Food Production

Micro-organisms

You might have watched advertisements on television saying tap water is unsafe, or use aqua-guard, a water purifying system in order to get water safe for drinking. Then they show various germs that are magnified and labelled as culprits for our bad health. **Have you ever thought what these tiny monsters or germs are?**

Living organisms which are not visible to the naked eye are known as **micro-organisms**.

These germs are microorganisms or microbes. They are the tiniest possible living organisms that are too small to be seen through naked eyes. They are living organisms that can be seen only with a microscope or a magnifying glass.

Microorganisms were observed for the first time by Anton von Leeuwenhoek in 1674, using a microscope of his own.

Is the water that seems to be clean, clear, and transparent safe for drinking?

No! The water that seems to be clear and transparent is not always safe for drinking. It may contain some of the disease-causing microorganisms and other dissolved impurities that you cannot see with your naked eyes. However, if you view the water with the magnifying glass, you can see several microorganisms in it.

Therefore, it is advised to purify the water before drinking. The purification can be done by water purifying system or by boiling the water.

Microorganisms make up the largest number of living organisms on the planet. They are not just billions or trillions around the earth, but trillions of trillions and many more. There is a huge variety of microorganisms present on earth.

There are five major groups of microorganisms that include bacteria, protozoa, fungi, algae and viruses.

Can you tell what is the study of these microorganisms called?

The study of microorganisms is called **microbiology.**

Do you Know that these microorganisms can be cultivated in artificial media under certain conditions?

Microorganisms can be grown in laboratories in a special medium called culture media. This medium provides an appropriate environment for the gowth of microorganisms in the laboratories. Depending upon the special requirements of particular microorganisms, different kinds of culture media are formulated. Some are given below:

Microorganisms	Culture meida
Bacteria	Nutrient Agar(NA)
Fungi	Potato Dextrose Agar (PDA)
Protozoans	Nutrient Broth media
Algae	Beneck's Media
Virus	Animal cells

There are many scientists who have contributed in the field of microbiology. Let us discuss about the contribution of some scientists here.

Louis Pasteur (1822-1895)
The main contributions of Louis Pasteur are:

- He disapproved the theory of spontaneous generation of life. He proved this by his famous experiment known as **swan neck flask experiment**. Earlier it was thought that new life originates from non living things, but Pasteur disapproved this and established the theory of biogenesis.
- He developed the method of pasteurization to prevent spoilage of food by bacteria.
- He also contributed to the development of vaccines.

Robert Koch ((1843-1910)

The main contributions of Robert Koch in the field of microbiology include:

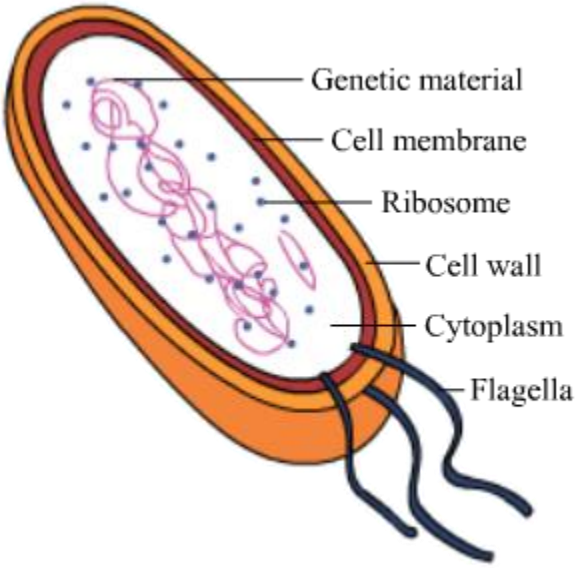
- Robert Koch developed the germ theory of disease that established the microbial cause of disease.
- He identified anthrax disease that infected cattle, sheep and even humans.
- He developed agar growth medium for the culture of microbes.

A General Study of Bacteria

Bacteria are the most primitive and diverse unicellular organisms found in living world. They are prokaryotic in nature as their genetic material, i.e. DNA, is not enclosed within a nuclear membrane. Because of their unique biochemical pathways and properties, they are of high economic importance to the human beings. Let us take a look at a general account of various features of bacteria.

Structure

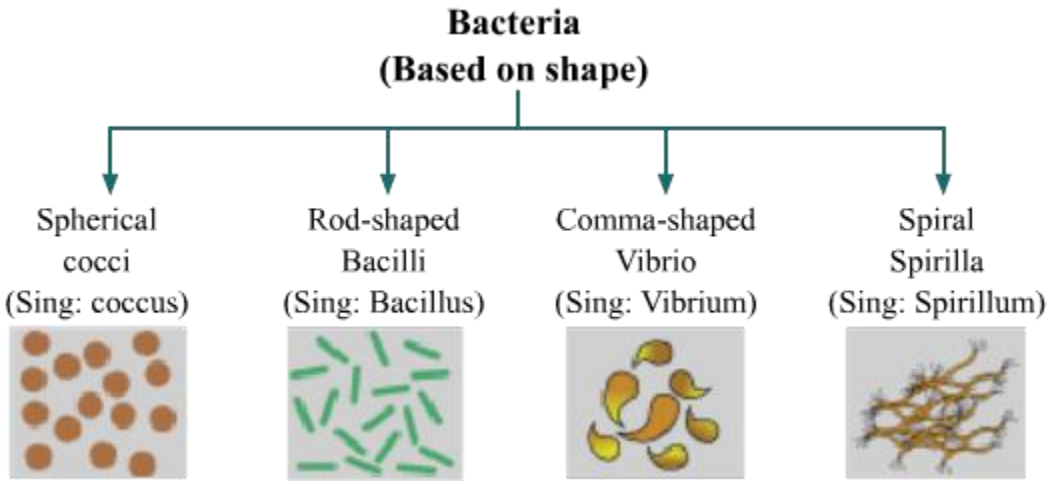
- Bacterium is unicellular in nature, consisting of a cell wall made up of peptidoglycan, cell membrane and protoplast.
- The cytoplasm lacks any cell organelle, except vacuoles and ribosomes.
- DNA lies freely in the central region of the cytoplasm.
- In some cases, the cell wall is further surrounded by a slimy protective layer, called capsule.
- Some bacteria also contain whip-like flagella that help them in their movement.



A Bacterial Cell

Shapes of bacteria:

Bacteria are of different shapes. They can be classified in four groups based on their shape.



(i) Rods: They are rod-shaped bacteria and are called bacilli. Examples are *E.coli*, *Salmonella*, and *Clostridium botulinum.*

(ii) Spheres: They are round in shape and are called cocci. An example of cocci is *Staphylococci.*

(iii) Spirals: They are spiral-shaped and are called spirilli. The comma-shaped bacteria, *Vibrio cholerae* is also an example of spiral bacteria. Another example is *Treponema pallidum*.

A General Study of Fungi

Fungi is a group of eukaryotic, unicellular as well as multicellular, non-photosynthetic organisms that includes mushrooms, moulds and yeasts. These organisms have a rigid cell wall made up of chitin and are found in diverse shapes and sizes.

Nutrition
Most of the fungal species are saprophytic in nature. Some of them are parasitic on various plants and animals as well.

Reproduction in Fungi

- Most fungi reproduce asexually, though sexual reproduction may also take place in few cases.
- Asexual reproduction may occur in the form of spore formation (as in *Rhizopus*) or as budding (as in yeast).

Use of Microbes in Food Industry

Do you know that micro-organisms are used to prepare a number of food items we consume?

Let us explore the use of micro-organisms in the preparation of food.

i. Use of bacteria in preparing curd and yoghurt

You must have seen your mother preparing curd by adding a small amount of curd to warm milk and keeping it to set the whole night.

What do you think the small amount of curd contains, which helps in the preparation of curd from milk?

Curd contains several micro-organisms like the bacterium ***Lactobacillus*****,** which promotes the formation of curd. It multiplies in milk and converts it to curd.

Bacteria are also used in the preparation of cheese, pickles, and many other food items.

You must have heard about 'Yakult', seen its advertisement or tried it yourself. But why are we talking about 'Yakult' here?
It is because 'Yakult' is a probiotic drink. Now you may think what a probiotic is.

Probiotics are such edible preparations which contain useful active bacteria, like *Lactobacillus, Acidophilus, Lactobacillus casei, Bifidobacterium bifidum,* etc. These bacteria are beneficial for the intestine as they help in the process of metabolism.

They are usually given when a person is suffering from diarrhoea or is under antibiotic treatment. Antibiotics kill both beneficial and harmful bacteria present in our body, thus affecting the metabolic process. These probiotics form the colonies of useful microbes in alimentary canal and thus aid in the digestion process.

ii. Use of yeast in preparing bread and cake

But how are micro-organisms useful in the preparation of bread?

Let us find out by performing this simple activity.

Take ½ kg of *maida* and add some sugar to it. Mix it with warm water and add a small amount of yeast powder to the mixture. Knead the *maida* to make soft dough. Keep the *maida* aside and record your observation after two hours. You will notice that *maida* has risen and has become fluffy. **Do you know the reason behind the fluffiness of *Maida*?**

This happens because yeast added to *maida* reproduces rapidly, and produces carbon dioxide gas while respiring. This gas fills the dough and increases its volume making it to rise.

Maida with Yeast Powder Raised maida

Based on this principle, yeast (which is a micro-organism) is used in the preparation of breads and cakes. It helps in making them spongy.

iii. Use of yeast in preparing alcohol and wine

Micro-organisms are used commercially to prepare alcohol, wine, and vinegar. Yeast is the most common micro-organism, which is used to prepare alcohol and wine. Let us find out how yeast takes part in the production of alcohol.

During the preparation of alcohol, yeast is grown on natural sugars present in grains like rice, wheat, barley, or crushed fruit juices. Yeast breakdowns the sugar present in these grains into alcohol, leading to the large-scale production of alcohol. This process of conversion of sugar into alcohol is known as **fermentation**.

iv. Use of bacteria in other food industries

- In the production of vinegar - Sugar solution is converted into acetic acid (vinegar) by the action of the bacteria called *Acetobacter*.
- In the curing of tea - Bacteria act upon the tea leaves and give tea its characteristic flavors.
- In the production of **cheese:** Cheese is a valuable food having high quantities of proteins, some fats, calcium, phosphorous, vitamin A and some quantities of vitamin B. It is prepared from milk with the help of *Lactobacillus* bacteria. Its preparation involves following steps:
- **Curdling of milk:** Done by adding *Lactobacillus*; curd thus produced is separated from whey.
- **Processing of curd:** Extra moisture is removed to form cottage cheese.
- **Salting:** To further remove moisture and prevent growth of undesirable microbes
- **Ripening:** To give cheese its characteristic flavour; done at suitable temperature and humidity

Did you Know?

- The bacterium *Propionibacterium sharmanii* is used in ‘Swiss cheese’ to give it its characteristic holes by producing large amount of carbon dioxide.

- ‘Roquefort cheese’ is ripened by growing certain fungi on them to give them their specific flavour.

v. Use of mushroom and *Penicillium* in food industries

- Some varieties of mushrooms such as *Agaricus* are edible and good sources of proteins and vitamins, but some wild mushrooms such as *Amanita* species are poisonous.
- *Penicillium spp.* is used in the flavouring of cheese.

Mushroom Cultivation

You must have eaten some delicious dishes made of mushrooms at your home or hotels. You might also be aware that mushrooms that we eat are a type of fungus. However, are all mushrooms species growing in wild edible? The answer is, **no**. In fact, most of the them are highly poisonous! Let us study more about the edible mushrooms and how they are cultivated.

Edible Mushrooms

Edible mushrooms are fleshy, non-poisonous fruit bodies of mushrooms that have desirable taste and aroma. Some of the most widely cultivated kinds of mushrooms are:

- *Agaricus bisporous* (white button mushroom)
- *Volvariella* (paddy straw mushroom)
- *Pleurotus* (oyster mushroom)

Out of these, *Agaricus bisporous* is undoubtedly the most common edible mushroom eaten all over the world.

Can you find out some examples of non-edible mushrooms?

Apart from their rich flavour, mushrooms are also widely popular for their high nutritional values. They are the excellent source of vitamins and minerals. Some common vitamins found in mushrooms are niacin, pantothenic acid and biotin.

Nutritional Facts of Mushrooms

Nutrients	Amount
Water	85-95%
Proteins	3%
Carbohydrates	4%
Fat	0.3-0.4%
Minerals and Vitamins	1%

Cultivation of *Agaricus bisporous*

Cultivation of *Agaricus bisporous* or white button mushrooms is widely popular in India.

It is usually done indoors, thus eliminates the requirement of large area of land. There are five major steps involved in the cultivation of mushrooms. Let us study each of them in a little detail.

- **Composting**: First of all, a nutrient-rich compost is prepared, comprising of wheat or paddy straw, chicken manure and some organic and inorganic fertilizers. This compost mixture is then kept at about 50ºC for almost a week.
- **Spawning**: Some amount of the mycelium of the required mushroom, or 'mushroom seed', is then introduced in the compost. It is then allowed to spread for few days.
- **Casing**: In this step, a thin layer of soil is spread over the compost. This step is highly important as the layer of soil gives support to the mycelium and provides humidity to it. It also helps in regulating the temperature and prevents quick drying of the compost.
- **Cropping and harvesting:** There are three principle stages of growth of mushrooms.
- The mycelium first grows all over the compost within 2-6 weeks.
- Once fully spread, tiny little pin heads start appearing at the surface.
- Next, the button stage arrives, in which the pin heads continue to expand and ultimately enlarged, button stage mushrooms are formed.
- Once fully grown, the mushrooms are then cultivated.
- **Preservation**: Since mushrooms are highly perishable in nature, they must be preserved to increase their shelf-life. The preservation process includes:
- Vacuum cooling
- Freeze drying in acidic solutions
- Irradiating with gamma rays and storing at 15ºC, etc

Use of Microbes in Increasing Soil Fertility

Which element is the major element of the air? 'Nitrogen' is the most abundant element present in the air.

Information about nitrogen

Symbol	N

Atomic number	7
Atomic mass	14
Electronic configuration	$Is^2\ 2s^2\ 2p^3$
Valency	+3, +5
Physical state	Gaseous
Colour	Colorless

Nitrogen is the major element which is inevitable for the growth and sustenance of living organisms as it is the essential constituent of proteins.

So animals get nitrogen in the form of protein but what about plants? **From where plants get nitrogen?**

Do you know that some bacteria help in increasing soil fertility?

There are some bacteria which help in the conversion of ammonia into nitrites and nitrates by the process of nitrification. Plants take up these nitrites and nitrates from the soil. E.g. *Nitrosomonas* and *Nitrobacter*. In this way, they help in increasing the fertility of soil.

Certain bacteria and blue-green algae fix the atmospheric nitrogen into soil and thereby, increase the fertility of soil. They are known as biological nitrogen fixers. This process of conversion of nitrogen into nitrogenous compounds is known as nitrogen fixation.

These nitrogen-fixing bacteria can be both free-living (E.g. *Azotobacter*) and can have symbiotic relationships (E.g. *Rhizobium*) with the roots of leguminous plants like pulses. It lives in symbiotic association with plants and fixes the atmospheric nitrogen in leguminous plants.

Micro-organisms not only increase soil fertility, but also help in recycling matter within the ecosystem, and thus help in cleaning the environment.

Let us understand how micro-organisms take part in recycling matter by taking a look at the nitrogen cycle.

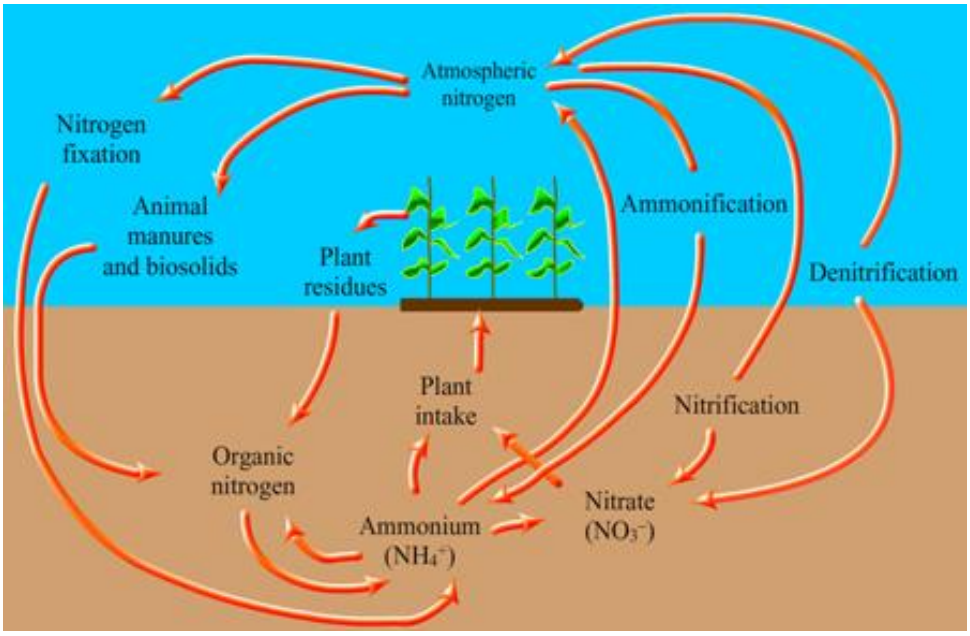
Nitrogen cycle

You know that our atmosphere contains 78% of nitrogen. But all this nitrogen cannot be taken up directly by plants and animals. As studied earlier, certain bacteria and blue-green algae fix the atmospheric nitrogen into soil and convert it into compounds of nitrogen. *Rhizobium* is one such bacterium which does this.

It converts the atmospheric nitrogen into usable form, which is then taken up by plants through their roots. This nitrogen is then utilized by plants to synthesize proteins and other such compounds. Nitrogen is then transferred to animals in the form of proteins when they feed on plants.

But how does this nitrogen reach back into the atmosphere? When plants and animals die, micro-organisms like bacteria and fungi present in soil convert nitrogen present in dead organisms into nitrogenous compounds by the process of **decomposition**, which can be used by plants again.

Some micro-organisms convert these compounds into nitrogen gas, which goes back into the atmosphere. Therefore, micro-organisms help the nitrogen cycle to continue and maintain the percentage of nitrogen present in the atmosphere.

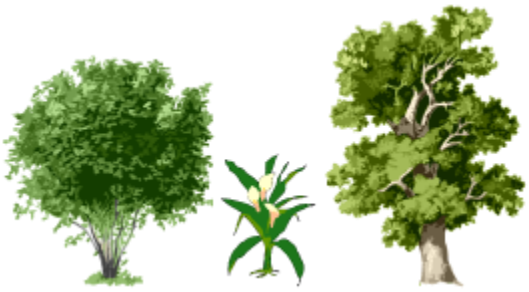


- Fungi are decomposers and reduce organic matter and release valuable nutrients into the soil and hence help in the recycling of nutrients.

- Some fungi form symbiotic associations with the roots of plants (Mycorrhiza), which help the roots to effectively absorb nutrients from the soil.

Herbs, Shrubs and Trees

You must have seen a garden with a large number of plants. **Do all the plants have the same characteristics or are they different from each other?**



You must have observed that while some plants are very small, others are tall. Also, some have soft stems, while others have very thick and strong stems. Based on their characteristics, plants are classified into different categories. Let us learn out about them.

(i) Herbs: These are plants having green and tender stems. They are generally short and do not have many branches. For example, tomato, potato etc.

(ii)Shrubs: These are plants having hard stems, which are not very thick. Their stems branch near the base. For example, lemon, rose etc.

(iii)Trees: These are plants having hard, thick, and brown stems. Their stems branch in the upper part. For example, mango, *neem* etc.

Explore a garden

Go to a garden. Compare your height with that of different plants. Also, observe the colour, thickness, and hardness of their stems.

Classification of Plants Depending Upon the Time Required In Completing their Life Cycles

Depending upon the time taken to complete the life cycle, plants can be annuals, biennials, and perennials.

Annuals

They complete their life cycle in one growing season.

When the seeds are produced, no stem, roots, or leaves remain. Only seeds remain that fall on the ground to give rise to new plants.

e.g., paddy, wheat, maize, etc.

Biennials

They complete their life cycle in two years. In the first year, they concentrate on making and storing food; and in the next year, they flower to produce seeds.

e.g., cabbage, turnip, etc.

Perennials

They complete their life cycles in several years. After many years, they fruit and produce seeds. They just keep on growing.

e.g., mango

Some Interesting Facts:

- **Some plants such as *Petunia*, marigold etc. live for a year or less than that. They flower and produce seeds once in their lifetime.**
- **Some plants such as water lily, *Geranium* etc. last longer and keep flowering for many years.**

Crops

Earlier, man was basically a hunter collecting food from forest. In those days, human beings consumed plant parts and animals without cooking. When these early humans settled at different places, they started growing plants for food. Slowly, this activity became systematic and began to take place on a large-scale.

The practice of growing plants at a place is known as **agriculture.**

Plants grown for food on a large-scale are known as **crops.**

Crops are of the following types:

• **Cereals** − Wheat, paddy, maize etc.

• **Vegetables** − Potato, brinjal, mustard etc.

• **Fruits** − Mango, orange, apple etc.

• **Fibres** − Jute, cotton, hemp etc.

• **Beverages** − Tea, coffee etc.

On the basis of the purpose of their production, crops can be of two types:

- **Food crops**: Crops cultivated for the production of food. Examples include cereals, vegetables, oil-seeds, etc.

- **Cash crops**: Crops cultivated for commercial purposes. Examples include tea, coffee, rubber, etc.

  Crops are categorized on the basis of the growing season as follows:

  • ***Kharif* crops** − They include crops like rice, maize, soyabean, groundnut etc, which are grown in the rainy season (during June-September.) They are dependent on South-Western monsoons.

- **Soil requirement:** Alluvial loam with a subsoil of clay

- **Cultivation methods:** Seeds for *Kharif* crops can be sown through broadcasting (throwing seeds over the soil), dibbling (dropping seeds at regular intervals in the furrows made by ploughing), drilling (sowing seeds inside a hole made in soil), or transplantation (seeds are first sown in nurseries; the seedlings formed are then transferred to a seed bed, and only the healthy and well-developed seedling are then transplanted to the regular field).

  • ***Rabi* crops** − They include crops like wheat, gram, pea, mustard etc., which are grown in the winter season (during October-March.) They are not dependent on monsoons.

- **Soil requirement:** Clay loamy soil or black soil

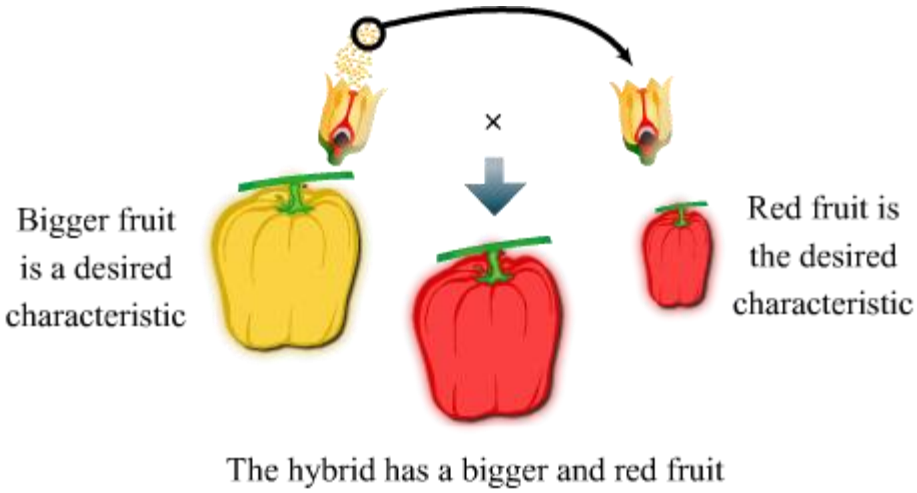
- **Cultivation methods:** Seeds for *Rabi* crops can be sown through broadcasting, dibbling, or drilling. The seeds are generally sown soon after the rainy season.

Curiosity Corner:

Have you heard about hybrid seeds? Do you know what they are?

Hybrid seeds are the type of seeds which have the characters of two different plants. Hybrid seeds are obtained by the process of hybridization. Hybridisation is the process by which two dissimilar plants with desired characteristics are mated or crossed. The resultant plant will have the characteristics of both the parent plants.

This is very easy to understand through the given pictorial representation.



Green Revolution: It is a programme started in the 1960s to increase the agricultural productivity by the use of improved seeds and advanced agricultural technologies.

Know your scientist:

Dr. Norman Borlaug: An American scientist was instrumental in promoting green revolution in India, Mexico and Pakistan.

Dr. M.S.Swaminathan: He is considered to be the pioneer of green revolution in India. He brought different varieties of seeds developed in Mexico and cross-bred them with the local varieties to obtain hybrid variety. This helped transform India from a famine-prone country to an agriculturally self-sufficient country.

Organic Farming

Organic farming is the practice of cultivating crops without the use chemical fertilisers, weedicides or pesticides. As awareness regarding harmful effects of using chemical fertilisers or pesticides is increasing, the organic farming is slowly gaining popularity among the cultivators. Farmers are now using organic manure, made from animal and plant wastes, to provide supplements to the soil. Practices like crop rotation, mixed cropping, inter cropping, hand weeding, etc are also used.

Roof Top Gardening

Roof top gardening has emerged as a new trend for urban households who do not have much space for outdoor gardening. Roof tops can be used for growing plants of various types such as, ornamental plants, vegetables, fruits, etc. but certain precautionary measures are required.

Some benefits of roof top gardening are as follows:

- It leads to improvement in air quality.
- It can be used as a source of recreation.
- It provides habitats to butterflies and birds.

Animal Husbandry

Do you know what animal husbandry is?

- **Animal husbandry** is the science of managing **livestock**. It involves feeding, breeding and controlling diseases in farm animals.

- Animal husbandry involves rearing animals like cattle, poultry, fishes and bees to obtain the desired products from them. So, animal husbandry deals with cattle farming, poultry farming, fish farming and bee farming.

What is the need for animal husbandry?

Animals are sources of food such as milk, eggs and meat. Increase in human population increases the demand for these foods. Animals also act as beasts of burden, doing a lot of heavy work for humans. Thus, there is the need for animal husbandry or rearing of livestock for specific purposes.

Livestock wealth is an index to the prosperity of a country. So, improving livestock with the help of various tools and techniques is important with respect to the growth of a country. The objectives of the various tools and techniques of livestock improvement are to increase:

- milk production

- meat production

- egg production

- the outputs of other products and services obtained from animals

Types of animal husbandry:

- Cattle farming
- Bee farming
- Poultry farming
- Fish farming/ Pisciculture

Cattle Management

An important part of cattle management is **the feeding of cattle**. **C**attle should be given healthy and nutritious food. Their food requirements can be classified into the following two types.

- **Food for general maintenance**: It comprises food items required to keep cattle healthy and strong.
- **Food for milk-production:** It includes the food given during lactation period.

Cattle should be provided a well-balanced diet containing all essential nutrients in proportionate amounts. The types of food comprising such a diet are as follows:

- **Roughage**: It largely consists of fibre and provides low nutrition. Examples include green fodder, hay, silage and legumes.
- **Concentrates**: These are high in proteins and other nutrients, but low in fibre. Examples include cottonseeds and oilcakes.
- **Feed additives**: These contain micronutrients that promote the health and milk output of dairy animals.

Diseases of Cattle

A variety of diseases affect cattle. The diseases adversely affect the production of milk and, in some cases, even cause death. **Parasites** are the common causes of cattle diseases. The parasites present on the body surface of an animal cause skin diseases. Such **external parasites** include lice, ticks, mites and fleas. Apart from these, there are disease-causing parasites that are found inside the body of an animal. Such **internal parasites** include worms (found in the stomach and the intestine) and flukes (found in the liver).

Cattle are also infected by viruses, bacteria and fungi.

Viral diseases

1. Cows, buffaloes, sheep, goats and fowls are infected with smallpox.
2. Viral skin infection can be seen in sheep and goats.

Bacterial and fungal diseases

1. Diarrhoea is common among cattle.
2. Necrosis disease affects the hoofs and tail.
3. Pinkeye, a bacterial eye infection, is also common among cattle.

4. Other bacterial diseases of cattle include anthrax and haemorrhagic septicaemia.

Prevention of diseases in cattle

- Proper cleanliness should be maintained.
- The animals should be provided with nutritive food and clean drinking water.
- **Vaccination** helps prevent viral and bacterial diseases.

Know More

Mad cow disease is a fatal disease. It is caused by the build up of abnormal proteins called **prions** inside the brain. Mad cow disease is a major epidemic in cattle in Britain. As per an estimate, over 160000 cattle had died due to the disease in UK by the end of January 1997. Human beings can also be infected with the same disease if the infected meat is consumed.

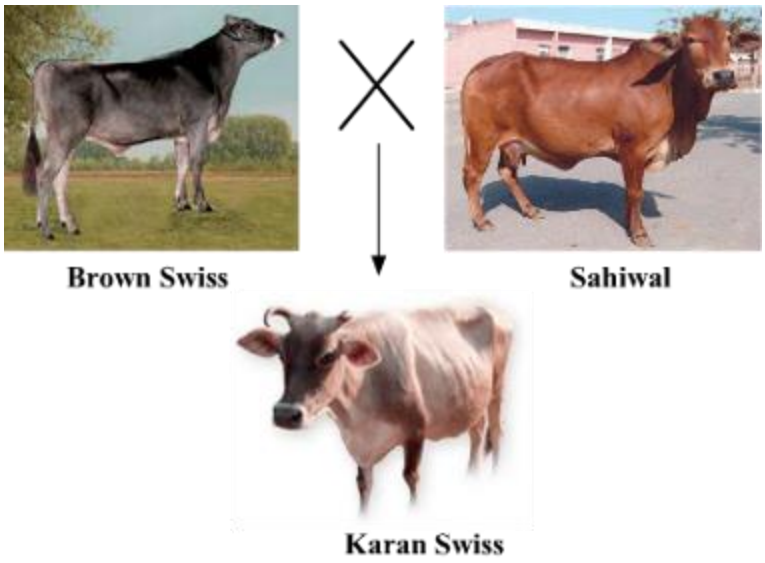
Breeding Cattle

Choosing an improved cattle breed is another element of cattle management. **Hybrid cattle breeds** are produced via **hybridization or crossbreeding** for improving productivity. Hybridisation is the process in which two genetically dissimilar individuals (varieties) are purposely crossed to get a hybrid variety.

In this way, characteristics from both the parent varieties can be obtained in the hybrid offspring. A hybrid cattle breed is produced by crossing two cattle breeds having the required qualities.

Cattle breeds

Exotic or foreign breeds such as Jersey and Brown Swiss are selected for their **high milk production**. Local breeds such as Red Sindhi and Sahiwal are selected for their **high resistance to diseases.** The breed selected for its milk-production is crossed with the breed selected for its resistance to diseases. The produced hybrid breed contains the characteristics of the parent breeds. Therefore, the offspring not only produces more milk, but is also more resistant to diseases.



Know More National Dairy Research Institute (NDRI) in Karnal, Haryana has developed improved breeds of cows such as Karan Swiss, Karan Fries and Frieswal by crossing exotic and indigenous breeds.

- Karan Swiss is a hybrid variety produced by crossing Brown Swiss and Sahiwal.
- Karan Fries is a hybrid variety produced by crossing Holstein-Friesian and Tharparkar.

These hybrid breeds can yield two to three times more milk than our indigenous cows.

Solved Examples

Easy

Example 1:

Name two exotic breeds of cow.

Solution:

Jersey and Brown Swiss are two exotic breeds of cow.

Medium

Example 2:

What is humane farming?

Solution:

The word ‘humane’ means ‘having or showing compassion or benevolence’. Humane farming refers to the practice of farming in which the care and needs of livestock are not neglected. They are raised outdoors in a healthy environment where they are able to express their natural behaviour and have access to basic amenities like fresh clean water and food.

Under humane farming, farm animals are protected from cruelty and abuse. Further, the public and the environment are protected from the adverse impacts of industrialized animal factories.

Poultry Farming

Poultry farming involves large-scale rearing of poultry birds.

Why is poultry farming required?

Poultry farming is undertaken to meet the demand for eggs and meat**. It deals with the management of domestic fowl to improve the quality and production of eggs and meat.**

Meat Eggs

Poultry birds

- **Meat-giving fowls are called broilers. They are chickens of either gender that are slaughtered for meat** when about 5 to 8 months old.
- **Layers** are hens that are used for egg production until they are about 18 to 24 months old.
- Broilers have different housing, nutritional and environmental requirements for their fast growth and low **mortality**.
- Broilers are fed with protein- and vitamin-rich supplements (mainly vitamins A and K), with adequate amounts of fat. This helps in maintaining their feather and **carcass** quality. It also reduces their mortality rate.
- Food supplemented with respective nutritional needs is provided to poultry.

- For good production of poultry, proper management techniques should be followed. Regular cleaning of the farm is of utmost importance. Maintenance of temperature is also required.

Diseases of Poultry

Poultry birds suffer from a variety of diseases caused by bacteria, viruses, fungi and parasites. They also suffer from nutritional deficiencies. Diseases in poultry can result in economic losses.

- Bacterial diseases of poultry include cholera, tuberculosis and diarrhoea.
- Fowl pox is a viral disease of poultry.
- Aspergillosis is a fungal disease of poultry.

Preventing diseases in poultry

- Poultry should be provided a clean housing area, with regular sanitation and spraying of disinfectants.
- Vaccination prevents the spread of infectious diseases.

Breeds of Poultry

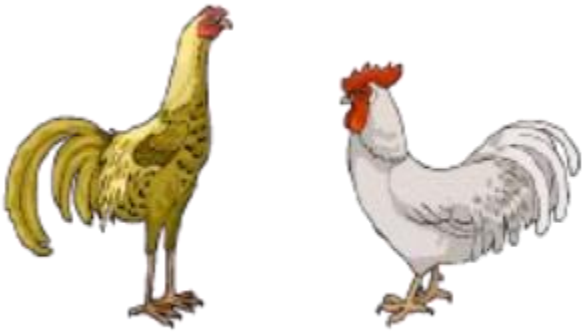
Indigenous breeds such as **Aseel** provide high yield of meat. Aseel has four popular varieties—Peela, Yakub, Nurie and Kajal.

The exotic breeds used popularly in our country are as follows:

- **White Leghorn**: It is popular for its small body size which means that it requires less feed for its maintenance. It produces long white eggs.
- **Rhode Island Red**: It is a dual type of breed as it is both a good layer and broiler.

Hybridization

Improvement in poultry variety is achieved through hybridization or crossbreeding.



Aseel White Leghorn

An indigenous breed like *Aseel* is crossed with an exotic breed like the *Leghorn* to produce an improved hybrid variety with the desired traits.

Some desirable traits of hybrid poultry are as follows:

- Good quality and large size of eggs
- Low maintenance requirement
- High resistance to diseases
- Tolerance to high temperature
- Good quality and quantity of chicks
- Ability to utilize cheaper diets produced from agricultural wastes

Fish Farming

You now know about poultry farms and dairy farms, but **have you ever heard about fish farms? What do you think is done in a fish farm?** Let us find out.

Fishing is an occupation for some and a diversion or sport for certain others. You would see different varieties of fishes if you were to visit a fish market. All of these are good and cheap sources of animal proteins. That is why fish is an important part of human diet.

Fish farming or **pisciculture** is the practice of raising fish population commercially. It involves the production of aquatic animals that are of high economic value. These can be true fishes as well as shell fishes such as prawns, lobsters, crabs, shrimps, mussels and oysters.

Fish Farming

Need of Fish Farming

The capturing of fishes to meet the demand of an ever-increasing population depletes the natural fish stocks. So, to restore the balance and to continue meeting the demand for fishes, fish farms or culture fisheries become necessary.

Thus, there are two ways of obtaining fishes.

- **Capturing of fishes:** It is the process of obtaining fishes from natural resources**.**
- **Culturing of fishes:** It is the practice of raising fishes in fish farms.

The capturing and culturing of fishes can be done in both freshwater (such as rivers and ponds) and marine ecosystems.

Categorisation of Fishes on the Basis of Water Resources

Marine fisheries

In India, marine fishery is carried out along the 7500 km coastline and in the deep seas beyond. Fishing is done using fishing nets and boats. The amount of caught fish can be increased by locating schools of fishes using satellites or echo sounders. Some examples of marine fishes include mackerel, tuna, sardine, pomfret and Bombay duck. Some varieties of marine fishes are of high economic value. Finned fishes (such as pearl spot, *bhetki and* mullet) and shelled fishes (such as prawn, mussel and oyster) fall

in this category. The cultivation of marine organisms for commercial purpose is known as **mariculture.**

Inland fisheries

Canals, ponds and rivers are some freshwater resources. Brackish-water resources are generally found where seawater and freshwater occur together. It includes estuaries and lagoons. Freshwater and brackish-water fisheries are called **inland fisheries**.

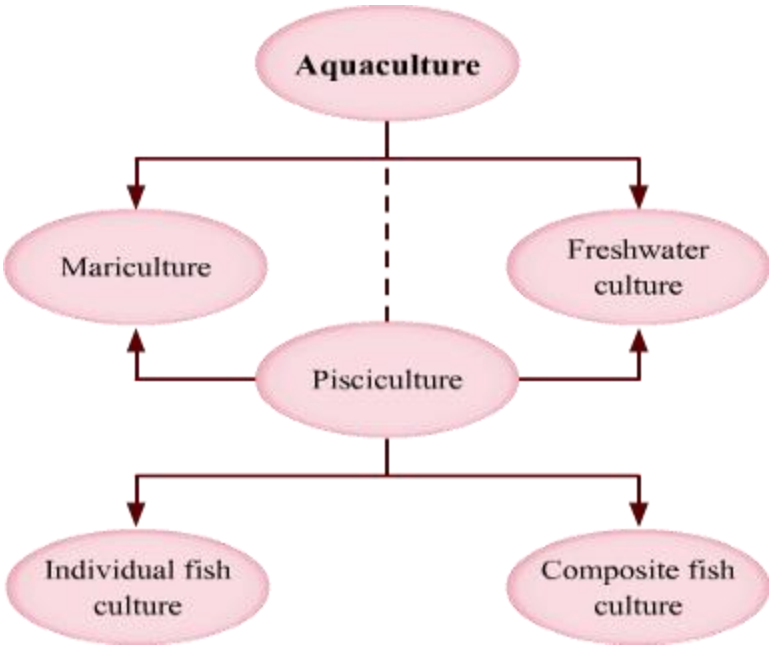
Culture Fisheries

Aquaculture is the farming of aquatic plants or animals (marine or freshwater) for food or commercial purpose.

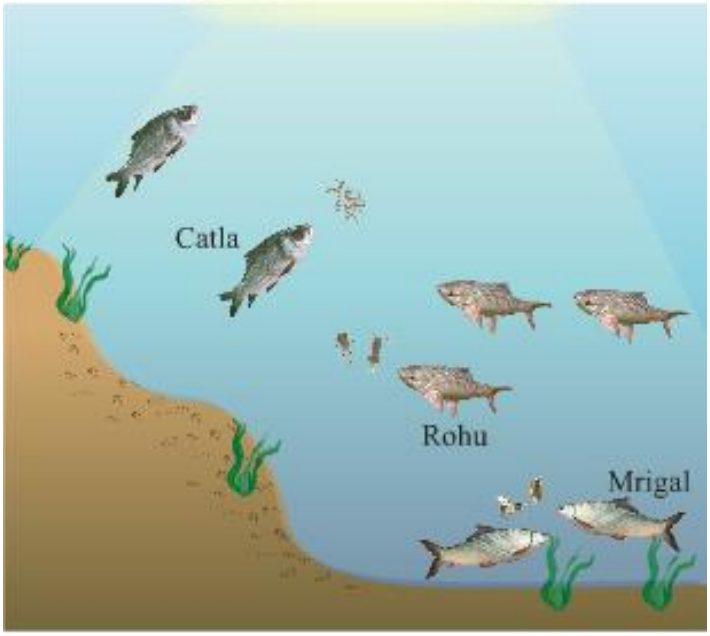
Freshwater culture is a type of aquaculture. It involves cultivation of freshwater organisms for commercial purpose.

Mariculture is another type of aquaculture. It involves cultivation of marine organisms for commercial purpose.

Pisciculture or fish farming is also a type of aquaculture. It can be done in marine water or freshwater. Fish culture can be practised either separately for different fishes or as a composite fish-culture system.



Culture Fisheries



Composite Fish Culture

An intensive way of farming fishes is the **composite fish-culture system**. In such a system, five or six different species of fishes are grown together in a single fishpond. Fishes with different food habits are chosen so that they do not compete for food amongst themselves.

For example, *catla* feeds on the surface of water; *rohu* is a middle-zone

feeder; *mrigal* and the *common carp* are bottom feeders; and the grass carp feeds on weeds. This ensures complete utilization of food resources in the pond. Such a system increases fish yield. A composite fish-culture system is shown in the given figure.

A major **problem** with this system is that many of these fishes breed only during the monsoon. So, the rate of fish production slows down at other times of the year. However, the use of hormonal stimulations has provided a solution to this problem.

Solved Examples

Easy

Example 1:

Why are the fishes obtained from culture fisheries more useful commercially?

Solution:

The fishes obtained from fisheries are larger as they receive proper food and nutrition, and have a healthy environment for their growth. Thus, they are more useful commercially.

Did You Know?

- **A person who studies fishes is called an ichthyologist.**
- **The largest fish is the whale shark. It can grow up to the length of 12 m or more.**
- **The smallest fish is the freshwater goby. It is less than 1 cm in length. It is found in the Philippine Islands.**

Meat Providing Livestock

Besides poultry and fish, meat is also obtained from goat, sheep and pig.

Goats

Goats are commonly reared in India, not only for their meat, but also for their milk which is very nutritious in nature. They need a dry and safe shelter to protect them from excessive heat and cold. They normally feed on the leaves of a variety of plants. Some important breeds of goats are *Gaddi, Kashmiri, Pashmina,* etc.

Sheeps

Sheeps are reared for their mutton, wool and skin. They do not require any well structured shelter. They normally feed on green grass, weeds and other farm wastes.

However, when they are reared for their mutton, more nutritive feed is provided that includes gram chaff, oil cakes and mineral mixtures. Important breeds of sheep are *Nali*, *Deccani*, etc.

Pigs

Pigs are reared for their meat (pork) and animal fat (lard). Pork is a rich source of proteins and is also cheaper in cost.

Lard is used as a cooking medium and is also used in manufacturing soaps, lubricants, grease, and candles. The stiff body hairs of pigs are used for making painting brushes.

Pigs can feed on any possible food source, such as kitchen wastes, vegetables, or even garbage. The domesticated pigs are usually fed on grains.

The commonly reared indigenous breeds of pigs are Desi and Ghori. Some exotic breeds include Berkshire, Yorkshire, etc.

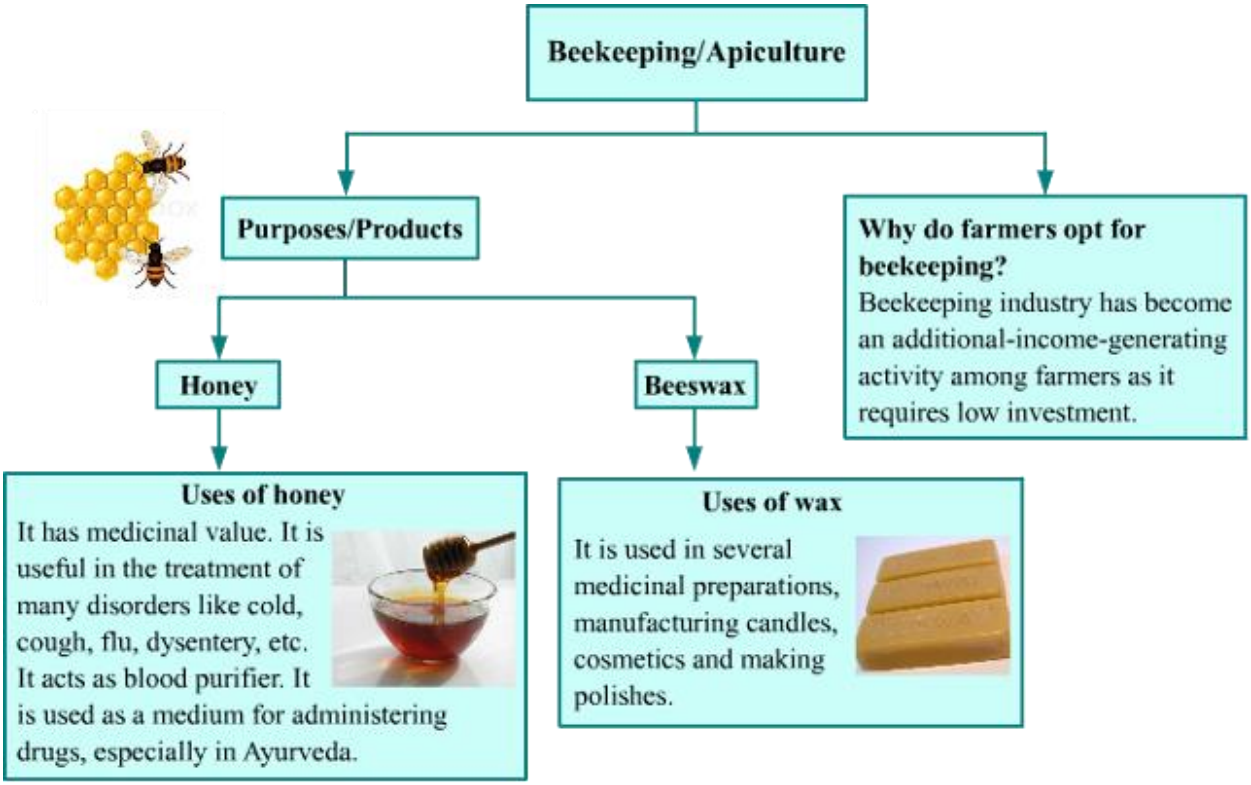
Apiculture

We use honey for different purposes in daily life. We know that this honey is produced by bees, but how is it obtained commercially? Are there any bee farms just like there are cattle, poultry and fish farms?

Yes, bees are also reared like fishes, poultry and cattle for their products such as honey and beeswax.

Beekeeping is practised all over the world due to the extensive demand for honey. The practice of beekeeping is known as **apiculture** and the bee farms are known as **apiaries.**

Apiculture is the rearing, care and management of honeybees for obtaining honey, beeswax and other products such as propolis, bee venom and royal jelly.



Know More

Honeybees are social insects. They live in colonies, in nests or **beehives**. A colony of honeybees has three types of castes—worker bees, drones and the queen bee. **The worker bees collect pollen and nectar from flowers to make honey inside their gut and, thus, also help in cross-pollination.**

Honey is a sweet food made by bees using nectar. It is composed of sugars, minerals that are known to purify, heal and soothe the skin. It also contain several compounds such as chrysin, catalase, pinocebrin which function as antioxidants (i.e., they protect the healthy cells from damage caused by free radicals). It is also a rich source of vitamins B1, B2, B3, B5, B6 and C and minerals such as copper, iodine and zinc.

Bee Farms

Let us take a look inside a bee farm.

Honeybees require proper feed and good shelters for apiculture. Apiaries are rectangular containers having wooden frames inside them. They are set near good pasturage to form good honey. **Honeybees make their hives in these apiaries. Compartments of hives are called honeycombs.**

Apiaries

Factors affecting the quality of honey produced

- The quality of honey produced is greatly affected by both the quantity and quality of the available flowers (pasturage) from which bees collect nectar and pollen.

Did You Know?

Bees communicate with one another about food sources by dancing in a particular manner.

Sericulture

You must have seen your mother wearing rich silk *sarees*. But do you know that the silk used to make these *sarees* is actually obtained from an insect?

The silk is obtained from the cocoon (pupa stage) of an insect commonly known as silkworm. The artificial rearing of silkworm and obtaining silk from them is known as **sericulture**.

These silkworms feed on the leaves of mulberry tree. While entering the pupa stage, they develop a cocoon around them by secreting a fibre from the silk glands found in their mouth. It is from this cocoon from where the silk fibre is obtained.

To obtain the silk, cocoons are first treated with boiling water to kill the living pupa inside them. The silk thread is then obtained from the killed cocoons through a process called reeling. The silk fibre thus obtained is then treated and used for commercial purposes.