



Crop Production and Management

Learning Points



- ❖ Agriculture a way of producing food.
- ❖ Methods of crop production.
- ❖ Increasing crop production.
- ❖ Nitrogen cycle.
- ❖ Animals as sources of food.

Food provides nutrition to all living organisms. It is a basic need of all of us to grow and survive. The plants can make their food themselves. This is the reason they are called **producers**. The animals and humans depend on plants and other animals for their food requirements. The energy gained by food is utilized for growth, development and other activities of the body. The increasing population of humans demands more food for its survival. So, in order to meet the need of food of all people, regular production, proper management and distribution of food is necessary. Let us know how it can be done systematically.



Fig 1.1: Plants can make their own food

Agriculture >>>

The branch of science which deals with cultivation of plants and rearing of animals is called **agriculture**. In other words, the art or practice of cultivating land is referred as agriculture. The branch of agriculture which deals with food, health and management of animals is known as **animal husbandry**.

Agriculture is the largest occupation in our country and a major amount of our population depends on it. We depend on it for our food, clothing, shelter and many other things that we use in our everyday life. The plants which are grown by farmers in large numbers to get useful products are known as crops or crop plants

KNOW MORE

Humans lived nomadic life till 10,000 B.C. They moved place to place in search of food and shelter. Their food was mainly raw meat, fruits, vegetables, etc. They hunted animals to get food, skins to make clothes and bones to make jewellery and weapons. They gradually learned farming and tamed wild animals to obtain milk and meat and used them for transportation. Over the time, the traditional method of agriculture changed considerably. Now there are advanced technologies to produce sufficient food for the large population of our country.

Crops and Their Classification

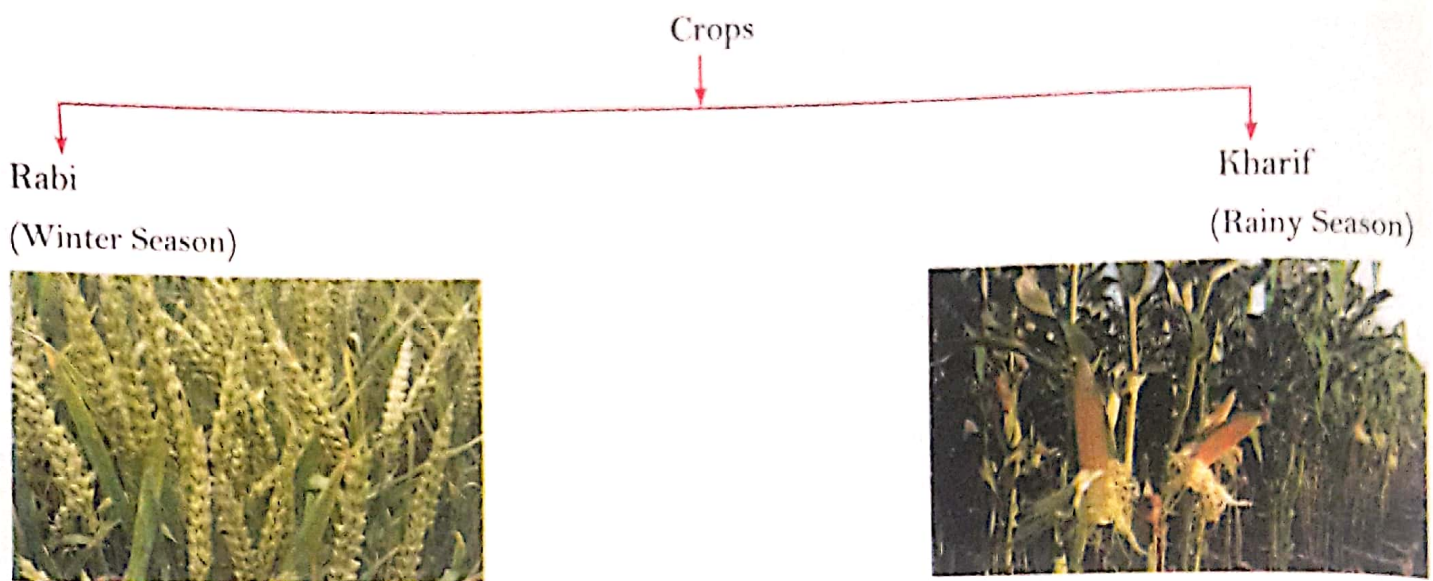
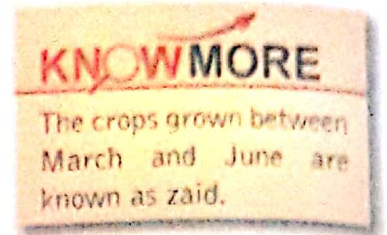
Crops are the plants grown and cultivated together at one place on a large scale. Depending on various factors, there can be different types of crops in India :

On the Basis of Cropping Season

On the basis of cropping season, crops can be **rabi crop** and **kharif crop**.

Rabi crops: The crops which are sown in November and harvested in April are called **rabi crops**. For example, wheat, barley, mustard, gram, pea, etc.

Kharif crops: The crops which are sown in June and harvested in October are called **kharif crops**. For example, rice, maize, bajara, cotton, groundnut, etc.



On the Basis of Their Uses

Depending upon the uses of crops, they can also be classified as farm crop, commercial crop, or horticulture crops.

Table: 1.1: Types of crops based on their uses.

Farm Crop	Horticultural Crop	Commercial Crop
Cereals: Wheat, rice, maize, barley, oats, bajara, etc.	Fruits: Plum, apple, mango, grapes, guava, plum, etc.	Medicinal plants: Mint, deadly nightshade, belladonna, cinchona, isabgul, opium poppy, etc.
Pulses: Grams, soya beans, peas, lentils, moong, arhar, etc.	Vegetables: Onion, potato, spinach, tomato, cabbage, radish, carrot, beetroot, cauliflower, etc.	Fibre crops: Cotton, jute, flex, hemp, etc.
Spices: Turmeric, ginger, clove, coriander, cardamom, pepper, saffron, etc.		Timber plants: Teak, oak, mahogany, sheesham, etc.
Beverages: Tea, coffee, cocoa.		
Sugar: Sugarcane, sugar beet.		

On the Basis of Their Lifespan

The life span of the plants can also be a deciding factor for the classification of crops. According to this, plants can be classified as **annuals**, **biennials** and **perennials**.

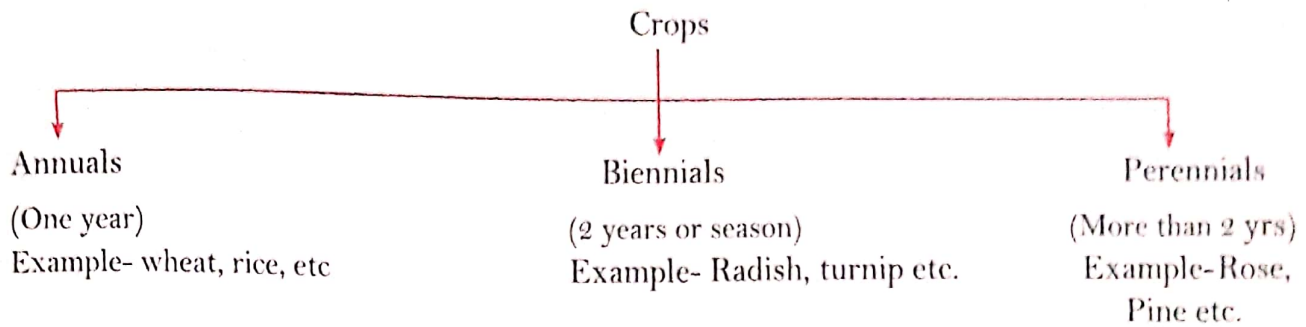


Fig 1.4: Types of crops based on life span



Activity 1.1

Find out the crops grown in your area. Classify them as rabi and kharif crops.

Amazing Fact

Fruit farming began sometime between 6000 and 3000 B.C. Figs were one of the first cultivated fruit crops.

Methods of Crop Production >>>

All the activities which are involved in cultivation of plants from sowing to harvesting are known as **agricultural practices**.

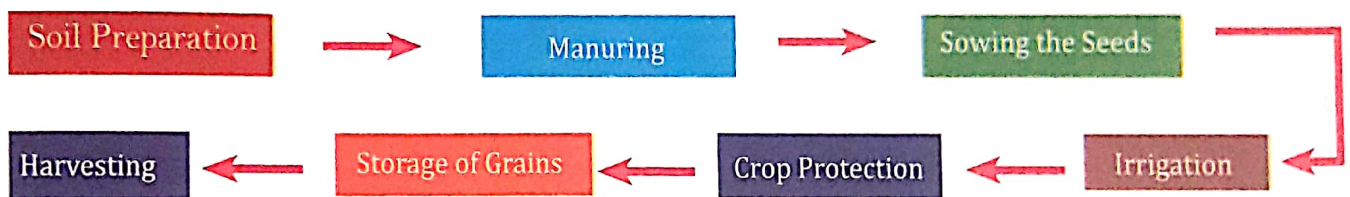


Fig 1.5: Steps involved in agriculture

Soil Preparation

Plants grow in soil. The soil is a mixture of sand, clay, decayed leaves, bacteria, earthworms and varying amount of moisture and air. The plants obtain water and nutrients from the soil through their roots. Roots are held in place by the soil. The soil microbes and other organisms such as earthworms help to increase soil fertility. It is therefore, important that the soil is well prepared. The soil preparation involves following three steps:

Ploughing

The process of loosening and overturning of soil to make it aerated and suitable for the growth of organisms living in it is called **ploughing** or **tillage**. In case of excessive dry soil, watering is needed before ploughing. The benefits of ploughing are given below:

1. It allows roots to penetrate deep into the soil.
2. The loose soil helps the roots to breathe easily even in deep soil.
3. It helps earthworms and microorganisms to grow. These are called farmer's friends as they add humus to the soil.

4. It helps to uproot weeds from the soil.

5. The soil particles trap air which is utilized by the roots of the plants.

Tools for Ploughing: The soil needs to break into fine particles before sowing the seeds. The main agricultural implements used for this purpose are **plough, hoe and cultivator**.

Plough: It is made of wood or iron. Plough is drawn with the help of bulls, horses and camels, etc. A plough contains a strong, triangular iron strip called **ploughshare**. The main part of plough is a long log of wood which is called **plough shaft**. At one end, a handle is attached to the shaft. The other end is attached to a beam which is kept on bulls' necks. Plough needs one pair of bulls and a man to handle it.

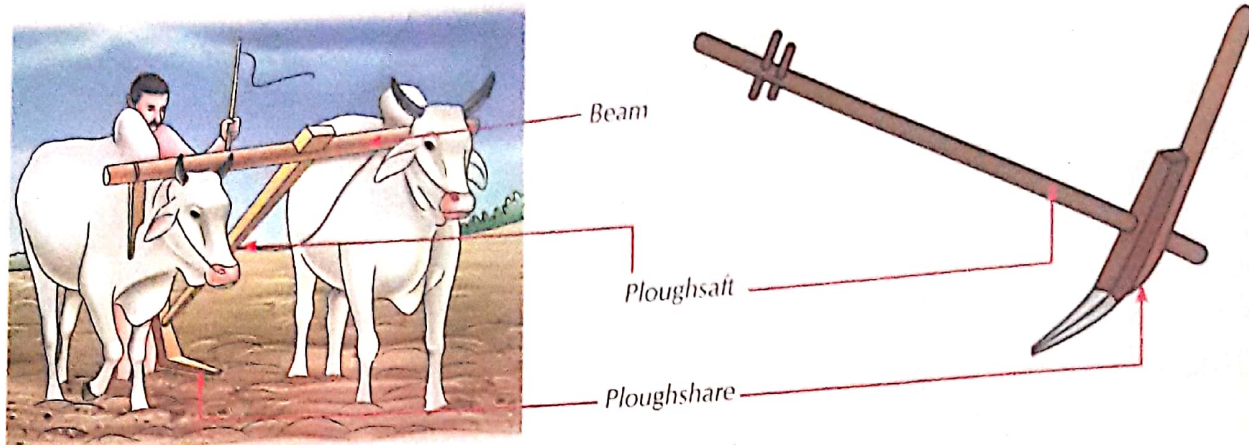


Fig 1.6: The plough

Hoe: It is used to remove weeds and loosening of soil. It contains a long rod of wood or iron. A strong broad and bent plate is fixed to one of its ends which acts like a blade. Hoe is pulled by animals.

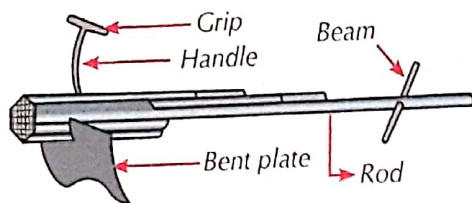


Fig 1.7: Hoe

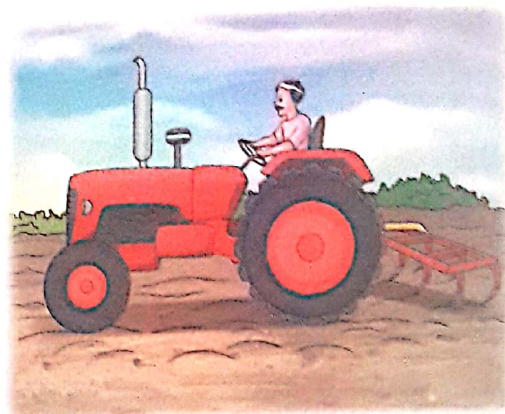


Fig 1.8: Cultivator drawn by a tractor

Cultivator: Nowadays, ploughing is done by a tractor driven cultivator. The use of cultivator saves labour and time.

Levelling

The ploughed field may have big pieces of soil called **crumbs**. It is necessary to break these crumbs with a **plank**. The field is levelled for sowing as well as for irrigation purposes. The levelling of soil is done with the help of a **leveller**.



Fig 1.9: Leveller

Sowing of Seeds

Sowing is the process of placing the seeds at proper depth in the soil. The *good quality and timely* sowing of seeds gives better yield of crops. Seeds should be:

1. Healthy, clean and fertile.
2. High-yielding variety.
3. Disease-free.

After selection of good quality seeds, sowing in soil should be done in this way for good production:

1. It should be done in moist and appropriate depth, neither too shallow, nor excess deep.
2. Spacing should be adequate to avoid crowding and competition for nutrients, air and water.
3. Sowing should be in time according to the type of crop.

Methods of Sowing Seeds: Seeds are sown both by hand and by machines by following methods:

1. Seeds are scattered by hand on the soil. This is called **broadcasting**.
2. Seeds can also sown by **seed drills** at right distances. The traditional seed drill contains a funnel-shaped container, from where the seeds pass and get placed into the soil. Seed drills help in uniform sowing of seeds.
3. Some plants like paddy, tomato and chillies are sown first in nurseries. When they grow as small plants are shifted to big fields for further growth with adequate spacing. This process is called **transplantation**.



Broadcasting



Seed drill



Transplantation

Fig 1.10: Methods of showing seeds



Activity 1.2

To find out the quality of good seeds.

Take a glass bowl with some water. Put some wheat grains in the bowl. Leave them undisturbed for some time. You can see that some seeds settle down at the bottom while some float on the surface. It shows that the seeds which are healthy settled down at the bottom due to their weight. The lighter seeds are damaged and become lighter, so they float on the surface of water.

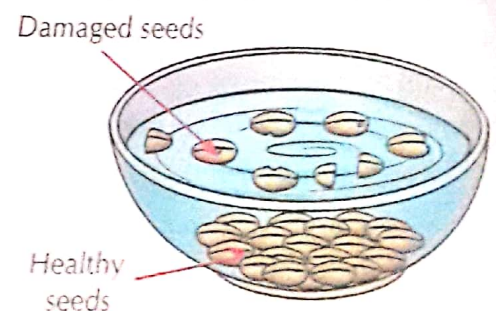


Fig 1.11: Healthy seeds settle down in water

Manuring

Manuring is the process of adding nutrients into the soil in the form of manure and fertilizers. It is the next step after soil preparation. The nutrients are necessary for the growth of plants. In the absence of nutrients, the plants can be weak and may not give good production.

Manure: The product of decomposed material of cattle dung and urine with straw and litter is called **manure**. Farmers generally dump this waste in the pits at open places and allow it to decompose. Decomposition is done with the help of microorganisms. The decomposed matter contains nutrients which is used as manure. Manure is obtained by natural sources, so it is also called as natural fertilizer. It can also be prepared by composting and vermicomposting method.

Fertilizers: When large fields are brought under cultivation, natural fertilizers are not sufficient to compensate the soil of its rapidly decreasing nutrients. In this case, the artificial fertilizers are used to compensate the nutrients deficiency. The fertilizers are nutrient-specific. They make the soil enriched with particular nutrients.

Some common fertilizers used in crop fields are urea, ammonium phosphate, potash, super phosphate and NPK (nitrogen, phosphorus and potassium). However, the excessive use of fertilizers is harmful for our environment. They wash away with rainwater and pollute the water sources.

Table: 1.2: Difference between fertilizer and manure

Fertilizer	Manure
It is a chemical substance.	It is a natural substance obtained by the decomposition of plants and animals (leaves, straw, cattle dung, urine).
It is prepared in factories.	It is prepared in the fields.
It does not contain any humus (organic matter).	It provides a lot of humus to the soil.
It is rich in specific nutrients, so required in very small quantities.	It is less rich in nutrients, so required in large quantities.
It causes water pollution.	It does not cause water pollution.

Other Methods of Soil Enrichment

If the same crop is grown in a field year after year, the fertility of the soil goes on decreasing. This is because the soil becomes poor in nutrients. The soil can be enriched by **crop rotation**, mixed farming and **green manuring**.

Crop Rotation: If different crops with different nutrient requirements are grown in different seasons, the fertility of soil is not affected. For example, wheat or rice crops use large amounts of nitrogen from the soil. This nitrogen can be replenished if the next crop grown is capable of fixing atmospheric nitrogen. Such a crop can grow in the nitrogen deficient soil. At the same time, the soil is replenished with usable nitrogen because of its ability to fix atmospheric nitrogen. Leguminous crops such as pea, bean, soybean or groundnut are some such crops. The



Fig 1.12 Crop rotation

practice of growing different crops in different seasons in rotation so that the soil is not depleted of its nutrients is called **crop rotation**. Leguminous crops are used in crop rotation.

Mixed Farming: The method in which two different crop varieties are grown in the same field at the same time is called **mixed farming**. It is also called multiple or double cropping. Its advantage is that the two crops can grow at the same time and labour to harvest them is also less.



Fig 1.13 Mixed farming



Fig 1.14 Green manuring

Green Manuring: The practice of enriching the soil by ploughing or burying the green plants into the soil is called **green manuring**. Legumes, leaves of bushes and small plants are allowed to decompose in the field. *Rhizobium* bacteria are present in the root nodules of leguminous plants. These bacteria trap atmospheric nitrogen and make it available for the plants. The crops like rice, maize, sugarcane, wheat, cotton, etc., require high nutrients to grow healthy, so are raised in green-manured field.

Practice Time

Say Yes or No.

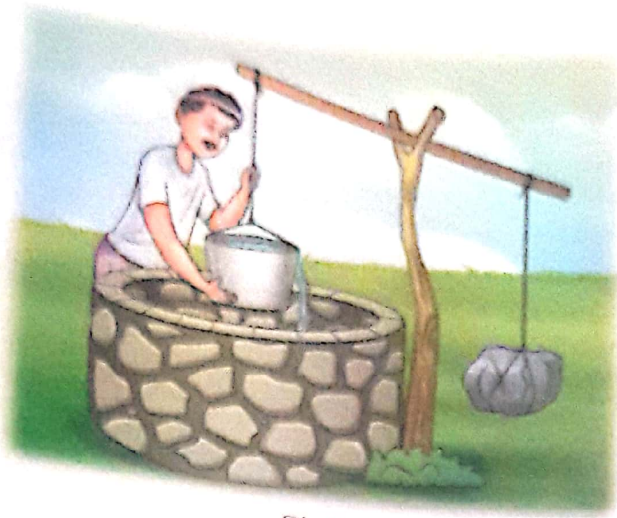
1. On the basis of cropping season, crops can be rabi crop and kharif crop. _____
2. Soil microbes and other organisms such as earthworms help to decrease soil fertility. _____
3. Decomposition is done with the help of plants. _____
4. Leguminous crops are used in crop rotation. _____

Irrigation

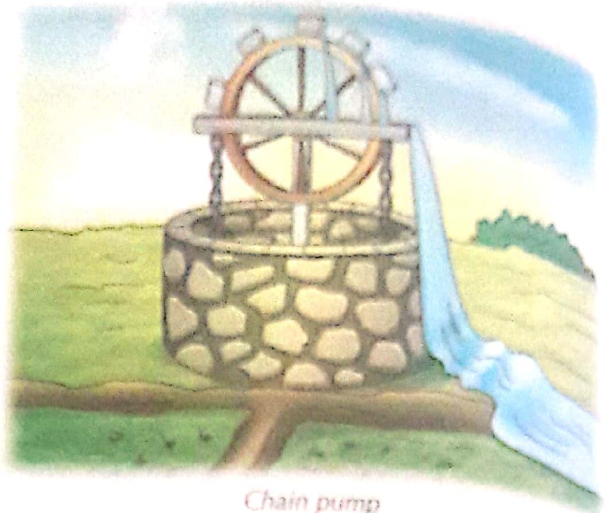
The artificial watering of soil for the growth of plants is called **irrigation**. The seeds sown in the soil need water to emerge as tiny plants. Sometimes, soil gets water naturally by rain. But, growing crops need water in right time. In case, rain does not occur in time, whole crop can be destroyed. In such cases, watering plants is done by artificial methods. The time and frequency of irrigation varies from crop to crop, soil to soil and season to season. The common sources used for irrigating plants are ponds, rivers, canals, wells, tube wells and reservoirs. There are both traditional and modern methods of irrigation used for irrigating the plants.

Traditional Methods of Irrigation

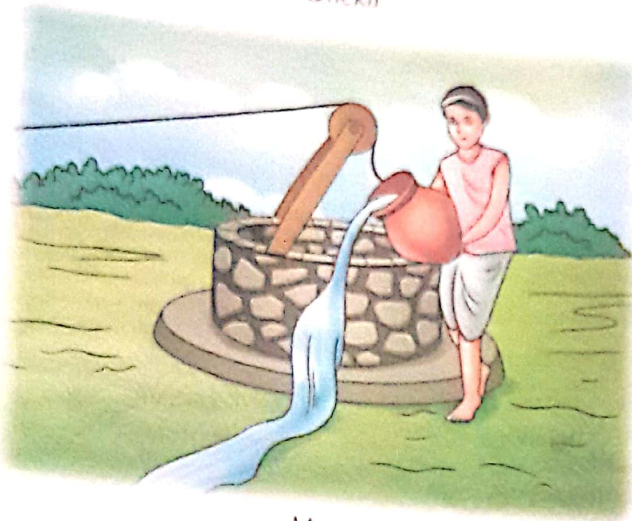
Farmers use various traditional methods of irrigation to water their fields. These are pulley-system (moat), chain pump, (dhelki) and lever system (rahat), furrow irrigation and canal system. These methods are used to draw water from wells, lakes, rivers and canals. These methods of irrigation are cheap as they involve human and cattle labour but are less efficient.



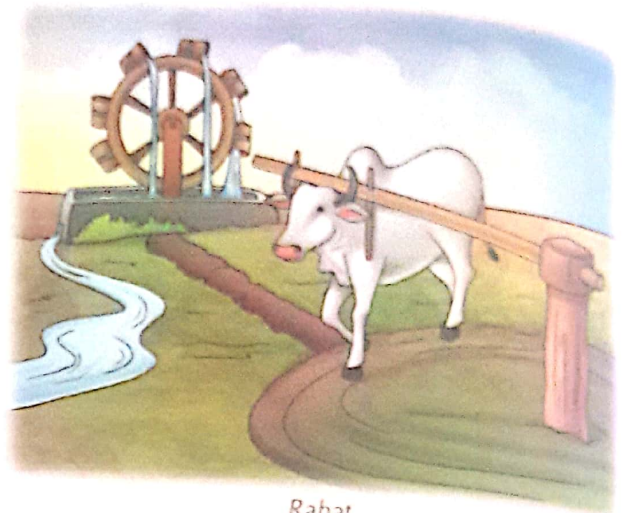
Dhekli



Chain pump



Moat



Rahat

Fig 1.15: Traditional methods of irrigation

Modern Methods of Irrigation

The modern methods of irrigation involve **sprinkler system** and **drip irrigation**. These methods are more efficient in working and saving water than traditional methods.

Sprinkler System: This system is used where land surface is not equal. Water is allowed to flow through the rotating nozzles which appears like raining. The method is suitable for sandy soil where the soil cannot retain water for longer time.

Drip Irrigation:

Drip irrigation allows water falls drip by drip just at the place of roots. Wastage of water does not occur. The drip system is mostly used to water fruit plants and gardens.



Fig 1.16: Sprinkler system



Fig 1.17: Drip irrigation

Weeding

The unwanted plants in the fields are called **weeds**. The removal of these unwanted plants is called **weeding**. The seeds of these weeds spread through the agencies like air, water, birds and other animals. Weeds share water, sunlight, space, nutrients with the crop plants. Thus, they compete with the crop plants.

Therefore, their removal is necessary. Otherwise, crop plants do not get sufficient space, water, sunlight and nutrients to grow healthier. Weeds are weeded out either by hand or with the help of an implement called **harrow**. Nowadays, for checking the growth of weeds, certain chemicals are used. These chemicals are called **weedicides**, such as 2, 4-D. The common weeds which grow with crop are grass, Amaranthus (Chauli), Chenopodium (Bathua) and wild oats, etc. Weeds can be removed manually by the trowel or harrow. Some weedicides like simazine, metachlor, butachlor and MCPA are sprayed in the field.

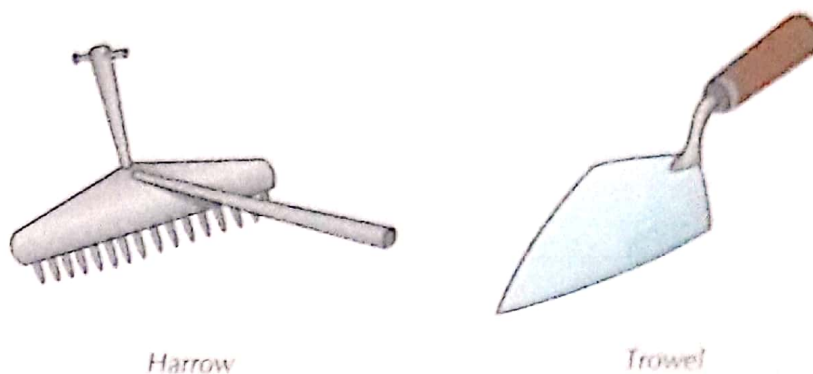


Fig 1.18 Sprinkler method

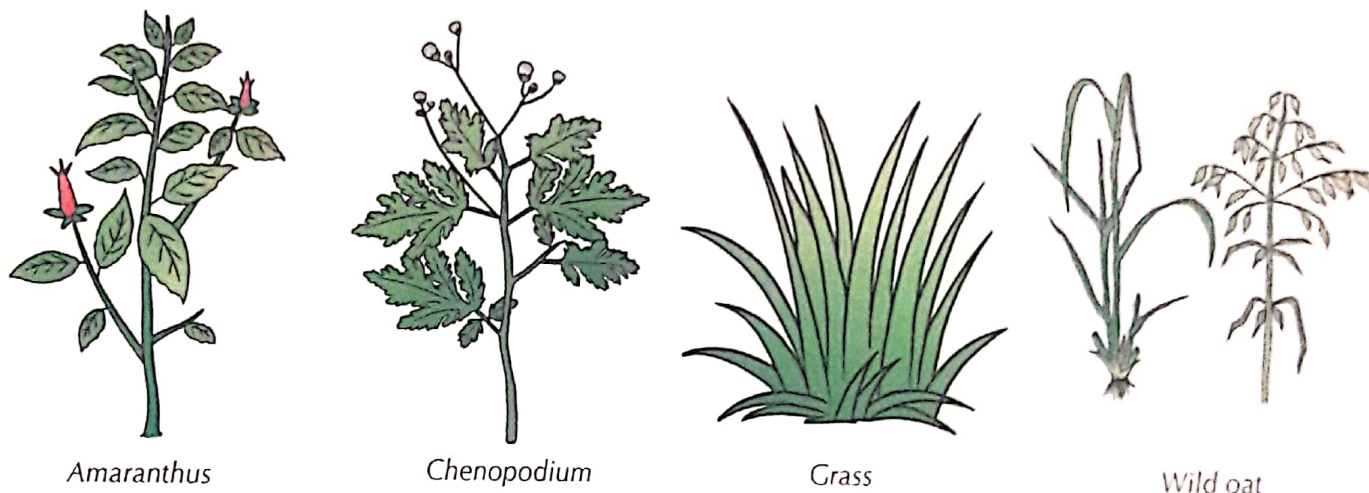


Fig 1.19: Different types of weeds

Crop Protection

There are some microorganisms like virus, bacteria and fungi which cause various diseases in crops. The small animals such as rats, birds and insects also destroy crops. An organism which destroys crops is called **pest**. These pests can also be controlled by spraying pesticides. The examples of some common pesticides are DDT, BHC, Malathion, sulphur and Warfarin. The weedicides are diluted with water to the extent required and sprayed in the fields with a sprayer. However, weedicides and pesticides are poisonous chemicals and they have following disadvantages.



Fig 1.20: Spraying weedicides

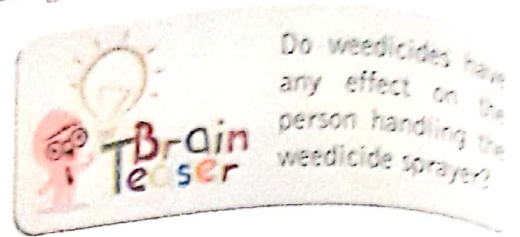
1. Health of farmers can get affected by their continuous exposure.
2. Traces of these chemicals may remain with harvested crops and can reach our food plate. So, a thorough washing should be done before using them.

Harvesting, Threshing and Winnowing

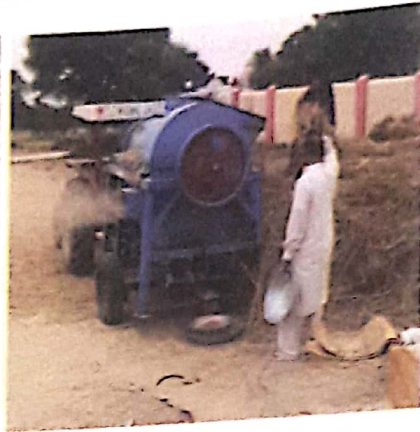
When the crop matures, it needs to be processed by harvesting, threshing and winnowing.

Harvesting: The process of cutting and gathering of mature crop is called **harvesting**. When crop is mature, it is cut and allowed to gather in heaps. Harvesting is done with the help of using sickle by hand. Combine machine is also used for harvesting and threshing the crop. After harvesting, grains are beaten out from the crops.

Threshing: The process of separating the grains from the straw and chaff is called **threshing**. It is done by using a **thresher** and a **combine** which is the combination of a thresher and a harvester.



Sickle



Thresher



Combine harvester

Fig 1.21: Different methods of harvesting

Winnowing: The grains separated after threshing need to be separated from chaff. This process of separation of chaff and grains is called **winnowing**. For winnowing, farmers stand on a raised platform and fall grains from the height through a winnow. The chaff being lighter, blows away with the wind. The heavier grains fall straight on the ground and are separated.



Fig 1.22: Winnowing

Crop Storage

The grains obtained by threshing are dried in the open. The dried grains are stored in **gunny bags**, and placed in properly ventilated cemented halls, known as **godowns**. Farmers keep dried grains in **jute bags** or **metallic bins** or **mud bins**. The large scale storage of grains is done in **silos** and **granaries**. For storing large quantities of grains in big godowns, specific chemical treatments are done to protect them from pests and microorganisms.

The storage area must be kept clean and dry. It must be protected from humidity and small animals like rats and insects. Regular inspection of storage area is also necessary. Moisture promotes the growth of fungi on the grains. In home, neem leaves are used to

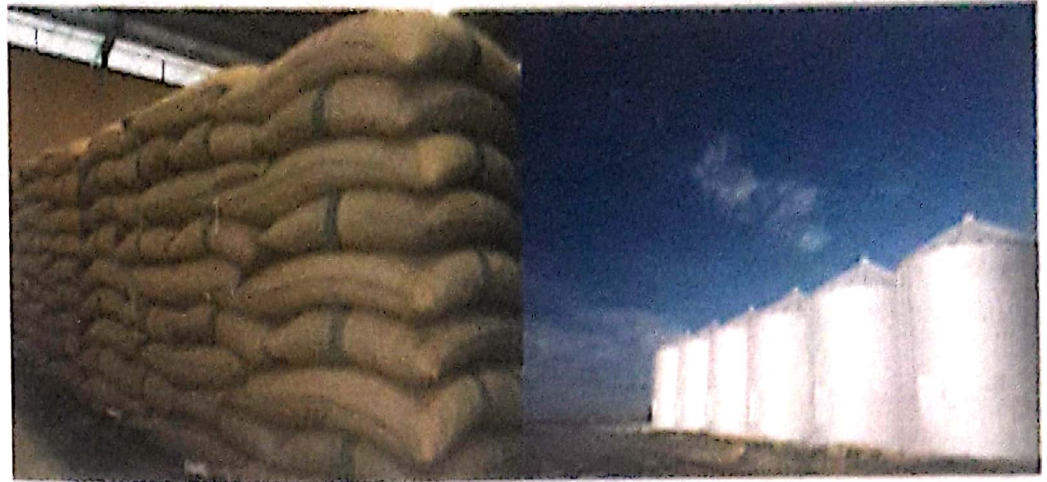


Fig 1.23: Gunny bags

Fig 1.24: Silos

protect stored grains. In big godowns, a special chemical treatment is required to protect grains. Certain types of fruits and vegetables need cold storage (below room temperature) to prevent from spoiling.

Increasing Crop Production >>>

The crop production means the quantity of crops produced by cultivating a particular area of land. It is measured in units like tonnes per hectare. So, improving crop yield means taking measures to increase the amount of food produced per unit area of cultivated land. The production can be increased by following ways.

1. Improving the fertility of the soil with the help of fertilizers and manure. If the soil has more nutrients, plants grow better and yield is better.
2. Ensuring that crop plants get the amount of water they require.
3. Protecting crops from pests and diseases is an essential step.

The three steps mentioned above can improve crop yield only to a certain extent. To meet the growing demand for food, scientists all over the world are trying to develop better varieties of crop plants, which yield more food. One of the popular modern method of increasing crop production is hybridization.

Hybridization

The aim of hybridization or cross-breeding technique is to produce plants which have a greater yield and can resist various diseases. Breeding means reproducing.

Scientists cross-breed different varieties of plants so that the offspring they produce may have some 'desirable' characteristics of both the varieties. For example, a particular variety of mango produces large mangoes which are not too sweet. If you cross-breed it with another variety which produces smaller mangoes which are very sweet, you may get a cross-bred, or hybrid, tree which produces large, sweet mangoes.

Thus, **hybridization** is the technique of cross-breeding different a species (plant or animal) to produce offspring which have desirable characteristics of both the varieties. The offspring produced by hybridization are called **hybrids**. The process of developing hybrids with desirable characteristics is long, and requires painstaking work.

Green Revolution

The earliest success in producing high-yielding varieties (HYV) of wheat by using the technique of hybridisation was achieved in Mexico by Norman E Borlaug in the 1960s. Soon after that, agricultural scientists in our country, led by Dr. MS Swaminathan, developed hybrid varieties of wheat by cross-breeding traditional Indian varieties with Mexican varieties. The cultivation of these varieties led to a great increase in the production of wheat in the late 1960s and 1970s. So spectacular was this increase, that it is often referred to as the Green Revolution!

Nitrogen Cycle >>>

Air contains about 78 per cent nitrogen as its component. However, the plants cannot use it directly in this form. Instead, they rely on bacteria present in the soil to break down the nitrogen into a usable form. Hence, a complex, interconnected network systems help in maintaining the concentration of nitrogen in the atmosphere and also to ensure the survival of dependent living organisms.

Basically, nitrogen cycle is the re-circulation and re-use of nitrogen in various forms to meet the demand for various environmental and biological activities. Nitrogen in the atmosphere is present in a diatomic form i.e., N_2 . Therefore, the plants cannot use the nitrogen in this form. Therefore, they need nitrogen fixing bacteria, lightning, root nodules, forest fires, etc., to convert the nitrogen into nitrate compounds like NO , NO_2 , NO_3 . The nitrogen is fixed in soil in the following steps:

Ammonification: When decomposition takes place, organic nitrogen (present in animals and plants) is converted into inorganic components like ammonia or ammonium ions. As a result, the ecosystem gets enriched with nutrients. This process is called **ammonification**.

Nitrification: In this step, ammonia obtained is first converted to nitrite (NO_2) by bacteria like *Nitrosomonas*, *Nitrococcus*, etc., and then to nitrate (NO_3). Bacteria involved in nitrification are called *chemoautotrophs*. The reaction involved in the process of nitrification is following.



Denitrification: Once the nitrate is utilized by plants, the excess nitrate in the soil is reduced back to nitrogen by *Pseudomonas* and *Thiobacillus* bacteria. This process is known as **denitrification**.

Nitrogen Fixation: The concentration of usable form of nitrogen in the atmosphere is less. But certain bacteria called nitrogen-fixers help to fix the nitrogen. **Nitrogen fixation** is the process in which diatomic nitrogen is converted into ammonia by bacteria

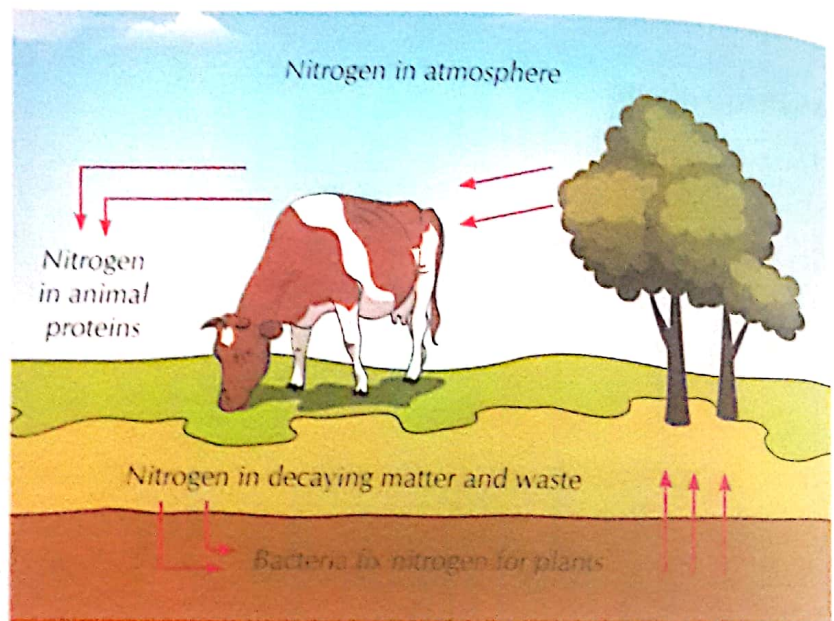


Fig 1.25. Nitrogen cycle

like *Rhizobium*, *Azotobacter*, etc. The conversion is carried out by an enzyme called *nitrogenase*. Nitrogenase is an oxygen-sensitive enzyme which requires a strict anaerobic environment. A compound called *leghaemoglobin* acts as an oxygen scavenger and fulfills the demand of the enzyme. The process of nitrogen fixation is initiated within the nodule of the roots in certain plants like legumes. A symbiotic relationship exists between the plants and the bacteria *Rhizobium*. These bacteria divide and form colonies around the root hair where they aid in nitrogen-fixation for the plant. The nitrogenase enzyme in the root nodule catalyzes the formation of ammonia.

Types of Nitrogen Fixation

Atmospheric Fixation: It is a natural phenomenon where the energy of lightning breaks the nitrogen into nitrogen oxides and is then used by plants.

Industrial Nitrogen Fixation: It is a man-made alternative that aids in nitrogen fixation by the use of ammonia. Ammonia is produced by direct combination of nitrogen and hydrogen and later, it is converted into various fertilizers such as urea.

Biological Nitrogen Fixation: We already know that the nitrogen is not usable directly from the air for plants and animals. Bacteria like *Rhizobium* and blue-green algae transform the unusable form of nitrogen into other compounds that are more readily usable. These nitrogen compounds get fixed in soil by these microbes.



Fig 1.26: *Rhizobium* bacteria lives in root nodules



Activity 1.3

To observe the root nodules of legume plants.

Visit a nearby farm or a garden where you can see legume plants growing. Request the farmer to allow you uproot a plant. Observe the nodules on its root. Nitrogen-fixing bacteria live in these root nodules.

Animals as Sources of Food >>>

Like plants, animals are also the important sources of food for us. So, just like crop production, we need animals to be raised carefully to get food from them. Animals are reared in large scale to produce food for whole population of the country. This large scale rearing, caring and breeding of domesticated animals for food and food products is called **animal husbandry**. The animals raised for different purposes under animal husbandry are called **livestock**. Let us know what food items we get from these animals:



Fig 1.27: Food items we get from animals

Milk: Animals which give us milk are called **dairy animals** or **milch animals**. Cow and buffalo are the main milch animals. Some other animals which give us milk are goat and camel. The milk of these animals is used to produce milk products like ghee, butter, curd and cheese.

Meat: The animals which produce meat for us are mainly goat, chicken and fish. Some other sources of meat for humans are pigs, prawns, shrimps, etc.

Eggs: The egg-producing animals are chicken, duck and turkey. The practice of keeping and breeding of egg producing animals is called **poultry**. Poultry products are the rich sources of proteins.

Honey: The insects which provide us honey are called honey bees. The honey bees keep their honey in beehive. The rearing of honey bees for large scale production of honey is called **apiculture**.

Table 1.3: Some important breeds of livestock.

Animals	Breeds
Cow	Jersey, Sahiwal, Sindhi, Holstein.
Buffalo	Murrah, Nili, Surti, Bhadawari
Goat	Kashmiri, Gaddi, Chamba, Pashmina
Poultry	Rhode Island, Sussex, White Leghorn, Minorca

Practice TIME

Fill in the blanks.

- The _____ compounds get fixed in soil by the microbes.
- Combine machine is also used for harvesting and _____ the crop.
- An organism which destroys crops is called _____.
- The _____ of irrigation is mostly used to water fruit plants and gardens.

Life Skills

- ◆ Do not waste food. A farmer does very hard work to produce food. It would be insult to his labour if you do so.
- ◆ Crops are protected by spraying pesticides and insecticides. These may be harmful to our health. Hence, it is important to wash them before use.

Keywords

- Agriculture** : Growing plants for food, clothing and other useful products.
- Crops** : Plants of the same type grown on a large scale for food and other uses.
- Ploughing** : Process of loosening and turning of soil.
- Levelling** : Breaking big pieces (crumbs) of soil into small pieces.
- Broadcasting** : Sowing of seeds by hand.
- Manure** : An organic substance obtained from decomposition of plant and animal wastes.
- Fertilizer** : Chemical substance rich in a particular nutrient.
- Sickle** : A hand tool used for cutting the ripe crop.

E. Write 'T' for the true and 'F' for the false statements.

1. Drip irrigation allows water to fall drip by drip just at the place of roots.
2. Growing crops need water all the time.
3. Fertilizers are nutrient-specific.
4. Ploughing allows roots to penetrate deep into the soil.
5. Seeds are sown by broadcasting at right distances.
6. Weeding is the process of removal of weeds.
7. Paddy is sown by transplantation method.
8. Furrow-irrigation is the modern method of irrigation.

F. Answer in brief.

1. Name any two rabi crops and kharif crops.
2. Which methods are used for soil enrichment?
3. What is winnowing?
4. Name the number of teeth in temporary set and permanent set.
5. What is the role of *Rhizobium* bacteria in nitrogen fixation?
6. List out all the agriculture practices.
7. Soil is a mixture. Explain.
8. How is manure made?
9. What is transplantation method of sowing seeds?
10. What is mixed farming and its advantages?

G. Answer in detail.

1. Explain the term crop and classify it into different categories.
2. What is ploughing and its benefits?
3. List out any four differences between manure and fertilizer.
4. Write a short note on traditional and modern system of irrigation.
5. Answer the followings:
 - i) What is weeding?
 - ii) Which weeds grow with crops?
 - iii) How the weeds removed from the field?

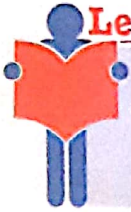


1. Collect the pictures of different agricultural implements. Paste them on a scrap book. Write the applications below each of them.
2. Collect seeds of different kinds, label them and make a seed herbarium.
3. Draw nitrogen cycle on a chart paper.



Microorganisms

Learning Points



- ❖ Habitat of microorganisms.
- ❖ Types of microorganisms.
- ❖ Food poisoning and food preservation.
- ❖ Useful microorganisms.
- ❖ Harmful microorganisms.

The living organisms which are too small to be seen with naked eyes are called **microorganisms** (Greek, mikros – small, organismos – organism). They can be seen only with the help of a microscope. These microorganisms are so small in size that they cannot be seen with the unaided eye. Some of these, such as the fungus that grows on bread, can be seen with a magnifying glass. Others cannot be seen without the help of a microscope. That is why these are called microorganisms or microbes. The study of microorganisms is called **microbiology** and the scientists which study them are called **microbiologists**.



Fig 2.1: Microorganisms can grow everywhere

Habitat of Microorganisms >>>

The microorganisms thrive almost in every habitat. It may be air, water, soil, food items, sewage, hot water springs and even inside the body of living organisms. They are also present in extreme habitats like great depth of ocean, in streams, in the snow of polar regions and in deserts. The air we breathe, the water we drink and the food we eat all contain microbes.

Microorganisms form a hard outer covering around their body called **cyst**, which protects them from unfavourable conditions. When favourable conditions return, they emerge from the cyst, multiply and complete their life cycles.



Fig 2.2: Cysts is a hard outer covering in microorganisms



Activity 2.1

To observe that how we can see things bigger under the microscope.

In a beaker, take some moist soil and some water. Stir the contents thoroughly. Filter it by using filter paper. Put one drop of this filtered water on a clean glass slide and examine under a microscope. You can observe some small organisms floating on the slide. It shows that the soil contains microorganisms.

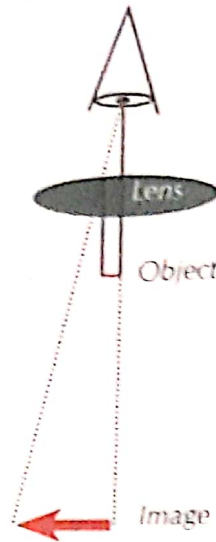


Fig 2.3: Enlarged image of object can be seen this way under microscope.

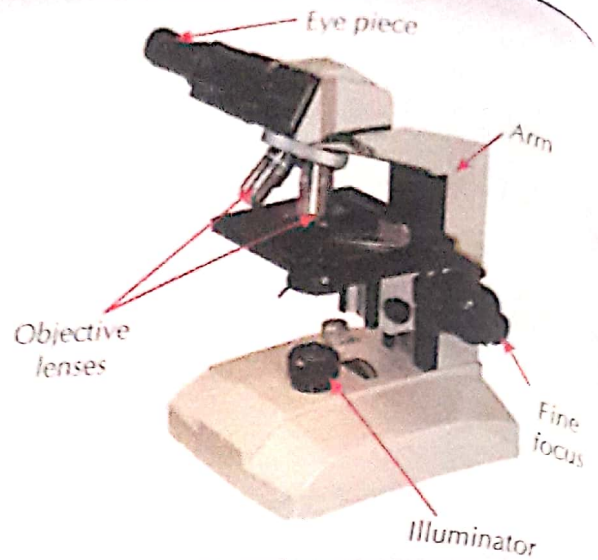


Fig 2.4: A simple microscope.

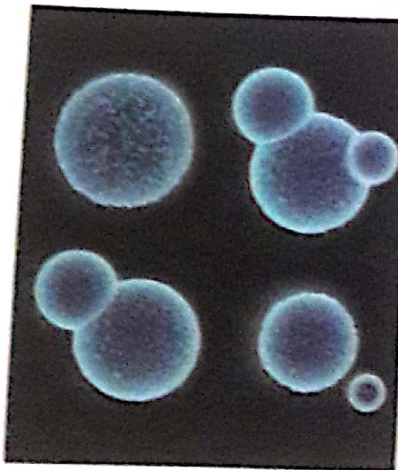
Types of Microorganisms >>>

The microorganisms are mainly of five types. These are classified on the basis of their specific characteristics. These are bacteria, fungi, algae, protozoa and viruses.

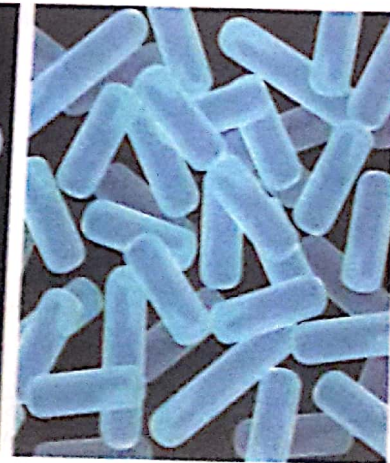
Bacteria

Bacteria (sing. bacterium) are microscopic organisms which have cell walls but do not have nucleus. Some bacteria are autotrophs but most are heterotrophs. The size of bacteria varies from 0.2 to 100 microns (1 micron = 0.000001 meter). Bacteria are found in different shapes like rod-shaped, spiral, spherical and comma-shaped. Examples are *Rhizobium*, *E. coli*, *Pseudomonas*, *Streptococcus*, etc. The four different forms of bacteria are:

1. Cocci (sing. Coccus): These are round-shaped. E.g., *Staphylococcus*.
2. Bacilli (sing. bacillus): These are rod-shaped. E.g., *Salmonella typhi*
3. Spiral (sing. Spirillum): These are like a spiral. E.g., *Treponema*
4. Curved: These are comma-shaped bacteria. E.g., *Vibrio*



Cocci



Bacilli



Spiral



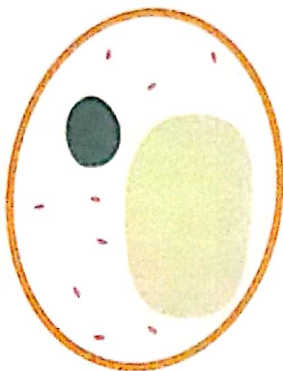
Curved

Fig 2.5: Types of bacteria.

Fungi

Fungi (sing. fungus) have cell wall and nucleus in their cells but do not have chloroplasts. These are saprotrophs, i.e., they feed on dead remains of plants and animals. Almost all fungi are microscopic, except mushrooms. They may be unicellular (yeast) or multicellular (moulds). The bodies of most fungi are made up of slender, thread like filaments called as **hyphae**. A mass of hyphae is called **mycelium**. The fungi are mainly of following four types:

1. Yeasts: These are ovoid or spherical in shape like: *Candida*, *Saccharomyces*
2. Mildews: Some of them are parasitic on plants like potato, grape, wheat, rose, etc.
3. Moulds: They form a network of hyphae on the substrate on which they grow like, *Rhizopus*, *Penicillium*, etc., which grow over various food items.
4. Mushrooms: These are composed of thousands of interwoven hyphae like, *Agaricus*.



Yeast cell



Mildew on potato



Mould on onion



Agaricus

Fig 2.6: Types of fungi



Activity 2.2

To observe the bread mould under microscope. Take a slice of bread, moist it slightly by sprinkling some water. Place it on a plate in a warm place. Carefully observe the change on the slice after some days. This is bread mould or *Rhizopus*. Examine the hyphae under a magnifying glass. You can see dark sporangia containing dark or pale spores. At the base of the sporangia are root like rhizoids. You can also see *Rhizopus* on decaying fruits, soil and house dust.

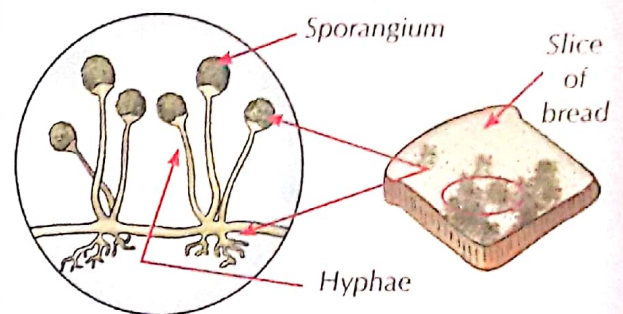


Fig 2.7: Magnified view of bread mould

Algae

Algae (Alga-sing.) are simple plants having no root, leaves and stem. These contain chlorophyll which makes them capable to synthesize their food by photosynthesis. They flourish on moist surface and water. The size of algae can vary from 1 micron to several meters as in large seaweeds. Algae can be unicellular as well as multicellular. These can be classified as following:

1. Green algae - *Chlamydomonas*, *Spirogyra*
2. Brown algae - *Sargassum*, *Fucus*

3. Red algae - *Gelidium*
4. Blue-green algae - *Nostoc, Anabaena, Oscillatoria*
5. Diatoms. These are microscopic, unicellular and may be found in colonies and filamentous forms. Examples are *Pinnularia, Cyclotella* and *Navicula*



Fig 2.8: Types of algae

Protozoa

Protozoa (sing. Protozoan) are simple, minute, unicellular organisms that exhibit animal like characteristics. They are found in freshwater pools, tanks, moist soil and also in other animals. The size of protozoa ranges from 2-200 micron. They do not possess a cell wall. They can be free-living, symbiotic or parasitic. Some common examples of protozoa are Amoeba, Paramecium, Euglena, Trypanosoma, Plasmodium, Giardia, etc. Amoeba is the most well-known member of the protozoa.

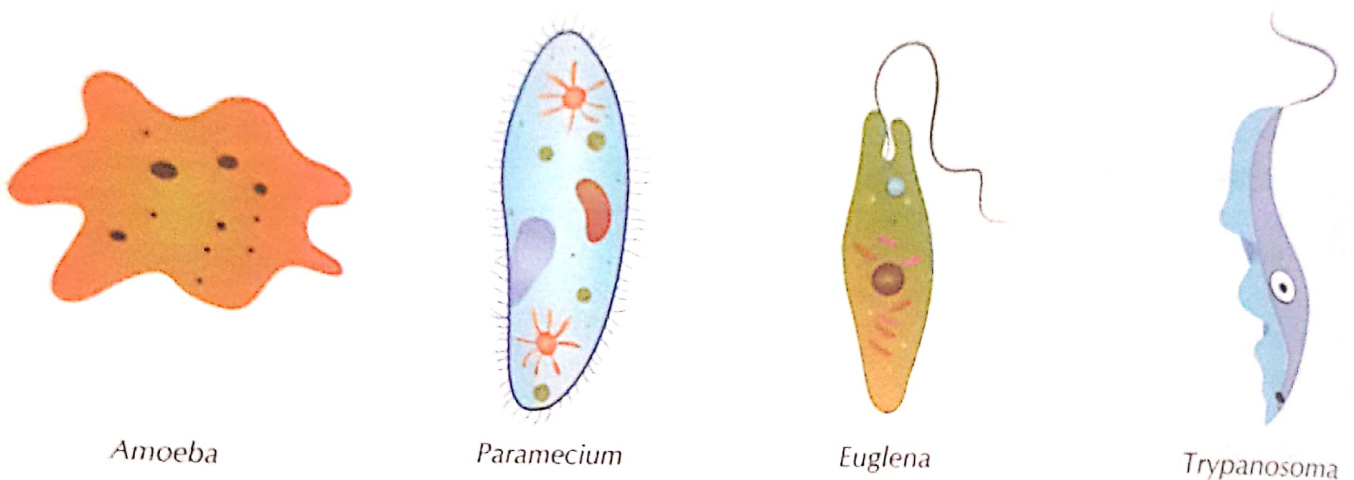


Fig 2.9: Some common protozoa



Activity 2.3

To observe some protozoa in a slime sample.
 Scrap some slime from the surface of a leaf or stone in a pond with help of a knife. Place it on a slide with a drop of water.
 Observe it under a microscope.
 You can observe some small organisms moving.
 Try to observe Amoeba or other protozoans in it.



Fig 2.10: Slime-a green colour layer on stones

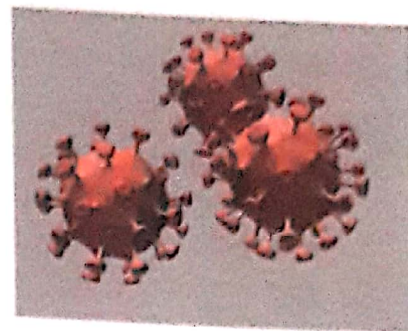
Virus

Viruses are tiny organisms that may cause mild to severe illnesses in humans, animals and plants. This may include flu or cold to something more life threatening like HIV/AIDS.

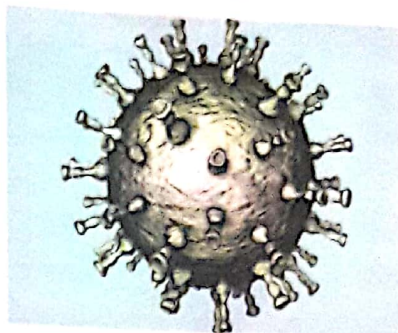
They cannot be seen under the ordinary microscope. Their size varies from 0.015 micron to 0.2 micron. Viruses cannot grow or multiply on their own and need to enter a human or animal cell and take over the cell to help them multiply. They have a variety of shape and may be rod-shaped, polygonal, spherical or cubical. They are found in plants, animals and human beings. The virus which affects bacteria is called **bacteriophage**.



Polio virus



Aids virus



Chickenpox virus



Bacteriophage

Fig 2.11: Some types of viruses

Viruses cannot reproduce themselves. They reproduce inside the living body and use the energy of host organisms to reproduce themselves. As they multiply and grow, the host cell bursts open to release them. Some examples of viruses are polio virus, rabies virus, cold virus, Tobacco mosaic virus, AIDS virus, chickenpox virus, herpes virus, measles virus, mumps virus, etc.

Practice TIME

Fill in the blanks.

1. Algae grow on moist surface and _____.
2. A mass of hyphae in fungus is called _____.
3. The _____ thrive almost in every habitat.
4. The microorganisms are mainly of _____ types.

KNOW MORE

The zika virus is spreading in many places around the world. It spreads mainly through the bite of an infected mosquito but also through other ways. So, it is best to prevent mosquito bites. It causes zika fever in infected person.

Useful Microorganisms >>>

Microorganisms are useful for us in many ways. Some important uses of microorganism are discussed below:

Microorganisms in Making Food

1. Curd contains several microorganisms. Of these, a bacterium called *Lactobacillus* promotes curd formation. The bacteria multiply in warm milk and convert it into curd after 4 -5 hours depending on the season. Cheese and paneer are milk products prepared by using bacteria

Lactobacillus and *Streptococcus*. The variety of cheese can be made by using different kinds of bacteria. Some fungi like *Aspergillus* and *Penicillium* are also added to cheese to give a special flavour.

- In bread making, a fungus called yeast is added to the uncooked dough to make it rise. The dough rises due to the production of carbon dioxide (because of the respiration of yeast) in the dough. The bread can now be baked. Heat of baking removes carbon dioxide, making the bread porous and soft.



Fig 2.12 Uses of microorganism in food industry

- The common food dishes like *idli* and *dosa* are also prepared by the action of yeast cells. The mixture of ground rice and dal is allowed to stand for a few hours. This mixture rises and becomes sour due to the growth of yeast cells. A popular dish of Gujarat called *dhokla* is also made by the action of yeast cells to make the mixture soft and fluffy.
- A fungus called *Aspergillus* is used to produce large quantities of citric acid used in soft drink industries.
- Some algae like *Chlorella*, *Porphyra* and sea weeds are used as food in many countries. *Chlorella* is very rich in proteins and vitamins.
- Some species of fungi are edible. For example, *Agaricus*, *Ramaria*, *Clavaria*, *Morchella*. They are used as vegetables or in soups.



Activity 2.4

To understand the use of fermentation process in baking industry.

Take some wheat flour or maida and some sugar. Mix both with warm water.

Add a small amount of yeast powder and knead to make a soft dough.

Observe after two hours? What do you observe?

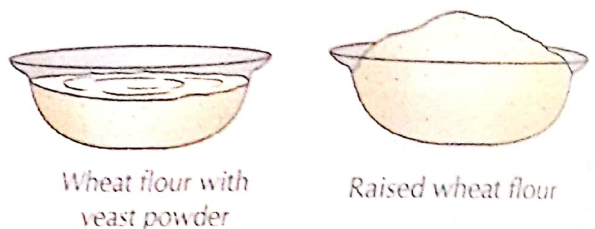


Fig 2.13: Fermentation of wheat flour

You may observe the dough rising. This is because yeast reproduces rapidly and produces carbon dioxide during respiration. Bubbles of the gas fill the dough and increase its volume. This is the basis of the use of yeast in the baking industry for making breads, pastries and cakes.

Commercial Use of Microorganisms

Some microorganisms are used for the large scale production of alcohol, wine and acetic acid (vinegar). Yeast is used for commercial production of alcohol and wine. For this purpose, yeast is grown on natural sugars present in grains like barley, wheat, rice and crushed fruit juices, etc. The process of conversion of sugar into alcohol is called fermentation. Yeast are tiny single-celled fungi that contain special enzymes responsible for this reaction.

Fermentation is the process in which yeast breaks down sugar into alcohol and carbon dioxide. Carbon dioxide gas bubbles out of the fermenting solution into the air leaving a mixture of ethanol and water.

Glucose + Yeast \longrightarrow alcohol + Carbon dioxide

Medicinal Use of Microorganisms

1. The medicines which kill or stop the growth of disease causing organisms are called antibiotics. These are designed to destroy bacteria by weakening their cell walls. Many antibiotics like streptomycin, tetracycline and erythromycin, etc., are prepared by using bacteria and fungi. Penicillin is obtained from the fungus *Penicillium notatum*. Antibiotics are prepared by growing specific microorganisms on a large scale to cure different diseases. Edward Jenner discovered the vaccine for smallpox in 1798
2. Vaccines are prepared against several infectious diseases like smallpox, tuberculosis, cholera, hepatitis, polio, etc. When a pathogen enters our body, the body produces antibodies to fight against it and protect the body.

The body also has memory to fight against this infections, if it occurs again in future. This is the reason that when dead or weakened microbes are introduced into a healthy body, the body fights and kills them by producing specific antibodies. These antibodies provide immunity to the body and protect us from further infection. A vaccine works by this mechanism.

The vaccines are available in Government hospitals and health centres at free of cost. It is necessary for all children to get vaccination against these deadly infectious diseases. Vaccination cause immunization of the body from several diseases.

KNOW MORE

In 1929, Alexander Fleming was working on a culture of disease causing bacteria. Suddenly he found the spores of a little green mould in one of his culture plates. He observed that the presence of mould prevented the growth of bacteria. In fact, it also killed many of these bacteria. From this the mould penicillin was prepared.



Fig. 2.14 Antibiotics

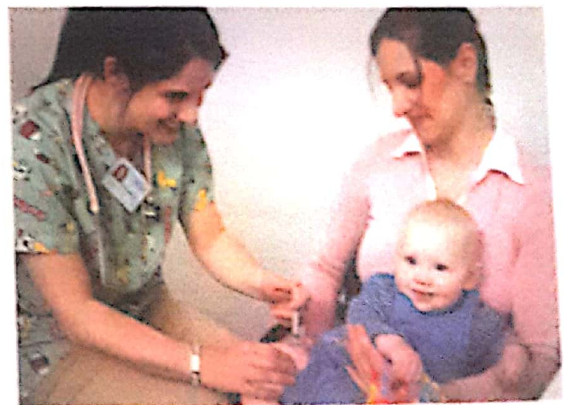


Fig. 2.15 Vaccination of children

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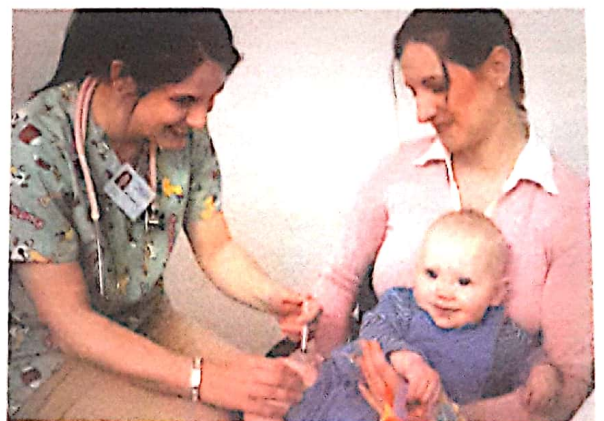


Fig 2.15 A child being vaccinated

A worldwide campaign against smallpox has finally eradicated it from most parts of the world. Nowadays, several vaccines are made on a large scale using microorganisms to protect animals and humans from several life threatening diseases.

Precautions while Taking Antibiotics: Antibiotics should always be taken only with the advice of a qualified doctor. Once taken, the course of antibiotics must be completed as prescribed. When antibiotics are taken without uses or in wrong doses, these may become less effective when you actually need them in future. Antibiotics also kill beneficial bacteria in the body. These are not effective in case of cold and flu and other virus caused diseases.

Increasing Soil Fertility

Microorganisms help in recycling of nitrogen in the environment. The microbes like blue green algae and *Rhizobium* fix nitrogen from the atmosphere to enrich the soil with nitrogen and increase its fertility. These bacteria live in root nodules of plants, such as gram, pea, bean and other legumes and absorb nitrogen from the air and convert it into nitrates. The nitrates are then absorbed by the plants as natural fertilizers. These microbes are also called **biological nitrogen fixers**.

Cleaning the Environment

1. The microorganisms like bacteria and fungi decompose biodegradable waste and help in recycling of nutrients to the environment. They break the bodies of dead and decaying organisms into simple substances which are readily absorbed by the plants from the soil. Thus, they also clean the environment by recycling the nutrients.
2. The compost made by using plant and animal waste materials is actually the function of microorganisms.
3. Bacteria are also used in decomposition of sewage. The heap of garbage, dead plants and animals are decomposed by the microbes. They degrade the harmful smelly substances present in sewage and make it less harmful for the environment.
4. The microorganisms like algae can carry out photosynthesis and produce oxygen. In this way, these also purify air.

Various Other Uses of Microorganisms

1. Retting of flex and jute fibers is done by using some bacteria. In the jute industry, jute plants are submerged in water, where bacterial action help fibers to separate from the tissue of the plants. These separated fibers are then converted into ropes.
2. Tea leaves are cured due to the action of bacteria to get a characteristic aroma and flavour.
3. Bacteria are also used in tanning (to make skin of animal into leather by treating it with chemicals) of leather.
4. Some bacteria called *Mycoderma aceti* help to produce vinegar or acetic acid.
5. Agar and algin obtained from red and brown algae respectively. These are used in preparation of medicines, food and cosmetics.
6. Sea weeds are directly added to the agricultural fields as manure because they are rich in nitrogen and potassium.
7. Some sea algae such as *Laminaria* is used as fodder for sheep and cattle.

- Some bacteria and protozoa live in the digestive system of cud-chewing animals like cow, goat, sheep, etc. These bacteria help them in breaking of plant fibre called cellulose which is hard to be digested by these animals.

Harmful Microorganisms

Microorganisms cause many harms to the plants, animals and human beings. Such microbes are called **pathogens**. The pathogens spoil food, clothing, leather and cause disease.

Disease Causing Microorganisms in Humans

The disease causing microorganisms like bacteria, fungi, virus and protozoa enter our body parts through various means such as, food and water, air, skin and through various carriers. These pathogens enter the body of healthy person when an infected person sneezes or coughs. Due to this, thousands of common cold causing viruses enter the air and reach to the nearby healthy person via breathing.

Many insects also carry disease causing microorganisms and transmit them into healthy persons. Some examples of these insects are given here.



Fig 2.16: Mosquito injects parasites through biting

- Anopheles* mosquito (female) is a carrier of malaria causing parasite in it and injects it to the human body by biting.
- The female *Aedes* mosquito acts as a carrier of dengue virus.
- Many food borne diseases are spread by house fly. It sits on garbage and excreta and carries disease causing pathogens with it. When this housefly sits over uncovered food, fruits, vegetables and other eatables, the pathogen stick to the food and enter our body.

The diseases which can spread through air, water and food are called **communicable diseases** or **infectious diseases**. The agents which transmit diseases causing microorganisms from infected person to healthy person are called **carriers** or **vectors**. The housefly and mosquitoes are examples of carriers of diseases. Mosquitoes breed in water. We should not let water collected in coolers, tyres, flower pots, small pits, etc. There are various infectious diseases which affect humans, animals and plants. These diseases are listed in following tables.

Table 2.1: Some common diseases caused by virus in humans.

Diseases	Pathogen	Transmission Agents	Preventive Measures
Common cold	Virus	Droplets of moisture when the person coughs and sneezes.	Hygienic habits, covering nose and mouth while sneezing, coughing.
Chicken pox	Virus	Breath and saliva of infected person	Vaccination, avoiding contact with blisters falling off from patients.
Polio	Virus	Contaminated food and water. Excreta of patient may be carried by flies to food and water.	Vaccination, hygienic conditions
Rabies	Virus	Through saliva of infected animal when it bites human beings.	Washing the area with soap and water. Rabies vaccination to the bitten person.

Table 2.2: Bacterial diseases in humans.

Diseases	Pathogen	Transmission Agents	Preventive Measures
Cholera	Bacteria	Contaminated food and water	Vaccination, drinking boiled water, hygienically prepared food.
Tuberculosis	Bacteria	Air	BCG vaccination, antibiotics to patient.
Typhoid	Bacteria	Infected food and water	Anti-typhoid vaccine, sanitation, protection of food and water from houseflies.
Diarrhoea	Bacteria	Contaminated food	Proper sanitation. Food and water should be covered.

Diseases caused by Microorganisms in Animals and Plants

Animals are also vulnerable to the diseases caused by microorganisms. Some common diseases in animals are given below:

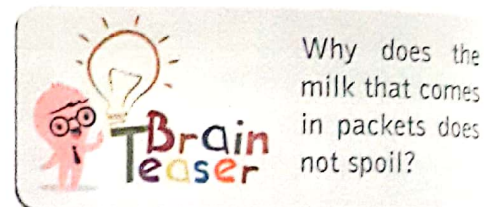
1. Anthrax is a common disease caused by bacteria in cattle. It occurs through the use of contaminated soil. Humans can get infection through the infected animals.
2. Rinderpest is a viral disease occurs in animals due to the use of contaminated air, water and infected animals.
3. Foot and mouth diseases of cattle is caused by contact with diseased animals.
4. Many plants like wheat, rice, potato, okra, sugarcane, orange, apple also suffer from several diseases caused by microorganisms. They can be protected by spraying some chemicals. Some common plant diseases caused by microorganisms are given in following table.

Table 2.3: Some common plant diseases caused by microorganisms

Plant Diseases	Micro-organism	Mode of Transmission
Citrus canker	Bacteria	Air
Rust of water	Fungi	Spores
Yellow vein mosaic of bhindi (Okra)	Virus	Insects

Food Poisoning >>>

The health problem caused by eating spoilt food items is called **food poisoning**. Food gets spoiled due to the action of microorganisms. Food poisoning may occur due to the consumption of food spoilt by microorganism like fungi and bacteria. These grow in food items and release toxic substances. For example, fungi grow on stale bread, souring of milk, rotting of fruits and vegetables, putrefaction of meat are all due to microbes.



On the availability of favourable conditions, microorganism grow on food items and produce toxic substances. These substances make the food poisonous and unfit for eating. If eaten, it can cause serious problems and even sometimes death. Hence, we should always eat fresh, covered

and properly cooked food. The spoilt food can be identified by its bad smell, discoloration on surface, slimy or cotton like growth, sour taste, etc. We have learnt about methods of storing and preserving food grains after harvesting in earlier chapter. In this chapter, we will learn about methods of preserving food items so that these can be used for longer time.

Food Preservation >>>

Spoilt food emits bad smell and its colour also changes. This can be prevented by applying food preservation techniques. **Food preservation** is a technique of treating food items to slow down or stop the growth of microorganisms as well as maintaining the quality, flavour, colour and texture of the food item so that these can be stored for longer time. The preservation techniques create unfavourable conditions for the growth of microbes. We can preserve food items in our home by adopting some simple food preservation methods.

Heating: It is a simple method of preservation used in our homes for protecting milk from spoilage and killing germs in water. Boiling kills growth of harmful microorganisms.

In commercial scale, milk is boiled at high temperature of 700°C for about 15 to 30 seconds and then cooled quickly. This method kills most of the bacteria which can spoil milk. This is called **pasteurization**. It is used in large scale storage of milk. The pasteurization technique was discovered by Louis Pasteur.

Cold Treatment: Low temperature prevents the growth of microbes. They need moderate temperature to grow. So, we store many food items like milk, curd, cooked food, raw vegetables and fruits in refrigerator to store them for longer time.



Fig 2.17: Storing things in refrigerator

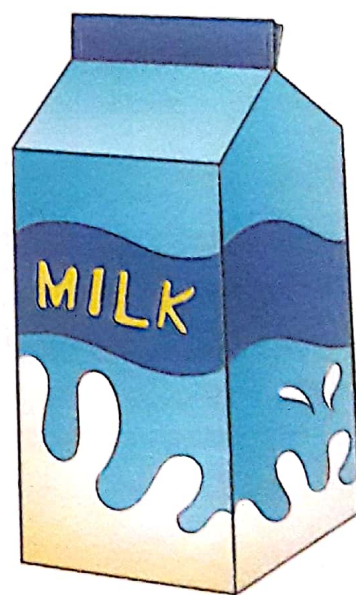


Fig 2.18: Pasteurized milk

Preservation by Salt, Sugar, Oil and Vinegar: Salt, sugar, oil and vinegar prevent growth of microorganisms. Salting is done to preserve meat, fish, amla, raw mangoes, tamarind, etc. Jam, jellies, and fruit juices are preserved by using sugar. The moisture reduces due to sugar and the growth of bacteria and fungus remains inhibited. Oils and vinegar are best known for preserving

pickles. Some vegetables, fruits, fish and meat are also preserved in oil and vinegar for longer time.

Chemical Methods: Chemical preservatives are also used to prevent the growth of microbes in food items. The common chemicals used as preservatives are sodium benzoate and sodium metabisulphite. These are used to preserve jams and squashes to be sold for commercial purposes.



Fig 2.19: Preservation by salt and sugar



Fig 2.20: Sun drying of grains

Drying: It is the method of removing moisture from the food items. Microorganisms need moist conditions to grow and dryness of air inhibits their growth. The food grains like cereals and pulses are sun dried after harvesting before their storage. The lack of moisture in seeds helps them to remain stored for longer time.

Storage and Packaging: Nowadays, dry fruits and vegetables are sold in sealed air tight containers to prevent them from growth of microorganisms. You understand that microorganisms need moist air and suitable temperature for their growth. The air tight condition does not allow their growth.



Fig 2.21: Some food items in air tight containers

Practice TIME

Say Yes or No.

1. In bread making, yeast is added to the uncooked dough to make it rise.
2. In fermentation, bacteria breaks down sugar into alcohol and carbon dioxide.
3. Vaccination causes immunization of the body from several diseases.
4. Bacteria are also used in decomposition of sewage

Life Skills

- ◆ Keep yourself clean to stay healthy and away from infections.
- ◆ Maintain hygiene in your home and surroundings. The microbes flourish easily in dirty places.

2. Examples of multicellular microorganism are _____.
 - a. Algae and bacteria
 - b. Bacteria and fungi
 - c. Bacteria and viruses
 - d. Algae and fungi
3. Some medicines obtained from micro organisms are applied to kill or stop the growth of disease-causing microorganisms. Such medicines are called _____.
 - a. Antibodies
 - b. Antibiotics
 - c. Antiseptics
 - d. All of the above
4. A common preservative used in jam and pickles is _____.
 - a. Sodium benzoate
 - b. Nitric acid
 - c. Sodium chloride
 - d. Copper sulphate
5. *Rhizobium* found in root nodules of leguminous roots is an _____.
 - a. Atmospheric carbon fixer
 - b. Atmospheric oxygen fixer
 - c. Atmospheric nitrogen fixer
 - d. All of the above
6. *Lactobacillus* is commonly found in _____.
 - a. Cake
 - b. Curd
 - c. Bread
 - d. All of the above
7. The process of conversion of sugar into alcohol by yeast is called _____.
 - a. Fermentation
 - b. Pasteurization
 - c. Alcoholism
 - d. All of the above
8. The pores in the bread is due to gas bubbles of _____.
 - a. Oxygen
 - b. Nitrogen dioxide
 - c. Nitrogen
 - d. Carbon dioxide
9. Deliberately injecting weak microbes into a healthy body and producing antibodies to fight against strong microbes is called _____.
 - a. Medication
 - b. Antibiotics
 - c. Vaccination
 - d. All of the above
10. The microbe responsible for malaria is carried by _____.
 - a. Male Anopheles mosquito
 - b. Female Anopheles mosquito
 - c. Male Aedes mosquito
 - d. Female Aedes mosquito

B. Fill in the blanks.

1. Microorganisms are found in _____ place.
2. Cocci bacteria are _____ shaped.
3. Moulds are _____ that form a network of branches called hyphae.
4. Lichens are _____ organisms.
5. The virus which affects bacteria is called _____.
6. Yeast is a _____ fungi.
7. Bacteriophage are virus which affect _____.
8. The smallest microorganisms are _____.

C. Coin one word for these statements.

1. They have cell wall and nucleus in their cells but do not have chloroplast. _____
2. They are simple, minute, unicellular organisms that exhibit animal like characteristics. _____
3. The medicines which kill or stop the growth of disease causing organisms. _____
4. The diseases which can spread through air, water and food. _____
5. The health problem caused by eating spoilt food items. _____

D. Match the following columns.

- | A | B |
|--------------|-----------------|
| 1. Chlorella | a. Amoeba |
| 2. Yeast | b. Fermentation |
| 3. Bacteria | c. Fungi |
| 4. Protozoa | d. Polio |
| 5. Alcohol | e. Fix nitrogen |

E. Write 'T' for the true and 'F' for the false statements.

1. Viruses show characteristics of both living and non-living. _____
2. Bacteria are also used in sewage treatment. _____
3. Citrus canker, a viral disease of plants. _____
4. Rinderpest occurs due to the contaminated of air and water in animals. _____
5. Typhoid is a bacterial diseases caused by contaminated food and water. _____
6. Vector of malaria diseases is Aedes mosquito. _____
7. Bacteria help in retting of cotton fibres. _____
8. Common cold is caused by bacteria. _____

F. Answer in brief.

1. Write the different shapes of bacteria.
2. Which are called smallest microorganisms? Write their shape and size.
3. How are microbes involved in the preparation of idli and dosa?
4. Name the types of fungi and one example of category.
5. Write the features of protozoa.
6. Define the term vaccine and antibodies.

G. Answer in detail.

1. Write in detail that micro organisms are useful commercially,.
2. Describe the role of micro organisms in sewage treatment.
3. How do microbes enter the human body?
4. What are the importance of antibiotics and vaccines?
5. In what way micro organisms are harmful for us?

6. Write short notes on:

- i) Food preservation
- ii) Disease causing micro organisms

7. How will you preserve these food items:

- i) Milk
- v) Pickles

- ii) Jam
- vi) Peas

- iii) Cereals
- vii) Cauliflower

- iv) Dry fruits



1. Try to make curd yourself. Take some warm milk in a pot with a lid. Add a spoonful of prepared curd and add into it. Leave it for about 5-6 hours. Lift the lid of pot. You can see that the milk is changed into curd. Do you know the spoonful of curd that you added into milk contains a bacterium called Lactobacillus.



Fig 2.22: Making curd

2. Collect the labels of packed food available in your home. For example, jams, jellies, chips, etc. Write the list of contents used in making these food items. Discuss the material used in them which keep these food items safe for longer time.



1. Find out about the vaccination scheme of the Government. Ask your parents that you have undergone this scheme or not? Try to collect information about new vaccines developed in the country. Tell your parents also to get vaccinated complete vaccination. Make a project on your findings and show to your teacher.
2. Visit any bakery shop. Observe the process of dough making for various bakery products. Find out about yeast cells from the baker. Make a project on your observations and submit to your teacher.



Fig 2.23: A bakery shop