

Crop Production and Management

LEARNING OBJECTIVES

After completion of the Chapter the students will be able to:

1. Understand about agriculture.
2. Explain the seasons for growing different crops, i.e., kharif crops, rabi crops.
3. Describe the process of preparation of soil used for growing crops.
4. Explain the use of fertilisers.
5. Explain the importance of crop rotation.
6. Understand the importance of irrigation and different types of methods used for irrigation.
7. Give details on how to protect the crops from weeds.
8. Explain the different foods we get from animals.

Food is the most vital source of energy for all organisms including us. We know that among the living beings, it's the plants which prepare their own food and all other animals, including human beings, are dependent on plants for food. Our history reveals that the people in the olden days learnt to grow crops and passed agricultural knowledge from one generation to another. They were the food gatherers and food producers. They started living in colonies for the same reason.

► Agriculture

The word agriculture comes from the Latin word 'ager' meaning 'field' and 'cultura' meaning 'care'. Agriculture means growing of plants or raising of animals for human use. Quality in agriculture comprises mainly of activities that are essential in improving the environment for the growth of plants and animals and thereby improving the usefulness of plants and animals. The practice or the business of agriculture is usually called farming and the place where the work is done is called a farm.

Plants of the same type grown and cultivated in large quantities in a field are known as crops. For example, crop of rice indicates that all the plants grown in that field will have paddy plants. The product of cultivated crops is known as crop produce. Based on the type of products obtained, the crops are classified as cereals, pulses, oil crops and fibre crops.

Do You Know?

Growing the same crop on the same soil year after year is called monoculture.



Cereal (Rice)



Pulses (Chickpea)



Oil crop (Sunflower)



Fibre crop (Cotton)


Ripening of strawberries
(Horticulture)


A herbarium sheet

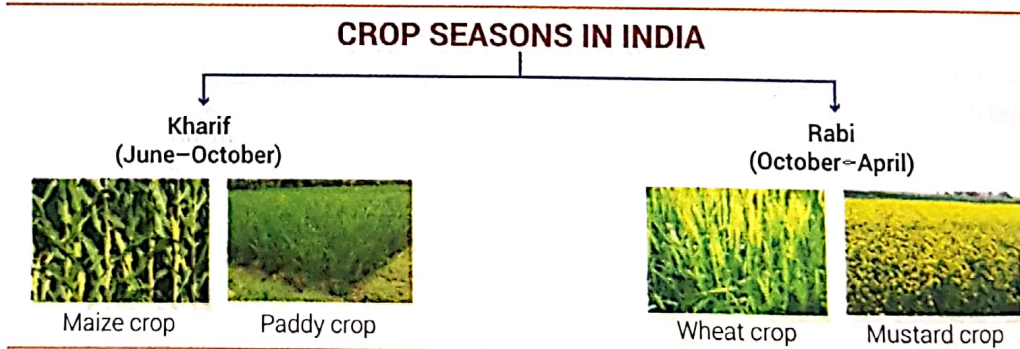
The word **Horticulture** is derived from two latin words: '*Hortus*' which means '*garden*', and '*cultura*' which means '*care*'. Thus, horticulture is the branch of science that deals with the growing and production of vegetables, fruits, flowers and ornamental plants.

ACTIVITY 1.1

Making a herbarium

- Visit the nearby agriculture farm. You must have seen some plants growing in different fields.
- Collect some plants from the farm.
- From these collected plants prepare herbarium specimens. The teacher will help you in preparing herbarium specimens.
- Write some uses of different crop plants collected from the farm.
- Now visit the agriculture farm at the time when crops are maturing.
- Collect some matured seeds of the same plants that are collected above.
- Observe these seeds and draw a sketch on a chart paper.

► Crop Seasons in India



There are two main crop varieties depending on the seasons. They are:

- **Kharif crops:** These are sown in rainy season starting from the month of June and harvested around October. For example, paddy, pigeon pea (*Arhar*), maize, cotton, soyabean and groundnut are **kharif crops**.
- **Rabi crops:** These are sown in winter season starting from the month of October and harvested around April. For example, wheat, gram, peas, mustard, linseed, oilseed and barley are **rabi crops**.

► Agricultural Practices

The steps involved in agriculture which are followed by farmers for good crop yield are known as agriculture practices.

The various agricultural tasks are as follows:

- | | |
|--------------------------|------------------------------------|
| (i) Soil preparation | (ii) Manuring or adding fertiliser |
| (iii) Selection of seeds | (iv) Sowing of seeds |
| (v) Irrigation | (vi) Weeding |
| (vii) Harvesting | (viii) Threshing |
| (ix) Storage | |

Let us discuss these one by one.

1. Soil Preparation

The soil has to be prepared and be made ready for cultivation. This involves the basic steps like **ploughing or tilling** and **levelling**.

Ploughing

The loosening and turning of a few inches of the top soil is known as ploughing or tilling.

- (i) It helps in loosening the soil so that it can hold more water and air. The air helps the roots of crops to breathe.
- (ii) The loose soil also helps in the growth of earthworms and microbes which make the soil rich in nutrients.
- (iii) It is also easy to mix the fertilisers and manures in the loose soil.
- (iv) It helps in removing the weeds by uprooting them.
- (v) Loose soil allow growth of roots into the soil for firm binding.

Ploughing is done by using a plough. It is a wedge-shaped block of wood or iron which is either driven by oxen, horses or camels and even tractors. It has a strong triangular iron strip known as ploughshare that penetrates the soil to make furrows. The ploughshare is attached to a long log of wood which is known as **plough shaft**. It has a handle at one end. The other end of the plough shaft is attached to a beam which is kept on the animal's neck while ploughing. A plough is used for tilling the soil, removing weed, scraping the soil, etc.

Levelling

After ploughing, the field is levelled and pressed using a wooden plank or iron leveller. A leveller is driven by a machine or animals. Levelling is important because:

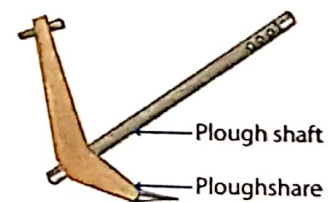
- the big chunks of soil commonly known as crumbs are packed down with the help of leveller.
- levelling allows the soil to settle so that it is not eroded by wind or water.
- levelling brings uniformity to the field so that water and manure can be distributed evenly to all parts of the fields.



Traditional method of ploughing soil using oxen



Modern method of ploughing soil using tractor



Plough



Levelling the soil

2. Manuring or Adding Fertiliser

Manuring is the process of adding manure into the soil for better yield of crops. As the plants grow, they keep on using some nutrients naturally available in the soil according to their needs. The nutrients get used up in some time. This results in low yield of crops. Therefore, it is important that the nutrients of the soil should be replenished. This is done by either natural methods or by adding organic manure or fertiliser to the soil.



Adding fertiliser and manure to the soil

The deficiency of plant nutrients and organic matter in the soil is overcome by adding manures and fertilisers to the crop fields. Both manures and fertilisers are major sources of nutrients for the plants.

But the excessive use of fertilisers gives rise to soil and water pollution and also affects the fertility of the soil. The use of fertilisers should be minimised by adopting natural methods of increasing the fertility of soil.

Differences between Manure and Fertilisers		
	Manure	Fertiliser
1.	Manure is natural.	Fertiliser is man made.
2.	Manure is obtained from decomposing of plant, animal or human wastes naturally.	Fertiliser is prepared in factories from chemical salts.
3.	Manure is not very rich in plant nutrients.	Fertiliser is rich in plant nutrients like nitrogen, potassium and phosphorus.
4.	Manure is cheap and easily available.	Fertiliser is costly.
5.	Manure adds humus to the soil.	Fertiliser does not add humus to the soil.

Natural Methods to Maintain Soil Fertility

Field fallow

One method of allowing land to naturally regain the nutrients is to leave it free or fallow for one or more seasons. The dead plants, animals and other organic matter that get collected on the field are decomposed by microorganisms. Therefore, the nutrients are returned to the soil.

Mixed cropping



Mixed cropping

The practice of growing two or more crops simultaneously on the same piece of field is known as mixed cropping. It is an age-old practice in our country. Farmers mix the seeds of two crops and sow them in the field. The crops are chosen in such a way that the products and waste materials from one crop help in the growth of the other crop. For example, if a cereal crop such as wheat is grown along with a leguminous crop such as pulse (e.g., gram), then the uptake of nitrogen from the soil by cereal is compensated by the addition of nitrogen in the soil by the nitrogen-fixing bacteria like *Rhizobium* present in the legume.

Crop rotation

Wheat crop is planted during the month of November and harvested in March and April. Rice crop is planted in June-July and harvested in



Crop rotation

October-November. Now in between these two seasons, the land lies empty. Instead of leaving it as it is, the farmers plant a pulse crop during this time. A pulse crop does not take as long as wheat or rice to grow and replenishes the soil with nutrients. So, by the time the farmer has to plant the cereal crops, the pulse is ready to be harvested. The process of growing a crop in between two similar crops is called crop rotation. This method maintains soil fertility, prevents crop diseases and pests, and ultimately gives better crop yield.

However, these natural methods alone are not enough to maintain the fertility of the soil and farmers have to add manures and fertilisers sometimes.

3. Selection of Seeds

The farmers today are aware of the fact that good quality of seeds is a must for a good crop. The farmer therefore must select the seeds that are

- healthy
- of good quality
- dried properly and have no dampness that may encourage the growth of fungi
- not mixed with the seeds of weeds
- free from any infection
- stored in strong bags
- free from insects and pests
- not contaminated with wastes, rotting food materials, excreta of animals, etc.

Do You Know?

There are certain crops like paddy for which seeds are not directly sown in the field. They are first germinated in nurseries and then the seedlings are transferred to the main field. This is known as transplantation.

ACTIVITY 1.2

To test the viability of seeds

- Take some kidney beans (from the stock which are to be used for sowing) and soak it overnight in water.
- Remove the seed coat and chop thin slice of one of the cotyledons.
- Put the slices of seed in the Petri dish, add few drops of dilute sulphuric acid and leave it for some time.
- If the seed turns blood red then it is viable to grow and if not then it is not fit for growing.



4. Sowing of Seeds

The process of spreading the seeds in the soil to germinate is known as sowing. For sowing seeds the following points must be kept in mind:

- Proper spacing of the seeds must be ensured. This is because overcrowding of the seeds may result in a shortage of nutrients, air, sunlight, water and can kill the seedlings.
- The seeds must be sown in proper rows so that watering them or transplanting them is easy. Cotton, potato, maize, soyabean are all row crops.
- The seeds must be sown at a reasonable depth under the soil so that



they get air, water and suitable temperature to germinate. If they are sown too deep they may suffocate without air and if they are spread on the soil, they may be eaten up by the birds.

- Seeds must be sown in proper season.
- Soil must be prepared well so that it has adequate moisture content for the germination of seeds.



Broadcasting of seeds



Drill sowing



Seed drill



The seeds can be sown by the following methods:

- Broadcasting: When the seeds are scattered randomly with hand on the soil, the method is called broadcasting. In this method, seeds are sown manually, spread in the entire field with no uniformity of rows, no proper spacing and not in the proper depth of the soil. Cereals like, wheat and rice are grown by this method.
- Drill sowing and dribbling (making small holes in the ground for seeds) are better methods of sowing the seeds. Once the seeds are put in the holes, they are then covered with soil. This saves time and labour and prevents the damage of seeds by birds.
- Another method of sowing the seeds is with the help of a simple device consisting of a bamboo tube with a funnel on it attached to a plough. As the plough moves over the field the tube attached to it leaves the seeds kept in the funnel at proper spacing and depth. The plough keeps making furrows in the soil in which the seeds are dropped by the seed drill. The seed drill is the modern form of this method.

ACTIVITY 1.3

To segregate healthy and good seeds from the unhealthy ones

- Take handful of seeds which are to be grown and add it into the container filled with water. Let the seeds remain under water. After some time you will notice that some seeds are afloat and some sinks down to the bottom of the container.
- This shows that the seeds which are either hollow from inside or not developed fully are lighter and so they keep afloat. These are not fit for sowing.
- The seeds which are healthy and good sink to the bottom and are recommended for sowing.

✓ CHECK YOUR PROGRESS

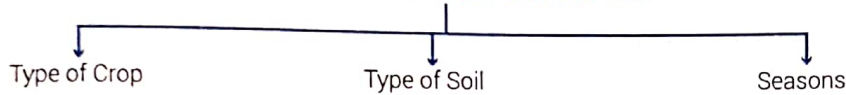
1. Define the term agriculture.
2. What is a crop?
3. Give examples of *kharif* crops and *rabi* crops.
4. How does loosening of soil allow the roots to breathe?

5. Irrigation

Irrigation is the supply of water to agricultural field. Sufficient supply of rainwater is not always present, therefore, it is required by the farmers to supply water to the fields. Some crops require more amount of water.

like paddy plants and some require lesser amount of water, like wheat. Sometimes the requirement of water depends upon the type of soil used for growing crops. A sandy soil requires more water than clayey soil. Loamy soil requires moderate water due to its texture. The crops grown in summer need more water due to excess of evaporation in comparison to the crops grown in winters. So we should consider other factors too while planning for irrigating fields.

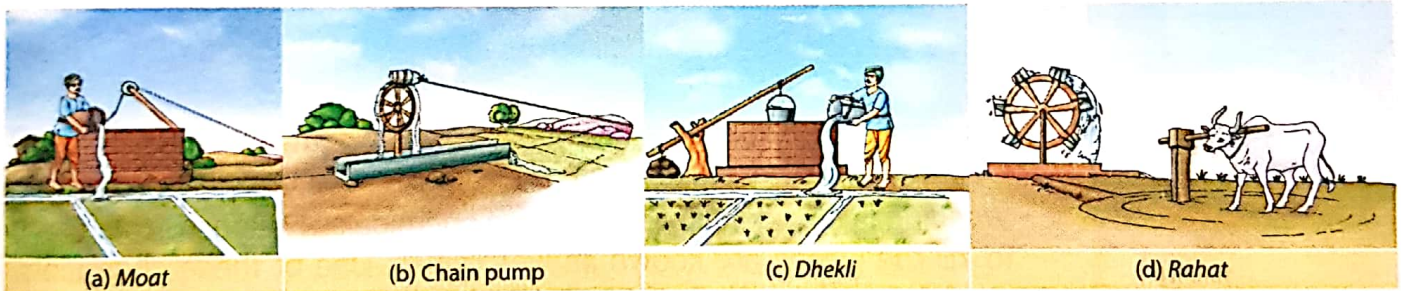
IRRIGATION DEPENDS ON



Each crop needs specific quantity of water at various stages of growth and fruiting. Irrigation from wells, tanks and canals was practiced throughout India in the ancient times. A new water-lifting device such as a Persian wheel had been adopted and is still widely used. It consists of a leather bag with ropes pulled by bullocks to draw water from the wells for irrigation.

Traditional Methods of Irrigation

The various traditional methods of drawing water out from wells, lakes and canals were *moat* (pulley system), chain pump, *dhekli* and *rahat* (lever system). Cattle or human labour is used in these methods. These methods are cheaper but less efficient.



Traditional methods of irrigation

Modern Methods of Irrigation

It is important to use water economically. Some modern methods of irrigation have been developed for this purpose.

Sprinkler system: This method is used where the soil cannot retain water for long or where sufficient water is not available. Rotating nozzles are attached to perpendicular pipes at regular intervals. Water is sprinkled on crop as if it is raining.

Drip system: This system involves providing water drop by drop at the roots of the plants. Thus, water is not wasted. This system is practiced in regions where water availability is less. However, this method is very expensive.



Water Logging

In crops such as wheat and maize, excess water supply to the fields results in a condition called **water logging**. Water logging reduces air in the soil, thereby damaging the roots. Even soil organisms get killed if water logging



Water logging

persists for a long time. Water logging increases the amount of salts in the soil and damages the soil fertility.

6. Weeding

The unwanted plants growing along with the cultivated plants on their own are known as **weeds**. They are a threat to commercial crops as they compete for sunlight, air, nutrients and water. In comparison to cultivated crops, the seeds of weeds germinate easily and flower early. They produce large number of seeds.

Do You Know?

Growth of weeds is more in kharif crops in comparison to rabi crops.

In fact, weeds take up all the nutrients and reduce the growth of crops in various ways. They also spread diseases to the cultivated plants as they become hosts to many insects and microorganisms. Therefore, weeds must be removed from the fields. The process of removing weeds from the fields is known as **weeding**. Some common weeds are given here.



Grass



Amaranthus



Chenopodium



Wild oat



Convolvulus

Certain common weeds



Harrow



Weeding by hand

The following methods are used for getting rid of the weeds:

- Weeding is done by either pulling out the weeds with hands or by using hoe or harrow or seed drill.

The fields are ploughed so that majority of weeds are uprooted and they do not grown again. It can be removed using trowel.

- Weeding is also done by using some chemicals. The chemicals used to kill the weeds are known as **weedicides**. One of these chemicals used very commonly is 2,4-D (2,4-Dichlorophenoxy acetic acid). This chemical kills only the weeds and not the cultivated crops.

- Biological methods to control weeds are better than chemicals. Some insects that do not cause harm to the crops can be made to breed and grow. They then destroy the weeds leaving the crops safe.

7. Protection from Pests and Diseases

Organisms that cause diseases to the plants are called **pathogens**. The organisms that damage or destroy the crops are known as **pests**.

The methods used to protect the crops from pathogen and pests are:

- Spraying the chemicals at regular intervals. Such chemicals are known as pesticides. Some commonly used pesticides are DDT, BHC and malathion. They are either sprayed by hand-operated machines or by low flying aircraft, if the area to be covered is large.

- Though the pesticides used are very effective, yet care must be taken while using them. Excess use of pesticides is very harmful to human beings as they irritate the skin and cause gastric and respiratory disorders.



Spraying pesticides to protect crops

8. Harvesting

The process of cutting and collecting the matured crops from the fields is known as harvesting. Almost all the crops complete their cycle of maturity in 3 to 4 months. The matured crops are cut manually using a **sickle**. Harvesting is done with a machine known as **harvester**. Once the crop is harvested then the grains are separated from the chaff.



Harvesting crops

9. Threshing

Threshing is the process by which the grains are separated from the chaff. Threshing is done manually by beating the crops against the solid surface or by stamping on by animals. The harvested crop is spread on the ground and the bullocks or camels are made to walk over them again and again till the grains come out of the **chaff**. Nowadays tractors are used for doing this job. The leaves and the stems of the crops get crushed into smaller pieces. The grains are then separated from the chaff, dried leaves and stems of the crops in a machine or by winnowing. Harvesting and threshing can be done simultaneously with the help of a machine called **combine**.

Do You Know?

Pongal, Holi, Baisakhi, Bihu are festivals associated with the harvest season.



Thresher



Combine harvesting

CHECK YOUR PROGRESS

1. Weeding is usually done before flowering. Why do you think that is so?
2. Reena and her family recently harvested their wheat crop. But the crop had both wheat grains and chaff. How should they separate wheat grains?
3. Classify the following irrigation methods into traditional methods and modern methods.

Drip system chain pump moat sprinkler system rahat well canal

10. Storage

The harvested grains have lots of moisture content, so the seed grains are left in the field to dry in the sun before they are stored otherwise the moisture may spoil the grains.

The grains must be stored properly. Large scale storage of grains is done in **silos** and **granaries** to protect them from pests like rats and insects. Care must be taken that the grains are kept:

- away from moisture
- safe from rain
- protected from pests and birds



Storage of grains in granaries



Silos for storage of grains

- in air-tight godowns
- in proper bags for the purpose of transportation.

► Crop Improvement

After having made improvement in various agricultural practices, it will be of no use if the quality of the grains is not improved. Crop improvement therefore is a very important task. Scientists are now working on producing new varieties of crops with desirable features such as

- crops with more yield
- crops with better quality of grains, and
- crops which are disease resistant

This has been done by **cross-breeding**. Two plants with different desired features are taken as parent plants. The cross-breeding between them results in the new generation plants with desired features.

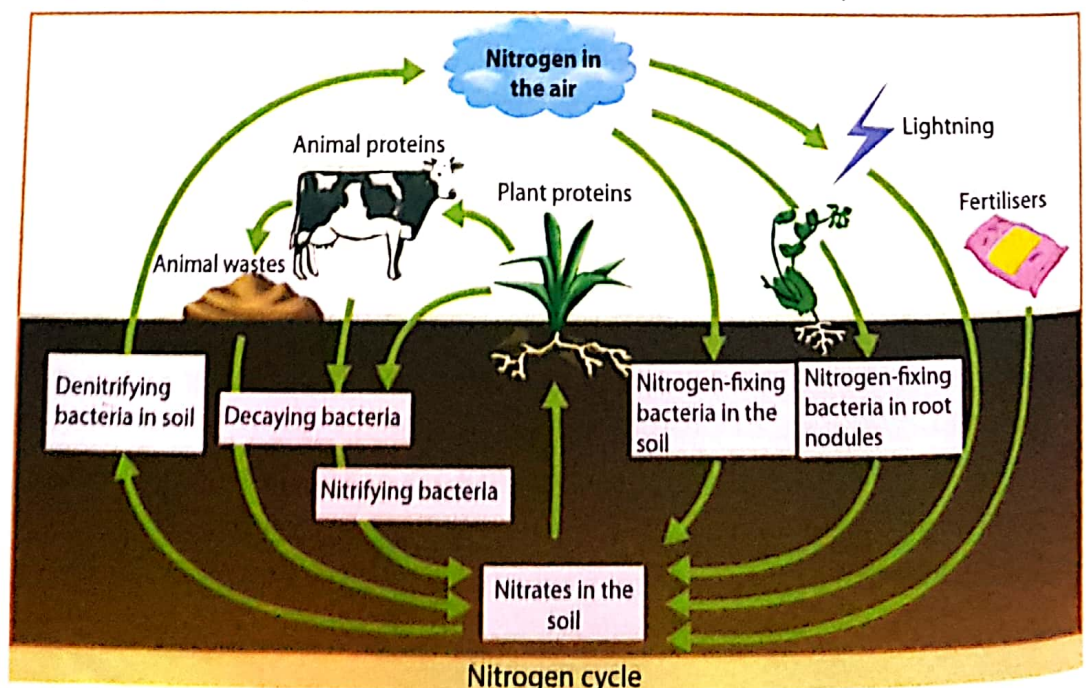
With increasing population, the land available for agriculture is decreasing, therefore, there is need to have high yielding crops. Scientists are now experimenting to develop new varieties of crops which are more resistant to the climatic changes such as drought, heat, cold, winds and also to various soil conditions.

Some of the high yielding varieties of crops are:

- **Wheat:** Sonalika, Sonara-64, Kalyan Sona
- **Rice:** Jaya, Padma, IR-8, Pusa-205
- **Maize:** Ganga, Rankit, Deccan hybrid

► Nitrogen Cycle

Nitrogen is the major component of air. Air consists of nearly 78 per cent of nitrogen. Plants and animals cannot use it in its free form available in the atmosphere. It has to be changed to nitrates before it can be used by plants. Plants can use the nitrogen in the form of nitrates to make proteins and animals get their nitrogen from plant proteins when they eat plant and plant products. But how is nitrogen gas changed into nitrates? Look at the diagram (nitrogen cycle) given below to understand the process better.



Let us learn about the nitrogen cycle by studying the various agents taking part in the process.

Decaying Bacteria

These bacteria break down dead remains and animal wastes releasing ammonium compounds into the soil. This process is called **ammonification**.

Nitrifying Bacteria

These bacteria in the soil can change ammonia into nitrates. Ammonia is another chemical that contains nitrogen. It is present in animal waste and dead remains. This process is called **nitrification**.

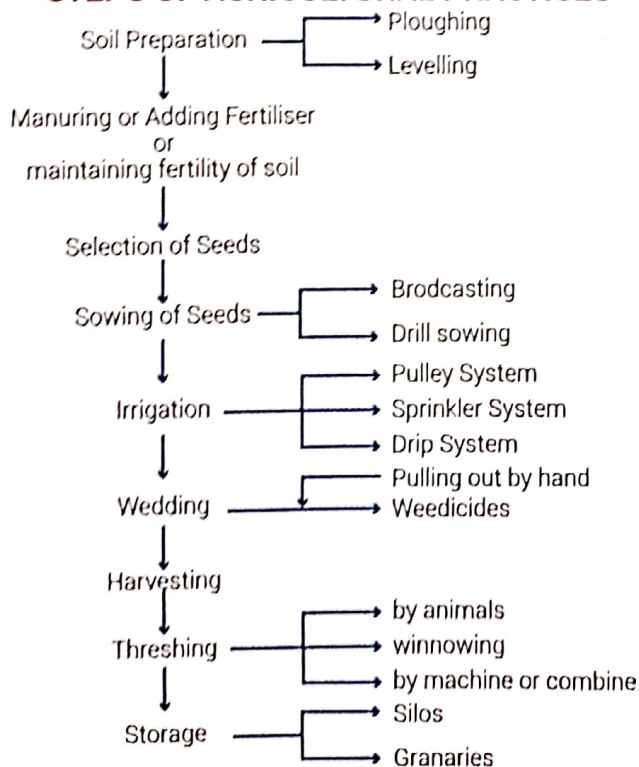
Nitrogen-fixing Bacteria

These bacteria (like *Azotobacter*) are found in the soil. They convert nitrogen from the air into nitrates. Plants take up the nitrates with their roots. Nitrogen-fixing bacteria (like *Rhizobium*) are also found in the roots of **leguminous plants** like peas, beans and clover. These bacteria make lumps on the roots called **root nodules**. They can change nitrogen into nitrates that the leguminous plants can use.

Lightning

The high temperature of lightning discharge causes some of the nitrogen and oxygen in the air to combine and form oxides of nitrogen. These oxides in the rain are washed into the soil as acids (weak), where they form nitrates. When plants and animals die, bacteria and fungi present in the soil convert the nitrogen wastes into nitrogenous compounds to be used by plants again. Some of it is converted into nitrogen gas by bacteria, which goes back to the atmosphere. Thus, the percentage of nitrogen in the atmosphere remains constant. The conversion of nitrates into nitrogen by the denitrifying bacteria is called **denitrification**.

STEPS OF AGRICULTURAL PRACTICES



► Food From Animals

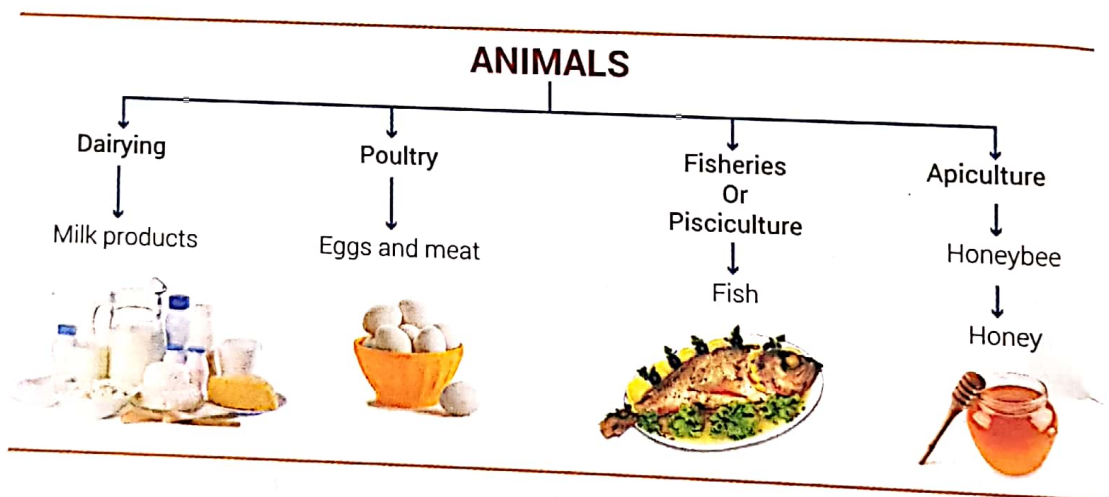
Like from plants we receive many food items from some animals too. They provide us with edible products like milk, cottage cheese, curd, meat, honey, eggs, etc. So, in order to provide us with quality products animals need proper food, care and shelter. The science which deals with breeding, feeding and caring of domestic animals is called **animal husbandry**.

Pisciculture

The rearing of fish is called pisciculture. Fishery is the farming of fish. The fish found in marine water are called sea fish or marine fish, e.g., Salmon, Hilsa and the fish found in fresh water fish, e.g., Rohu, Catla.

Apiculture

The rearing of honeybees is called apiculture. It is done on large scale in farms. Honeybees produce honey by sucking nectar of flowers which is rich in minerals and sugar.



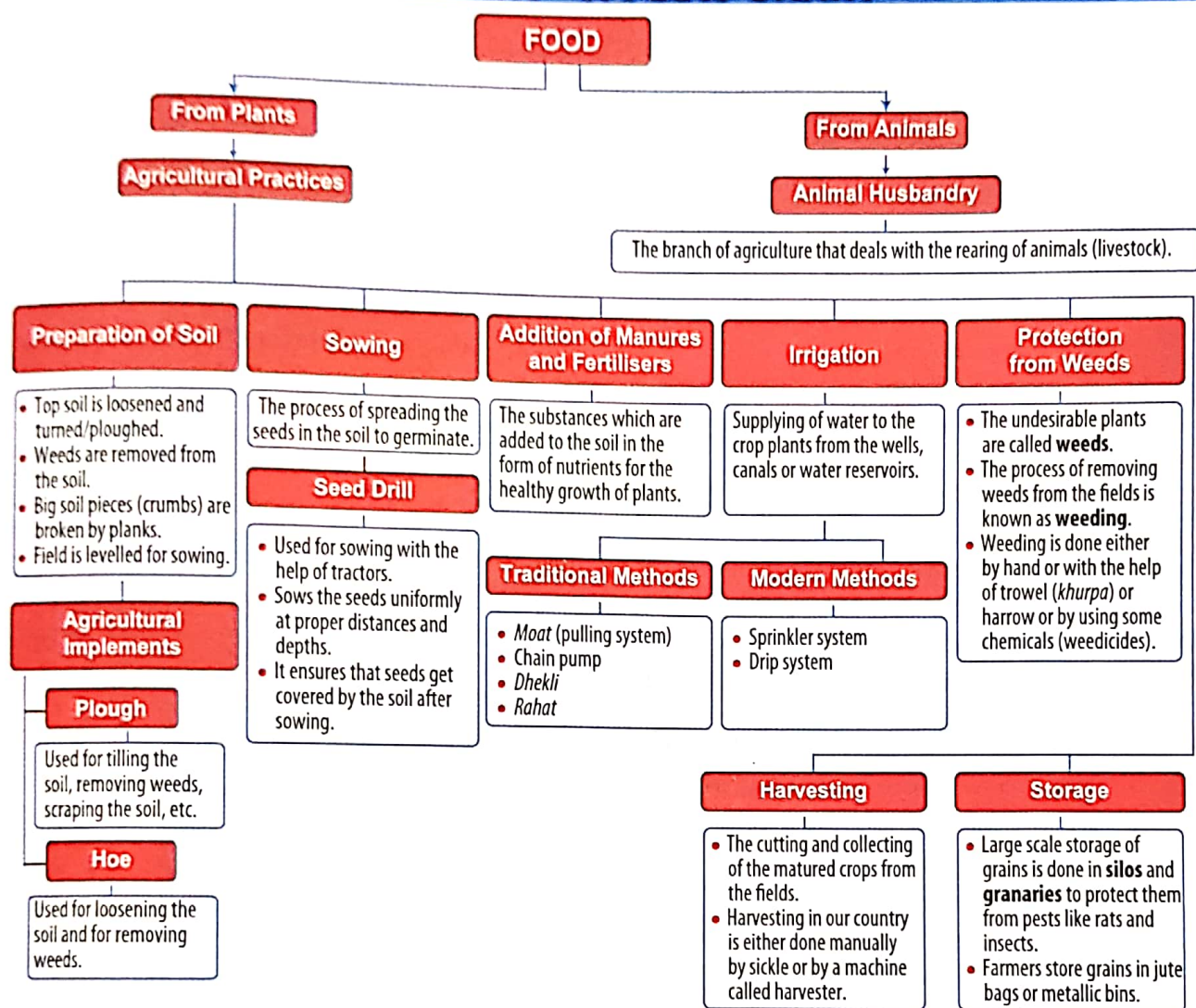
✓ CHECK YOUR PROGRESS

1. Categorise the following animals into milk giving, meat and egg giving.
goat sheep camel duck fowl cow hen

Milk giving animals	Meat and Egg giving animals

2. Name some grain storage devices.
3. Why should seed grains be dried properly before storing them?

SUMMARY—A FLOW CHART



ASSESSMENT

A. Multiple Choice Questions

Tick (✓) the correct option.

1. Which of the following is not a cereal?

- (a) Wheat ☐ (b) Rice ☐ (c) Gram ☐ (d) Maize ☐

2. A crop which is not a plantation crop is

- (a) rubber ☐ (b) coconut ☐ (c) gram ☐ (d) coffee ☐

3. Which of the following crops can be transplanted?

- (a) Rice ☐ (b) Tomato ☐ (c) Chilly ☐ (d) All of these ☐

4. An example of a dairy animal is

- (a) hen ☐ (b) duck ☐ (c) sheep ☐ (d) camel ☐

5. The production of fish is called

- (a) apiculture ☐ (b) sericulture ☐ (c) pisciculture ☐ (d) agriculture ☐

6. Agricultural chemicals are those which

- (a) enhance crop yield ☐ (b) protect crops ☐
(c) regulate growth ☐ (d) all of these ☐

7. Agricultural chemicals include
 - (a) pesticides
 - (b) pesticides and fertilisers
 - (c) pesticides, fertilisers and growth regulators
 - (d) fertilisers and growth regulators

B. Fill in the blanks.

1. _____ is used to level the fields.
2. Kharif crops are sown in _____ season and harvested around the month of _____.
3. Rabi crops are sown in _____ season and harvested around the month of _____.
4. Fertilisers are _____ compounds containing nutrients.
5. _____ is a place where milk and milk products are sold.

C. Write true or false. Rewrite the false statements correctly.

1. Different crops are irrigated at different intervals.
2. It is better to use fertilisers than organic manure.
3. The same crop should be grown on the same piece of land year after year.
4. Water logging is good for plants.
5. Threshing is done for vegetables as well as fruits.

D. Answer the following questions in one or two sentences.

1. What do you mean by the term ploughing?
2. What are weeds?
3. Define irrigation?
4. What are pests?
5. What is animal husbandry?
6. What is winnowing?
7. What do you understand by the term threshing?
8. If a crop is sown in June and harvested in October will it be Rabi or Kharif?

E. Answer the following questions in three or four sentences.

1. What are the agricultural practices carried out by farmers?
2. What do you mean by drip irrigation?
3. What is the sprinkler system of irrigation?
4. What does the overcrowding of seeds result in?
5. Why is the soil loosened before the seeds are sown?
6. Why is it important to sow the seeds at a proper depth of the soil?
7. List some important methods by which grains are stored safely.
8. Explain water logging.
9. List the ways by which weeds are removed from the soil. Which among them is the best method?
10. Explain nitrogen cycle in detail.
11. After loosening the soil before sowing seeds why is it necessary to level the soil after ploughing?
12. Seeds are first grown in nursery and then transplanted to the fields. What is the advantage of this?