Crop Production and Management

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.

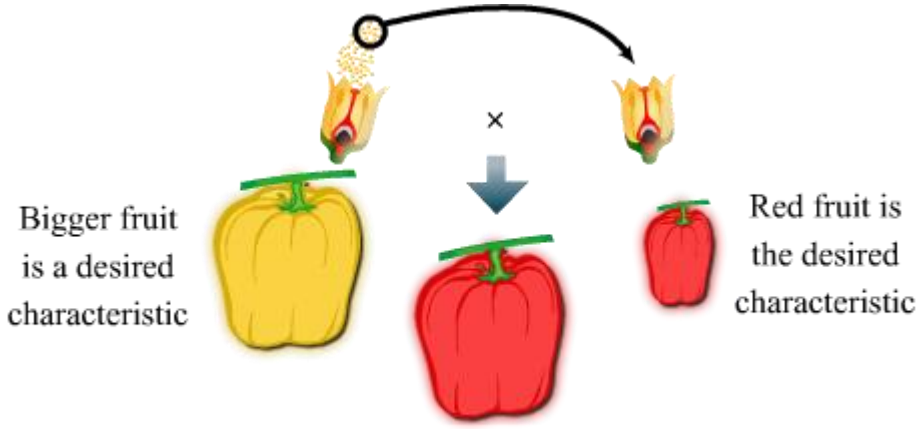
- **Soil requirement:** Clay loamy soil or black soil
- **Cultivation methods:** Seeds for *Rabi* crops can be sown through broadcasting, dibbling, or drilling. The seeds are generally sown soon after the rainy season.

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.



The hybrid has a bigger and red fruit

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.

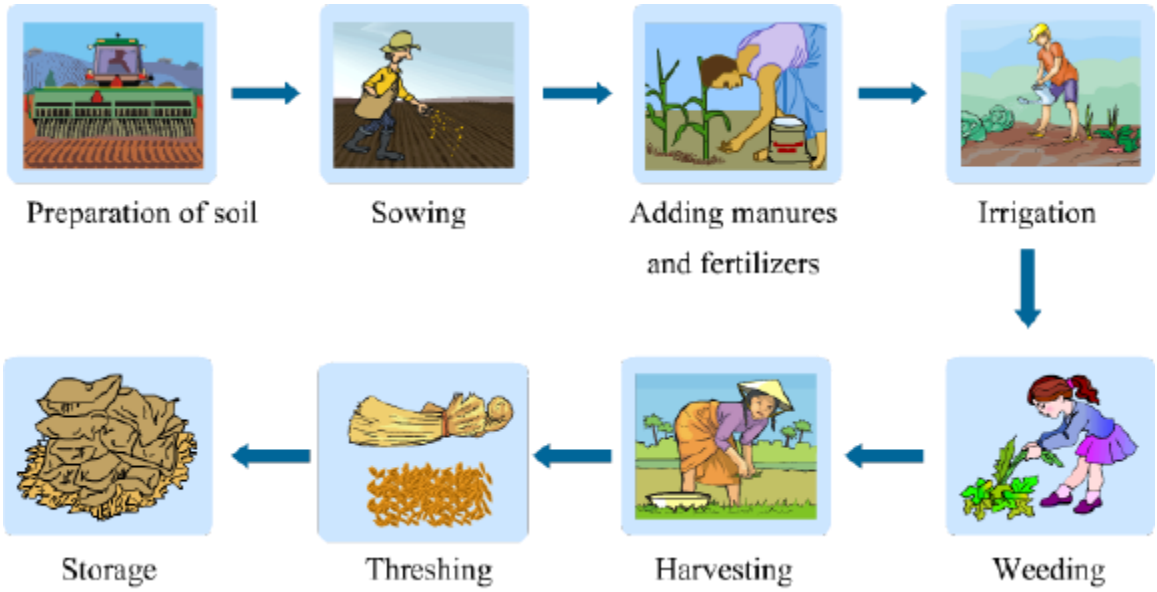
Some benefits of roof top gardening are as follows:

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

Basic Practises of Crop Production

Cultivation of crops involves several agricultural practises, which are undertaken by farmers over a period of time.

Major practices included in agriculture are as follows:



The basic steps given above for the crop production do not always occur in the same series. The water requirements of different crops are different but as the plants require a regular supply of water, irrigation of crops is carried out on a regular basis. Hence, irrigation is a continuous process, until the crops are ready for harvesting. Most farmers irrigate their crops before or after the application of manures and fertilisers as water makes the nutrients in the manures and fertilisers easily available to the plants.

Components of Soil and Preparation of Soil for Cultivation

Soil is made up of small particles of different sizes. Dead plants and animal parts are decomposed by soil organisms. This decomposition process releases various nutrients in soil. These nutrients are absorbed by plants as they are important for the growth of a plant.

Thus, soil is essential for a plant's growth.

Do you know that air is present in soil?

Take some soil in a container. Add water to the container till the soil gets saturated in it. Then, let the soil dry. After a few days, carefully dig this soil.

You will find that crumbs (small pieces) of soil are formed. Break these crumbs and add water to them. You will observe air bubbles coming out of soil.

Can you tell why air bubbles appear out of soil on adding water?

This happens because water expels air from soil. This indicates the presence of air in soil.

In addition to air, soil also contains various minerals, water, dead plants, animal parts, and some living organisms.

The preparation of soil is the first step of growing a crop. This includes methods like **ploughing**.

Ploughing is **tilling** the land with the help of a plough. It turns soil upside down.

Curiosity Corner

Earthworms are called a farmer's friend. Do you know why?

Earthworms are called a farmer's friend because their burrowing action helps to loosen the soil particles. This also improves the physical structure of the soil and creates channels for the roots of plants to penetrate. They also help in the formation of humus.

Importance of ploughing

• It helps to loosen soil. Hence, it improves air circulation in soil.

• It helps in the retention of moisture.

• It helps in uprooting weeds from soil.

• It enhances the water retaining capacity of soil.

Ploughing forms big pieces of soil called crumbs. Ploughing is followed by levelling.

Tools for ploughing:

Plough

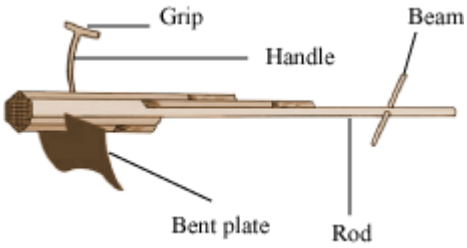
Ploughs are being used since ancient times for the purpose of tilling soil. A plough is made up of wood, and is drawn by a pair of bulls. It contains a strong iron strip, which is triangular in shape and is known as a ploughshare. The main part of this tool is made up of a long log of wood, which is known as a ploughshaft. At one end of the shaft, there is a handle while at the other end a beam is attached, which is placed on the neck of the bull. Nowadays, wooden ploughs have been replaced by iron ploughs.

Wooden plough

Iron plough

Hoe

Hoe is a tool, which is used to remove weeds from soil and to loosen soil. It is made up of a long rod of wood or iron. It has a bent plate of iron fixed at one of its ends. It acts like a blade and is pulled by animals.

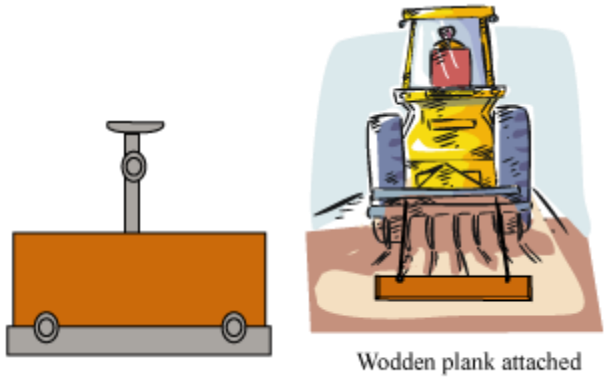


Cultivator

Ploughing is also done using a tractor-driven cultivator, which saves both time and labour.

Tractor tilling

Levelling: The crumbs formed during ploughing are broken by a wooden plank. Levelling is done with the help of a wooden-leveller, or a wooden plank attached to a tractor. Fields must be levelled properly before sowing and irrigation.



Wooden leveller

Wodden plank attached to a tractor

Curiosity Corner

How will you know whether the soil is fertile or not?

Soil testing provides the solution to this problem. Prior to preparation, some amount of soil is collected. This soil is subjected to a series of chemical tests to know its nutrient potential. If it is found that the soil is lacking certain nutrients, then manures and fertilisers are added to the soil. Ploughing is then carried out to ensure the proper mixing of the nutrients.

Selection of Seeds and Sowing Techniques

To obtain higher crop yields healthy seeds must be sown.

Do you know what is sowing?

Sowing is a process which involves planting of seeds in soil. For example, wheat, maize, millet etc. are grown by sowing seeds. Healthy seeds are selected for sowing.

However, all seeds look the same. How do we know which seeds are healthy?

In large agricultural farms, high quality seeds are purchased or selected by many methods. Let us find out how you can identify healthy seeds for sowing.

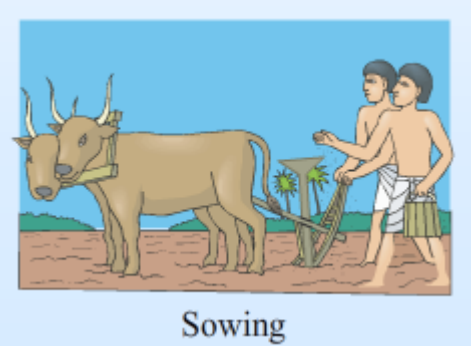
The test given below is one of the simplest methods to know if the seeds are healthy.

Take around 100 g wheat seeds and put them in a container filled with water. Shake the container and leave it aside. You will observe that while some seeds start floating, others settle at the bottom. Generally, the floating seeds are spoilt or eaten by pests, while the healthy seeds are heavy. Hence, they sink at the bottom of the container.

After selecting healthy seeds, soil is dug and healthy seeds are planted. More soil and water are then added to it.

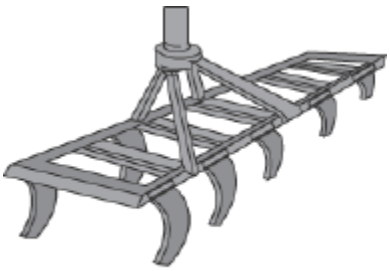
Do you know how seeds are sown in large agricultural fields?

Seeds are sown with the help of the following methods:


Sowing

1. Traditional methods of sowing seeds include the use of a funnel-shaped tool. Seeds to be sown are filled in the funnel and are passed through two or three pipes having sharp ends. Ends of these pipes pierce through the soil and sow the seeds in soil.

2. Seed drills are automatic devices, which sow seeds at an equal depth.



Seed drill

The use of seed drills is beneficial because

• It allows sowing seeds at an appropriate depth

•Seeds at a depth cannot be picked by birds

•Seeds sown in proper rows result in uniform growth and reduce overcrowding. Thereby, providing sufficient nutrients, water and sunlight to all plants.

Did you know that all plants are not propagated through seeds? The given table gives the names of some plants that are not propagated through seeds. Can you name the parts from which these plants are propagated?

Plant	**Plant part**
Rose	
Sugarcane	
Banana	
Bryophyllum	
Potato	

Importance of Manures and Fertilisers

Do you know what manures and fertilisers are?

Manures and fertilisers are substances, which are added to soil to increase the nutrient content of soil for the healthy growth of plants.

Can you tell how soil becomes deficient in nutrients?

Sometimes, farmers grow the same crop year after year in a field. This leads to the deficiency of a particular nutrient (nitrogen, potassium or some other nutrient), which is used up by that particular crop in the field.

Thus, farmers add manures and fertilisers to replenish soil, which is deficient in nutrients. This process is known as **manuring**.

Manures

Manures are the decomposed, organic matter. These include cattle dung, oil cakes, vegetable wastes etc. These animal or plant wastes are decomposed by micro-organisms such as bacteria and fungi. This decomposed matter is used as **manure**. It contains essential nutrients required by plants for their growth.

Manuring is advantageous because it:

- improves soil texture
- improves water retaining capacity of soil
- replenishes soil with nutrients
- increases the number of useful micro-organisms in soil

    - **What is urea**?
    - **Urea** is a type of a fertiliser**. Fertilisers** are substances, which are rich in inorganic nutrients. Fertilisers provide specific nutrients like nitrogen and potassium to soil. Substances like urea, ammonium sulphate, potassium chloride, potassium sulphate, NPK (nitrogen, phosphorus, and potassium) etc. are various types of fertilisers used by farmers.
    - Now, let us perform an activity to find out how different substances affect the growth of plants.

Fertilisers help farmers obtain a better yield of crops. **But, then why is the use of chemical fertilisers not encouraged?** This is because they have a number of disadvantages.

- These fertilisers can enter water bodies through runoff water and cause water pollution.
- The fertilisers in the water can also enter the body of humans through food chain and can be harmful to human health.
- Excessive use of fertilisers can reduce the natural replenishing ability of soil.

- Excessive use of fertilisers can change the chemical nature of soil and make it less fertile.

  Let us take a look at the table given below to study the differences between fertilisers and manures.

Fertilisers	**Manures**
1. They are inorganic salts. 2. They are manufactured in factories. 3. They do not add any humus to soil. 4. They are rich in plant nutrients like nitrogen, phosphorus, potassium, etc.	1. They are natural substances made from decomposed residue of plant and animal wastes. 2. They are prepared in fields. 3. They add humus to soil. 4. They have a relatively poor content of plant nutrients.

Curiosity Corner

What is fallowing?

In fallowing, the field is left uncultivated for some time. This helps to replenish the nutrients in the soil by the decomposition of organic matter left behind during the harvesting of the previous crop. Thus, fallowing helps to enrich the soil again.

Farmers often grow different crops together without any definite pattern. Why do they do this?

These methods increase the yield. Let us see how?

Three different cropping patterns, namely mixed cropping, intercropping, and crop rotation are generally practiced.

pping patterns, namely mixed cropping, intercropping, and crop rotation are generally practiced.
Let's understand them through this animation.

- **Mixed cropping:** It allows two or more crops to be sowed simultaneously in the same land. Wheat and gram, wheat and mustard, groundnut and sunflower etc. are some common examples of mixed cropping.

  In mixed cropping, crops are chosen in such a way that they require different amounts of minerals. Mixed cropping also increases soil fertility by maintaining microbial diversity.

- **Intercropping:** It allows farmers to grow two or more crops simultaneously in the same field in a definite pattern.

For example, cauliflower and chilli plants are grown together in alternating rows. To ensure the maximum utilization of nutrients applied, crops are selected in such a way that their nutrient requirements are different.

- **Crop rotation:** Different crops have different nutrient requirements. Therefore, to replenish the lost nutrients of soil, a new crop with different nutrient requirements (instead of the same crop) can be grown in the next season or year.

  For example, in a field where legumes (as fodder crop) are grown in one season, wheat can be grown in the next season. Legumes contain *Rhizobium* bacterium in their root nodules, which fixes the atmospheric nitrogen in soil. This practice of growing crops alternatively is known as crop rotation.

Process of Irrigation and Its Importance

Rohan loves his plants and waters them regularly. He observes that a plant requires frequent watering during summers. **Can you tell why?**

We know that water is essential for the survival of plants. Plants require frequent watering in summers as water from soil and plant surface evaporates.

But why is water important for plants?

- Seed requires water to carry out the process of germination. In the absence of water, germination does not take place.
- Also, water is required by plants to transport nutrients to other parts of plants in a dissolved state.
- Water also protects crops from frost and hot currents.

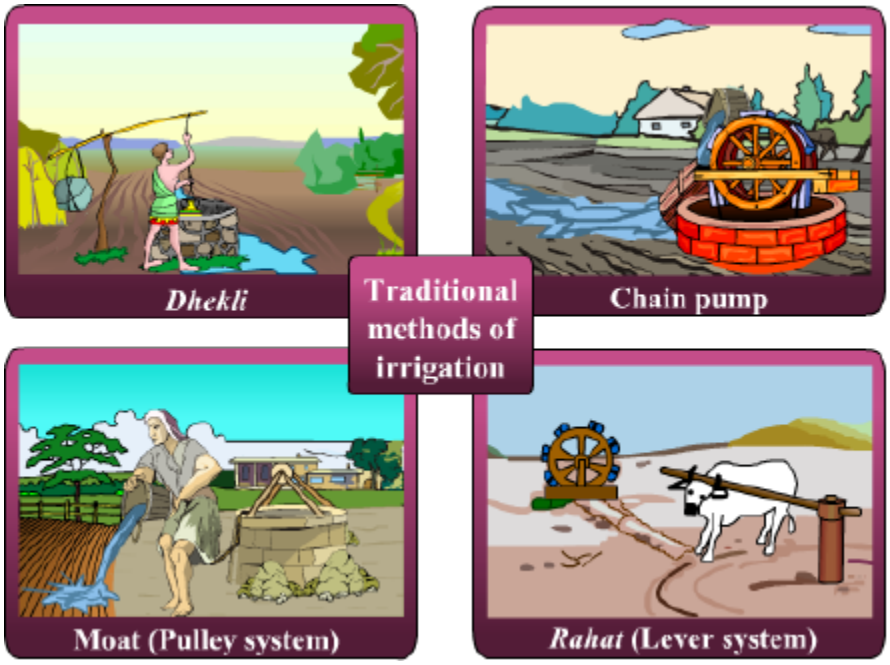
Therefore, crop fields need to be watered regularly in order to maintain healthy crops.

Irrigation is the practice of supplying water to crops through canals, wells, and waterways. The amount of water supplied to crops is extremely important as excess water can also damage crops.

But how is irrigation carried out? Let us study the different methods of irrigation.

Traditional methods of irrigation

Traditional methods of irrigation involve different ways of obtaining water from wells, lakes, and canals and transporting it to fields with the help of cattle or by human labour. Traditional ways of lifting water from water sources are as follows:

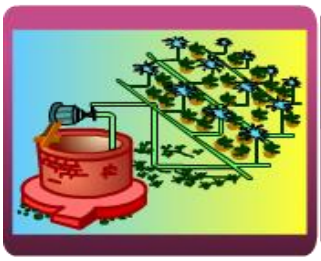


Pumps are used to lift water. They normally run on biogas, electricity, or solar energy.

Know more	
Canal lift system used by ancient Egyptians: Ancient Egyptians used a simple machine known as the Shaduf to lift water from the canal. A Shaduf consists of a large pole balanced on a crossbeam, a rope and bucket on one end and a heavy counter weight at the other. The bucket can be lowered into the canal by pulling the rope. The farmer then raises the bucket of water by pulling down on the weight. He then swings the pole around and empties the bucket onto the field.	

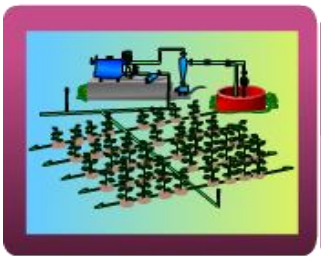
Modern methods of irrigation

Modern methods of irrigation help save water. They include:



Sprinkler System

This system consists of perpendicular pipes, which have a rotating nozzle on top. These pipes are joined to the main pipeline at regular intervals. Water in these pipelines flow at a high pressure, and gets sprinkled on crops. This method is useful in irrigating sandy soil.



Drip system

In this system, water falls drop by drop on the position of roots. This is the best technique to water plants as it prevents wastage of water.

Curiosity Corner

You have seen that water is necessary for plant growth but what will happen if excessive water is supplied to the plants?

Excess water reduces the supply of air in soil spaces. This causes death of roots due to lack of oxygen.

Sometimes, crops get damaged because of natural calamities like untimely rains and hailstorms. Hailstorms can result in the fall of mature crop plants (at grain maturation stage); for example, in the case of wheat.

The fall of mature crops is called **lodging**.

Water logging is a condition when water supplied to a field is not properly drained. This excess water accumulates in the area around roots, and thus damages crops.

But have you noticed a lot of water stagnant in rice fields?

Rice is a crop that requires excess water to grow. Hence, rice is grown in clayey soil which is capable of water retention.

Crop Protection

Rohan's visit to a wheat field

Rohan visited a wheat field and observed that there were other plants growing in the field other than wheat.

Uncultivated and undesired plants, which grow at any place and utilize the space, water, and nutrients of that area, are known as **weeds***. Corn cockle, Agrostemma, Oxalis*, *Plantago* etc. are names of some common weeds.

Weeding is the process of removing weeds from fields.

Why are weeds unwanted and unrequired?

- Weeds compete with crops for nutrients, water, and space. Thus, they can reduce the crop yield.
- They can interfere in the process of harvesting.
- Some weeds can be poisonous for human beings and other animals.

Do you know?

Do you know, Chenopodium (Bathua) and Amaranthus (Cholai) are two common weeds that are eaten as vegetable in India.

Chenopodium (Bathua)

Amaranthus (Cholai)

How can weeds be removed?

- Weeds can be easily uprooted and killed **by tilling before sowing**. However, it must be ensured that seeds of weeds are not mixed up with crop plants.

- Weeds can be removed by **uprooting,** or by **cutting their shoots** close to the ground with the help of a *khurpi* or a harrow.

- Weeds can also be removed by using **weedicides**.

  Weedicides are certain chemicals, which are sprayed in crop fields to kill weeds. These chemicals do not cause any damage to crops.

  Weedicides like **2,4-D** are diluted in water and sprayed on fields using a sprayer. They are sprayed during the vegetative growth phase of weeds, which occurs before flowering and seed formation.

  Pests
  Crops can also be damaged by various animals such as insects and rodents. These animals are known as **pests**. They can be controlled by the application of **pesticides** and **rodenticides**.

  Harmful effect of weedicides and pesticides

  Spraying weedicides and pesticides can affect the health of farmers and farm animals. Therefore, farmers should take precautions while spraying weedicides on crops. For example, they should cover their mouth and nose while using weedicides. Often pesticide and weedicide residues remain on fruits and vegetables that can cause harm the health of the consumer. Hence, fruits and vegetables should be washed thoroughly before they are consumed.

  Organic Farming

  The process of raising crops without the use of any chemicals such as fertilisers,

weedicides, pesticides etc. is known as **organic farming**. This method is gaining popularity in many countries now.

Harvesting

The process of gathering mature crops from crop fields is known as **harvesting.**

Different crops have a different maturing time. Therefore, they yield at different times.For example, paddy or wheat takes a few months, whereas sugarcane takes about two to three years. Grains obtained after harvesting are called **produce** that represents the **crop yield.**

Harvesting methods may vary depending on resources and crops. They can be differentiated into the following types:

Manually with the help of a sickle.

Using **tractor-driven machines** called harvester in case of wheat and paddy.

Plucking in case of fruits and vegetables.

Threshing is the process of separating grains from chaff. Threshing can be done by using machines called combine.

Farmers having a small piece of land use methods of **winnowing** to separate grains from chaff.

Combines perform the functions of harvesting and threshing simultaneously. They work very efficiently, but produce less amount of fodder in case of wheat.

Farmers burn down the remaining crop/straw in the field after harvesting. This causes pollution and may damage the crops in the field. Hence, such practices should be avoided.

Know More

The people of ancient Egypt grew everything they needed to eat. The Egyptians grew their crops along the banks of the River Nile on the rich black soil. The fertile soil was ideal to grow healthy crops. Egyptian reapers used wooden sickles fitted with sharp flints to cut the ripe crops. Cattle were used to trample over the cut corn to remove the grain from the cob. Then the grain was tossed into the air so the wind blew the light useless chaff away.

Methods of Storage

The produce, which is harvested, needs to be stored safely to prevent it from getting eaten by pests and rodents. Therefore, farmers employ a number of storage methods to protect their produce and prevent it from getting spoilt. Let us explore these methods in detail.

- Farmers sun-dry their seeds before storing them to reduce moisture in them. This protects the grains from insect pests, bacteria, and fungi.
- Farmers store grains in **jute bags** or **metallic bins**. **Granaries** and **silos** are used for large-scale storage of grains. This protects the grains from pests like insects and rodents.

Jute bags

Metallic bins

- Dried neem leaves are also used for storing grains at home. On a larger-scale, certain chemicals are used to protect the grains from pests and micro-organisms.

Curiosity corner

Have you ever seen this insect in the rice stored at home?

This is the Rice weevil. It is a common pest found in rice.

How do you get rid of this pest?

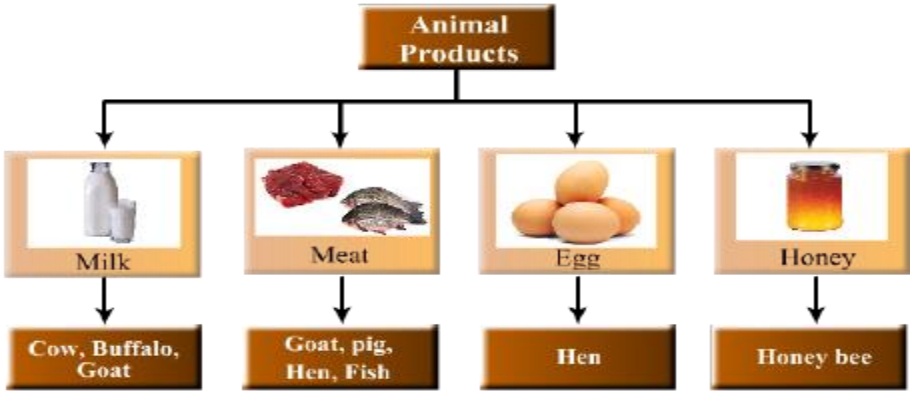
Sun drying is the best method. Keeping the rice in sun, kills this insect and its larvae. For small quantities, handpicking can also be done.

Food from Animals

You know that animals provide us different types of food products like plants. For this purpose, animals are reared in farms or homes, and are provided with proper food, shelter, and care.

The science of rearing animals for a commercial purpose is known as **animal husbandry**.

Let us take a look at the table given below to find out about the food products obtained from animals.



Apart from the food materials, animals are also used for many other purposes. They give us leather, wool and many more things. Let's see through this video how much we are dependent on animals for our various requirements.

Curiosity Corner

What animals did the ancient Egyptian farmers have?

Animals were very important to ancient Egyptian farmers. Animals helped them with farming tasks such as separation of seeds from chaff, pulling the plough, eating unwanted grain or wheat and providing the Egyptians with food and drink. They kept animals such as cattle, goats, pigs, ducks, cows, and geese.