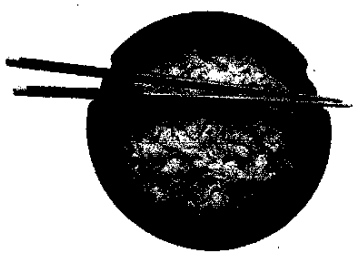
Food Production and Management II

8

LEARNING OUTCOMES

- Agriculture: cash and food crops; *rabi* and *kharif* crops; annuals, biennials, perennials
- Different types of soil
- Agricultural practices
- Crop protection
- Modern hybrid seeds
- Crop rotation and organic farming



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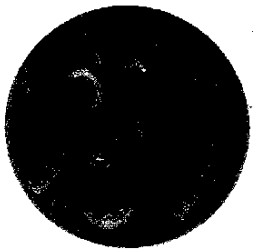

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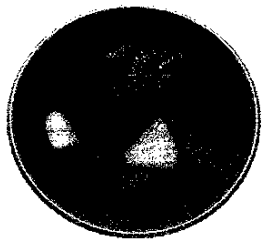


(c)

Useful plants

Cereals (e.g., rice and wheat)
Pulses (e.g., peas, beans, and gram)
Vegetables (e.g., cabbage, lettuce, and spinach)
Fruits (e.g., mango and apple)
Spices (e.g., clove and turmeric)
Oil seed crops (e.g., groundnut and mustard)
Beverage crops (e.g., tea and coffee)
Fibre crops (e.g., jute and hemp)
Medicinal plants (e.g., *Cinchona* and *Rauwolfia*)
Timber trees (e.g., teak and mahogany)

Observe pictures (a) to (c) carefully. Where do you think the products shown in these pictures are obtained from? All three products shown in these pictures are obtained from plants. Plants grown on a large scale, for human or animal consumption, are termed *crops. The science and art of farming or cultivating the soil, producing crops, and raising livestock that sustains humans is termed* ***agriculture.***

In this chapter, we will discuss different types of crops. We will also examine different types of soil and discuss which is most suitable for crops. We will also discuss different agricultural practices in detail.

TYPES OF CROPS

Crops can be divided into groups based on different criteria.

Based on the life span Crops can be classified as annuals, biennials, and perennials on the basis of their life spans.

Annuals These are soft-bodied seasonal plants that live for only one season, lasting only for a few months in a year. While some of these live for about three months, there are others that last almost a year. Sunflower, wheat (Fig. 8.1), tapioca, and pea are examples of annuals.

Biennials These are also soft-bodied plants, but they complete their life cycle in two years. During the first year they grow their vegetative parts (roots, stem, and leaves) and store food in underground parts such as the root or the stem. In the second year they produce flowers, fruits, and seeds. Carrot and beetroot (Fig. 8.2) are examples of biennials.

Perennials These are plants that live for several years. They grow their vegetative parts during the first year and shed their aerial shoots at the end of the flowering season. The underground stem again grows new shoots after the rains. Ginger, arrowroot, and banana (Fig. 8.3) are true perennials. All shrubs and trees are also perennial.

Fig. 8.1 *Wheat*

Based on the growing season Crops can be classified as *kharif* crops and *rabi* crops based on their growing season.

Kharif crops These crops are sown in June and harvested in October. Rice, maize, tobacco, potato, and onion are examples of *kharif* crops.

Rabi crops These crops are sown in November and harvested in April. Wheat, legumes, and barley are examples of *rabi* crops.

Fig. 8.2 *Beetroot*

Based on use Crops can be classified as food crops and cash crops based on their use.

Food crops These are plants that are cultivated to meet the basic food requirements and include cereals, pulses, vegetables, and fruits.

Cash crops These plants are grown solely for commercial purposes. These include plants that essentially provide us with shelter and clothing and also include certain edible products such as spices, oil seeds, and beverages.

Fig. 8.3 *Banana plant*

Orchards

An orchard is an area of land devoted to the cultivation of fruit and nut trees. The trees are planted in rows at sufficient distance from one another so that each tree gets adequate light and air. The distance depends upon the kind and size of the trees. Orchards of mango, oranges, apple, pear, peach, guava, gooseberry, plums, coconut, cashew nut, sapota, pomegranate, grapes, etc., are being established in different parts of the country, depending upon the climatic conditions needed for each tree. Once planted, the trees being perennial establish themselves vegetatively during the first few years and then yield fruits every season. Introduction of drip irrigation has been instrumental in increasing the productivity. Besides producing the much needed fruits, propagation of orchards in our country is also helpful in improving the quality of the environment as it supplements the afforestation programmes of the Government.

AGRICULTURAL PRACTICES

Food production and management has been, and still is, the most important occupation the world over, for the simple reason that it's a basic necessity of life. The basic requirement for food production is land—an open field with good top soil and plenty of sunlight and air, protected from grazing animals, if any. Agricultural practices include soil preparation, selection of the right crop and quality seeds, irrigating the land (as and when necessary), supplying adequate nutrients (fertilizers), weeding (as and when necessary), and harvesting and storage of grains. Let us examine each of these separately.

TECH FILE

Soil is not always brown. It is found in a variety of colours! Soils that exhibit a peculiar colour are rich in a particular mineral. The following minerals impart characteristic colours to soil.

Mineral	*Colour*
Iron sulphide	Black
Haematite	Red
Ferrihydrite	Dark red
Jarosite	Pale yellow
Calcite	White
Dolomite	White
Quartz	Light grey
Glauconite	Dark grey
Gypsum	Pale brown
Goethite	Strong brown

Soil preparation

Soil provides the medium for the growth of plants. Before we discuss how soil is prepared for cultivation, let us recall different types of soil and their suitability for plant growth. Based on the size of its particles, soil may be classified into the following three groups: sandy, clayey, and loamy.

Sandy soil has a large number of sand particles. Due to the larger size of sand particles, this type of soil allows sufficient air to reach the roots. However, for the same reason (large size of particles), it does not hold much water and is, therefore, not very good for growing crops.

Clayey soil has a large number of clay particles. Due to the small size of clay particles, it has good water-holding capacity.

However, small, tightly packed clay particles do not allow much air to reach the roots and also hinder their growth. Therefore, clayey soil is not too good for plant growth either.

Loamy soil contains relatively equal amounts of sand, silt, and clay. This type of soil is best for plant growth as it holds sufficient water and also allows sufficient air to reach the roots.

The chemical properties of soil are also important in determining its fertility. Soil with a relatively large concentration of hydrogen ions is said to be *acidic*, whereas that with a relatively low concentration of hydrogen ions is said to be *alkaline*. If the soil is acidic, the nutrients become too soluble and are leached from the soil. On the other hand, alkaline soil reduces the solubility of nutrients, making it difficult for plants to extract them. Both acidic and alkaline soils need to be treated, by adding chemicals that lower their acidity or alkalinity, to make them suitable for growing crops. Acidic soils can be treated by application of quicklime or slaked lime. Sulphur, iron sulphate, and aluminium sulphate can be used to treat alkaline soil.

FACT FILE

Soil is composed of particles of varying size. These particles are divided into three main groups: Sand (largest), silt (medium-sized), and clay (smallest).

Note: An ion is an atom or group of atoms that carries a charge (positive or negative) as a result of having gained or lost one or more negatively charged particles called electrons.

ACTIVITY

Aim: To compare the water retaining properties of soil samples.

Materials required: Three funnels, three measuring cylinders, filter papers, sand, clay, loam (garden soil), and water.

Procedure:

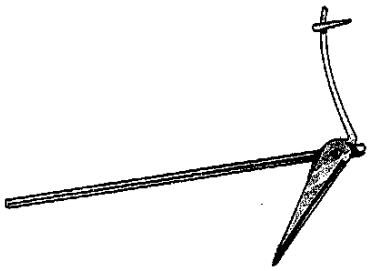
1. Take equal amounts (say one cup each) of sand, clay, and loam. Place them separately in the three funnels after lining the funnels with filter paper.
2. Place the funnels containing the soil samples over the mouth of the measuring cylinders. Pour 100 ml of water into each.
3. After about an hour, when the water stops dripping down, take the measurement of water in each cylinder.
   Record your observations.

(**Note**: Water collected in the cylinder under the sand will be the maximum and water collected in the cylinder under the clay will be the least. Water under the cylinder under the loam will be less than that of sand and more than that of clay. This demonstrates that clay retains most water while sand retains the least. Loam retains more water than sand but less than clay.)

Aim: To find out if a soil sample is acidic or alkaline.

Materials required: Litmus paper strips and the water collected in the measuring cylinders during the previous activity.

Procedure: Dip the litmus paper in each cylinder. An acidic sample turns blue litmus paper red (but doesn't affect red litmus paper), whereas an alkaline one turns red litmus paper blue (but doesn't affect red litmus paper).



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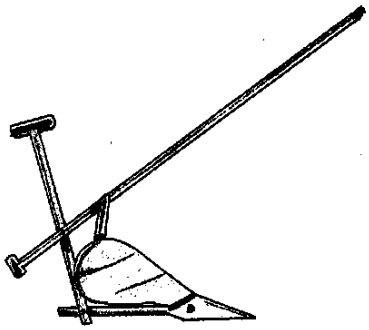


(b)

Fig. 8.4 *(a) Wooden and (b) metal plough*

Land for cultivation is prepared by ploughing, followed by harrowing.

Ploughing *or tilling is the process of breaking and loosening the soil and turning it over for uprooting the weeds and aerating the soil.* Ploughing is done with the help of an instrument called *plough.* A plough may be made of wood or metal (Fig. 8.4). Ploughing improves the physical, chemical, and biological properties of soil. The plough is drawn by a pair of bullocks to which it is attached by means of a *yoke.* The ploughman controls the plough and guides the bullocks. The field is ploughed and cross-ploughed, till the soil is well loosened. Ploughing the land serves many purposes.

1. Loosened soil traps enough air, necessary for the germination of seeds.
2. It allows roots of young plants (seedlings) to 'breathe'.
3. It allows roots of seedlings to anchor themselves firmly.
4. The manure added gets evenly mixed and distributed uniformly.
5. Ploughing promotes the aerobic microbes and other soil organisms that increase the fertility of the soil.

Harrowing involves crushing lumps of soil (or clods) using a blade harrow or a spike tooth harrow, as is suitable. Harrowing not only breaks the clods but also levels and smoothens the seed bed and *destroys the germinating weeds.* The modern farmer uses tractors (Fig. 8.5) to which different mechanical gadgets and implements can be attached for all tilling operations. Tractor ploughing cuts the soil deeper, thereby improving and enhancing soil properties.

THINK QUEST

Why are earthworms called farmers' friends? (*Hint: What do earthworms do to the soil?*)

Fig. 8.5 *Tractor*

Selection and sowing of seeds

A farmer usually keeps the required quantity of seed material from the harvested grains for sowing in the next season. For this purpose the best grains are selected and are carefully cleaned. The selected healthy grains are sun-dried. The dried grains are stored safely till the next sowing season. High-yielding hybrid varieties of seeds developed by our scientists can also be procured by the farmers for cultivation to increase productivity. To prevent seed-borne diseases they may be treated with fungicides, prior to sowing.

Once the field is prepared by ploughing and harrowing, the selected seeds are sowed either by hand or by using a *seed drill*

(Fig. 8.6). *The process of scattering seeds in the field by hand is known as* ***broadcasting.*** Sowing seeds using mechanical gadgets like seed drills ensures placement of seeds at the correct depth and correct spacing.

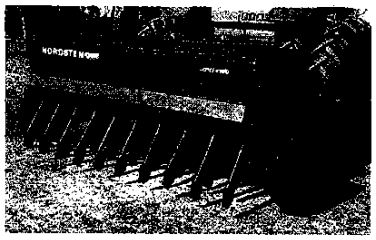


Fig. 8.6 *Seed drill*

Though most seeds are sown directly in the prepared field, some varieties of paddy, chilly, and tomato are first sown in specially prepared nursery beds where they are grown into small seedlings. These are then transferred to the regular fields where they are grown to maturity. *The process of transferring the seedlings from the nursery to the field is referred to as* ***transplantation.***

Timely sowing of seeds and transplantation of seedlings is important because plant growth is influenced by the seasons of the year. The flowering of plants is related to the day length. *Rabi* crop should be sown before winter. *Kharif* crop should be sown as the monsoon sets in.

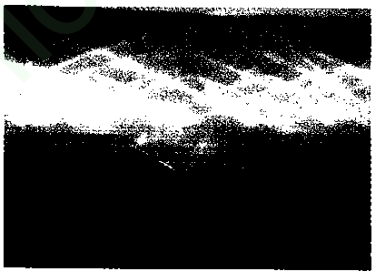
Fig. 8.7 *Irrigation canals*

Irrigation

Plants can absorb only those nutrients that are dissolved in water and hence sufficient water in the soil is extremely important for the healthy growth of plants. *The artificial process of supplying water to the crops in a field is called* ***irrigation.*** Certain crops (like wheat) grow only in well-drained soil while others (most varieties of paddy) can grow only if they are partially submerged in water.

Traditional methods of irrigating the field with water wheels and lift irrigation, both operated by draught animals, have now been mostly replaced by the more efficient pump sets operated by electric motors. Irrigation canals (Fig. 8.7) have also been constructed in several states for the benefit of farmers. In areas of water scarcity, sprinkler irrigation (Fig. 8.8) and drip irrigation are employed by which the wastage of precious water is minimized.

(a)

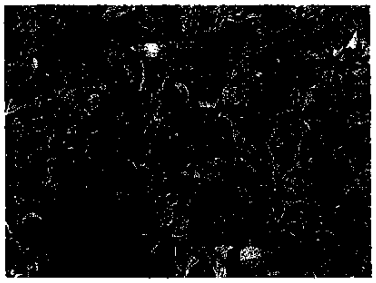


(b)

Fig. 8.8 *Sprinkler irrigation*

Manuring

The minerals that the plants require for their growth are continuously extracted by them from the soil. Therefore, the soil becomes deficient in minerals over a period of time. The minerals that are thus exhausted are chiefly compounds of nitrogen, phosphorus, and potassium (NPK).



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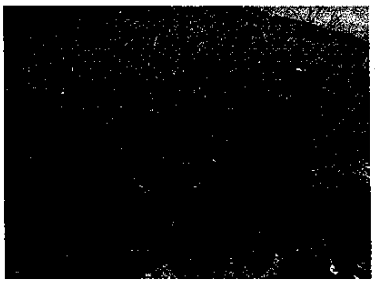


(b)

Fig. 8.9 *Amaranthus and Chenopodium*

Fig. 8.10 *Trowel*

Fig. 8.11 *Threshing*

The major elements—macronutrients—that plants need for their healthy growth are nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, carbon, hydrogen, and oxygen.

The elements required in minute quantities—micronutrients—are iron, manganese, zinc, copper, and boron. These minerals must be replenished through fertilizers, which may be natural (obtained from plants and animals, e.g., manure) or artificial (chemical fertilizers such as urea). However, overuse of chemical fertilizers can be harmful to the crop as well as to the soil, besides causing environmental pollution.

Weeding

Along with the crop plants, some unwanted seeds lying in the soil also germinate. The seedlings of such plants compete with the crop plants for nutrients, water, and sunlight. Such unwanted plants are called *weeds*. Besides competing with the crop plants, they may also become instrumental in spreading diseases, acting as hosts for insects and microbes. They could also provide a hideout for rats and snakes. Therefore, timely removal of weeds is essential for the healthy growth of the crop. The removal of weeds is referred to as *weeding* and it needs to be repeated from time to time. Different species of grass and plants such as *Amaranthus* and *Chenopodium* (Fig. 8.9) are the common weeds that affect the crops.

Weeding is done with the help of a trowel (Fig. 8.10) or a small harrow with the help of which the weeds are easily uprooted. *Herbicides*, chemicals used to destroy weeds, are also used extensively by the modern farmer. Gramaxone, which kills monocots such as grass selectively or 'round up' that kills all weeds (monocots and dicots) are in common use.

Harvesting

The food crops ripen in about four months. When the green fields turn golden yellow, it is time for cutting and gathering the crop. The cutting and gathering of mature crop is referred to as *harvesting*. Manual harvesting is done with a sickle. After reaping the harvest, plants are bundled and stored for a few days so that grains fall of easily from the stem. The process of beating out grains from the stem is known as *threshing* (Fig. 8.11). Rice is often threshed by hand, but wheat and millet are threshed mostly by making bullocks walk over the heaped bundles. Some farmers use mechanical threshers.

Threshing is followed by another process known as winnowing. *Winnowing* is the process of separating the grain from the chaff. Small farmers do it manually by pouring the grain mixed with chaff from a basket held at a height. The heavier grains fall under the basket; the lighter chaff is blown off, forming another heap. Mechanical threshers perform winnowing automatically, with the help of an attached fan.

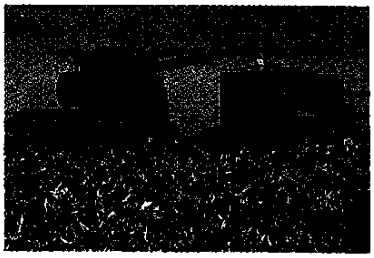


Fig. 8.12 *A combine harvester*

In large commercial farms, a machine called combine harvester (Fig. 8.12) is used. It combines the whole sequence of operations involved in harvesting the crop; it reaps the crop, threshes it, and winnows it.

Storage of grain

Harvested grains have high moisture content. In order to store them for long the grains are first dried in the sun. The dried grains are stored in various ways, inside metal containers, large earthen pots, or large structures called granaries (Fig. 8.13). If not protected well, stored grains are often damaged by insects. Mice are also a threat to the stored grains. Buffer stocks are stored in large warehouses to meet an emergency, such as failure of monsoon or natural calamities.

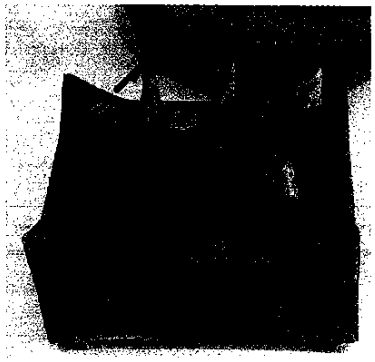


Fig. 8.13 *Model of an ancient Egyptian granary. The practice of building granaries for bulk storage of grains dates back to ancient times*

While storing food grains, the following precautions need to be taken.

1. Grains must be thoroughly dried before storage, as moisture content often causes fungal infections that damage the grains.
2. Grains need to be stored in dry rooms free from moisture and dampness. Tin boxes are preferred as they have the added advantage of being mice-proof.
3. In large godowns, grains stacked in gunny bags (Fig. 8.14) must be kept over a dry platform. Chemicals to repel insect pests may have to be used cautiously, without contaminating the grains. Old gunny bags should be sun dried.

During transport, bags containing grains should be properly covered with tarpaulins or plastic sheets.

Fig. 8.14 *Grains stored inside gunny bags*

Crop protection

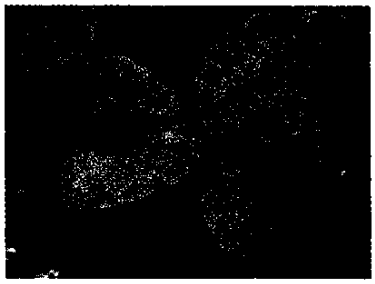
Almost all crops are affected by different types of insects and mites that partly or fully destroy the crop, adversely affecting the yield. Such animals that live on the crop plants are referred to as

THINK QUEST

Why do farmers place scarecrows in their fields?

pests. In addition to them, there are visiting birds and rats that eat away a portion of our crop. Disease-causing microorganisms, chiefly bacteria and fungi, also cause various plant diseases. Fungi cause more serious damage to our crop plants. 'Smuts' and 'rusts' [Fig. 8.15(a)] of cereal crops and late blight of potato [Fig. 8.15(b)] caused by fungi have in the past resulted in the death of millions of humans due to starvation as a result of large-scale crop failure. Crop protection is effected in two different ways.

Chemical control Chemicals that kill pests like insects and mites are called *pesticides.* Pesticides used to kill insects are termed *insecticides.* They may be stomach poisons such as lead arsenate and sodium arsenate or contact poisons such as DDT (dichloro-diphenyl trichloro-ethane), BHC (benzene hexachloride), and malathion. However, the disadvantage with the use of a pesticide is that it destroys friendly insects along with the pests. A good pesticide should be selective in action and biodegradable.



(a)

(b)

Fig. 8.15 *(a) Soya bean rust and (b) late blight of potato*

A mixture of copper sulphate, and lime dissolved separately in water and mixed together in equal proportions (called the Bordeaux mixture) can be sprayed on infected plants to destroy disease-causing fungi. Excessive use of pesticides causes pollution of the environment. Natural insecticides extracted from plants such as *neem* are effective in controlling insects without any harmful effects.

Biological control The practice of employing a harmless animal to destroy a harmful pest is referred to as *biological control* and is an effective means of controlling pests. The friendly animals can be reared and released into the field as and when necessary. Adults and larvae of ladybird beetles (Fig. 8.16) feed on the harmful insects called *aphids* (green flies) and other soft-bodied pests and their eggs. Syrphid fly larvae also feed on aphids. Ground beetle larvae feed on caterpillars of gypsy moth, a pest. Adult ground beetles feed on the pupae of gypsy moth.

Fig. 8.16 *Ladybird beetle*

MODERN HYBRID SEEDS

Hybridization is a process in which two crop varieties are crossed, each having one or more desired characteristics. The hybrids thus obtained are screened and cross-bred again, till a single variety with a combination of best characteristics is obtained.

Through hybridization, it is possible to produce a single crop variety that has many favourable characteristics such as high yield, resistance to pests and diseases, and drought resistance. Hybridization, however, has certain drawbacks. The process is time-consuming and expensive besides producing sterile hybrids among plants and animals.

Some Mexican varieties of wheat have been crossed with our native varieties to produce hybrids suited to Indian environmental conditions. Sonora-64, *Kalyan sona*, and *Hira moti* are some of our hybrid varieties of wheat. *Padma, Jaya, IR-8*, and *Pusa-205* are some of our high-yielding hybrid varieties of rice.

TECH FILE

Green revolution is a term used to describe the increased crop production in Asian countries between the late 1950 and 1970s due to the introduction of modern agricultural technologies. This period saw the introduction of high-yielding varieties of crops, chemical fertilizers, and pesticides in developing countries such as India.

CROP ROTATION

Crops often vary in their nutrient requirements. A particular crop may require a certain nutrient more than the others. When the same crop is raised in a field repeatedly, the soil may gradually become deficient in a particular nutrient. To prevent this, a method called crop rotation is employed.

***Crop rotation** is the practice of growing different crops each season in a particular field.*

This method allows soil to recover the lost nutrients. For example, growing leguminous plants such as beans or peas after wheat or rice restores nitrogen in the soil. This is because leguminous plants have nitrogen-fixing bacteria in their roots. Crop rotation also helps to control pests, diseases, and weeds.

If crop rotation is not feasible because of the need to raise the same cereal crop year after year, the essential elements lost will have to be replaced by prudent use of chemical fertilizers.

Norman Borlaug (born 1914)

American agricultural scientist Norman Borlaug is known as the father of the Green Revolution. He played a key role in promoting this programme in Mexico, India, and Pakistan. For his contributions, Borlaug was awarded the Nobel Peace Prize in 1970.

ORGANIC FARMING

Organic farming is a type of agriculture in which crops are grown without using chemical fertilizers and pesticides (Fig. 8.17). Organic farmers mostly rely on animal manures and methods such as crop rotation. Foods grown using this method are known as organic foods.

Increased consumer awareness of issues related to food safety and environment has contributed to the growth in organic farming in recent years.

***Fig. 8.17** An organic farm*

KEYWORDS

Crops Plants grown on a large scale for human or animal consumption
Agriculture The science and art of farming and cultivating the soil, producing crops, and raising livestock that sustains humans
***Kharif* crops** Crops sown in June and harvested in October
***Rabi* crops** Crops sown in November and harvested in April
Food crops Plants cultivated to meet the basic food requirements
Cash crops Plants grown solely for commercial purposes
Ploughing The process of breaking and loosening the soil and turning it over for uprooting the weeds and aerating the soil
Broadcasting The process of scattering seeds in the field by hand
Transplantation The process of transferring the seedlings from the nursery to the field
Irrigation The artificial process of supplying water to the crops in a field
Weeds Unwanted plants
Herbicides Chemicals used to destroy weeds
Threshing The process of beating out grains from the stem
Winnowing The process of separating the grain from the chaff
Biological control The practice of employing harmless animals to destroy a harmful pest
Hybridization The process in which two crop varieties, each having one or more desired characteristics, are crossed
Crop rotation The practice of growing different crops each season in a particular field
Organic farming A type of agriculture in which crops are grown without the use of chemical fertilizers and pesticides

SUMMARY

- Crops can be divided into groups on the basis of life span (annuals, biennials, and perennials), growing season (*kharif* and *rabi*), and use (food crops and cash crops).
- Based on the size of its particles, soil may be classified into three groups: sandy, clayey, and loamy.
- Ploughing, selection and sowing of seeds, irrigation, manuring, weeding, harvesting, and storage of grains are important agricultural practices.
- Crops are protected from pests and diseases by both chemical and biological means.
- Through hybridization it is possible to produce crop varieties that combine many favourable characteristics.
- Crop rotation helps in preserving the fertility of the soil.

EXERCISES

I. Review questions

A. Fill in the blanks

1. Wheat is an ..... (annual/biennial).
2. ..... (*Kharif*/*Rabi*) crops are sown in November and harvested in April.
3. NPK stands for nitrogen, potassium, and ..... (krypton/potassium).
4. Sonora-64 is a hybrid variety of ..... (rice/wheat).
5. Late blight of potato is caused by ..... (fungi/aphids).

B. Tick the correct answer

1. Which of the following is a perennial?
   (a) carrot (b) ginger (c) pea (d) sunflower
2. Which of the following is a weed
   (a) *Amaranthus* (b) banana (c) wheat (d) all of these
3. Which of the following is a macronutrient
   (a) phosphorus (b) potassium (c) calcium (d) all of these
4. Which of the following is a pesticide
   (a) DDT (b) BHC (c) malathion (d) all of these
5. Which of the following can be used to treat acidic soil
   (a) sulphur (b) iron sulphate
   (c) aluminium sulphate (d) quicklime

C. Correct the statements that are false

1. Plants grow best in acidic soil.
2. Sandy soil has good water-holding capacity.
3. Winnowing is done immediately after threshing.
4. Cereals, pulses, vegetables, and fruits are examples of food crops.
5. Zinc, copper, and boron are examples of micronutrients.

D. Answer the following

1. How are crops classified on the basis of their life span?
2. Name the three main types of soil. Which soil type is best for plant growth?
3. What is ploughing? List any two advantages of ploughing.
4. Define broadcasting.
5. What is irrigation? Name two methods of irrigation through which wastage of water could be minimized.
6. Why are weeds considered harmful for crops?
8. What precautions need to be taken while storing food grains.
9. What is biological control?
10. Define organic farming.

II. Skill-based questions

E. The following table shows the yields of five successive crops grown by farmer Suresh between the years 1989 and 1994. Examine the table carefully and answer the questions given below:

Year	Crop	Yield (tonne/hectare)
1989	Wheat	8.1
1990	Wheat	7.6
1991	Wheat	6.8
1992	Wheat	5.2
1993	Bean	4.5
1994	Wheat	7.5

1. Plot a graph showing the yield of wheat between the years 1989 and 1993.
2. What do you think could be the most likely reason for decrease in wheat yield between the years 1989 and 1992?
3. Why do you think wheat yield was more in 1994 as compared to 1992?

4. Discuss all methods that could have prevented the decrease in wheat yield between 1989 and 1992. Also discuss the disadvantages of each of these methods, if any.

III. Fun Time

Complete the following words.

.... N .... U L	I .... R .... A .... O	H .... I .... I .... E
R .... B	.... A .... C .... T .... G	T .... E .... I .... G

PROJECT IDEAS

- Students can make a compost pit following the procedure given below and conduct experiments to find out how long different materials take to get degraded in a compost pit.

Procedure: Dig a pit and line it with straw. Put organic wastes such as leaves and vegetable and fruit peels into the pit. Also put in a metal can and a couple of plastic bottles. Cover the pit with a thin layer of soil and water it once or twice a week to keep it moist. Turn the contents of the pit every 15 days. Observe what happens to the materials you had originally put in the pit. You will find that organic wastes degrade over time, whereas metals and plastics do not. Keep on adding more layers of organic wastes and soil. Compost, which is an excellent manure, will be ready in about four months.

- Students can set up a vermicomposting unit in the school garden following the procedure given below.

Materials required: A spade, hoe, baskets, straw, cow dung, and live earthworms.

Procedure: Dig a pit about 4 feet long, 2 feet wide, and 2 feet deep. Put alternating layers of straw and cow dung until the pit is full. Sprinkle some water to keep the contents of the pit moist. Introduce a few earthworms into the pit. Sprinkle a layer of mud over the pit. The earthworms convert the straw and cow dung into vermicompost, which can be used as manure, in about four months.

- Students could find out the names of common pesticides used by farmers/gardeners and write a report describing their useful and harmful effects. They can use books/Internet for reference.

TEACHER'S NOTES

- A visit to agricultural areas may be organized to observe various agricultural practices.
- An agricultural scientist could be invited to the classroom to talk to students about various agricultural practices.

Website References

http://www.agclassroom.org/kids/index.htm (accessed 16 June 07)

PRACTICE SHEET I

❶ Fill in the blanks

(a) The ..... (excretory/circulatory) system is responsible for transporting materials such as food and oxygen from one part of the body to another.
(b) A person with AB blood group is referred to as universal ..... (recipient/donor).
(c) The process by which seeds are scattered is called ..... (pollination/dispersal).
(d) In ..... (hypogeal/epigeal) germination, the cotyledons remain under the ground.
(e) ..... (Retina/Pupil) regulates the amount of light entering the eye.
(f) ..... (Oestrogen/Insulin) is secreted by the pancreas.
(g) The substances that trigger allergic reactions are known as ..... (formites/allergens).
(h) ..... (Afforestation/Deforestation) results in soil erosion.
(i) ..... (Smog/Acid rain) is produced when smoke is mixed with fog.

❷ Match the following

1. Antibody	(a) gametes
2. Sexual reproduction	(b) ear
3. Stolon	(c) *Plasmodium*
4. Cochlea	(d) strawberry
5. Malaria	(e) pollution
	(f) antigen

❸ Correct the statements that are false

(a) Mature RBCs lack nuclei.
(b) In external fertilization, the ovum is fertilized inside the body of the female.
(c) Cranial nerves originate from the spinal cord.
(d) Fever is a vector-borne disease.
(e) Dodo is an endangered bird.

❹ Answer the following

(a) What is blood transfusion? Why is it important to check the blood groups of the donor and the recipient before a blood transfusion is done?
(b) Name any three types of underground stems, giving one example of each.
(c) Explain the human male reproductive system with the help of a labelled diagram.
(d) Name the three parts of the human nervous system.
(e) Name any three endocrine glands and the hormones secreted by them.
(f) What causes metabolic diseases? Name any two metabolic diseases.
(g) What are endangered animals? What steps should be taken to protect them?
(h) What is air pollution? Name any two sources of air pollution.
(i) What are drought animals used for? Name any two draught animals.
(j) How are crops classified based on the growing season.

PRACTICE SHEET II

❶ Fill in the blanks

(a) Transpiration occurs through ..... (roots/stomata).
(b) *Hydra* reproduces by ..... (binary fission/budding).
(c) The larva of a butterfly or a moth is called a ..... (caterpillar/chrysalis).
(d) Lens focuses light on the ..... (choroid/pupil).
(e) ..... (Sensory neurons/Interneurons) carry impulses towards the brain or spinal cord.
(f) Adrenal ..... (medulla/cortex) secretes adrenaline.
(g) Deficiency of vitamin ..... (K/B3) causes pellagra.
(h) ..... (Crop rotation/Terrace farming) involves raising different types of crops, one after the other.
(i) Plastic and glass are ..... (biodegradable/non-biodegradable).

❷ Match the following

1. Atrium	(a) gall bladder
2. Offset	(b) heart
3. Gynoecium	(c) Red Data Book
4. IUCN	(d) hydrocarbons
5. PAN	(e) carpels
	(f) water lettuce

❸ Correct the statements that are false

(a) WBCs are smaller than RBCs.
(b) *Spirogyra* reproduces by fragmentation.
(c) The outermost layer of the eye is called choroid.
(d) *Spirulina* is used in the baking industry to make bread light and fluffy.
(e) Ginger is a biennial.

❹ Answer the following

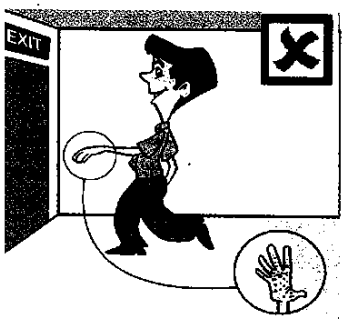
(a) Name the different types of blood vessels in the body.
(b) Explain how water is absorbed by the roots of a plant.
(c) What is germination? Explain the conditions required for germination.
(d) Explain the structure of the human eye with the help of a labelled diagram.
(e) Explain any three biological methods of soil conservation.
(f) What is the main problem associated with the use of fossil fuels? Name any four alternate sources of energy.
(g) What is soil pollution? List any two effects of soil pollution.
(h) What are milch animals? Name any two diseases affecting cattle and buffaloes.
(i) How is soil classified based on the size of its particles?
(j) What is irrigation? List any two methods of irrigation.

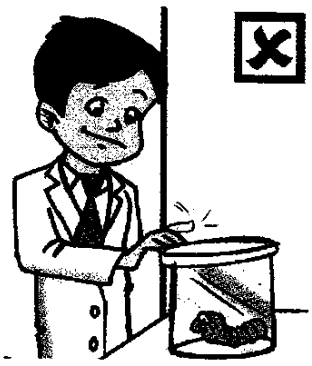
Appendix

I. Materials required for performing the activities given in the book:
Beakers, funnels, measuring cylinders, filter papers, cotton wool, watch, quill feather, cardboard box, large plastic box, crusher, wire mesh sieve, spade, hoe, baskets, cow dung, petroleum jelly, litmus paper, old newspapers and magazines, starch, sand, clay, loam, *Bryophyllum* leaves, ginger, potato, onion, bean seeds, gram or maize seeds, and live earthworms.

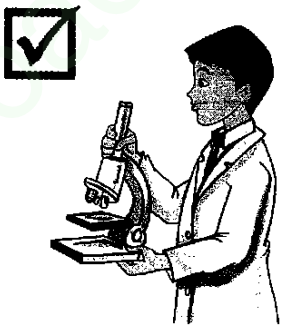
II. Safety in a science laboratory:

- Handle dissecting instruments, such as scalpels and dissecting needles with care.
- Don't leave the laboratory before washing your hands with soap and water.
- Handle live/preserved specimens with care. Do not tease live animals.
- Always wear your coats/aprons and shoes in the lab; use gloves and safety glasses as instructed by your teacher.





- Always tie long hair and secure loose clothing before beginning to work on any experiment in the laboratory.
- Follow all written and verbal instructions carefully. If you do not understand any direction or part of the procedure, ask your teacher before proceeding with the experiment.
- Keep your working area and equipment clean while working and after you finish your experiment.
- Never use broken or chipped glassware. Report any broken equipment to your teacher.
- Use Bunsen burners or any other source of heat and fire with caution.
- Keep paper, books, bags, etc., away from a flame.
- Handle thermometers, glassware, and other equipment with care.
- Do not immerse hot glassware in cold water; the glassware might shatter.
- Report any accident (spill or burn) to your teacher immediately, no matter how trivial you think it is.
- Make sure you handle the microscope properly while lifting it. Keep its lens clean.



III. Word roots, suffixes, and prefixes commonly used in biology:

Prefix/suffix/word root	Meaning	Examples
a, an	without	*a*biotic, *an*aemia
amphi	both	*amphi*bian
bi	twice	*bi*nary
bio	life	*bio*logy
carn	flesh	*carn*ivore
chloro	green	*chloro*phyll, *chloro*plast
chromo	colour	*chromo*some, *chromo*plast
derm	skin	epi*derm*is
eco	household	*eco*system
epi	on or beside	*epi*dermis
erythro	red	*erythro*cyte
herb	non-woody plant	*herb*arium, *herb*icide
homo	same	*homo*geneous
leuco	white	*leuco*cyte
logy	study of	bio*logy*
macro	large	*macro*nucleus
meso	middle	*meso*phyll
micro	small	*micro*organism
mito	thread	*mito*chondria
mono	one	*mono*coccus
omni	all	*omnivore*
ovi	egg	*ovi*duct
patho	disease	*patho*gen
ped, pod	foot	centi*pede*, arthro*pode*
photo	light	*photo*synthesis
phyll	leaf	meso*phyll*
phyto	plant	spor*ophyte*
plasm	form	cyto*plasm*
plast	particle	chloro*plast*
proto	first	*proto*zoa
pseudo	false	*pseudo*podia
soma	body	chromo*some*
trop	turn	*trop*ism
troph	nourishment	auto*troph*
vore	to eat	omni*vore*

BIOLOGY – CLASS 8

UNIT 1: LIFE PROCESSES: TRANSPORT OF FOOD AND MINERALS IN ANIMALS AND PLANTS

1. The circulatory system in human beings.
2. Different types of blood cells – blood groups – transfusion of blood.
   Functions of the blood.
3. Plants – absorption, conduction, rise of cell sap
   Transpiration
   Counting of pulse – finding an average – noting changes after exercise and rest (E)
   - Demonstrating conduction in plants – (revision) (E)
   - Finding out more about blood groups and blood transfusions (E)
   - Viewing slides of RBC/WBC – if available (E)
   - Extension activity: Talking to a pathologist to find out how blood test can reveal the presence of infection and other diseases like diabetes, HIV.

UNIT 2: LIFE PROCESSES: GROWTH, DEVELOPMENT AND REPRODUCTION

1. Germination of seeds – dicot and monocot – conditions required for germination.
2. Growth and development in various organisms – metamorphosis e.g. Life cycle of a butterfly
3. Sexual and asexual reproduction in plants and animals
   (a) Self and cross pollination
   (b) Artificial pollination – producing hybrids to improve quality of crops.
   (c) Fission – *Amoeba*
   - Germination of bean, pea and maize seeds – exploring conditions required for germination (using controls) (E)
   - Life cycle of a butterfly – may be observed directly if possible (D)
   - Growing *Bryophyllum, Sansiviera,* ginger, grass, potato, onion, carrot etc. through vegetative reproduction (E)
   - Study of the parts of a flower (E) – revision
4. Physical changes in human beings as a result of growth.
5. Adolescence and adulthood – problems related with adolescence.
   - Measuring height and weight of children in different classes – finding averages – tabulating results and arriving at conclusions (group work) (E)
   - Observing changes in self – through comparing photographs taken at different ages (E).
6. Reproduction in human beings.
   - Films on human development, puberty (D)

UNIT 3: LIFE PROCESSES: CONTROL AND COORDINATION

1. Sense organs and their functions – eye, ear, nose, skin, tongue.
2. Taking care of the sense organs.
3. Coordination – how this is done – voluntary and reflex actions.
4. Response to internal stimuli – hunger, fear, growth and development etc.
5. The endocrine system – names of endocrine glands – action of some hormones like adrenalin, thyroxine, insulin and pituitary hormone.
   - Simple experiments to test the sensitivity of the skin to touch in various parts of the body (E)
   - Identifying materials by smell/taste/touch e.g. garlic, soap, *tulsi,* lemon juice, rubber etc. (E)

UNIT 4: HEALTH AND HYGIENE

1. Diseases may be caused by a deficiency of nutrients. Protein/calorie malnutrition – brief revision of deficiency diseases on account of lack of specific vitamins/minerals.
2. Diseases may arise on account of malfunctioning of organs – e. g. pancreas – lack of insulin may lead to diabetes, malfunctioning kidneys can lead to accumulation of toxic substances in the body.

3. Communicable and non-communicable diseases. Diseases may be caused by infection – viruses, bacteria, protozoans, fungus, insect bite, ingesting infected food and water, pollution/ allergies.
   Examples of each of these.
   How diseases spread: Droplet infection (coughs, colds, influenza, tuberculosis); water-and food-borne diseases (diarrhoea, typhoid, cholera); vector-borne diseases (malaria, dengue, filarial, plague, yellow fever, gastro-enteritis, polio); contact infection (skin diseases, conjunctivitis, lice, chicken pox), bites (snake poisoning, rabies).
   Note: Detailed treatment of diseases is not required.
4. Fever, allergies.
5. Bites, stings and burns
6. First Aid measures for cuts, bites, stings and burns. What to do in case of fever?
7. Prevention of disease – routine steps – immunization.
8. Other bad habits that can lead to ill health: lack of personal hygiene and exercise, addictions to fast food, drugs, tobacco.
   - Quizzes, games can be developed by children and tried out amongst themselves or younger students on how to avoid ill-health. (E)

UNIT 5: POLLUTION AND CONSERVATION

1. Understanding the terms: renewable and non-renewable resources, biodegradable and non-biodegradable materials, conservation, deforestation, afforestation, corrosion, contamination, pollution.
2. Ways in which pollution can affect air, water and soil – steps to be taken to preserve these resources. (Note: Water and air pollution are also mentioned in relevant units in Chemistry, where they may be done briefly. Sound pollution done in class VI may be briefly revised here – as it affects both man and wildlife)
3. Deforestation and depletion of wildlife – upsetting the balance of nature – how it affects Man – what steps need to be taken to prevent/reduce these.
4. Fossil fuels – alternate sources of energy – briefly. (Link with Physics, Class VIII, Unit 5.)
5. Setting personal goals and practicing methods of reducing pollution and conserving energy and materials. (Link with Physics, Class VIII, Unit 5.)
   - Identifying local problems of VIII pollution and steps to be taken to reduce the same.
   - Practising small but significant changes in life style through participation in campaigns at school, home and outside. E.g. "Say 'NO' to plastic". Save water, Switch off.

Something (to save electricity), setting up compost pits in gardens, collecting garbage, recycling materials, creating useful products from waste etc.

- Experiments to find out how long different materials take to get degraded in a compost heap; which ones do not get degraded etc. (E)

UNIT 6: FOOD PRODUCTION AND MANAGEMENT

1. Useful microorganisms, plants and animals – products obtained from them.
2. Sericulture, apiculture, pisiculture, poultry farming, livestock farming – cattle for different uses, sheep – briefly. Production of animals against.
3. Agriculture: cash and food crops; *rabi* and *kharif* crops, annuals, biennials, perennials, orchards – examples of the same.
   Different types of soil – which is most suitable for crops (revision)- acidic and alkaline soils – how to treat them.
   Agricultural practices: soil preparation, selection and sowing of seeds, irrigation, manuring- natural and artificial fertilizers, weeding, harvesting and storage of grain. (in brief)
   Crop protection – pesticides/insecticides – useful and harmful effects.
   Modern hybrid seeds – useful and harmful effects of using such seeds.
   Crop rotation –organic farming.
   - Visit, if possible, to agricultural areas to observe the steps taken by farmers.
   - Visits to Sericulture farms, apiaries, poultry farms.
   - Films about these topics.
   - Experiments to observe the water-retention capacity of different types of soil. (E)
   - Testing soils for acidity/alkalinity. (E)
   - Finding about pesticides used by gardeners – extension activity.
   - Making compost in the school garden.
   - Vermiculture – setting up a small unit in the school garden
   - Interactions with agricultural scientists and veterinarians.