

FOOD PRODUCTION AND
MANAGEMENT – I

[Microorganisms and Plants]



SYLLABUS

1. Useful microorganisms and plants — products obtained from them.
2. Agriculture : cash and food crops; *rabi* and *kharif* crops, annuals, biennials, perennials, orchards — examples of the same.
Different types of soil — which is most suitable for crops (revision) - acidic and alkaline soils — how to treat them.

Agricultural practices : soil preparation, selection and sowing of seeds, irrigation, manuring - natural and artificial fertilisers, weeding, harvesting and storage of grain. (in brief).

Crop protection — pesticides/insecticides - useful and harmful effects.

Crop rotation — organic farming.

- * Visit, if possible, to agricultural areas to observe the steps taken by farmers.
- * Experiments to observe the water-retention capacity of different types of soil (E).
- * Testing soils for acidity/alkalinity (E).
- * Finding about pesticides used by gardeners — extension activity.
- * Making compost in the school garden.
- * Vermiculture — setting up a small unit in the school garden.
- * Interaction with agricultural scientists.

Food is the prime need of all living beings. Animals, including human beings eat either plants and plant products or feed on animals and animal products.

Originally, human beings were living in jungles and led a nomadic life. They knew nothing about agriculture or animal keeping. They used to hunt wild animals and ate them raw, but gradually they started roasting them on fire before eating. They also ate roots, leaves or fruits of different plants.

With the passage of time, man changed from the food-gatherer to the food producer. Besides growing crops, he also started breeding animals. Today, he gets food from several sources.

In this chapter, you will learn how microorganisms and plants are being utilised for getting food and other useful things.

MICROORGANISMS

Microorganisms are those organisms which cannot be observed by the naked eye. They are extremely small in size and can be seen only under a microscope. They are also called *microbes*. The science which deals with the study of such organisms is called **microbiology**. Most of these organisms are unicellular *e.g.*, viruses, bacteria, algae, fungi and protozoans. Microorganisms are found everywhere — in air, water, soil, food (milk, curd, vegetables, fruits) *etc.* Generally,

microbes are harmful as they cause different diseases like cholera, malaria, dysentery, tetanus, anthrax, *etc.*, but some microbes are useful to us in many ways.



Do You Know ?

Microbes were the first living organisms to appear on the earth. Leeuwenhoek, the father of microbiology, was the first to describe the shapes of bacteria found in rain water and saliva of mouth.

BACTERIA—GENERAL STRUCTURE

Bacteria are very small in size. They are of various shapes — round (*coccus*), rod-shaped (*bacillus*), spring-shaped (*spirillum*) and comma-shaped (*vibrio*). A bacterial cell is very simple in structure. It is surrounded by a wall and, has a primitive nuclear material (chromatin fibres) without a nuclear membrane. A bacterial cell has a slimy, gelatinous, protective layer in the form of a capsule. There is a thin cell membrane, below the cell wall, within which the cytoplasm along with some granules is filled. Certain bacteria move with the help of a thread-like structure called flagellum.

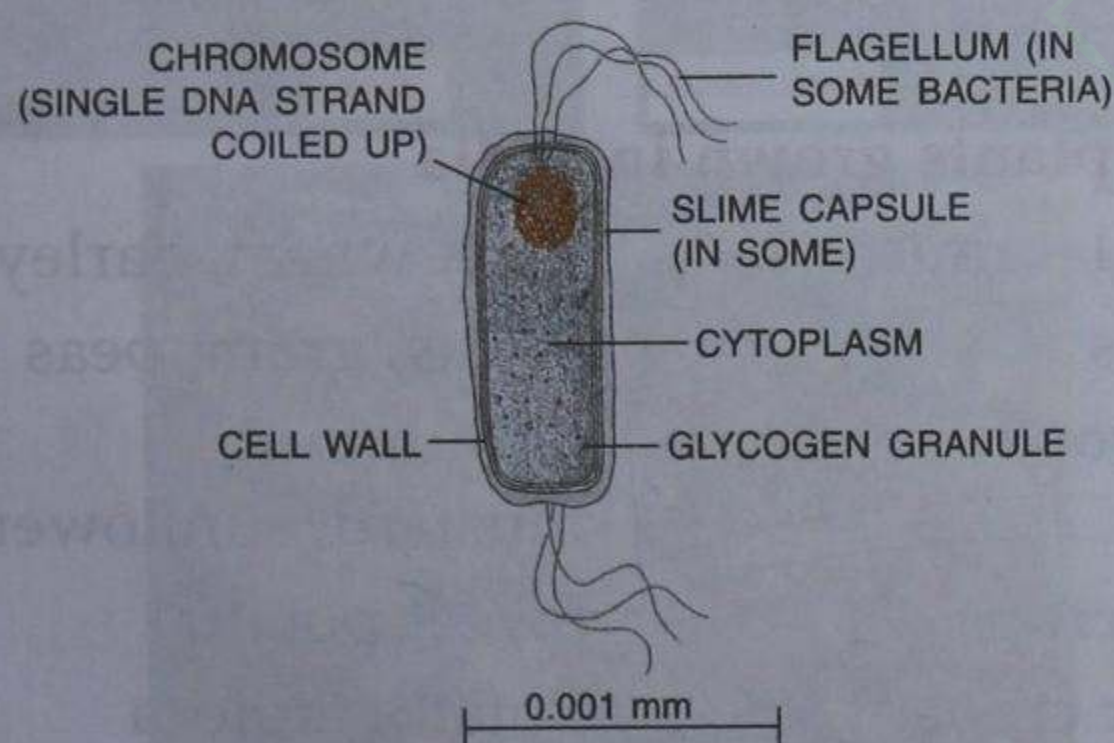


Fig. 10.1 Bacterium (highly magnified)

Important Uses of Microbes

1. Increase in soil fertility. Bacteria decomposes the dead remains of plants and

animals to form humus of the soil. Certain bacteria pick up nitrogen from the air and convert it into nitrites and nitrates which increase the soil fertility.

2. Nitrogen-fixing bacteria. In the roots of leguminous plants like pea, gram and pulses, bacteria found in the nodules of the root help in fixing free nitrogen of the soil into soluble nitrates which are useful fertilisers.

3. Decomposers and scavengers. Fungi and bacteria are decomposers and natural scavengers. They help in converting complex substances into simpler ones which are useful for the growth of plants. *For example*, nitrogen-fixing bacteria in the root nodules of leguminous plants.

4. In industry. Microbes are used in the preparation of medicines, beverages, food, textiles, *etc.* in the manner explained below.

- (i) **Antibiotics.** Penicillin, streptomycin and aureomycin are some very useful antibiotics which are manufactured with the help of microbes.
- (ii) **Curd and Acids.** Curd is produced by *Lactobacillus*, acetic acid by *Acetobacter*, and oxalic acid and citric acid by certain fungi.
- (iii) **Yeast** is used in distilleries for the fermentation of fruit juices, malt grains or molasses ("*sheera*") to make alcoholic drinks. In the bakery, yeast is used to raise the dough for making bread.
- (iv) **Animal skins and hides** are treated with bacteria to remove flesh and make them soft for tanning.
- (v) **Retting bacteria** help in separating the fibres of the stem, *e.g.*, flax and hemp.
- (vi) **Decomposition of hydrocarbons:** Many bacteria such as *Pseudomonas* are capable

of breaking hydrocarbons of the oil spills in marine and fresh water.

5. Sewage disposal. Many bacteria help in biological degradation of organic matter. Biogas used for cooking is being produced from human and animal excreta through bacterial activity.

6. Helpful in nutrition. Many bacteria live in our intestines where they synthesise certain 'B' vitamins. In the intestines of herbivorous animals like a cow and a buffalo, bacteria help in the digestion of cellulose.

MUSHROOMS — LARGE-SIZED RELATIVES OF MICROORGANISMS

Certain varieties of mushrooms (button mushroom) are eaten as food. They are highly nutritive and rich in proteins. Some mushrooms of wild nature are not to be eaten, because they may be poisonous. Therefore, always buy mushrooms from a reliable shop.



Fig. 10.2 A poisonous mushroom

AGRICULTURE – PRIMARY FOOD SOURCE

Agriculture is the backbone of human existence. Agriculture is defined as the science of growing food crops and other crops useful to man.

Primitive man, who was dependent for his food on animals, soon learnt how to cultivate plants. Prehistoric man lived on berries, tapioca (*kand-mool*), yam, juicy herbs, etc. To start with, as an agriculturist, man cultivated those plants which could be used as food, such as cereals, pulses, oil seeds, etc. With industrialisation, he used modern scientific practices like irrigation, fertilisers, better seeds and plant protection, which resulted in better production. To meet the increasing requirement of the fast growing human population, we need both extensive and intensive agriculture.

The cultivated crops can be classified under two categories :

1. Food crops : Crops cultivated for the production of food are called food-crops such as cereals, pulses, oil-seeds, etc.

2. Cash crops : Crops cultivated for commercial purposes are called cash- crops, such as rubber, tea, coffee, spices, etc.

Crop plants – The plants grown and cared in the field for food or other useful products and harvested, annually or seasonally, are known as crop plants. The edible parts obtained from them may be in the form of grains, roots, vegetables and fruits.

Crop plants grown in India

Cereal crops	– Rice, wheat, barley
Pulses	– Beans, gram, peas
Oil crops	– Groundnut, mustard, sunflower
Root crops	– Sweet potato
Tuber crops	– Potato, tapioca
Sugar crops	– Sugarcane, beetroot
Plantation crops	– Coffee, tea, rubber, coconut
Fibre crops	– Cotton, jute

Plant nutrients – Plants too require nutrients as we need, for their good growth. Such nutrients are carbohydrates, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, copper, zinc, manganese, chlorine, etc. Some are required in traces (micronutrients) and some in large amounts (macronutrients). The deficiency of any nutrient in the soil affects the crop yield. The three most important nutrients for plant growth are nitrogen, phosphorus and potassium (NPK). Such requirement of nutrients is met by using chemical fertilisers and manures in the soil.

HORTICULTURE is a branch of agriculture, in which we grow vegetables, fruits and decorative plants.

Horticulture crops

Vegetables – Cabbage, cauliflower, spinach, tomato, etc.

Fruits – Mango, grapes, apple, banana, etc.

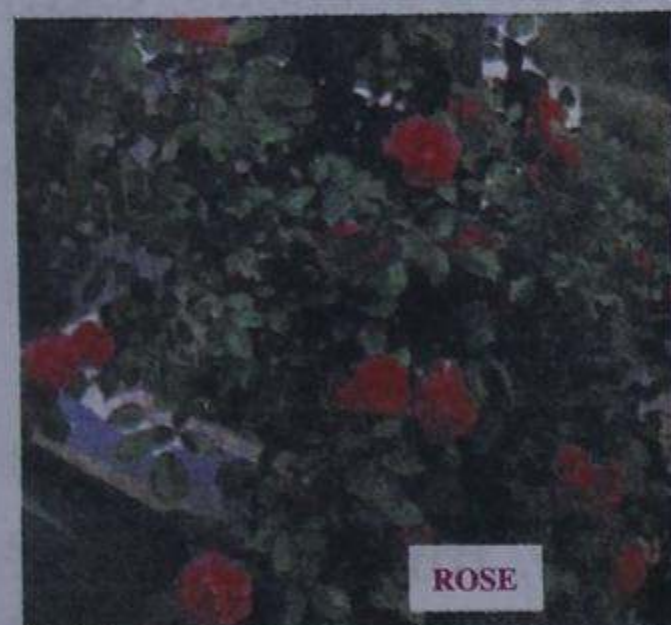


Fig. 10.3 Some flowering plants

Decorative plants – Crotons, coleus, ferns, bougainvillea.

Decorative Flowers – Rose, gladiolus, sunflower, jasmine, etc.

Nutrients in crops

- Cereals are rich in carbohydrates and starch;
- Pulses are rich in proteins;
- Nuts, coconut and mustard are rich in oils.
- Fruits and vegetables provide minerals and vitamins in particular.

FOOD CROPS

A. KHARIF CROP (means "autumn crops") : Kharif crops are raised in the rainy season (July to October). Rice is the most important kharif crop in India which occupies the largest area. Rice requires a temperature of 16°–20°C during the growing season and 18°–32°C during ripening. It needs rainfall from 150–200 cm, and needs flooded field during the growing period.

Soil for kharif crop. The paddy crop ideally grows on alluvial loam with a subsoil of clay. River valleys and deltas are most suitable for its cultivation. It can also be grown on hill slopes.

Cultivation methods for kharif crops

- Broadcasting** is by throwing seeds over the soil.
- Dibbling** is dropping seeds at regular intervals in the furrows made by a plough.
- Drilling.** In this method, seeds are sown inside a hole made in the soil with a bamboo shaft or a long iron tube having a funnel into the furrow made by a plough.

(iv) **Transplantation.** In this method, seeds are first sown in nurseries after soaking them for 24 hours in water. When the seeds grow into tiny plants (seedlings), they are transferred to the seed bed in a nursery. Only healthy ones and well-developed seedlings are then picked up and transplanted to the regular field. This is called transplantation. This work is done in flooded fields.

Sufficient water supply or timely rainfall, good soil fertility, adequate use of fertilisers, use of different seeds and proper methods of cultivation provide a rich yield.

B. RABI CROP (means "winter crop"): Wheat is important rabi crop of India. It is grown in alluvial soils of northern plains. Wheat is sown in October/early November. Winter rains are very important for the wheat crop.

Temperature for the wheat crop should be cooler (10°C to 15°C) and a warm and sunny weather is essential at the time of ripening. It requires a rainfall of 50 to 100 cm during the growing period. A little rain before crop grain ripens, helps to swell the grain.

Soil for rabi crop. Clay loamy soil or even black cotton soil is suitable. Some amount of lime in the soil is beneficial.

Cultivation method for rabi crop. Seeds are sown both by broadcasting and under dibbling (a pointed tool for making holes in the soil for seeds) and drilling. Sowing is done soon after the rainy season because there is enough moisture in the soil to help the growth of the plant in the first few weeks. The grain is formed by the end of January and the rising temperatures help to ripen the crop.

THREE CATEGORIES OF PLANTS ON THE BASIS OF THEIR LIFE-SPAN

Plants can also be classified on the basis of their life-span into three categories.

Annuals. Annuals are those plants which complete their life cycle in one year or one season, e.g., wheat, rice, gram, beans, pea, sunflower or most of the seasonal flowering decorative plants and vegetables. After the seeds are formed, the whole plant except seeds die.



MARIGOLD



SALVIA

Fig. 10.4 Some annual plants

Biennials. Biennials are those plants which live for two years or two seasons, e.g., beet root, radish, turnip and carrot in temperate regions of the world. In the first year, the plant bears vegetative parts and in the second year, it bears flowers, fruit and seeds. Some plants in tropical climate, like in India, complete their life cycle in one year only. Some such plants are, turnip, potato, carrot, etc.



TURNIP



POTATO



CARROT

Fig. 10.5 Some biennial plants

Perennials. These are the plants which live for more than two years and they bear

flowers and seeds every year, *e.g.*, rose, pine, mango, teak, guava, *etc.* Some plants live for hundreds of years like banyan, peepal, pine, *etc.* Bodhi tree of Sri Lanka is more than 2000 years old. Some pine trees in America are over 4000 years old.



GUAVA



OAK



PALM

Fig. 10.6 Some perennial plants

ORCHARDS

Orchards are the areas where fruit trees are grown in closed boundaries, *e.g.*, mango, litchi, apple, orange, *etc.* Fruit trees are propagated vegetatively by the method of stem grafting and layering.

SOIL

Agricultural production depends upon the quality of soil. Soil must be fertile and it should contain nutrients in sufficient quantity as required by plants. It should be able to retain water. Also, it should not be too acidic or too alkaline.

Soil is a mixture of minerals, decay matter (organic remains), humus, water and air. It also contains many living organisms like the bacteria, fungi and worms. Soil formation is a very slow process. It takes thousands of years to form. It occurs due to physical, chemical and biological processes. Disintegration of rocks into smaller fragments occur due to high temperature, cooling, wind and water. Composition of soil

depends upon the parent rock from which it has formed. Soil composition keeps changing due to pollution and decay of organic matter and by the addition of manures and fertilisers.

TYPES OF SOIL

Soil is broadly classified in the following three types :

1. Sandy soil. It contains more sand (90%) and less clay (10%). It is permeable to air and water due to large pore spaces which dry up very easily. It is suitable for fruits and vegetables.

2. Clayey soil. It has a high portion of clay. It becomes sticky in water. It is not aerated (air spaces). Roots find difficulty in penetration and it gets waterlogged in high moisture. It becomes suitable for farming by adding sand and lime.

3. Loamy soil. It is a mixture of sand and clay together with silt and humus. It is most suitable for plant growth.

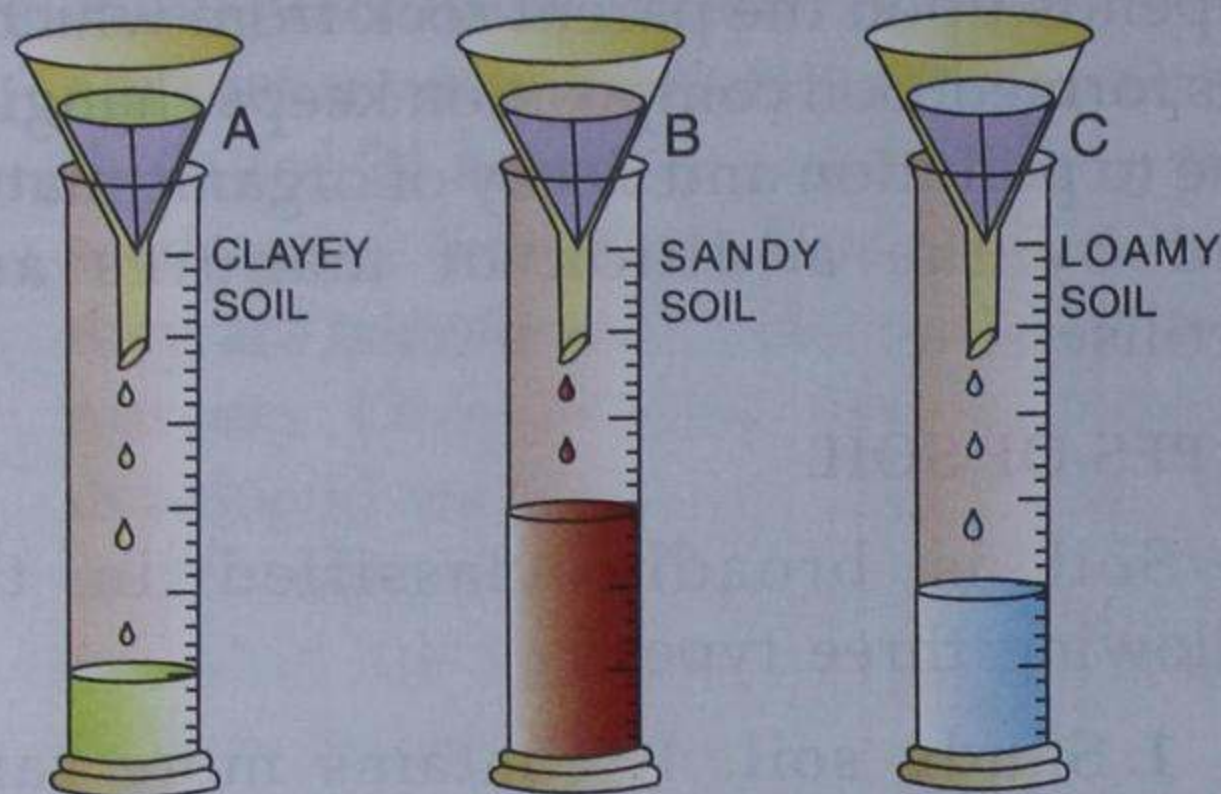


Activity 1



To observe the water-retention capacity of different types of soil.

- Take three types of soil — clayey, sandy, and loamy in equal amounts. [You can get loamy soil from the flower bed, sand from the place where some construction work is going on, and clay from the hobby-room of your school where clay-modelling is practised, or from a potter].
- Dry the soil samples and keep them in separate funnels (A, B, and C) lined with wet filter paper.



Water retaining capacity of clayey, sandy and loamy soil

- Place these funnels on the top of measuring cylinders.
- Gradually, pour 100 mL of water in each funnel.
- After about one hour, read the level of water in each cylinder.
- Record your observations in a table given below :

	Cylinder A (with clay)	Cylinder B (with sand)	Cylinder C (with loam)
Volume of water (filtered out) →	 mL	 mL	 mL

Conclusion :

- Funnel A with clayey soil has passed mL water (fill in the blanks by actual reading) and retained mL. The amount of water retained is more than that has filtered out. Thus, clay has more water-retention capacity.
- Funnel B (sandy soil) has passed mL of water at a faster rate. Thus, the sandy soil has very little water-retention capacity (..... mL).

- Funnel C (loamy soil) has passed more water than that in A and less than that in B. Thus, loamy soil has moderate water-retention capacity (..... mL)

Properties of Soil. Soil should have the following characteristics :

1. **Water-holding.** The soil should have a proper water holding capacity but, not waterlogging.
2. **Air.** The soil should be well aerated. Good air holding capacity helps the roots to respire.
3. **Texture.** Soil texture should be such that water and air can pass through its particles.
4. **Acidity and alkalinity.** Excess of acids or alkalis in the soil is harmful.
5. **Nutrients.** The soil must have both **macro** and **micro nutrients** in their proper quantities. C, H, N, P, K, Ca and Mg are **macro-nutrients**, while Mn, Cu, Zn, Cl, Fe and Mo are some **micro-nutrients**. These are needed for the fertility of soil. All these nutrients are found in the soil in the form of salts.

If a field is used for growing the same crop again and again, then the soil fertility reduces. Then, either the field should be left unused for one or two seasons for the activity of micro-organisms to replenish the soil nutrients or manure and fertilisers can be used to enrich the soil. Crop rotation is also a method to replenish soil nutrients. In this method, leguminous plants are grown in rotation alternately between two cereal crops. Leguminous plants contain nitrogen fixing bacteria in the root nodules which help in fixing free nitrogen of the soil into soluble nitrates.

AGRICULTURAL PRACTICES

In order to raise a crop (cultivate crop), a farmer performs the following tasks for getting a good yield. Such tasks are called agricultural practices.

1. Preparation of soil. The soil is prepared for sowing the seeds of the crop by ploughing, levelling and manuring.

(i) Ploughing. The process of loosening and tilling the soil is called ploughing. It is done with the help of ploughs. Ploughs are made up of wood or iron and driven by a pair of bullocks or by a tractor. It is done to make the soil loose and well aerated for the roots to penetrate and get proper air for breathing. It helps in the mixing of manure and prevents the growth of microorganisms, insects and worms.

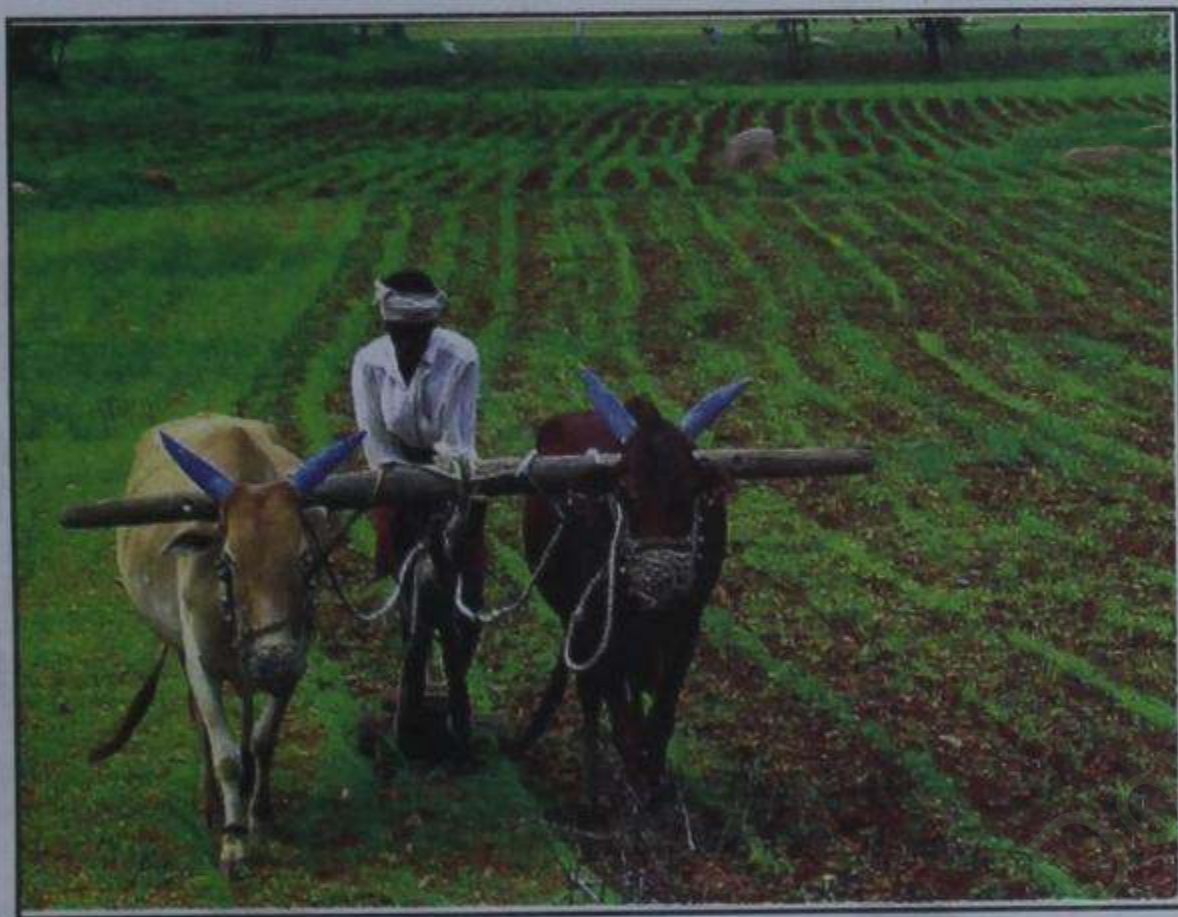


Fig. 10.7 Ploughing of a field

(ii) Levelling. The ploughed field is next levelled. It is done by pressing the soil with a wooden or iron plank. It is helpful for uniform distribution of water during irrigation.

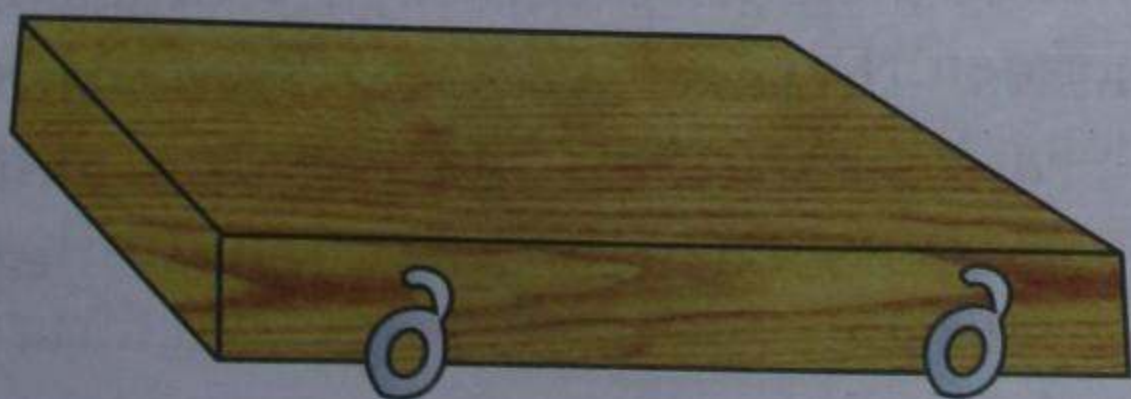


Fig. 10.8 A plank used to level the soil

2. Sowing. When the soil has been fully prepared, the seeds of a crop can now be sown in it. The process of scattering seeds in the field for growing a crop is called sowing. There are two methods of sowing the seeds in the soil :

(i) Broadcasting. In this method, seeds are sown by hand since regular interval is not maintained.

(ii) Seed drilling. In this method, an iron drill is used to sow the seeds. It is made up of iron tube having a funnel at the top. It is fitted at the back of a plough and the seeds are put into the funnel. As the plough moves, the seeds move from the funnel of the seed drill gradually into a soil furrow made by the plough. Seed drill helps in sowing the seeds at regular intervals.

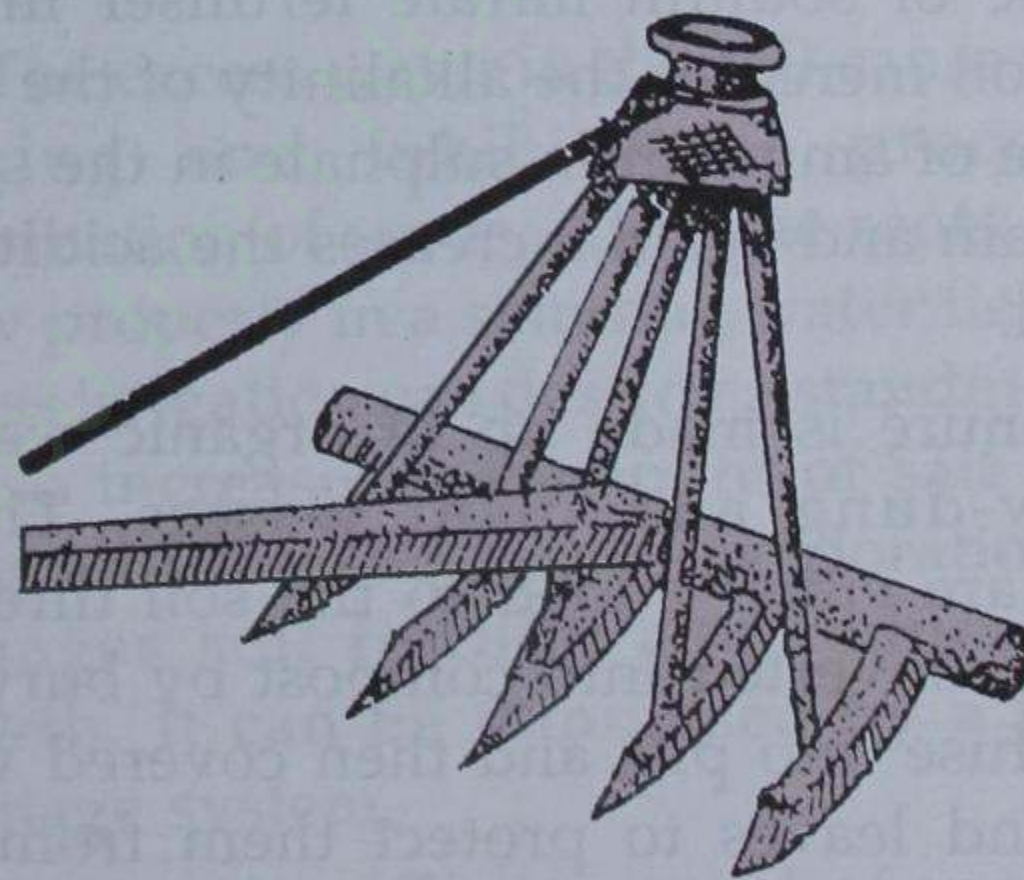


Fig. 10.9 A seed drill

(iii) Transplantation. Seeds of a rice crop and many vegetables are not directly sown in the soil. They are first sown in small areas of land or a nursery and allowed to grow into baby plants or seedlings. Healthy ones are then picked up and transferred to the main field. This is called **transplantation**.

3. Manuring. The use of manure (natural) and fertilisers (chemical) is called **manuring**. Manure is a natural substance obtained by the decomposition

of animal wastes like cow-dung, human wastes and plant remains which supply essential elements and humus to enrich the soil.

A chemical fertiliser is a salt or organic compound containing plant nutrients like nitrogen, phosphorus and potassium to make the soil fertile, e.g., ammonium sulphate (inorganic) and urea (organic fertiliser). Some others are ammonium nitrate and sodium nitrate. Manure provides a lot of organic matter like humus to the soil while a chemical fertiliser does not provide any humus to the soil. We should not use chemical fertilisers continuously as they can alter the nature of the soil making it too acidic or alkaline. They also cause water pollution in lakes and rivers. The use of sodium nitrate fertiliser in the same soil increases the alkalinity of the soil. The use of ammonium sulphate in the same soil again and again increases the acidity of the soil.

Manure is made up of organic wastes of cow-dung and plant wastes. These things are either added to the soil directly or first converted into compost by burying the refuse into pits and then covered with mud and leaves to protect them from air and light. Decomposers in the pit convert waste into inorganic material which is important for soil fertility. The humus is the dark layer of mixed organic material on the top soil made up of decomposed plant and animal remains and wastes. Humus makes the soil porous to retain water. A farmer uses a combination of manure and fertilisers to improve the yield of a crop. More recently, vermicompost is produced by the activity of earthworms.



Activity 2



To make compost in the school garden.

- Select a suitable isolated spot in your school garden, at some corner which does not disturb other persons.
- Dig out a rectangular pit about 1 metre long, 50 cm wide and 50-60 cm deep.
- Spread out some litter (bedding material of the farm animals) at the bottom.
- Prepare a mixture of some cowdung, seeds, crop stubs, etc.
- Spread this mixture evenly in the pit up to the top.
- Cover the entire set up by a layer of cow dung, and a layer of mud on the top.
- Leave the set-up for about 3 to 4 months.

After 3-4 months :

- Open up the trench little by little in the centre. You will find brownish material not distinguishable as cow dung, or any other substance.



Activity 3



To set up a vermiculture in your school garden.

- Select a suitable corner in your school garden. Dig out a pit about 1.5 metre long, 0.5 metre wide and 0.5 metre deep.
- Prepare a mixture of hay (dry grass) and cowdung.

- Lay the above mixture, layer by layer in the pit.
- Moisten each layer by sprinkling some water on it.
- When the pit is almost filled up, introduce some earthworms. [The earthworms may be collected by digging out empty flower beds].
- Finally, cover the entire heap by soft mud and leave it for sometime (3-4 months or even more).
- Afterwards, dig out the heap. The substance produced is a rich manure. The hay and cowdung have become a homogenous dark substance.

Conclusion :

- The earthworms feed on decomposing hay and cow dung. Their excreted faeces have rich plant nutrients.

4. Irrigation. The process of supplying water to crop plants in the fields by means of canals, reservoirs, wells and tubewells, etc., is known as **irrigation**. Irrigation is also another requirement of crops. Irrigation provides moisture to germinate seeds, for the growth of plants, shoots and roots and for

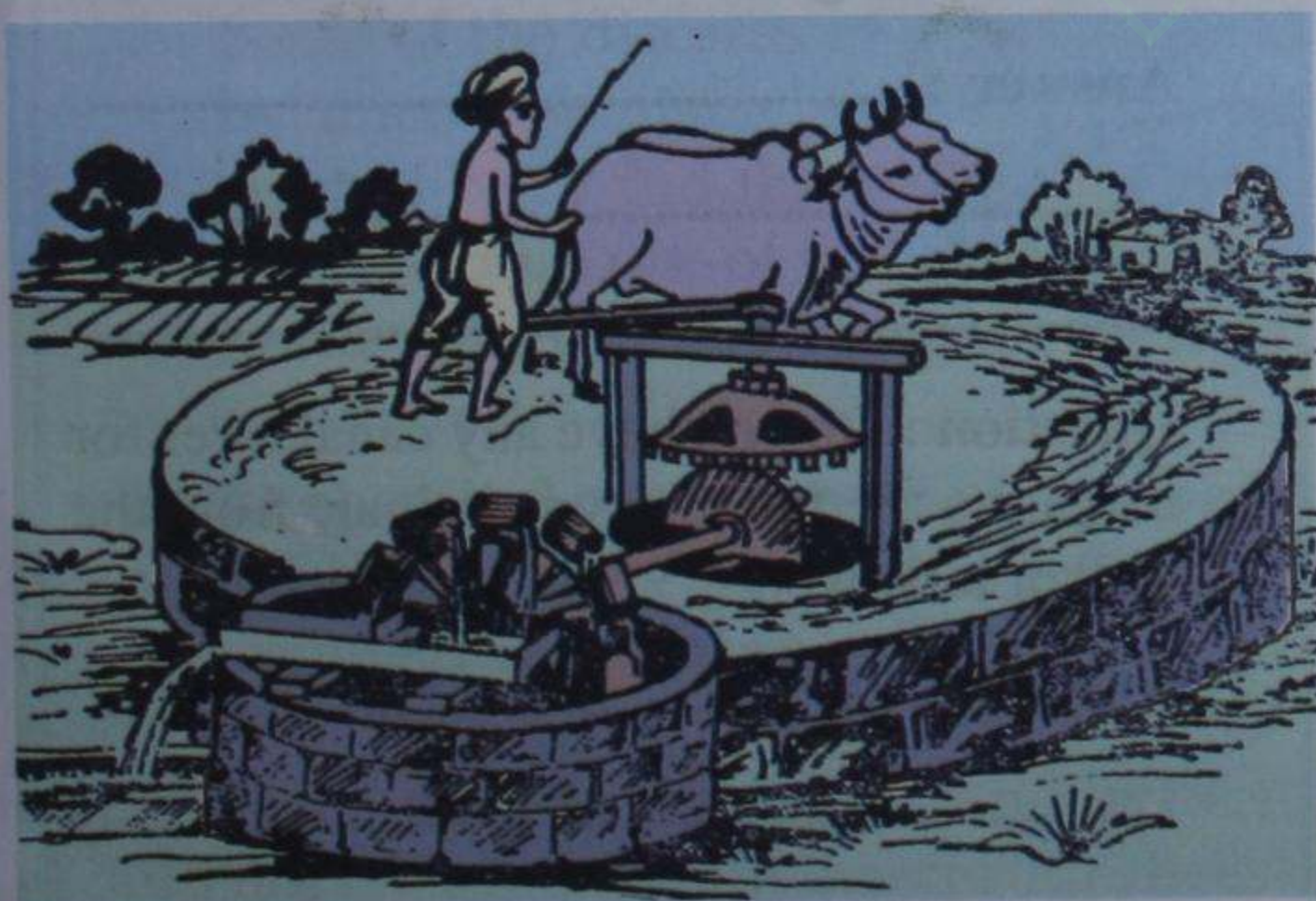


Fig. 10.10 Persian wheel used for irrigation

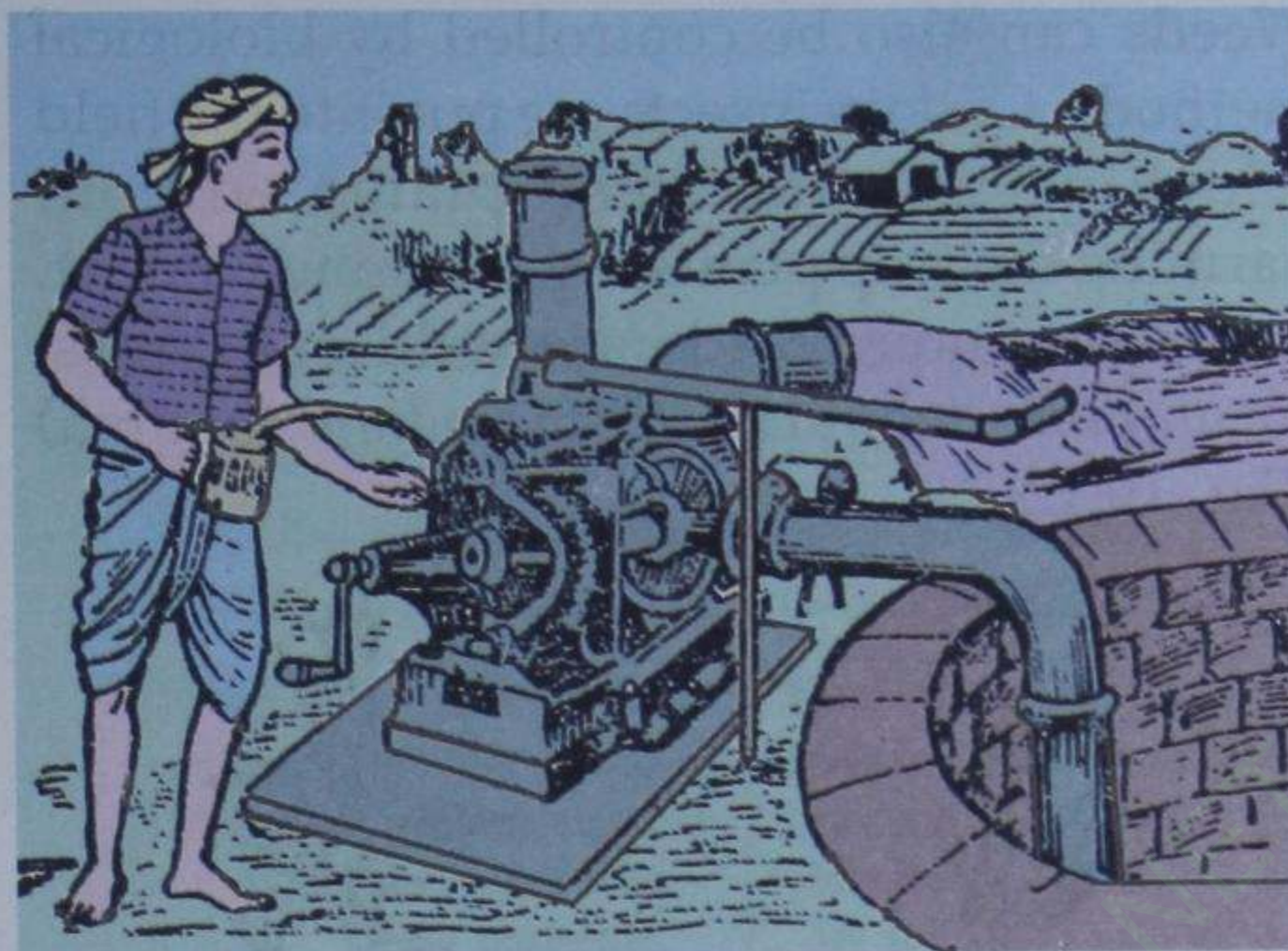


Fig. 10.11 Irrigation from a tubewell

the absorption of mineral water by the root hairs. Water dissolves nutrient salts from the soil into solution. In a dry soil, the roots cannot fix themselves and plants cannot grow.

The excess water in the soil causes water logging and inhibits the process of germination of seeds. Also, the roots cannot grow properly in a standing water field. The excess irrigation can destroy a standing crop. It also increases the amount of salt on the surface of the soil due to evaporation. Salt damages soil fertility and reduces crop growth. It can be minimised by a proper drainage system.

5. Weeding. The removal of unwanted plants (weed and wild growth) growing along with a desired crop from the field is called **weeding**. The growth of weeds in the field is harmful because they consume lot of fertilisers, water, sunlight and space and reduces the crop yield. Weeds also spread crop pests and diseases.

Weeding is done manually or with the help of a trowel or by a harrow. The harrow uproots the weeds like a comb, which can be used before sowing. Weeds are also destroyed by using weedicides like 2, 4 – D, MCPA.

Weeds can also be controlled by biological methods. Certain insects are put into the field which destroy the weed plants without harming the crop plants, *e.g.*, cochineal insect. Some common weeds are wild oat, grass, *Amaranthus* (chaulai), *Chenopodium* (bathua) (Fig. 10.12).



AMARANTHUS (CHAULAI)

CHENOPODIUM (BATHUA)

Fig. 10.12 Some weeds



Activity 4



Visit to an agricultural area to observe the steps taken by the farmers in raising the crop.

- Carry out this activity as a group excursion to a nearby agricultural farm.
- Prior permission from your principal must be taken. It will be better if the students are accompanied by a teacher.
- In northern parts of India, this trip should be taken up preferably in the months of November and December, when farmers are making preparations for the Rabi crops, like wheat, barley, mustard, etc. In other parts of India, other periods can be chosen.

- After reaching the agricultural farm, you can see various activities going on in the different fields. In some fields, the farmers may be preparing the soil by ploughing, others may be levelling the field, some may be sowing the seeds and some putting manure, *etc.*
- You may ask the following questions turn by turn to the farmers and note down the answers they provide.

Question : Why is the field ploughed ?

Answer :

Question : Why is the field levelled ?

Answer :

Question : When the field has been levelled, how the water will flow into the field for irrigation purposes ?

Answer :

Question : What will be the next step after levelling the field ?

Answer :

Question : Do you have any canal/river for irrigating the field, or you irrigate from the well or tube-well ?

Answer :

Question : How do you protect your crops from insects, pests, birds, etc. ?

Answer :

Question : Roughly, in which month will your Rabi crop be ready for harvesting ?

Answer :

(Note : Some more questions related to the above can be asked. Each participating student should note down the answers received).

6. Crop protection. Small animals like insects, mites, rats, and many birds eat up and damage crops. These are called pests, the disease-causing microorganisms. Viruses, bacteria and fungi also damage crops and reduce grain production.

- Rats damage and consume a large portion of grains.
- Birds eat and destroy standing crops.
- Insects damage crops at all stages.
- Plants are also damaged by the disease causing microorganisms which can be killed by pesticides and insecticides. Some of the diseases of plants caused by microorganisms are : seed-borne *ergot* of bajra and the leaf *spot* of rice, the air-borne *rust* of wheat or the soil-borne *smuts* of bajra and the *tikka* of groundnut.

In the chemical control method, pests are destroyed by spraying pesticides, *e.g.*, BHC (gammexene), malathion, sulphur, zinc phosphate, *etc.* Good pesticides are the ones which are degradable, and which should not kill other useful insects (*e.g.*, bees) and birds.



Activity 5



To find about pesticides used by gardeners.

Prepare a chart as given below :

COMPILATION OF THE CHART WITH THE INFORMATION PROVIDED BY GARDENER/FARMER

Name of the chemical/pesticide	The kind of plants which are being treated with this pesticide	Kind of insects/pests controlled by it	Any other information
1.			
2.			
3.			
4.			
5.			

- Contact your school gardener and fix some convenient time when you can sit with him for about 15 minutes.
- You can ask the gardener, the three main informations required, and fill up these in the chart.
- Repeat similar activity pertaining to a crop by interviewing a farmer.

7. Crop improvement. Crop yield (production) can be improved by sowing a better variety of seeds. Crop improvement can be done by breeding new varieties of crops having higher yields. The main criterion is to produce a new and better variety.

The rate of growth of India's population is very high. To meet the annual demand for food, we need 200 million tonnes of grains. It may be possible by using improved seeds developed by plant breeding. Scientific methods are improving soil fertility as well

as protection of crop plants by using insecticides and pesticides, better storage of grain and protection from diseases.

Cross breeding is to improve the variety of crops by breeding between a higher yield variety and a disease resistant variety. Daughter plants so produced will have qualities of both the parents. This process is called hybridisation. Such varieties are called hybrid varieties, *e.g.*, two improved varieties of wheat are a Mexican and Hira-Moti. High yield varieties (HYV) of rice are Jaya, Padma, Pusa-205, Basmati, *etc.*

8. Harvesting, threshing and winnowing. The cutting and gathering of food crop after its maturation is called harvesting. Both, wheat and rice crops, when ripe (golden yellow in colour), are cut with hand cutting tools (sickle) on the ground. Harvesting is also done with a machine in large fields.

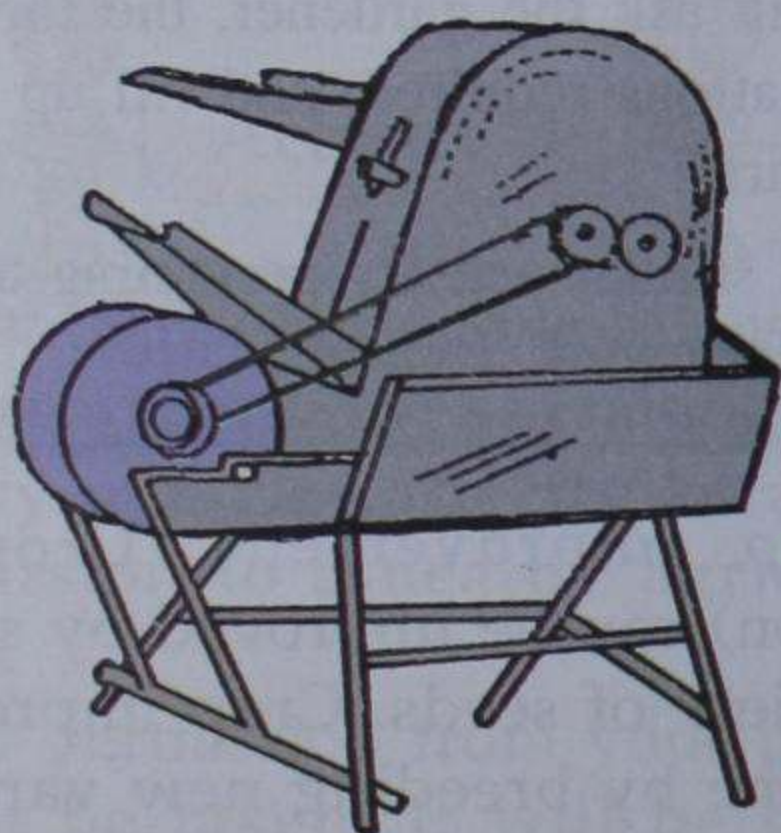


Fig. 10.13 A thresher

The process of beating out grains from the harvested crop plant is called **threshing**.

Winnowing is the process of separating grains from chaff and hay with the help of wind. Chaff and hay are much lighter, which blow away. When grain is made to fall from height, it falls straight on the ground due to its heaviness.



Fig. 10.14 Winnowing

9. Storage of foodgrains. More than 10% of foodgrains produced are lost due to inadequate storage space and wrong methods of storage. Grains are stored in containers called granaries or bins made up of mud or metal. Grains are weighed in bags / gunny bags and then stored in godowns. The godowns for grain storage should be free from insects, rodents (rats) and birds. There should be provision to easily spray pesticides or carry out fumigation to keep insects and pests away, and proper water proofing should be provided (to maintain moisture of the grains). It should be constructed away from garbage dumps. It is important to store grains dry because moisture and humidity cause the growth of fungi which is poisonous for human health.

10. Crop rotation and multiple cropping. The continuous use of the same land for growing crops causes severe loss in soil nutrients. To prevent this, crop rotation or mixed cropping is adopted. In crop rotation, two different crops are grown alternately. The maize and wheat crops are grown with leguminous plants like groundnut, gram, peas, *etc.* In mixed cropping/multiple cropping, two crops are grown in the field to save time and labour, *e.g.*, groundnut and cotton are often grown together. This method also helps in improving soil fertility, because the waste product of one crop plant helps in

the growth of the other crop plant. Leaving the field fallow (uncultivated) in one season is also useful. Use of manures and fertilisers allows the nutrients and humus to be regained.

Organic farming : Farmers are now becoming more aware of the harmful effects of using chemical fertilisers, pesticides and weedicides. As such, many farmers and horticulturists are now shifting to **organic farming**. Organic farming is the practice of raising crops without using inorganic fertilisers and pesticides. They use organic manure that has been prepared scientifically. In order to maintain soil fertility, and for weed and pest control, they use a combination of crop rotation, hand weeding, mixed cropping and biological control.

GREEN REVOLUTION

In India, agriculture is a primary industry which employs about 70% of the total population. Agricultural products account for 40% of the Gross National Product (GNP). Modern agriculture needs irrigation, tractors, farm implements, pumps, fertilisers, weedicides, pesticides and high yielding varieties of seeds.

There has been tremendous increase in the production of the wheat crop in India during the last 30 years. This is called **green revolution**. It has made our country self-sufficient in wheat production and has improved the economic condition of farmers. Now, agriculture has become an industry which gives employment to a large section of India's population and also in various related industries producing agricultural implements.

REVIEW QUESTIONS

Multiple Choice Questions :

1. Put a tick mark (✓) against the correct alternative in the following statements :
 - (a) Winnowing is a method of :
 - (i) Levelling of the land
 - (ii) Sowing the seeds
 - (iii) Separating grains from chaff and hay
 - (iv) Improving soil fertility
 - (b) Sowing of seeds by hand is known as
 - (i) Winnowing
 - (ii) Broadcasting
 - (iii) Weeding
 - (iv) Drilling
 - (c) Which one of the following is a rabi crop
 - (i) Mustard
 - (ii) Pea
 - (iii) Rice
 - (iv) Wheat
 - (d) The plants that live for more than two years are called :
 - (i) Annuals
 - (ii) Perennials
 - (iii) Biennials
 - (iv) Triennials
 - (e) Seeds of rice are first sown in the nursery and allowed to grow into seedlings. Healthy seedlings are then transferred to the main field. This is called :
 - (i) Winnowing
 - (ii) Transplantation
 - (iii) Threshing
 - (iv) Broadcasting
 - (f) High yielding variety of wheat is called :
 - (i) Jaya
 - (ii) Padma
 - (iii) Hira-Moti
 - (iv) Pusa-205

- (g) Irrigation is required during
 (i) Sowing (ii) Harvesting (iii) Weeding (iv) Manuring
- (h) Manure is preferred over chemical fertiliser because it
 (i) protects plants from disease (ii) is easily soluble
 (iii) causes pollution (iv) contains lots of humus
- (i) In nurseries
 (i) plants are cut (ii) plants are protected
 (iii) plants are irrigated (iv) seeds are grown into seedling on raised soil bed with care.
- (j) Hybrid varieties of crops
 (i) give good yield (ii) are disease-resistant
 (iii) require no pesticides (iv) are disease-resistant and give good yield.
- (k) Peas, gram, *etc.* are grown as rotation crops because
 (i) they are cheap (ii) they maintain soil fertility by converting soil nitrogen into nitrates
 (iii) provide pulses (iv) they do not require irrigation.

Short Answer Questions :

1. Answer the following questions :

(a) Give the **four** forms in which bacteria are found.

.....

(b) Name any **two** plant diseases caused by bacteria.

.....

(c) Name the category of organisms which can be studied only under the microscope.

.....

2. Fill in the blanks :

(a) Ringworm is a disease caused by

(b) Anthrax is caused by

(c) Nodules are found in the roots of plants.

3. Define the following terms :

Antibiotics

Retting bacteria

4. Answer the following questions :

(a) What is meant by agricultural practices ?

.....

(b) What is the need of irrigation ?

.....

(c) Why do we follow crop rotation, mixed cropping, and field fallowing ?

.....

(d) How will you protect the crops from diseases ?

.....

(e) Manure is preferred over chemical fertilisers. Give reasons.

.....

(f) How will you protect grains from humidity ?

.....

(g) What is transplantation ? Name *two* crop plants which require this method.

.....

(h) What is weeding ? What are weedicides ?

.....

(i) When the crop is ripened, name the further steps to be followed before storage of grains.

.....

(j) What is the importance of plant breeding ?

.....

5. Name the following crops :

(a) Sugar crop.....

(b) Plantation crop

(c) Tuber crop

(d) Root crop.....

(e) Cereal crop

(f) Fibre crop

6. Fill in the blanks :

(a) Agricultural practice performed before harvesting is called

(b) Rust and smuts are diseases.

(c) is a chemical fertiliser.

7. Define the following terms :

Harvesting

Winnowing

Sowing

Weeding

Manuring

8. Give *two* examples of each of the following :

(a) Biennial plants

(b) Cereal crops

(c) Crops grown by transplantation

(d) Leguminous crops

(e) Fibre crops

Long Answer Questions (Write the answers in your note-book) :

1. What are microorganisms. Name any four useful microorganisms, and state how they are useful to mankind.
 2. Differentiate between food crops and cash crops, and give two examples of each.
 3. Give a brief account of plant nutrients.
 4. What are kharif crops ? Give the name of the most important cereal plant of such crops. Briefly describe any *three* methods for cultivation of kharif crops.
 5. Write the *three* types of plants classified on the basis of their life span. Give *three* examples of each category.
 6. How would you differentiate between manures and fertilisers ? Why the continuous use of fertilisers is not recommended ?
 7. What do you understand by 'crop rotation' ? Giving a suitable example, explain how this practice is beneficial to the farmers.
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