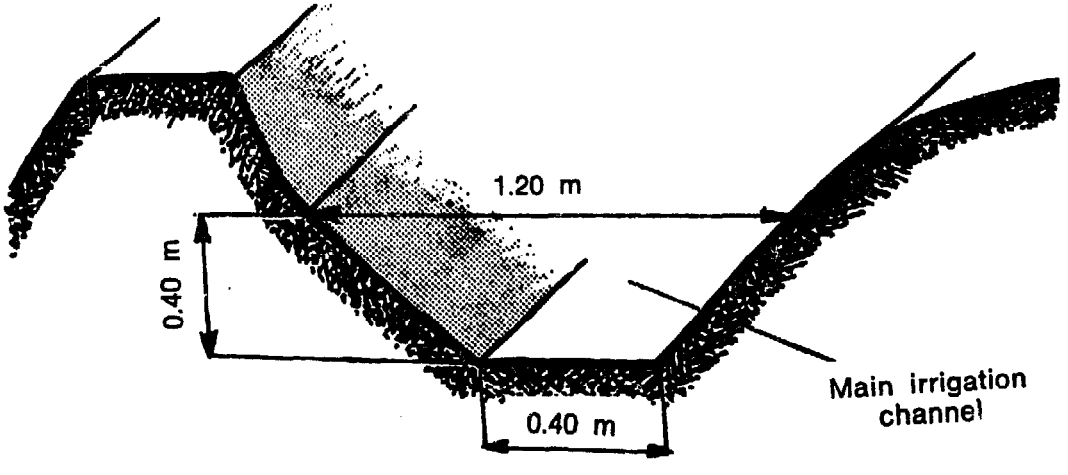


DIGGING THE MAIN IRRIGATION CHANNELS

9. The main irrigation channels take water to the whole of the field.



They follow the outside edges of the field.
The channels must be big enough to let the water flow through well.
If the field has no slope, the channels must be dug deeper near the second dam.

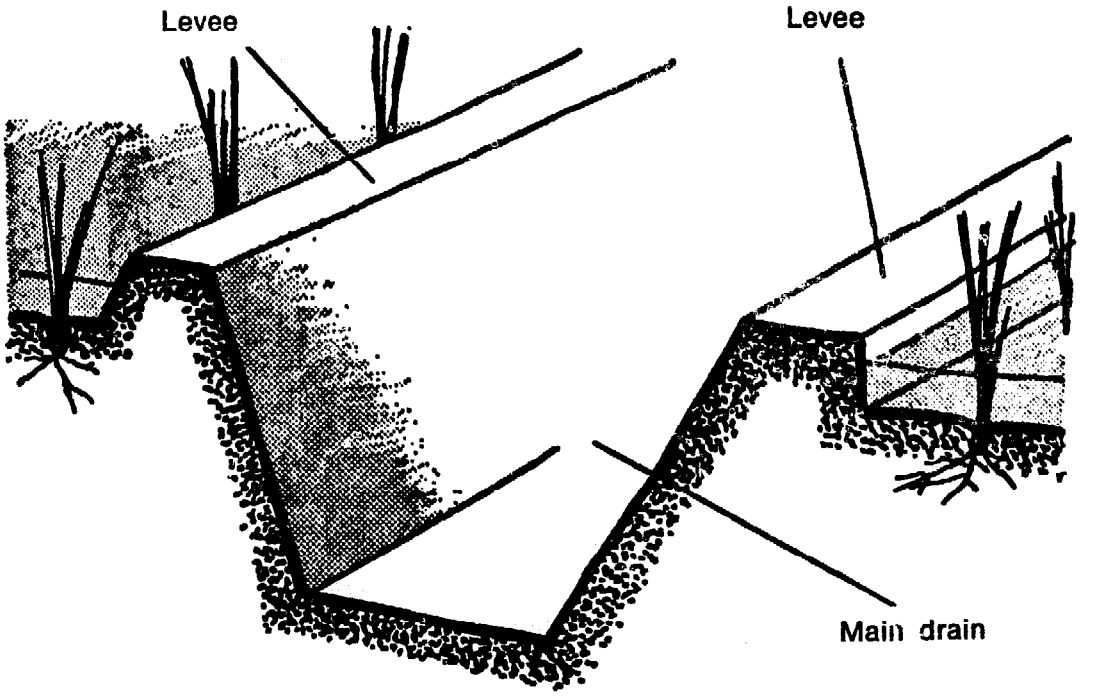


DIGGING THE MAIN DRAIN

10. The main drain starts at one dam and ends at another dam.

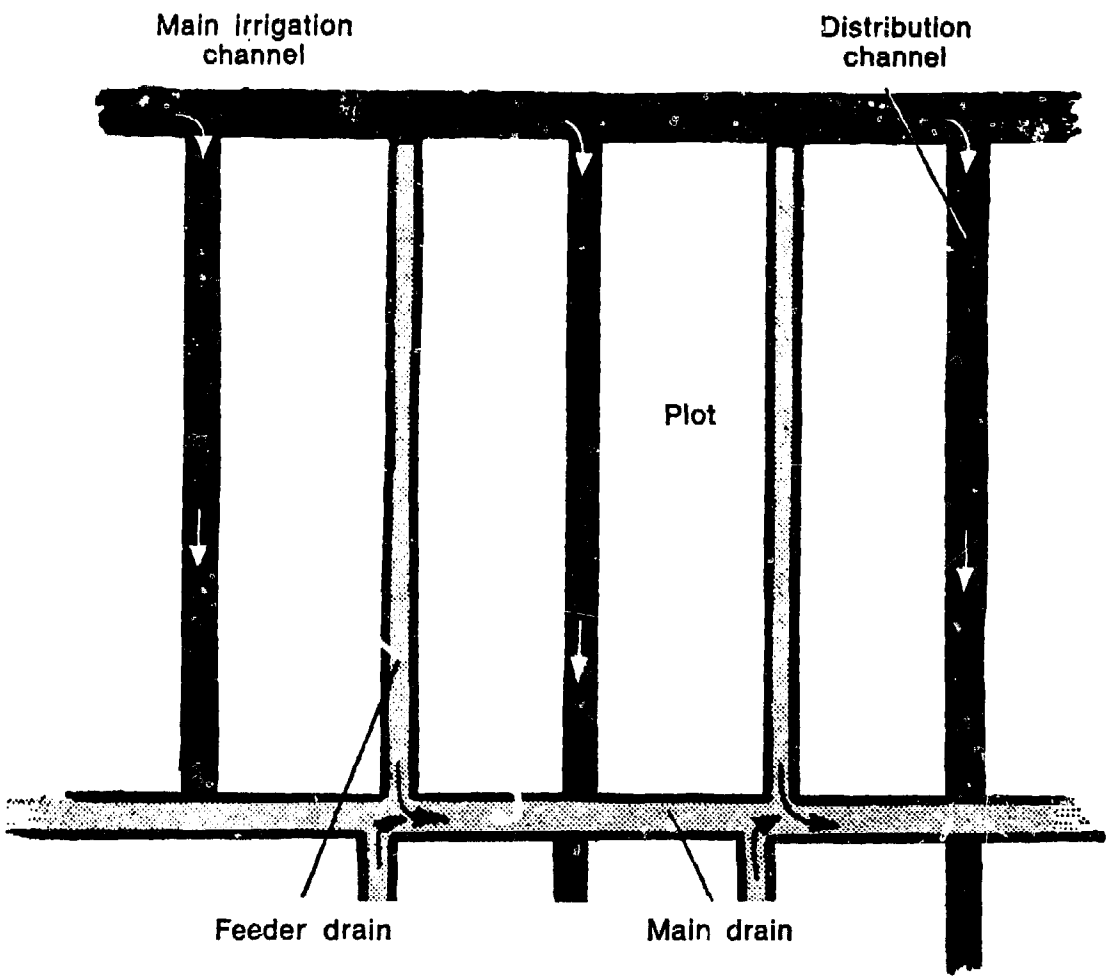
It is dug with a hoe and a shovel, right through the middle of the field.
Dig it as straight as possible: if it is not straight, the water is slowed up and can destroy the levees.

Levees are little walls on both sides of the drain.
These walls are made with the earth dug out when digging the drain.
The main drain carries away the water after it has irrigated the rice field.



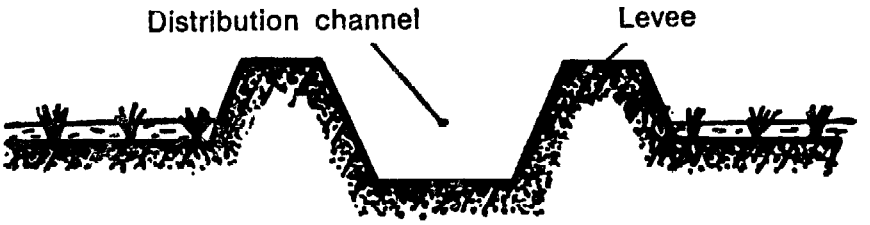
DIGGING DISTRIBUTION CHANNELS AND FEEDER DRAINS

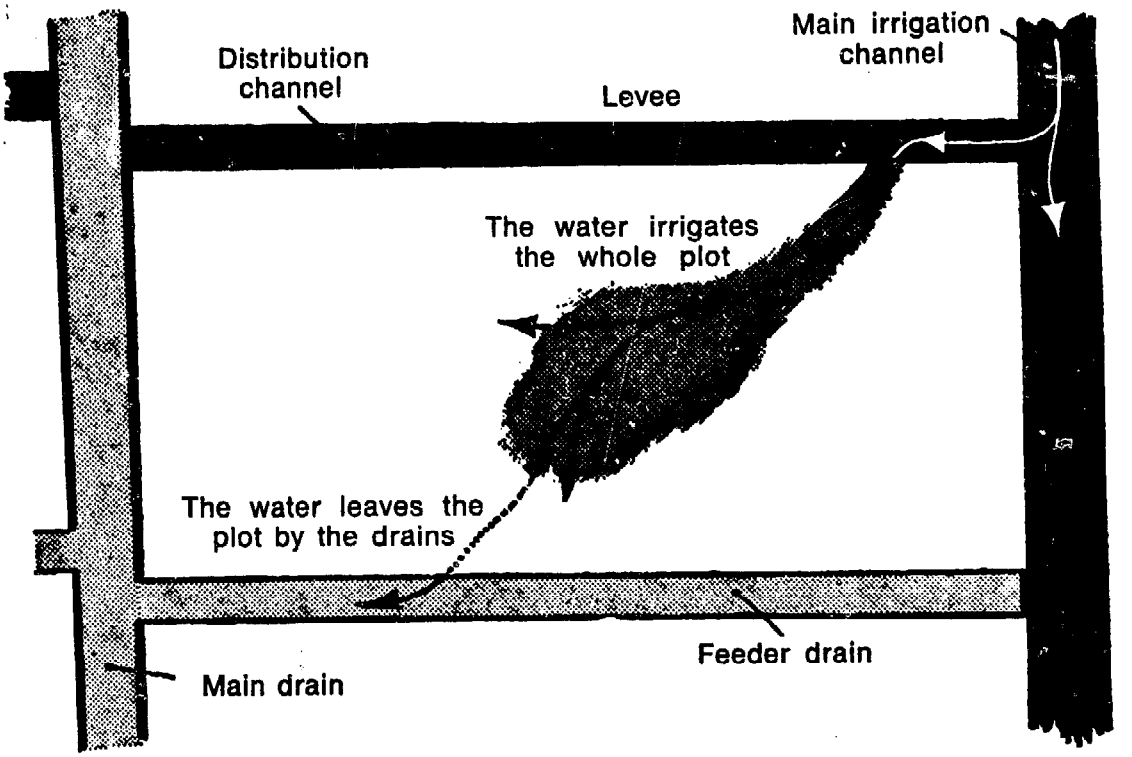
11. The distribution channels carry the water to all parts of the field.
They branch off the main irrigation channel.
The feeder drains take away the water from the rice field, and carry the water into the main drain.



12. All the channels should be quite straight.

The earth dug out in making the channels is used to build the levees.
Pack the earth down firmly on the levees so that you can walk on them.
The channels divide the whole field into small fields which are called **plots.**
The channels should not be wider apart than 20 metres.



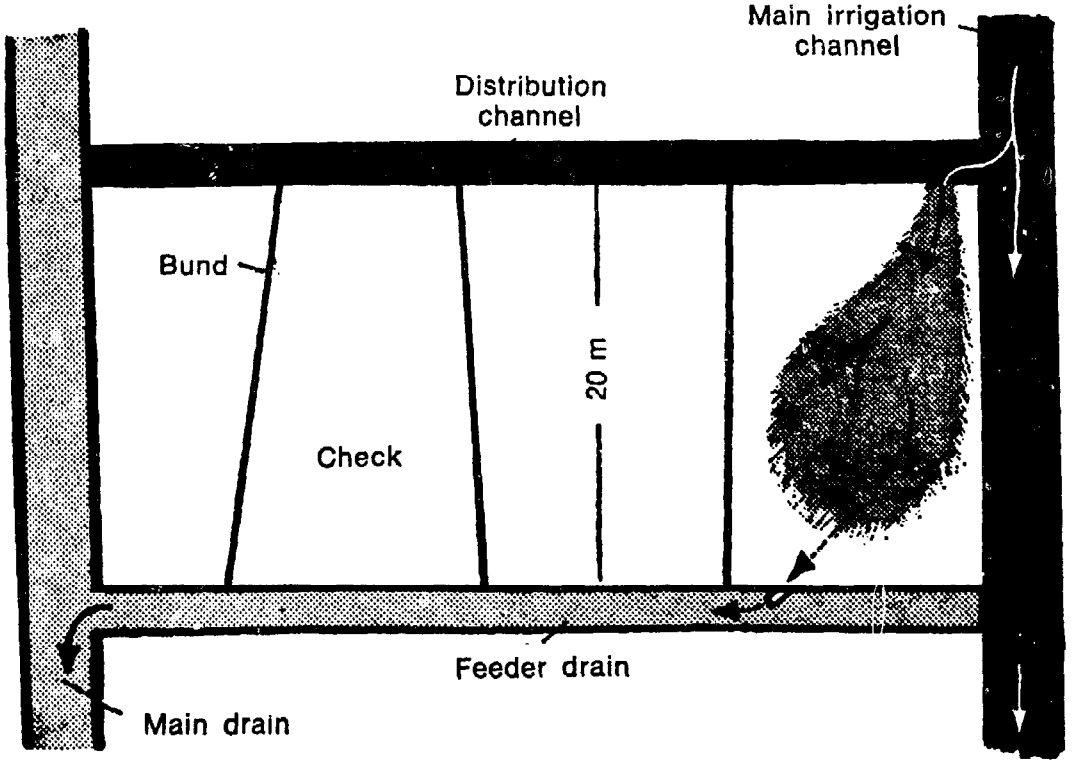


LAYING OUT CHECKS

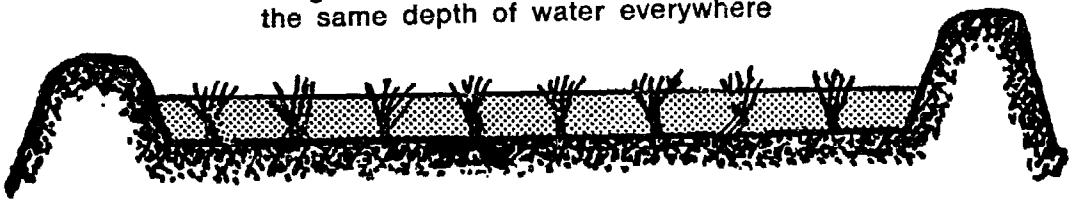
13. The field is divided into plots.

Often the ground of the plots slopes.
With sloping ground, it is impossible to have the same depth of water everywhere.
To get the same depth of water everywhere, you must have ground that has no slope.

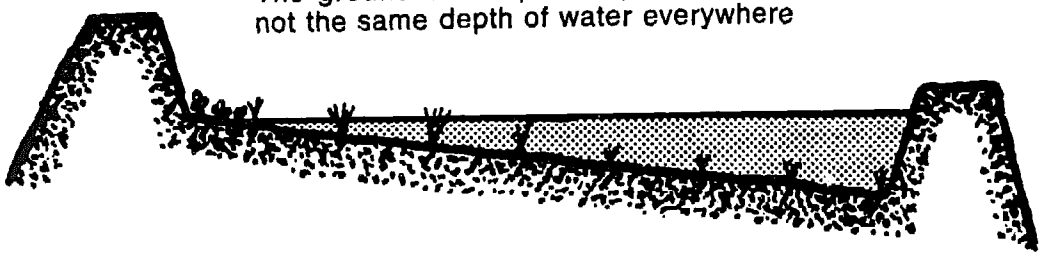
To get ground without slope, divide your plots into checks.
Checks are made by building bunds.
These are small earth embankments, each 30 centimetres high and 40 centimetres wide.
If the slope is steep, make many small checks.
Pack the earth of the bunds down firmly, so that you can walk on them.
Build the bunds so that they follow the contour lines.

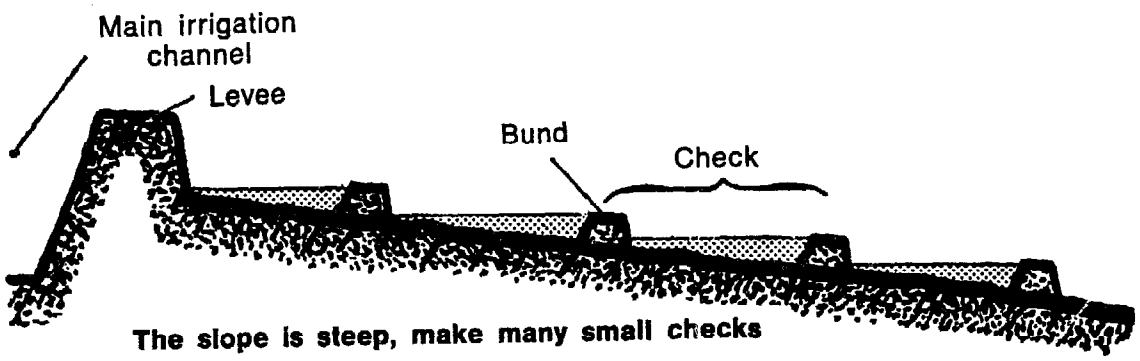


The ground of the plot is level, there is the same depth of water everywhere

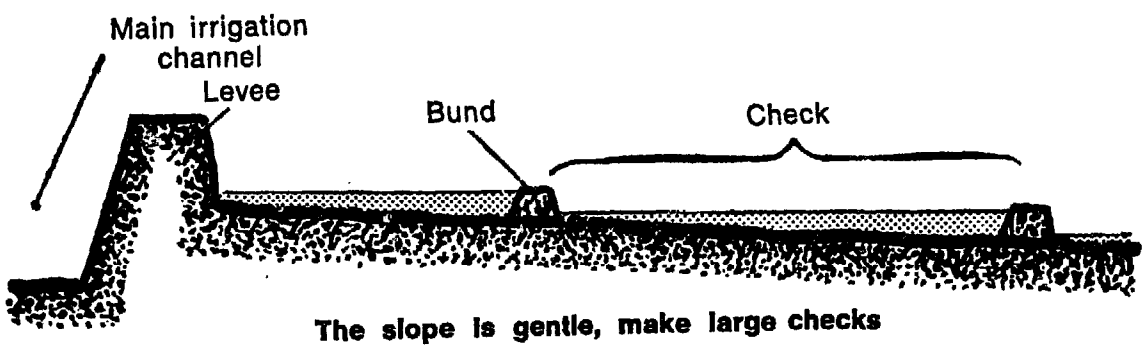


The ground of the plot slopes, there is not the same depth of water everywhere





The slope is steep, make many small checks



The slope is gentle, make large checks

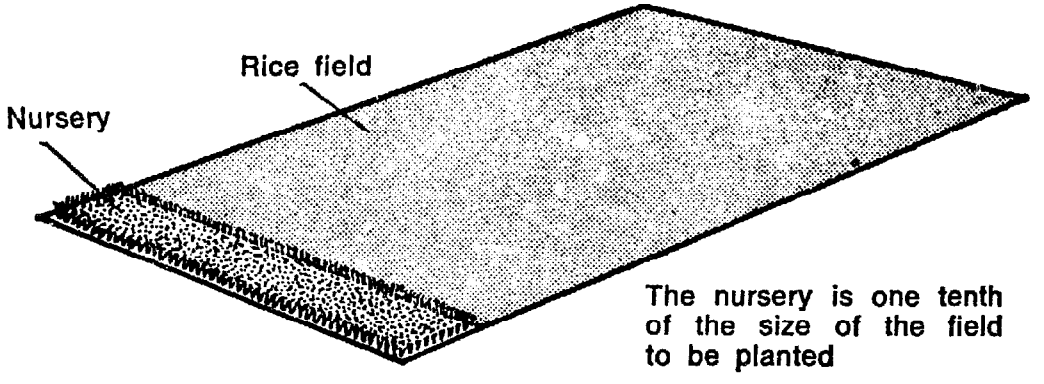
MAKING A RICE NURSERY

14. Where should the nursery be made?

You can make a nursery on one of the checks of the rice field, or close to your house.
If the nursery is near the house, it is easier to look after.
If the nursery is on a check, it needs less work to transport the seedlings and to water.

There should always be a watchman near the nursery, to protect it against rats, birds, cows and goats.
For keeping watch over the nurseries and for watering them, it is best for several farmers to come to an agreement to make their nurseries close together.

How big should your nursery be?
Your nursery should be big enough to give you a choice, so that you can choose from it the best seedlings, and also later replace any seedlings that do not grow.
The right size for the nursery is one tenth of the size of the rice field to be planted.
For example: if you have a rice field of 6 000 square metres, make a nursery of 600 square metres.



The nursery is one tenth of the size of the field to be planted

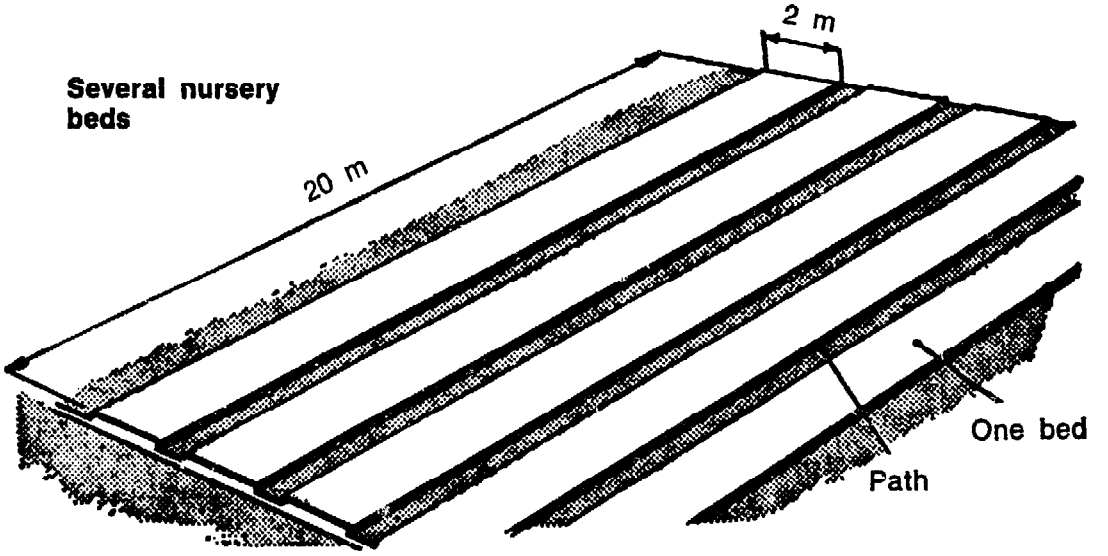
HOW TO PREPARE THE SOIL

15. The soil of the nursery must be tilled, so that the earth is loose, without weeds, moist and fertile.
This work is done with a **hoe,** 1 month before sowing in the nursery (and therefore 2 months before the right time for transplanting).

Put in 200 kilogrammes of manure per 100 square metres and turn over the soil.
Manure improves the soil structure and adds mineral salts to the soil.

Then let the soil rest for 2 weeks.
Break up clods of earth and remove weeds.
When the soil is well tilled and quite loose, divide the nursery into strips 1.5 to 2 metres wide, 10 to 20 metres long, and 20 centimetres high.

These strips are called beds.



Several nursery beds

SOWING

16. Before sowing, break up all small lumps of earth, fill up hollows and remove little stones.

Apply chemical fertilizers.

For each 100 square metres, apply:

1.5 kg ammonium sulfate
1 kg dicalcium phosphate
1 kg potassium chloride.

Spread these fertilizers all over the nursery.
For example: on a bed 20 metres long and 2 metres wide, apply:

600 grammes ammonium sulfate
400 grammes dicalcium phosphate
400 grammes potassium chloride.

This nursery of 40 square metres will give you enough seedlings for a rice field of 400 square metres.

17. Choosing the seeds.

To get good yields, you must have very fine seedlings. To get very fine seedlings, you must sow very good varieties.
Research stations and centres have discovered suitable varieties for the soil and climate of every region. Always sow unhusked rice grains, that is to say, paddy.

PREPARING THE SEEDS

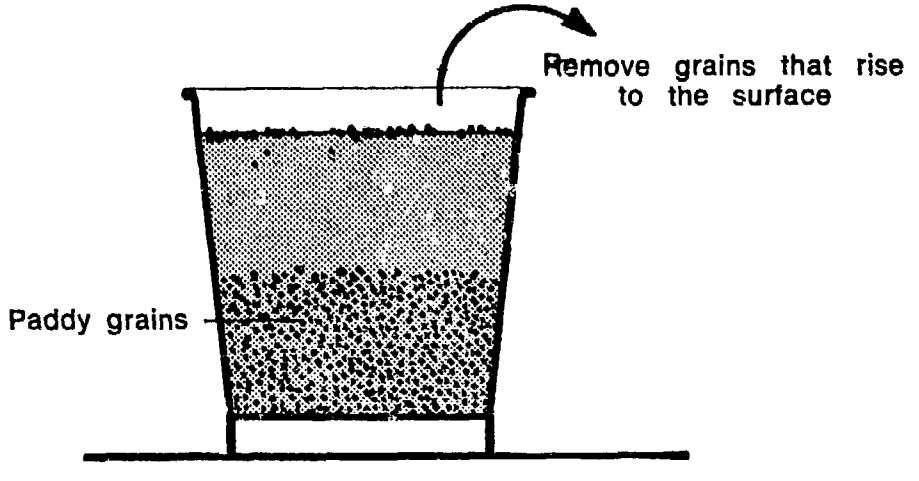
18. Before sowing, it is best to pregerminate the seeds and disinfect them.

Why pregerminate seeds?
To pregerminate means making the paddy grains germinate before sowing.
If you pregerminate, more of the paddy grains you sow will grow.
They will grow faster.
The rats and the birds will not eat them so easily.

How to pregerminate seeds
Put the paddy grains into a bucket.
Fill the bucket with water.
Leave the grains in the water for 24 hours.
Remove all the grains that rise to the surface: they will not grow.

Afterwards, put the grains into baskets or sacks, and leave them there for 1 to 2 days.
The grains then begin to germinate; you will see a tiny white spot on the grains.

Never pregerminate the grains more than three days before sowing.



DISINFECTING THE SEEDS

19. To disinfect the seeds, put a little disinfectant, for example Panogem, into the water which you use for pregerminating.

20. Sowing.
Sow the rice grains in the nursery 1 month before the date of transplanting the seedlings.

Broadcast your seed.
Use 6 kilogrammes of paddy for each 100 square metres.

For example: if the size of the nursery is 40 square metres, use 2.5 kilogrammes of paddy.
Then cover the grains with very fine earth.

TAKING CARE OF THE NURSERY

21. The nursery must be protected against animals, rats and birds.
If you have put your nursery close to the nurseries of other farmers, protection is easier.
There needs to be a watchman, especially during the first week.

Put straw on the beds.
Straw protects the baby seedlings against birds and against the sun.
Remove all weeds.
If the earth gets too hard, water the nursery in the morning and in the evening.

PREPARING THE SOIL IN THE RICE FIELD

TILLING

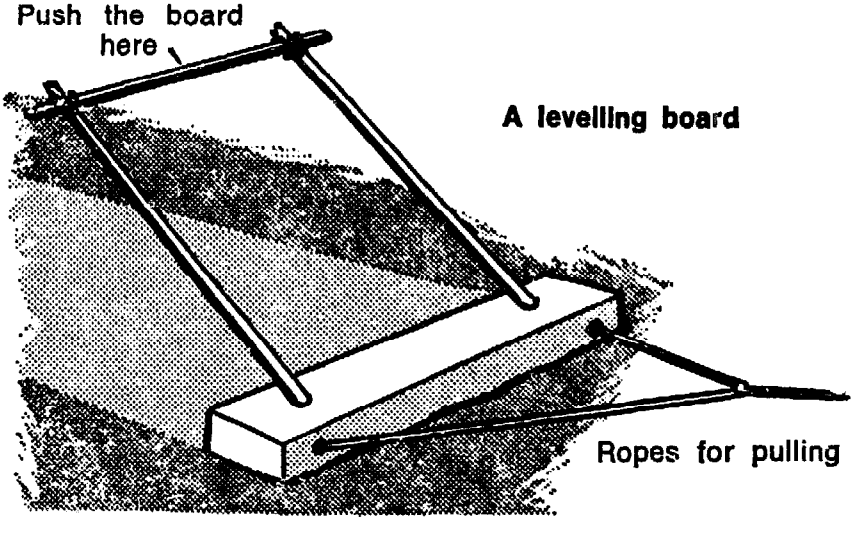
Till the soil of the plot or the checks two months before transplanting.
Weeds will grow: remove them.
When tilling, mix manure into the soil.
Well-tilled soil retains water better.
Till to an average depth of 15 centimetres.

LEVELLING

22. Levelling the soil in the checks.
To level means to make the soil quite flat.

How is this done?
Flood the soil with only a little water. Like that you can see better where there are humps, that is, places where there is little water, and where the water is too deep.

Remove the humps and put the earth into the hollows. When you have done this, go over the ground with a levelling board, to make sure the soil is quite flat everywhere in the rice field.



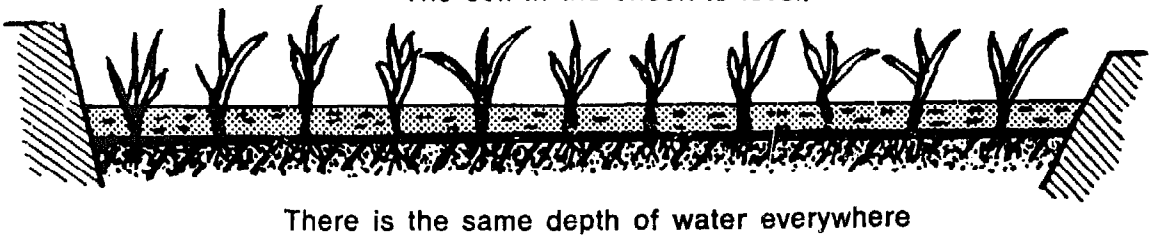
A levelling board

23. Why level the soil?

- **To get the same depth of water everywhere**
- **To drain the soil well**
  To drain means to take away all the water.

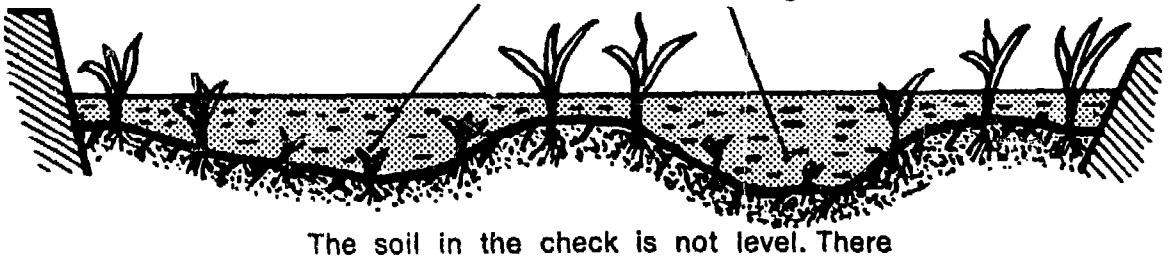
  It is important to be able to drain the soil well. If the soil is not level, water will remain in the hollows.
  If you have levelled the soil well, the water will cover all the soil and weeds cannot grow.

The soil in the check is level.



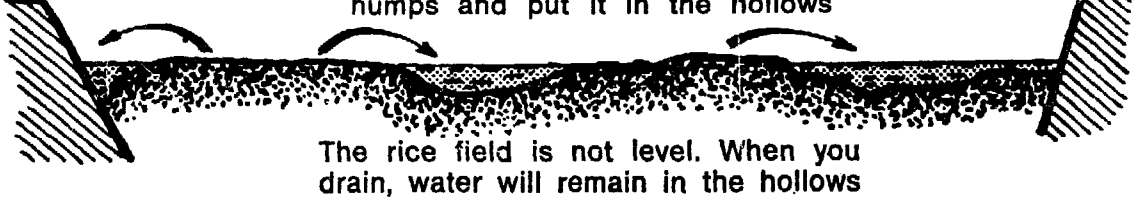
There is the same depth of water everywhere

Too much water. The rice does not grow well



The soil in the check is not level. There is not the same depth of water everywhere

When you level, take the soil of the humps and put it in the hollows



The rice field is not level. When you drain, water will remain in the hollows

TRANSPLANTING

REMOVING SEEDLINGS

24. Take the seedlings out of the nursery 30 days after sowing.

Do not leave the seedlings in the nursery more than 30 days.
If you wait too long, the seedlings will grow less well later.
But, if you do not wait long enough and the seedlings are too young, you will spoil them when you take them out.

Take out the seedlings when they have 4 or 5 leaves.

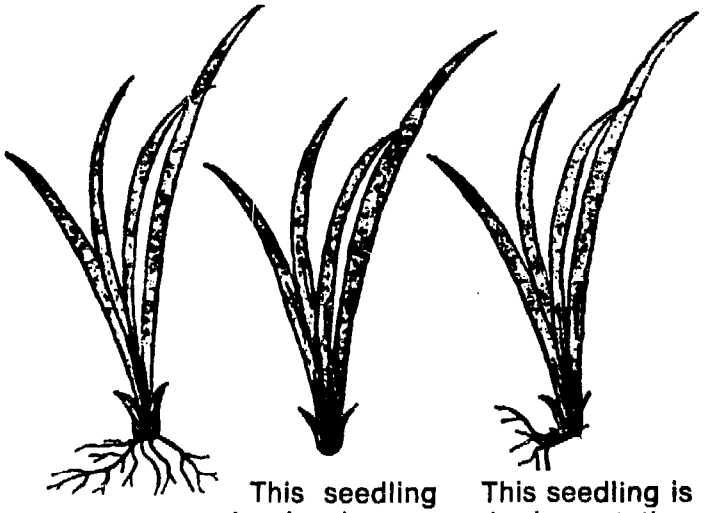
To get your seedlings out without damaging them, water the nursery beforehand.
When the soil is very damp, seedlings come out more easily.

SORTING OUT SEEDLINGS

25. It is very important to sort out seedlings before transplanting them.
Throw away any seedlings broken at the crown, seedlings that have no root, and seedlings that are too small.
If you sort out your seedlings well, all those you transplant will grow, and they will grow better.
When you have sorted out your seedlings, tie them together in small bundles. Like this you can transport them more easily.

PREPARING SEEDLINGS

Next, prepare the seedlings by cutting off the tips of the leaves.
Like this the leaves will stay straight and will not touch the ground.
The transplanted seedlings will grow better.
Do not wait longer than 2 or 3 days between taking out the seedlings and transplanting them.



Good seedling. Transplant it

This seedling has lost its roots. Do not transplant it

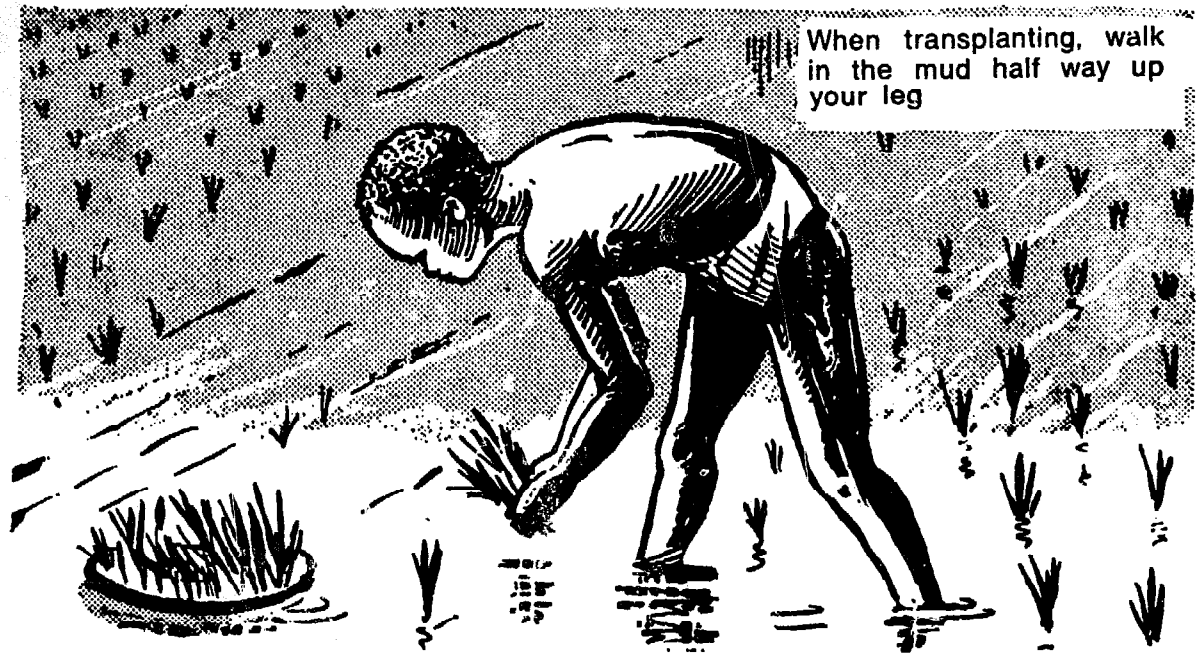
This seedling is broken at the crown. Do not transplant it

Cut off the tips of the leaves before transplanting

HOW TO TRANSPLANT

26. Transplanting is done in the mud.

To make the seedlings grow well, they must be transplanted into very wet soil.
The soil is right for transplanting when the mud comes up to your calf when you walk in the field.



When transplanting, walk in the mud half way up your leg

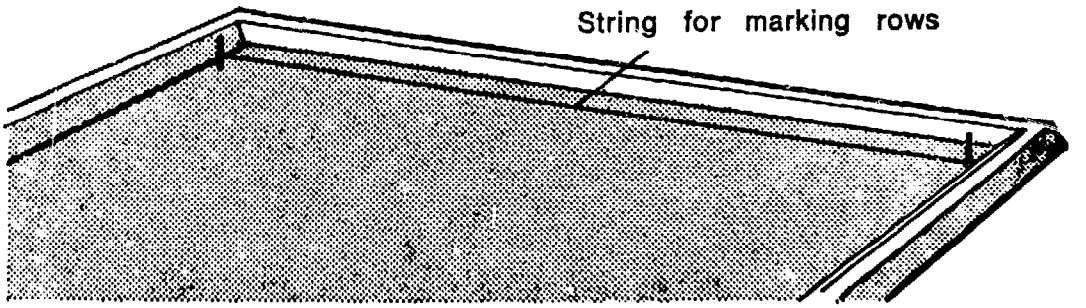
27. Plant the seedlings in straight rows.

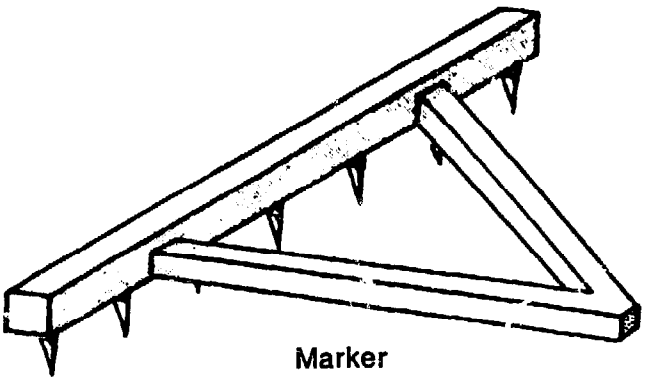
With traditional methods, the seedlings are planted in a haphazard way.
This is not a good method: it makes it more difficult to weed and to apply fertilizers.

When you plant the seedlings in rows:

- You get a better density.
- The seedlings are all at the same distance from each other.
- They tiller out better.
- It is easier to apply fertilizer, to weed and to hoe.

Mark out the rows with a string tied to two pegs.
Or you can use a marker.





Marker

28. Plant in rows and seed holes.

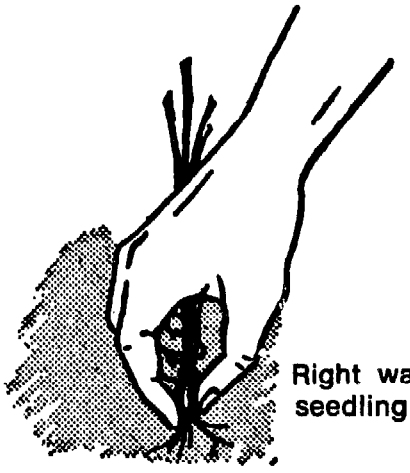
Leave 20 centimetres between rows and, in each row, 20 centimetres between each seed hole.
Put 2 seedlings in each seed hole.

But, if you have left the seedlings longer than 30 days in the nursery, put 4 or 5 seedlings in each seed hole.

Take the roots between your fingers and push your fingers 2 or 3 centimetres into the soil so that the roots will be at the right depth in the earth.

29. Replacing seedlings that have not grown.

If you see seedlings that have not grown 6 to 10 days after transplanting, replace them.
Take some seedlings out of the nursery and plant them in the field in the place of those that have not grown.
Do not wait too long before you do this work.



Right way to hold the seedling when transplanting

TAKING CARE OF THE RICE FIELD

WEEDING

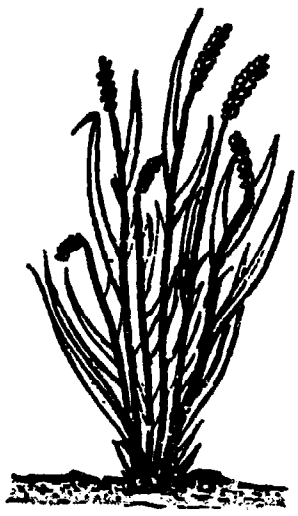
30. Why must weeds be removed?

Weeds take mineral salts out of the soil, so the rice cannot use them and will be undernourished.
Weeds get in the way of harvesting.
Weeds prevent the rice from growing and tillering well.

What does tillering mean? We say the rice tillers when it develops several stems on the same plant.
The buds at the bottom of the stem develop and make new stems.

After tillering, each grain you have sown will have several stems, and every stem makes a panicle (or head) of rice.
But weeds prevent tillering.

Weeds prevent tillering.
There are few panicles



Good weeding encourages tillering.
There are many panicles

31. When to weed.

If you have flooded your field before transplanting, no weeds will have grown.
But when you transplant, you drain the water away, and then the weeds can grow.

Weed 2 weeks after transplanting.
Pull the weeds out by hand.

Later more weeds will have grown.
You must weed again.

Every time when weeds have grown, you must pull them out.

This means a lot of work, but costs no money.
Rice grows much better in a field without weeds, and you will get a much bigger yield.

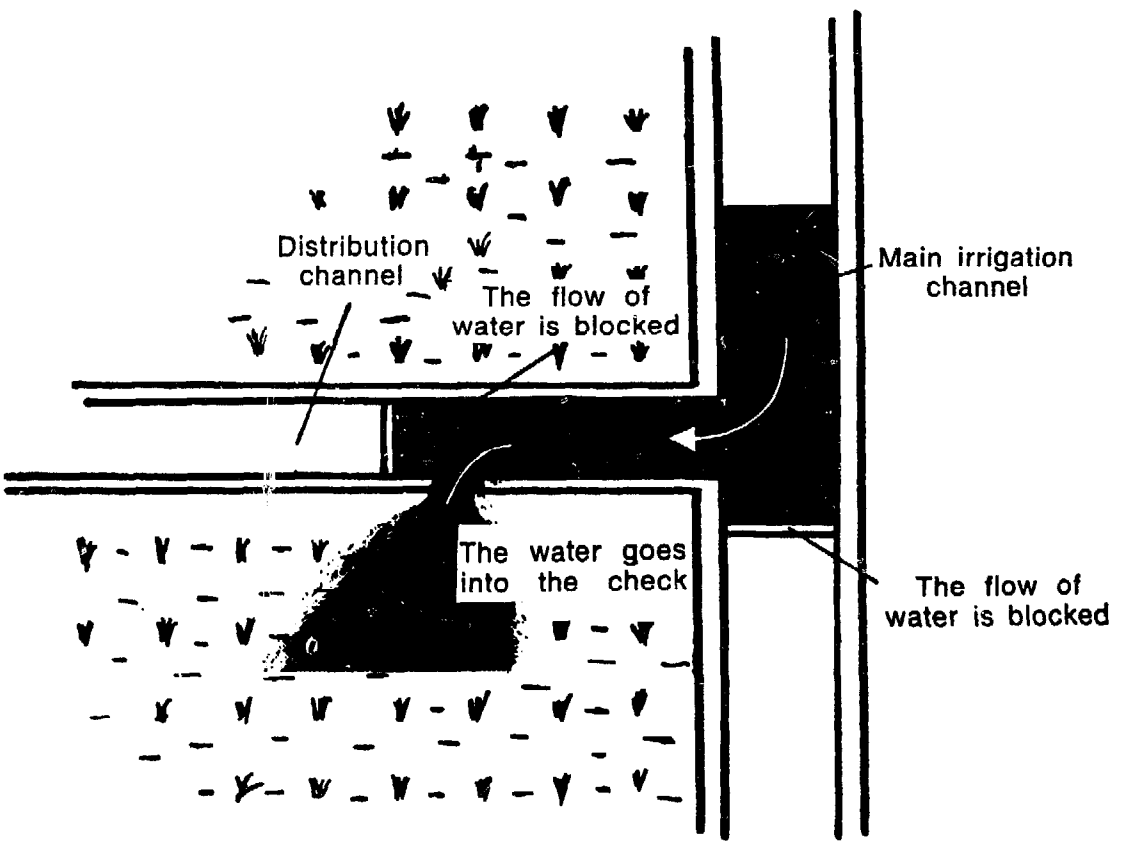
FLOODING AND DRAINING

32. Flooding.

If you want water in any particular check, block up the main irrigation channel with earth.
The water then flows into the distribution channel.

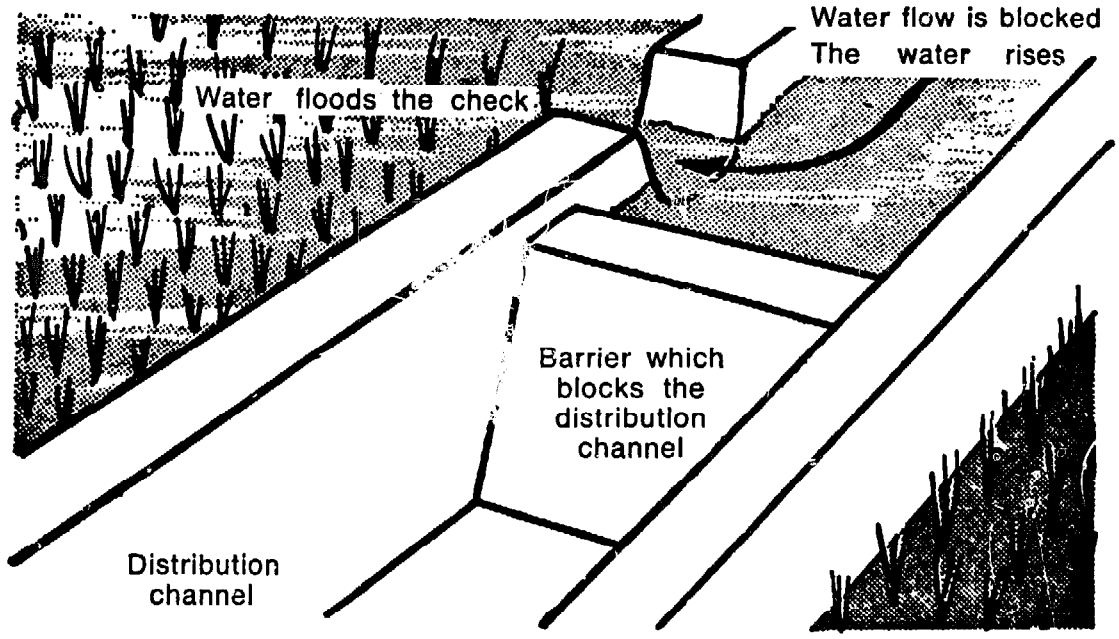
Make a hole in the levee of the check you want to flood.
Block up the distribution channel with earth.
The water will flood the check.

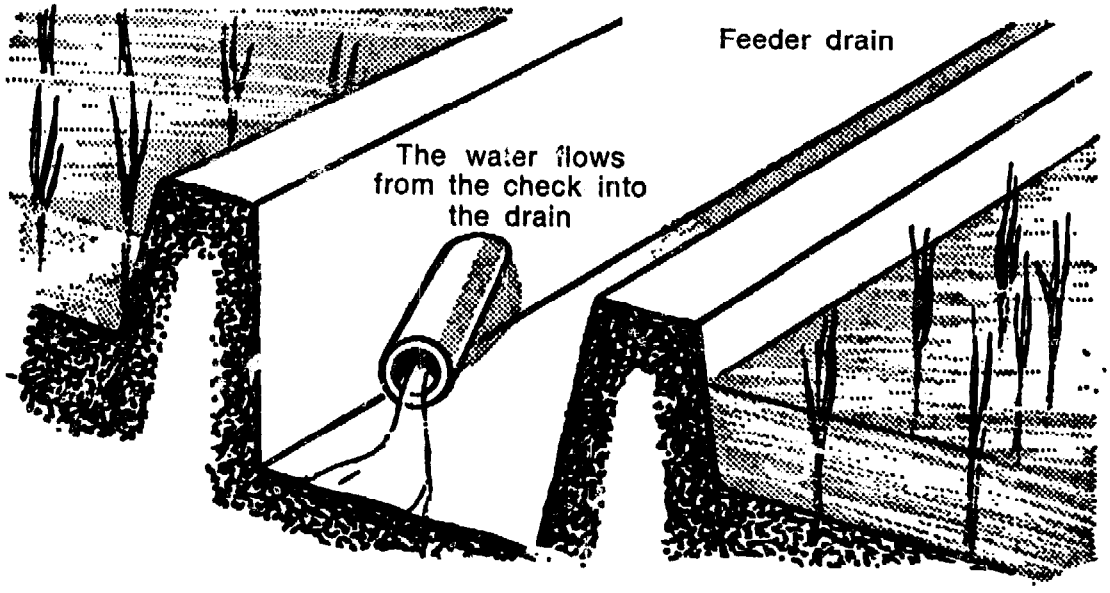
When there is a good depth of water in the check, close the hole in the levee, open the distribution channel and flood the next check.



33. Draining.

When you want the water to flow out of a check, you can make a hole in the levee that divides the check from the feeder drain.
Or you can push a pipe through the levee, for example a bamboo, to connect the check with the drain.





34. When to flood and drain.

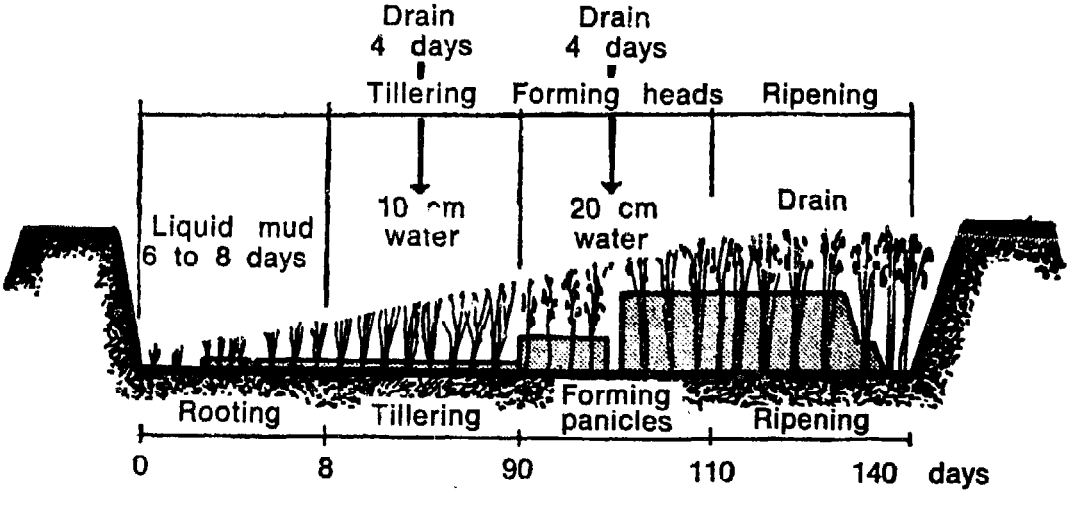
In order to produce a higher yield, the **rice must constantly stand in water.**

But it is wrong to flood the field always to the same depth of water.
For the first 6 to 8 days after transplanting, leave the soil a liquid mud.
If the soil becomes dry, let in only a little water.

About a week after transplanting, when the rice has begun to grow, flood the field with 2 to 3 centimetres of water and leave for 45 days.
But, twice during these 45 days, drain the field in order to apply fertilizers.
Each time, drain for 2 days.

After 45 days, that is, 2 months after transplanting, increase the depth of water to 10 centimetres.

When the panicles have formed and are turning yellow, the rice field must always be well flooded. It should have about 20 centimetres of water.
Afterwards gradually make the water less deep.
10 days before harvesting, drain all the water away.



APPLYING FERTILIZERS

35. 2 weeks after transplanting, pull out the weeds.
Drain all the water away.
Apply 100 kilogrammes of ammonium sulfate for every hectare of rice field.
This fertilizer contains nitrogen.
When the panicles are forming, drain and apply 50 kilogrammes of ammonium sulfate for every hectare.

PROTECTING THE RICE FROM PESTS

36. Rats and birds often do much damage to rice fields.

They eat the grains.
It is difficult to keep off these pests.

You can have a watchman near the field.
Noise can frighten the birds away.
Rice fields must be watched especially at the time when the grain begins to ripen.

There are also certain insects that damage rice, for example rice borers which lay their eggs on the leaves.
When they grow, they eat through the stem.
When you see stems going white, apply BHC and Aldrin, a product which can kill these insects.
Ask your extension service for this product.

HARVESTING

CUTTING THE RICE

You can get a better price for paddy if you cut your rice only when it is quite ripe — a ripe grain makes a crunching noise when you bite it; when the paddy is very clean, without any little stones or weed seeds; and when it is quite dry. If the heads are left on the ground too long, the grains may rot or germinate.

37. It is hard to know the right moment for harvesting.

The right moment to harvest is different for different varieties of rice.
Varieties that grow fast, for example in 4 months, are the first to be harvested
Varieties that grow more slowly, for example in 5 months, are harvested later.
The right moment for harvesting differs also according to the season, but is usually **after** the rainy season.

38. Cut the rice when it is well ripened.

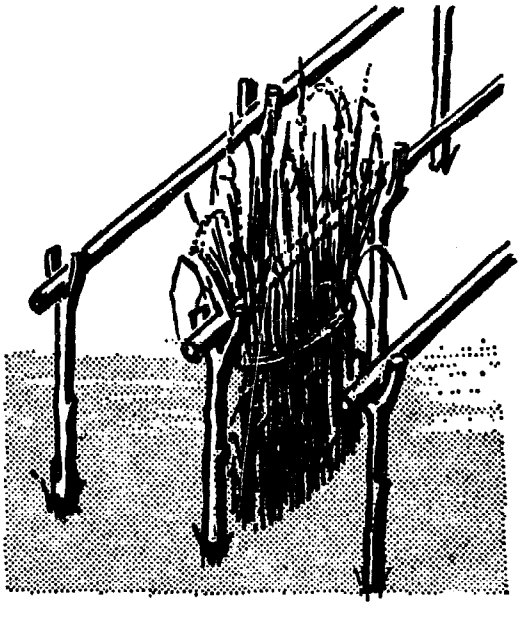
Wait until the heads are yellow.
Cut the rice with a sickle. This is the quickest way to do it.
Either cut the stems close to the ground, or cut only the panicle.

DRYING

39. When you have cut the rice, make sheaves by binding a lot of stems together.

Either: Stack the sheaves so that they lean against each other, standing upright with heads upward, and place one sheaf over the top of the heads, so as to protect the grains from the rain.

Or: Lean the sheaves against a stick supported by two poles.
Either way the rice can dry well.
Leave the rice to dry for three or four days before threshing.



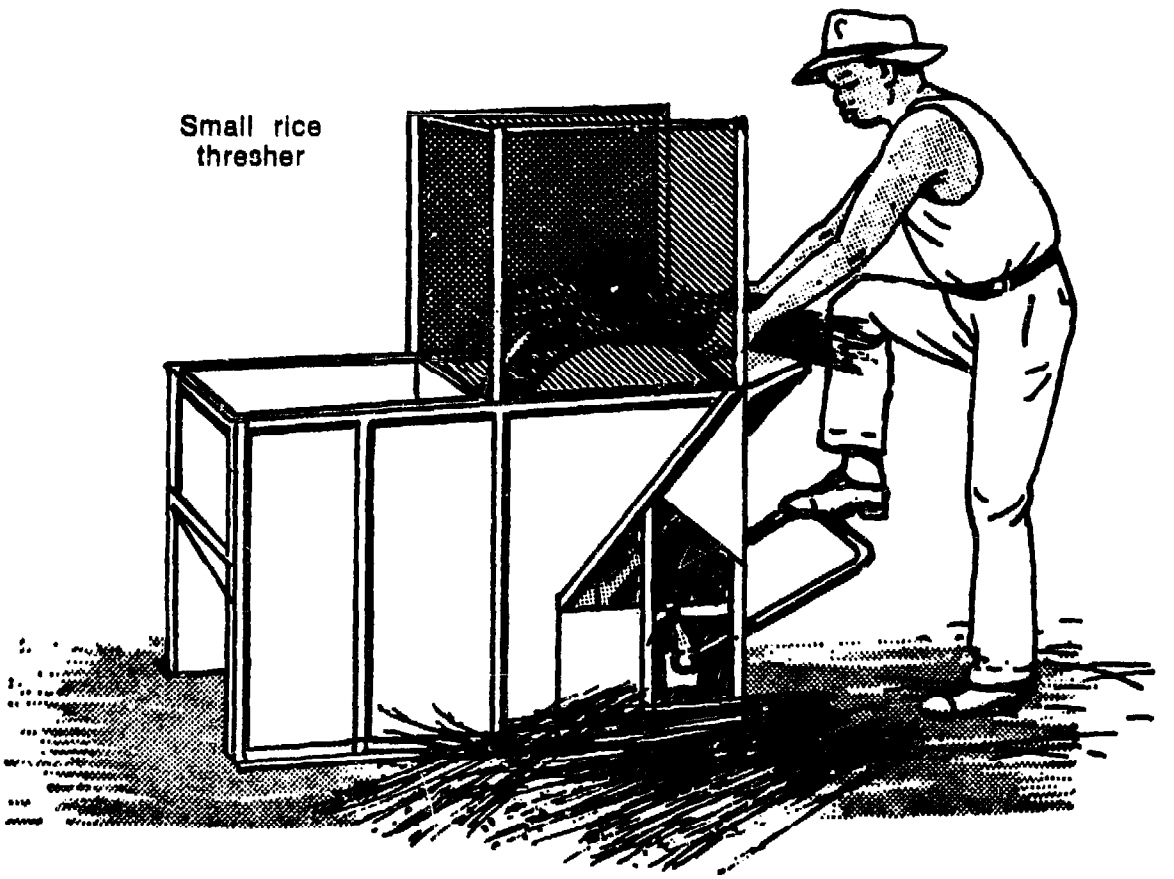
THRESHING

40. There are three ways of threshing:

Either: Put the rice on a hard piece of ground, very clean and without dust, or covered with mats, and beat the heads with a stick;

Or: Beat the rice against a large stone or a tree trunk;

Or: Use a small thresher. You can join with a few other farmers and buy a small thresher together. In this way the work can be done better and more quickly.



Small rice thresher

WINNOWING

41. It is important that the rice grains should be very clean, and not mixed up with earth and little stones. When you have threshed your rice, winnow it to make it quite clean.

For winnowing, use a sieve or else pour the rice from one flat bowl into another.

STORING

42. Rice can be stored either in sacks or in a barn.

The sacks or the barn must be protected

- against damp, which makes the grains rot,
- against rats and insects, which eat or spoil the grains.

The barn floor must not touch the ground.
This will keep the rice dry.

The barns must be disinfected.
Ask the extension service what disinfectants to use and how to apply them: some disinfectants are poisonous.

Rice can be eaten by the family.
Rice can also be sold, either at the market, or to companies which resell it afterwards.
Rice is a crop which can pay well.

HOW TO GROW CHINESE RICE

43. Chinese varieties of rice have a short cycle, which means that they grow fast, in 4 months.
In regions where there is water all the year round, 2 crops can be grown each year.

- **Nursery.**

  If you want to plant 1 hectare of rice field, sow a nursery of 400 square metres.
  Sow 12 kilogrammes of seed per 100 square metres.
  Apply fertilizers to a nursery of 100 square metres as follows:

  1.2 kg of ammonium sulfate
  1.5 kg of superphosphate of lime
  1.7 kg of potassium chloride.

- **Transplanting.**

  Transplant when the seedlings are 2 weeks old.
  Plant 4 to 5 seedlings per seed hole.
  Leave 25 centimetres between rows and 25 centimetres between seed holes.

- **Fertilizing and weeding.**

  After your first weeding, for every hectare of rice field apply:

  100 kg of ammonium sulfate
  50 kg of superphosphate of lime
  35 kg of potassium chloride.

  After your second weeding, for every hectare, apply:

  200 kg of ammonium sulfate
  100 kg of superphosphate of lime
  65 kg of potassium chloride.

  The seedlings are planted further apart; therefore more weeds will grow.
  You must weed often.

SUGGESTED QUESTION PAPER

FILL IN THE MISSING WORDS

Rice is a food that gives .....
A grain of unhusked rice is called a grain of .....
The dam ..... the water level.
Before sowing, the paddy grains are .....
When the rice seedlings have five leaves, they are ..... into the rice field.

ANSWER THE FOLLOWING QUESTIONS

Do you buy improved rice seed?
Who supplies you with these seeds?
Is there in your region any water control system for growing rice?
Do you transplant your rice seedlings in rows?
What is the date for transplanting rice in your region?
What is a dam for?
Why must the channels be quite straight?
What should you do to control weeds before transplanting?
What are the drain channels for?
Why should you make checks?
Why should you level the checks?
How should you level the checks?
How can you pregerminate the paddy grains?
How large should the nursery be?
What work needs to be done in the nursery?
Why should you sort out the seedlings lifted from the nursery?
Why should you transplant in rows?
How should the soil be when you transplant?
What is tillering?
How should you dry your rice?
How should you flood the checks of your rice field?
When should you flood and drain the soil?

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