



FOOD PRODUCTION AND ANIMAL-HUSBANDRY

Since ancient times humans have gathered plants and hunted animals for food. Later humans became dependent on agriculture to fulfill their needs for food. Agriculture is a composite term that includes all those activities which involve appropriate utilization of earth's resources for fulfillment of human needs of food, fodder, fibre and fuel, etc.

From time immemorial, India has been famous for its spices and fruits such as mangoes. Columbus actually embarked on a voyage to discover India for its spices during the course of which, he reached America instead. Agriculture includes growing of crops, fruits, flowers and vegetables, on one hand, and animal husbandry and fisheries, on the other. This lesson will help you know about the methods of food production and animal husbandry as is being carried out in our country.



OBJECTIVES

After completing this lesson, you will be able to:

- *discuss about the current status of crop production in the country keeping food security in mind;*
- *explain the methods of crop-production including organic farming;*
- *explain the methods of protection of crops from insects and weeds;*
- *appreciate the value of animal husbandry, poultry and fisheries as income generating activities;*
- *give credence to the use of both modern technology and genetic engineering thus removing the barriers between science and society in the process and;*
- *describe the link between production, storage and distribution.*



Notes

31.1 DEVELOPMENT OF AGRICULTURE AND GREEN REVOLUTION

Agricultural practices began around 1000 B.C. Early humans subsisted on raw fruit and roots and hunted animals for their meat. After the discovery of fire, humans learnt to roast the prey to make it conveniently edible and easily digestible. Subsequently, rearing of sheep and goats as animal husbandry and farming of wheat and barley as agriculture was initiated. Since vedic times, our country has been agriculture based though methods of farming have changed from time to time. Agriculture depended as monsoons at that time, through agricultural implements like the plough were already in use. Today agricultural research and sustainable farming has placed India among the top major agricultural nations. Between 1905 and 1907, agricultural universities were established in the country. Indian Agricultural Research Council (Pusa) is located in New Delhi. Several Indian Scientists are engaged in agricultural research and development.

31.1.1 The Green Revolution in Indian Agriculture

A big change related to crop farming and food production occurred in the Indian agricultural scenario between 1968 and 1988. This period has been termed the golden age of agriculture named **Green Revolution**. As a result of the Green Revolution, we have become self-sufficient in the field of agriculture. The credit for this Green Revolution goes to Dr. M.S. Swaminathan a great agricultural scientist of our country for his fight against hunger. He has been awarded the World Food Prize. The joint efforts of our scientists and innumerable farmers had made such a change possible.



Dr. M. S. Swaminathan

Green Revolution was initiated with improved wheat and rice farming. Under the Green Revolution agricultural yield increased in the fields with limited area due to the use of improved technology and additional resources. For the food security of India's growing population, agricultural productivity got enhanced. But sustainability of improved agriculture proved to be a major challenge.

As time passed, fertilizers and pesticides began to be used for increasing productivity. On the other hand ecological balance got upset, and productive capacity of the earth began to decline. Today, even though agricultural self reliance has increased, the harmful impact on soil and humans has also come to sight. Organic farming is now being encouraged to sustain the benefits of Green Revolution. The following are necessary for sustaining Green Revolution.

Today, we are at cross-roads, we have to decide whether we let status good prevail or we try to advance further:-

- Industries that manufacture agricultural implements, pumps, fertilizers, and insecticides need to be established.

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- Irrigation and power projects are to be encouraged to receive a regular supply of water and energy for farming .
- Research and Developmental institutes are needed for the generation of new, healthy, pest-resistant and high quality crops.

Under the aegis of the Green Revolution, encouragement to sustainable organic farming may be given as part of awareness campaigns in villages as well as cities. Also, there needs to be enhancement of decision taking skills and increased competencies in this regard.



ACTIVITY 30.1

Find out in your area of residence or your neighbourhood old ponds or water harvesting system. Then enquire of five specialists the history of that water body or technique. Also ask how fields used to be irrigated by these water bodies/ techniques in earlier times. Find out as to which crops were grown previously and what kind of implements were in use then. Fill in that information in the form of the following table.

Serial No.	Year/ Period	Crops grown during that period			Specific Techniques used in the agriculture of that period		
		Winter	Summer	Rainy Season	Irrigation	Implements	Insecticides/fertilise

If you get an opportunity to travel within Delhi, then definitely go to see the NASC (National Agriculture Science Council) Campus situated in the Todapur area. This trip can provide you with adequate information about the development of agriculture in the country. You can tabulate the relevant information in the table above.



National Agriculture Science Museum, Delhi

31.2. THE PRINCIPLES AND METHODS OF CROP PRODUCTION

The branch of agricultural science which is concerned with crop production and the management of farms is called **Agronomy**.



31.2.1 Principles of crop production

The following principles should be adopted for crop production and agricultural field management:

- Maintenance of fertility and productivity of soil needs arrangement for prevention of diseases, and removal of used pests and weeds.
- Sowing healthy seeds in the field at the right time, at the right distance and upto the correct depth.
- Proper arrangements for availability of water and fertilizers.
- Selection of right crop types in accordance with variation in type of soil and climate.
- Crop harvesting at a suitable time.
- Scientific storage of harvest.
- Use of multiple cropping and mixed farming.
- Crop rotation
- Soil improvement and management.

Methods of crop production

Following is a list of the main methods of crop production:

- (a) Crop rotation
- (b) Mixed farming
- (c) Multiple cropping
- (d) Organic farming

Let us now get detailed information about each one of these methods:

(a) Crop rotation

Growing of crops in a predetermined sequence, at a particular time, is called **crop rotation**. In this method, those crops are grown first that require more water. Subsequently crops requiring less water are grown on the same field. For instance first rice is planted; then gram. Similarly first those crops are grown which require more fertilizers. Subsequent to this, those crops are planted that require less fertilizer. For instance, first potatoes are grown then, Moong pulses. Similarly first deeps rooted crop are grown and then those with smaller roots. For example cotton is planted first and then 'Methi'.

If you are connected in some way to villages or farming then you must have noticed that wheat is planted in November and cut in March or April. Rice is



planted in June-July and cut in October and November. The soil that lies fallow between these two grain crops is utilized by farmers to plant a leguminous crop.

Peas, beans and pulses are leguminous crops:

They harbor **nitrogen fixing bacteria** in roots. These microbes convert the free nitrogen found in the atmosphere into usable form. Hence, after harvesting of these crops the soil remains fertile for other crops. (figure 31.1)

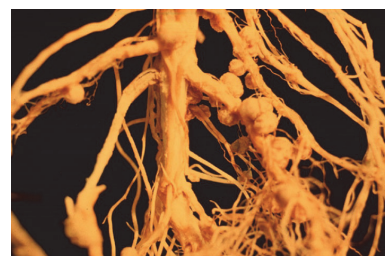


Fig. 31.1 Root nodules

Benefits of crop rotation

- Maintains fertility of fields and affords soil nutrition due to abundance of nitrogen
- Increases crop production
- Prevents soil erosion
- Economical crop production
- Effective use of available resources
- Control of insects and disease affecting crops
- Regular income throughout the year

(b) Mixed cropping

Mixed Cropping is the growing of two or more than two crops at the same time in the same field, For instance, mixed cropping of wheat with peas; of wheat with Mustard; or groundnut with sunflowers. During this process the crop seeds are combined and scattered in the fields or they are planted in separate rows as their maturation time and harvesting time are different.

The biggest advantage of mixed cropping is that the farmer gets two crops simultaneously at one time or within a short interval of time from the same field. Mixed cropping also maintains soil fertility.

(c) Multi cropping

Multi cropping is the planting of two to four crops, during the same year, in the same field. Multicropping is only possible when we plant crops that require planting for a shorter period of time. For better results, properly managed field is essential. In fact, multicropping is an ideal solution for a country facing food problems. Several crops become available at the same time from a small area.



The classification of crops

The classification of crops in India has been done primarily on the basis of their family. Their life cycle, seasons, economic considerations, specific use, are the factors that are duly taken into account, while classifying them on the basis of life cycle. The crops have been divided into annuals, biennials and perennials. On the basis of seasons, crops have been classified as 'Kharif' (Crops planted between October and December), 'Rabi' (Crops planted between April and July) and 'Zaid Crops'. Zaid crops are planted mainly during the summer season or planted in different season, in accordance with specific crops. In the same way, crops have been classified from the economic point of view into grains, spices, fibrous crops, fodder, fruits, medicinal plants, roots, sesame and pulses, stimulants sugary crops are included in this category. In a similar way, crops have been classified on the basis of specific use. For example intermediate crops, cash crops, soil protective crops and green fertilizers. In our country, crops are given priority mainly in the basis of seasons.

Classification of crops on the basis of Seasons

1. Kharif :- Rice, barley, cotton, groundnut, sugarbeet, 'urad', 'moong', 'lobia', 'millets', 'til', 'andi', 'jute', 'vemp', 'arhar', 'sugarcane', soyabean and lady finger.
2. Rabi – Wheat, millets grains mustard peas 'barseem', 'masoor', potatoes, tobacco, 'lahi' and 'jai'
3. Zaid – Pumpkin, water-melon, red-melon, gourd, 'torai', cucumber, green chillis, tomatoes and sunflower.

Ask your elders about medicinal properties of like turmeric, basil, garlic, ginger and spices like black pepper and cloves etc.

This information can be beneficial for you throughout your life.

(d) Organic farming

Organic farming works in conjunction with nature and is not opposed to it. It targets high quality crop yields, through the use of various techniques, in such a way, that the natural environment is not adversely affected. It also ensures that humans, who inhabit this natural environment are not affected in a negative way. You will see related information in section 31.3.

Horticulture

Horticulture includes the gardening of fruits and vegetables. In Horticulture the subject of the increased yield of fruits and vegetables and their appropriate cultivation is studied.

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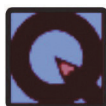
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The Agricultural Ministry of the Govt. of India has set up a 'National Gardening Mission', which is working in order to enhance horticulture and gardening in cities and villages across the country.



INTEXT QUESTIONS 31.1

1. Which council has been set up in India for Agricultural Research and Development?

2. Mention any three advantages of crop rotation.
(i) _____ (ii) _____ (iii) _____
3. In the table given below fill in the blanks and example has already been done for you.

Name	Method
1. Farming of 'Moong' after Potatoes	(A) _____
2. Growing four crops in the same field.	(B) _____
3. _____	(C) Organic farming
4. 'Barseem' barley, sun-flower	(D) _____

31.2.3 Improved agricultural practices

According to the prominent scientist, Dr. M.S. Swaminathan sustainable agriculture or progressive agriculture is the step-by-step increase in the production of grains in the context of changing environment, such as rise in the earth's temperature, rise in the sea levels and damage to the ozone layer. Such agriculture practices are concerned with enhancing agriculture production is match/meet such difficulties. In other words, alongwith the rise in earth's temperature increasing food production to feed the increasing population has emerged as a big challenge.

Unfortunately due to the excessive use of fertilizers, insecticides, pesticides and chemicals the condition of our soil has become worse. Not only have the beneficial insects, worms and other living beings found in the soil has also been destroyed. The quality of nutrients found in the soil has also been affected. Today agricultural scientists maintain that this process of degeneration can be halted by



the use of organic fertilizers. In order to enhance our food production, we may not only sow good quality seeds but can also improve the methods of sowing them for harvesting crops. Scientist can make use of scientific techniques. Methods have been discussed below, which have been developed by scientist and which are being used by our farmer in their fields.

(A) Making the soil suitable for farming

The uppermost, thin crust of the earth (top soil), covers the earth like a sheath. This itself functions as the basis for plant life and its growth. It functions as a natural medium. This upper crust is formed of the products derived from various kinds of stones that have combined with organic products.

Farming begins with the formation of this top soil. This is a significant process that helps the top soil become more fertile. After mixing fertilizers in the top soil, the top soil is leveled and made loose with the use of agricultural implements like spade, plough and other agricultural implements.

(B) Treatment of seeds:

Seeds are attacked easily by tiny microbes. The crop that is grown with diseased seed will also be diseased. In order to save these seeds from disease. Farmers 'treat' them by immersing them in chemicals such as Cerocin and Agrocen. These chemicals limit the damage done by these microbes to plants. After 'treating' them once, these seeds can be sown.

(C) The preparation of seed field and taking care of new plants

Seeds of some crops like rice and some vegetables are not sown directly in the main fields. Firstly these seeds are sown in the planted field. After a certain period, they are planted in the main field. These small plants are called 'New borns' ('Navodit' in Hindi) when the farmers prepare the plant fields, there are following facts should be taken in to account:

- **The field:** Top soil should be soft and loose, so that the delicate roots of saplings can grow properly. This is possible by digging and ploughing the field properly.
- Whenever the saplings are planted; the soil should be even leveled so that water gets distributed evenly upon irrigation.
- All the weeds or unwanted plants should be removed because they receive water and nutrition from the top-soil. As a result, desired plants do not receive adequate nutrition, it is essential to protect the young plants from disease and pests. Chemicals such as Parathion, Sevin, Dymicron and Rojar are sprinkled on the young plants to prevent pest and disease. Fig. 31.2



Fig. 31.2 Tractor for plantation

(D) Transplantation

The process of shifting the new plants from the field where they were sown to the main field is called **transplantation**. Plants containing at least 4-5 healthy leaves should be selected for transplantation. Saplings should be sown at a sufficient distance from each other so that their roots can penetrate deep into the soil and receive adequate nutrition. Before the actual transplantation, the field should be ploughed and fertilizer spread over it. Usually, rice and vegetables like tomatoes and brinjals are sown by this method.

The use of fertilizer and manner: For healthy growth, crops need nutrients, which they receive from the topsoil, a total of 16 nutritive elements are needed by plants. Plants receive carbon and oxygen from air, oxygen and hydrogen from water and the remaining thirteen nutrients minerals – are received from the soil.

Essential Nutritive elements for the plants

Out of the total number of nutrient element, six are needed by plants in larger quantity. These are called '**macro-nutrients**'. These include-nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. Out of the thirteen nutrient elements obtained from the soil. These are 7, that are needed in small quantity. These are called '**micro nutrients**'. These include iron, manganese, boron, zinc, copper, molybdenum and chlorine.

Manure and fertilizers provide all these nutrient elements to top soil and help in obtaining better harvest. Depending on varying kinds of top soil and crops. Different kinds of organic manure and fertilizers are used. Now, here, we shall learn in details about organic manure and fertilizers in section 31.4.

(F) The use of plant-growth regulators

These chemicals that control the rate of growth of plants, are called **plant growth regulators**. All the plants contain growth regulators that determining the height of plants and the size of fruits. For better growth of crops, we can use growth



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regulators such as Auxin, Gibberellins, Cytokinin, Absciscic acid etc. You shall learn about them in details in the next class.

(G) Irrigation:

Irrigation is necessary for the proper growth of crops. Irrigation depends upon the characteristics of the top soil and the type of crops. Crops need to be especially irrigated in their young stage, flower bearing stage and grain bearing stages. Rice requires continuous supply of water, now-a-days several methods of irrigation are available. Some of the modern irrigation methods include surface irrigation, underground irrigation, sprinkling irrigation and drip irrigation. (Fig. 31.3) A limited amount of water is used in all these types of irrigation. Thus wastage of water is prevented, in the drip irrigation method, water drips, drop by drop, by a special method as the top soil and mixes with it. In this way, it is available according to the need of the crop. These techniques have been successfully employed in deserts for growing crops.



Fig. 31.3 (a) Drip irrigation (b) Sprinkling irrigation

(H) Harvesting crops

Till some time back, the farmers used to cut the harvest with sickle but now this work has become easier after the invention of more sophisticated harvesting implements. More implements cut or dig only the required portion of the plants and their various parts. These implements first collect the various parts of the plants and then separate the usable portions and remove unwanted parts. Now-a-days, there are some implements that not only cut the plants, but also load them into auto vehicles. The size and function of these implements may differ in accordance with the types of crops being harvested. This in turn depends upon three factors—the type of crop, the part of the plant and the degree of ripeness of crop.

31.2 BIOFERTILIZERS

(A) Biomass /Organic manure

You have already learnt that organic manure and fertilizers make the top soil more fertile. This increases the crop yield. Different kinds of fertilizers and manure are



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used. Depending on the different types of top soil and variety of crops. Organic manures are all these natural ingredients (except water) which increase soil fertility. When mixed with the soil. From the scientific perspective organic manure includes material remnants such as grass, the droppings/urine of birds/animals or parts of organisms etc. usually all nutrients are contained in these remnants in small quantity. In previous decades our farmers used an excessive quantity of fertilizers in order to increase their crop yields. This unfortunately, had a negative effect on both the top soil and human health. Organic manure includes vermi-compost, cow dung and green manure etc. Now-a-days emphasis is being laid on a sustainable use of organic manure as a major alternative to fertilizers.

Since manure is derived from organic products; it is termed organic fertilizers. Following is a list of some commonly used organic manure.

- **Vermi-compost**

Vermicompost is also called earthworm culture manure or vermiculture. Earthworms are termed “The True Friends of the farmers’ or ‘The Natural ploughers’. Earthworms feed on cow dung, dry leaves, grass, remnants of rice plants and plant refuse in the fields and they leave their excrements products in the form of vermin-composts. This is a complete natural, nutrients-rich and balanced kind of fertilizers. Vermicomposting can become an income-generating venture for unemployed rural boys and girls.

- **Compost**

Compost is the manure created out of the decomposition of household wastes such as refuse a vegetables and animals (which is part in a ditch in the home backyard).

- **Farmyard manure**

As the name suggests, this is the mixture of urine/excrements of animals, fodder remnants and garbage.

(B) Fertilizer

Fertilizers contain one, two or three essential nutrients in large amounts. These fertilizers are prepared commercially in a factory. Nitrogenous fertilizers are usually given in two or three doses. Before transplantation, some of these fertilizers are mixed in the top soil. NPK is the name of the prominent fertilizer. There ‘N’ stands for nitrogen, ‘P’ for phosphates and ‘K;’ represents Potassium. The names of other fertilizers are Kpotassium, urea, Super phosphate and ammonium phosphate and Curate of Potash.

Case study

Haria’s owns a small agricultural field. He saw a programme on biofertilisers in Doordarshan’s ‘Krishi Darshan programme’. With the intention of enhancing his

crop production, he went to a shop after watching this programme but was shocked to discover that the fertilizers were far more expensive than manure. Now, he was caught in a dilemma and wondered which fertilizer he should buy? The organic manure was expensive, but fertilizers was cheaper. How will you help Hari take the right decision.



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Note: To help him take a decision, the method of vermicomposting is given below:



ACTIVITY 31.2

Come, let's make vermicompost

Making vermin-compost is not only an interesting experiment; it is also a memorable experience. You will be able to use vermin-compost made by your own hands to use your fields and gardens. For this purpose, collect waste such as un-used shoots of vegetables peels, old rotten vegetables, leaves and grass etc. and put all this in ditches measuring approximately 3'x1'x1' square meter size. (This should be in a dark place). Then, worms are bought from the market (from agricultural shops) and they are placed in these ditches under supervision of knowledgeable persons. These worms eat the waste matter contained in these ditches and excrete material, which forms the vermicompost. Vermicompost is ready by in approximately within one and half months time. Vermicompost made at home can be used by you in your farms and gardens. **For more information for related issues related to agriculture, you can dial Krishi Helpline No: 18001801551**

Difference between organic manure and fertilizer

S, No.	Organic manure	Fertilizer
1.	All the nutrients are found in this, but since their amount is limited. They have to be used in greater quantity.	Only a few nutrients are found in these; but since their amount is more, they are used in smaller quantity.
2.	These can be made easily in the fields.	These can be synthesized only in factories from chemicals.
3.	These cost more.	These cost less.
4.	Their effects in the soil are long-lasting.	Their effect on the soil lasts for in short time.
5.	Because of their use, the fertility of soil is enhanced. Circulation of air increases and the temperature remains controlled.	By their continued use, the condition of the soil becomes worse, air circulation does not increase. The temperature also does not remain in check.
6.	No special precautionary steps are required for their upkeep or storage.	Constant watch is required for their storage- as the fertilizer spoils due to moisture.



31.3 PROTECTION OF THE HARVEST

In the fields, crops are vulnerable to insects, weed as well as diseases. For getting better crop yield, weeds have to be removed. In addition, growing crop need to be protected from pests.

31.3.1 Control of weeds

Weeds are those useless plants like *Xanthium*, *Parthenium* and *Cyprus rotundus* that grow along with crops in fertile soil. These weeds compete with the main crop for sunlight, water and space, weeds also take away nutrients from the soil. This reduces the crop yield. Hence, for better yield, weeds should be removed from the fields in the beginning itself.

Some weeds like *Parthenium* cause diseases such as allergy and asthma in human beings. These can be removed by using the plough or harrow. If weeds grow again, along the crops, they can be removed manually. Spraying weedicides like N,C,P,A and Cymazine also removes the weeds.

31.3.2 Control of crop-pests and diseases

Insect pest attack plants in three ways:

- (i) They cut off the roots, branches and leaves.
- (ii) They suck the cellular fluids from various parts of the plants and
- (iii) They make holes in the branches and fruits.

The crop gets destroyed. Insect pests spread on the crops through the seeds, air and the top soil. Two common fungal diseases of wheat and rice are wheat rust and rice smut. To control these, insecticides may be sprayed. At the same time these pesticides may prove toxic for plants and animals, and cause environmental pollution. Just think, cannot disease resistant crop varieties be used as a control strategy? Along with chemical methods, biological control methods may be used. For example, some water weeds are get eaten up by fish.



Do you know

Carrot grass (*Parthenium*) is harmful for human health.

During 1955, India imported wheat from the USA. Along with this wheat, carrot grass (*Parthenium*) also came to India. Today *Parthenium* has spread throughout the country. Pollens from *Parthenium* flowers cause asthma and skin diseases. *Parthenium* causes skin allergy.



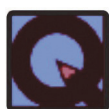
Wide spread campaigns have been initiated, not only to spread awareness about *Parthenium* but also to eradicate this grass.

You can also take the initiative of making your neighbours aware of the dangers of carrot grass.

31.4 STORAGE OF GRAIN

After harvesting, grains need to be stored. If there is lack of proper storage facilities, then the grain is vulnerable to attacks by insects, worms, fungi and various kinds of microbes. In the same way, lack of adequate moisture and right temperature at the place of storage increases the possibility of rotting of grain because of all these reasons, the quality of grain declines, its weight reduces and its capacity to bear grain decreases too. This reduces the price of the produce in the market. Following is a list of some techniques that have been developed to prevent the grain from deteriorating as well as maintaining their safe storage.

- **By drying:** Grain can be dried in the sun, or it can be dried by exposing it to hot/warm air.
- **By maintenance of storage vessels:** The godown, sacks, tanks or vessels used for storage of grain should not have crack or holes in them. They should be clean.
- **Chemical treatment:** Prior to storage, there is sprinkling of insecticides and fungicides chemicals on the godowns and the storage vessels. Fumigation (in the form of insecticidal mix or fumigant) is also used. This is known as **chemical treatment**. Grain is also treated with neem leaves, black pepper and oil. This is an organic cure that prevents insects from ovulating (laying eggs).
- **Vessels related to storage:** Now-a days such storage vessels of specific shapes are being manufactured. They are not only air free, but also rodent free and moisture free. Also they maintain an even temperature too. Some of their names are as follows:Pusa Bin, Pusa Cubide, 'Pusa Kothar'-SILOS



INTEXT QUESTION 31.2

1. Some statements are given below. Arrange them in the proper sequence so that the chain given below gets completed.

1. Use of grass cutting implement
2. Transplantation of new plants

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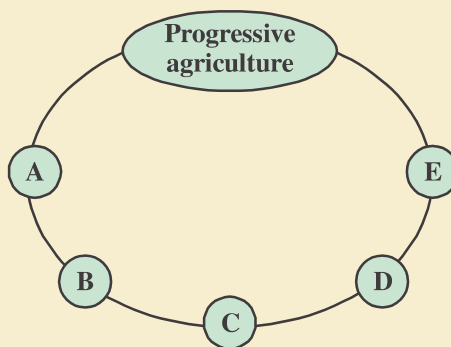
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3. Preparing the vermicompost
4. Treating the seeds by immersing these in ceresin or agrosin.
5. Use of mix cropping
6. Making topsoil fertile
7. Preparation of the field for sowing



2. Mention a chemical and an organic method for protecting growing crops against attack by weeds.

3. What can be done for removing plant destroying insects etc. what harm can be caused by chemical insecticides?

4. Mention any two better ways of storing grains.
(i) _____ (ii) _____

31.5 ANIMAL HUSBANDRY

Animal husbandry is that branch of science which is concerned with the management of various methods of better production of food items and procurement of better services from animals. Animal husbandry includes producing proper nutrition to animals, and management of issues related to reproduction and control of diseases. With the increase in population, fulfillment of requirements for food would be possible only if – alongwith agriculturing attention is also paid to animal husbandary. In this way, the production of eggs, milk, honey, wool and meat can be improved and increased.

31.5.1 Milch animals

Milch animals includes all those cattle from where human receive milk and also those animals which are helpful to farmers in agricultural work such, as ploughing, irrigation, bearing loads etc. Indian domesticated milch animals have two



categories- cow (*Bus indicus*) and buffalo (*Bus bucchi*). Milk giving cows are included in the category of milch animals.

Today, scientists are engaged in discovering how disease-resistant capacity of milch animals can be enhanced and how their milk delivering period can be increased. This period is the period when after the birth of the calf, the mother lactates. This means that milk production can increase, also it is essential that the animal be free of disease. The lactation period of certain foreign breeds such as Jersey, Brown Swiss etc. is very long. Similarly in Indian breeds like Red Sindhi, Sahiwal, etc. the disease resistant is higher. If both these breeds are intermixed (hybridised), offsprings are likely to have a combination of strong qualities from both parents, that offspring will have greater disease resistance and its lactation period will be longer.

The quantity and quality of the milk produced from cows and buffaloes are dependent upon these factors- the state of these animals's health and whether they are getting balanced diet. Milch animals should be cleansed regularly, in case of illness, veterinary specialists should have consulted constantly and their delivery place should have adequate light and air, where they can be protected from cold, heat and rain. Now-a days some people normally want to increase milk production by feeding these animals with steroids and hormones. This causes increase in udder size but the milch animals face difficulty in walking.

31.5.2 Animal reproduction

In order to get animals with certain desired characteristics in the offspring. Parents with desired qualities are selected and made to interbreed. For instance a variety of cow that yields less milk is mated with one from that yields more milk.

Artificial insemination is an important, effective method of obtaining a variety with desired characteristics. In this process, the semen of the male belonging to a variety growing high yield of milk is injected into the vagina of the female. This process produces offspring with higher yield of milk. This method is used for improving the breeds of the cows, buffaloes, hens, horses and goats.

31.5.3 Poultry farming

Poultry farming has a special place in our country. Eggs and chicken meat is major sources of proteins, vitamins and minerals. Poultry farming not only contributing to a better quality of food, but is also a major source of income for many many farmers in the country. Poultry farming enhances the quality of the breed and also enhances the production of eggs and chicken meat. Hens called '**layers**' are reared for eggs; and those reared for chicken meat are called **broilers**. In poultry farming there is a special place for new breeds of hens—so that the quality as well



as quantity of chicken may be enhanced. For production of a new breed of hens, local breed such as 'Asil' and a foreign breed (such as leghorn) are **interbred**. In this way, new chicken breed of chicken have an amazing capacity to tolerate high temperature and their proper rearing their costs much less.

From a commercial view point such chicken are reared which can be given fibrous meal, derived from agricultural by-products. In this way the hens get high protein diet derived from grains with very little fibre.

The production of eggs and broilers

The following factors need to be kept in mind for rearing hens for better production of eggs and broilers.

- Better management techniques are necessary for better production of which management of proper diet and proper shelter are of prime importance.
- The shelters for the hens should have the right temperature and provision for adequate amount of light and air. Their shelters need to be kept clean.
- The hens are healthy and they produce good quality of eggs and meat. Adequate amount of vitamins should be provided in the diet. For proper growth of broiler chickens.
- Poultry needs to be protected against both disease and pesticides. It is essential to take precautions so that death rate of broiler chickens remains low. At the same time the quality of their features and intestines is maintained.
- The shelter, diet and environmental needs of broilers is different from those of the egg producing hens. Broilers are given a diet of protein and fat, and are sold as meat in the market. A higher proportion of vitamin A and vitamin K is provided in the diet of egg producing 'layer hens'.
- Special attention should be paid to cleanliness in the shelters for hens. Dirty shelters with inadequate air circulation may lead to hens being affected with shelters.
- Germicidal medicines should be sprinkled regularly. Hens should be vaccinated against communicable diseases to avoid epidemics.

31.5.4 Fisheries and Aquaculture

The livelihood of lakhs of Asians is connected to fisheries. Fish is a rich source of protein in our diet. Fish is found in two kinds of water : sea water and fresh water. Fresh water is found in rivers and ponds. Hence, fisheries can be both freshwater fisheries and marine fisheries.



(A) Marine fisheries

The entire Indian Peninsula borders ocean where fish production is done on a large scale. We are proud to belong to a country where, on one hand the world's tallest mountain ranges are found and on the other hand there is an approximately 5600 km. long sea coast. Fishing is done on the shore of this vast sea coast as well as in the depths of the ocean, on a large scale Mackerel, Tuna and Sardine fishes are the most widely consumed sea fish. For catching fish, various kind of nets are thrown into the sea from fishing boats.

Today, with the help of new techniques like satellites and echo-machine, large scale of fish can be accurately detected. By using this methods, fish catch can be increased. By using these new technique the safety and security of fisherman can be established.

Today, fisheries and aquaculture is a successful industry. Finned fish like mullet, pearl spot, prawn, mussel, oysters and oceanic weeds are an inseparable part of the fishing industry and have tremendous economic importance. Oysters are caught their pearls.



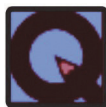
Do you know

Today marine fish are facing many dangers. In some places, there is reduction in the number of fish due to global warming; in other places fish numbers are reducing due to leakage of oil in ocean water. In future, the reduction in the quantity of marine fish, replenished through fisheries. If this type of preservation is called **Marine Culture Preservation**.

(B) Inland Fisheries

Do you have any experience of catching fish in a pond, lake, river or canal: if not, then do it whenever you get the chance. Inland fishery includes fishing in fresh , water sources like canals, ponds and rivers etc. wherever freshwater is mixed with sea water (salty water)- such as at mouths of rivers as estuary and lagoons. Major store houses fish.

When fishery is undertaken in land sources, its production gets limited. Maximum fish production is done through aquaculture. In India, farmers combine rice farming with fisheries, through mixed fishery, fish can be enhanced. In this process, both local and imported types of fish are used. Rohu, Katla, Mrigel, Silver carp etc are the names of some fishes that are produced in fresh water fisheries.



INTEXT QUESTIONS 31.3

1. Today, most schools of marine fish can be detected by the use of new technology, called_____.
2. _____ are cultured to get pearl.
3. Mention the names of any two fish of economic importance.
4. By increasing the lactation period of milch animals _____production can be simultaneously increased.

31.6 BIOTECHNOLOGY IN AGRICULTURE

When plant cells, tissues (collection of cells) and plant parts are used to drive useful products by mixing them with nutrients in test tubes or beakers, it is termed **BIOTECHNOLOGY**. Agricultural biotechnology is the term which is used for growing growing parts of plants, tissues and cells are in synthetic nutrient media in test tubes or beakers or culturing them.

Agricultural biotechnology can be of two types:

- (1) Tissue or cellular culture (2) Genetic engineering

(1) Tissue or cellular culture

Tissue culture involves separating of plant cells and tissues and culturing them in nutrient media in test tubes or beakers. Plants grown in this manner are then transplanted in the fields. Through this process better quality plants can be grown in a short period of time. This technique is highly effective for conservation of rare plants or those on the verge of extinction.

(2) Genetic engineering

This includes the transfer of a specific gene or DNA from a plant into the cells of another plant. In this process, gene/DNA is transferred from one plant to another through the use of recombinant DNA technology. DNA of one plant is entered into the genetic material of the other plant. Such plants are called **transgenic plants**. This technique is used to produce better quality plants. With the use of genetic engineering, Indian scientists have produced a Genetically Modified (GM) potato. By the use of this technique, potatoes been infused with protein of a specific variety (Amarind). Amarind is a food giving tree, where protein has been inserted now made by potatoes too.



Efforts to reduce the distances between science, farmer and society

Today, several ministries and departments of our government are disseminating new information associated with science, agricultural science and technology. The aim is to reach society and farmers information regarding research, associated with science and facts; regarding research, associated with science and facts about advancement of techniques, in their own language. For this purpose, Govt. of India has activated department like Vigyan Prasar, Govt. of India's Department of Science and Technology, National Science and Technology Communication Council and the 'Krishi Vigyan' Kendra established under the aegis of the Agricultural Ministry are largely engaged in spreading scientific information, giving publicity and also financing people for dissemination of scientific information. For further information, you can see the following websites:

www.vigyanprasar.gov.in; www.dst.gov.in; www.icar.org.in

31.7 FOOD SECURITY

Food security can be defined as the timely and convenient availability of food, for all the people of a particular region or country. This is especially to wherever there is a crisis in food production and the conditions of poor families of becomes depressing. Food production falls in times of natural calamities like floods, tsunami, droughts or famine. In this way, natural calamity produces food scarcity in affected regions. Due to lack of food, prices increase because of which, families with limited income, cannot bear food expenses. If natural calamity persists in a particular place for a long time, their conditions of livings may emerge-that, in turn, may turn into famine.

Food security is dependent upon the processes related to the public distribution system, governmental alertness and attempts to emerge out of food related issues.

Food security is dependent upon the following factors:

- (a) Availability of food:** Availability of food refers to food production, food consumption and storage of grain in governmental godowns in the preceding years.
- (b) Access to food:** This indicates that food is within the reach of every person in the country.
- (c) Capacity to bear food expenses:** This refers to availability of many with each person to buy safe, nutritious food for his daily needs.



In this way, food security can be established in a country, only in the presence of the following three conditions:

1. When enough food is available for all people.
2. When all people have enough purchasing capacity to buy nutritious food.
3. When there is no obstacle in procuring food.

31.7.1 Steps taken for food security

Today, a large proportion of the country's population is facing insecurity related to food and nutrition. More people who are either landless i.e who have access to very limited agricultural land are more affected. Today, those suffering for food insecurity include the rural laborers, very small scale self-employed people and those who beg for a living. In the urban areas, food insecurity is mainly labourers or who are engaged in work that pays little or who get work only in certain seasons. In addition to those categories, those people also qualify for food insecurity, who migrate from one place to another in search of work in times of natural calamities. A very large number of such people come under the category to those affected by food related insecurity.

31.7.2 Effects made in the country for self reliance in food security

After getting independence, the Indian policy makers have made every attempt to make India self-reliant in food. By adopting new agricultural strategies, India initiated the 'Green Revolution' which began especially with the increased production of wheat and rice. In July, 1968, the erstwhile Prime Minister Indira Gandhi issued a special postal stamp entitled, 'Green Revolution' and this conveyed the powerful message of this agricultural revolution to her countrymen. This success with wheat was repeated with rice, later on, although, it also cannot be denied that this increase in crop yield was unequally distributed in the country. Punjab and Haryana recorded the maximum yield in agricultural production. In states like Maharashtra, Madhya Pradesh, Bihar, Orissa, and North East States, the grain output swung between increase and decrease. Meanwhile, Tamil Nadu and Andhra Pradesh recorded high output of paddy (Rice).

Today, green revolution can be credited with protecting the country against famine in times of contrary seasonal conditions. Both our farmers and food security have been protected. During the last 30 years, India has achieved self-reliance in food security by growing varied kinds of crops.



31.7.3 Buffer stocks

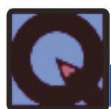
Buffer stocks are those stocks of grains that are obtained by the government through the medium of Food Council of India (FCI). Wheat and Rice have been included in the buffer stock. The Indian Food Council buys wheat and rice from the farmer of these regions, where they are grown in surplus. The farmers are paid a predetermined sum for their crops this sum is called the **Minimum Support Price**.

31.7.4 Public distribution system

The grain obtained from the Indian Food Council is distributed among the poor sections of society via the state controlled **Ration shops**. This is known as the **Public Distribution mechanism**. Today, ration shops exist in majority of the neighbourhood of our cities, towns as well as villages. There are approximately 4.6 lakh ration shops in the country.

Grain, sugar and kerosene oil are usually available in these ration shops. These are sold at lower rates than the open market. Any family can buy a rationed amount of these products from such shops on possessing a ration card. For example- 25-30 kilos grain, 5 litres kerosene oil, 5 kg sugar etc. In India distribution through the ration system was initiated in the 1940's.

In view of achieving food security, India's Public Distribution System has proved to be one of government's highly effective public policies. It has not only regulated the price of grains but is also providing ordinary people with items of food at nominal prices. From the perspective of food security, this has proved to be a significant programme.



INTEXT QUESTIONS 31.4

1. At any given time the capacity of the availability, easy accessibility and expenditure on food of all the people in any region/country is called———.
2. The grain stocks procured by the govt. through the medium of FCI is called———.
3. The rationed material, from the state controlled ration shops is distributed through the —— system.
4. Mention any two programmes that were initiated with the purpose of eradication of poverty and achieving food security.
5. The mixture of separated cells/tissues from plants and nutritive fluids in a funnel/beaker is called———.

**WHAT YOU HAVE LEARNT**

- For the purpose of agricultural research and development an institute was established that is today, known by the name of Indian Council of Agricultural Research.
- Between 1968-1988, a major improvement occurred in Indian agriculture in the field of crop-yield and food production. It was a veritable revolution that is known as the Green Revolution. We also call it the golden age of Indian agriculture. Its credit goes to agricultural scientist Dr M.S. Swaminathan.
- Organic farming is being encouraged in order to continue the Green Revolution. In organic farming, the limited amount of fertilizers are mixed with biofertilizers and used so that there is no ill effect upon the farms or human health.
- That branch of agricultural science that teaches about the management of crop production and farms is called Agronomy.
- Crop rotation takes place when, at an appointed time, crops are grown in a pre-determined sequence in the field.
- Soil has been badly affected by the excessive use of chemical fertilizers and insecticides. The lives of beneficial insects and worm, found in the soil, have been destroyed. The quantity of micro nutrients has reduced.
- Organic fertilizers are all those natural products that improve soil fertility, a being mixed with it. (These Natural products exclude water). From the scientific perspective natural products like grass, plants, urine and excrement of birds and animals and other remnants are an integral part of biofertilizers.
- Some essential nutritive elements are found in greater quantity in fertilizers: and they are prepared in an artificial manner in the factories.
- More chemicals that control the growth rate of plants are called plant-growth regulators- examples are auxin, gibberin, cytokinin, abscisic acid etc.
- Irrigation is essential for the proper growth of plants. The topsoil and the crops are irrigated, as per requirements.
- Till some years back, farmer used to cut the crops using hand-driven implements; but after the invention of special harvest-cutting implements, the task of cutting crops has become easier.
- Weeds are unwanted, unnecessary plants that grow alongside legitimate crops in fertile agricultural land some examples are Zanthium, carrot grass



(Parthenium) and Motha (*Cyranus prodentis*). These unwanted plants compete for sunlight, water and space in the fields.

- After cutting the harvest, grain is carefully stored. Of storage of grain is not safe, then grain can be attacked by insects, worms, fungi and microbes. And thus, they can be destroyed.
- Animal husbandry is that branch of science, which is conceived with the management of different techniques related to animal rearing and deriving better productivity and services out of them.
- Today, scientists are engaged in the process of seeing how the disease resistant capacity of milch animals can be enhanced; and how their lactation period can be increased.
- The quantity of milk received from buffaloes and cows is dependent upon two factors- the status of their health and the kind of balanced diet they are receiving.
- Eggs and meat of young chicks are major sources of protein, vitamins and minerals nutrients.
- For hen-rearing, such shelters should be available for the young chicks-that have the right temperature, light and air circulation.
- Today, new, sophisticated satellite and echo techniques can be used to detect large reserves of fish. Thus, such technology can be used to increase fish production.
- Biotechnology arises when cells, tissues and parts of plants are put in beakers/funnels and mixed with nutritive fluid to produce useful products.
- Genetic engineering is the transfer of specific genes or DNA from one plant to another plant's cells.
- Food security is achieved when availability, accessibility and expenditure for/of food is within the reach of people of any given country/region.
- Food security is dependent upon the following factors. Availability of food, accessibility of food and the capacity to buy a minimum amount of food.
- The grain obtained from Indian Food Council is distributed among the poor sections of our society through state regulated ration shops. This is known as the public distribution network.



TERMINAL EXERCISES

Multiple Choice Questions.

1. The name of the governmental campaign that is encouraging horticulture is:
 - a. National Green Mission
 - b. National Gardening Mission
 - c. National Food Mission
 - d. National Harvest Mission
2. The credit for the green revolution in the country goes to :
 - a. Dr APJ Abdul Kalam
 - b. Dr V Kurian
 - c. Dr M.S. Swaminathan
 - d. Dr. MGK Menon
3. The following are involved in the creation of biofertilizers:
 - (a) Grass, dry leaves and urine/excrete of animals
 - (b) Chemical products
 - (c) Radio-active substances
 - (d) Nitrogen fertilizers
4. Auxin or gibberelin chemicals is associated with this category
 - a. Weed killer
 - b. Fertilizer
 - c. Plant Growth Regulator
 - d. Fungicides
5. For crops productions and management of farms which principles should the farmer be informed of?
6. What do you mean by crop rotation? Classified the advantages of crop rotation?
7. From the prespective of food security, why is mixed cropping and multiple cropping considered better? Explain
8. Comment on the following
 - i. Formation of topsoil
 - ii. Treatment of seeds
 - iii. Preparation of field for sowingseeds aand looking after new-born plants
 - iv. Preservation of cells/tissues



9. just imaginfg that you have been invited to a village chaupal for giving a lecture on 'Arrangment for Protecting Harvest'. What will you tell the villagers and farmers on this topic.
10. During the storage of grains in granaries, tell about any two possibilities, by which, how can reach the door of the stored grains.
11. What advantage assures to the farmer through animal husbandary. Many animal rights activists protests against animal husbandary. Write a note of one or two pages on this topic.
12. How can the produce of hen rearing and fisheries' activities be increased?
13. . By explaining being made at the national level in relation to the country' food security, kindly explain as to why food security is in the country's interest today.
14. Comment on the following:
 - i. Food security for the increasing population
 - ii. Buffer stocks
 - iii. Public distribution system
 - iv. Green revolution



ANSWER TO INTEXT QUESTIONS

31.1

1. Indian Agricultural Reasearch Council
2. Better harvest, curtaining soil erosion, weeds ,control over pests and diseases
3. (i) Crop rotation (Mixed cropping)
(ii) to obtain harvest without damaging the environment.
4. National Gardening Mission
5. Agronomy
6. Crop rotation

31.2

1. (a) 1 (b) 4 (c) 7 (d) 2 (e) 3
2. Through the sprinkling of weed-killers like N,C,A,A and Cemazine etc.

MODULE - 7

Humans and Environment



Notes

Food Production and Animal-Husbandry

3. To remove insects, we can spray insecticides. But these can be poisonous for both plants and animals and can become a cause for environmental pollution. To control pests disease resistant types of crops can be used. Along with the chemical method, bio-controlled methods can also be used. For instance water weeds are eaten by some fish.
4. Pusa bin, Pusa cubicle

31.3

1. Through satellite and echo techniques
2. Oyster
3. Mullet, Pearl spot
4. Milk production

31.4

1. Food security
2. Buffer stocks
3. Public distribution
4. Mid day meal scheme, Annapoorna scheme
5. Tissue/ cellular preservation