

MODULE - 6

Sustainable
Development



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MODERN AGRICULTURE

Modern agriculture has made impressive contribution in increasing food grain production in the country. The country could achieve self-sufficiency in food grain production by using modern methods of agriculture using better quality of seed, proper irrigation and adequate supply of plant nutrients by using chemical fertilizers and control of pests and diseases in crop plants by using pesticides. It has also involved modern cultivation practices using tractors, combine harvesters and tube wells for irrigation. Rapid growth in food grain production from using seeds of high yielding variety is termed as Green Revolution. Protection of air, water, soil and human health while producing bumper crops should be the prime concern of modern agriculture.



OBJECTIVES

After completing this lesson, you will be able to:

- *define green revolution;*
- *know about the introduction of high yielding varieties (HYV) in India;*
- *understand the significance of the need for pesticides and fertilizers;*
- *emphasize the need of superior quality seeds, agricultural implements and irrigation;*
- *learn about newer agricultural practices like mushroom cultivation, poultry farming and fisheries;*
- *define animal husbandry;*
- *mention management of livestock with respect to shelter, feed and care;*
- *mention names of common diseases of livestock;*
- *relate disposal of dead livestock with environmental degradation;*
- *emphasize the detrimental effects of indiscriminate use of hormones on livestock and poultry;*
- *discuss the consequences of aquaculture.*

**Notes**

20.1 WHAT IS GREEN REVOLUTION

The term “Green revolution” refers to substantial increase in grain yield obtained by plant breeders by developing new crop varieties. The high yielding varieties (HYVs) of wheat and rice have been the key elements in green revolution. It was in March 1968 that the director of the US Agency for International Development (USAID), William Gand, first used the phrase “green revolution”, to describe the great gains in yields of rice, wheat, maize and other crops through the use of high yielding varieties (HYVs). Specifically the term “green revolution” refers to wheat and rice but some agricultural scientists even include maize, soyabean and sugarcane where spectacular gains in yield have occurred.

The factors which have helped to bring about the green revolution are:

- introduction of high yielding varieties of crops.
- multiple cropping, better irrigation and sufficient supply of fertilizers.
- use of crop protection measures against disease and pest.
- transfer of the technology of scientific farming from research farms to village farmers.
- better arrangements for transporting farm produce from fields to the market.

Spectacular increase in the yield of crops, particularly cereals, through the application of modern techniques in agriculture is called green revolution.

A cross between semi-dwarf Mexican wheat (high yielding and responded to fertilizer and irrigation) and Indian, wheat (disease resistant and good grain quality) resulted in high yielding and disease resistant varieties of wheat. Some important revolutionary varieties are ‘Kalyan Sona’, ‘Sonalika’ and ‘Sharbati Sonora’ etc.

20.1.1 Introduction of High Yielding Varieties (HYV) in India

The average national yield of wheat has remained at 800 kg/ha which was very low as compared to the wheat yields of agriculturally advanced countries. MS Swaminathan former Director General of ICAR (Indian Council of Agricultural Research) made a theoretical analysis of the factors responsible for the yield stagnation as well as instability in crop production. He stressed the need for reorientation of the entire breeding programme as the very morphological and physiological structure of tall varieties prevented any type of break through in the yield.

Through extensive wheat breeding programmes carried out during 1970-80, new amber seeded, high yielding dwarf wheat varieties were developed. The important high yielding varieties include ‘Kalyan Sona’, ‘Sharbati, Sonara’, ‘Sonalika’ were released. These varieties responded favourably to fertilizer and irrigation.



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On the request of Indian breeders Prof. Norman E. Borlaug was invited from Mexico in 1963 by the Government of India to assess the possibilities of using dwarf varieties in India. After travelling through major wheat growing areas in India, he recommended the feasibility of using semi dwarf wheats of Mexican origin as the agro-climatic condition prevailing in India are similar to Mexico. On his recommendation two semi dwarf varieties namely Lerma Rajo and Sonora-64 were chosen and were released for cultivation in irrigated fields. These varieties gave very high yield and brought in revolution in wheat production.

Dr. Borlaug joined the Rockefeller Foundation Cooperative project with Mexican Ministry of Agriculture as the head of Wheat Research and Improvement Programme. In 1966 his “Quiet Revolution in Wheat Improvement” created worldwide interest and International Wheat and Maize Improvement centre was established in Mexico. In 1970 he was awarded Nobel prize for “Green Revolution” which helped India.

Dr. M.S. Swaminathan an outstanding mutation geneticist produced ‘Sharbati Sonara’ and released it for cultivation in 1967. This ambar coloured mutant variety was produced in a mutation breeding programme by subjecting Sonara 64 to gamma and ultraviolet radiations. ‘Sharbati Sonara’ had bold, amber, and lustrous grains and was found to contain 15-25% more protein than the parent Sonara 64.

20.2 FERTILIZERS AND PESTICIDES

• Fertilizers

Fertilizers are substances that are generally applied to soil to promote healthy growth of plants. Fertilizers restore the lost plant nutrients in the soil. Farmers use both organic fertilizers produced from plant and animal wastes as well as commercial chemical fertilizers produced from various inorganic compounds.

Fertilizers are mainly applied through the soil to be absorbed by plant roots; it can also be applied as foliar spray to be absorbed by leaves. Chemical fertilizers are generally of the following types:

- (a) **Nitrogenous fertilizers:** Nitrogen containing fertilizers e.g. ammonium sulphate, ammonium nitrate and urea.
- (b) **Phosphate fertilizers:** Phosphate containing fertilizers e.g. ammonium phosphate, calcium dihydrogen phosphate (superphosphate)
- (c) **Potassium fertilizers:** Potassium containing fertilizers e.g. potassium sulphate and potassium nitrate.

Nitrogenous fertilizers promote plant growth and are essential for food production. But they should be used judiciously. Inefficient absorption by crops and wasteful application of



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fertilizers are the main causes of environment pollution. The unused fertilizers then enter surface water (rivers, lakes, ponds) and ground water. Fertilizers cause environmental pollution when used indiscriminately and cost us money.

• Organic fertilizers

Organic fertilizer is produced from plants and animal waste matter by biological degradation by microorganisms. This is known as manure or compost and is produced from cattle dung and other animal wastes or from fallen leaves, twigs and other vegetable wastes by biodegradation by microorganisms. Organic fertilizers or manure or compost are environment friendly as it does not cause any type of pollution either to the soil or to water. Organic fertilizers enrich the soil with nutrients and improves the overall quality of the soil like soil texture, soil aeration and water holding capacity.

• Pesticides

Pesticides are chemicals which have been developed to kill or control organisms called pests which are unwanted by man especially in agriculture.

Modern pesticides increase food supplies, increase profits for farmers and are safe if used properly. Pesticides control most pests quickly and have a long shelf life and are easily shipped and applied. When genetic resistance occurs farmers can use stronger doses or switch to other pesticides. Pesticides, when used in the approved regulatory manner, pose no risk to either farm workers or consumers.

Level of DDT (chlorinated hydrocarbon) in the body of tissues of people living in New Delhi is the highest in the world.



INTEXT QUESTIONS 20.1

1. Define “green revolution”.

2. How was “Sharbati Sonora” produced by Dr. Swaminathan?

3. Define fertilizer.

4. What are the advantages of using organic fertilizers or manure?.



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20.3 NEED FOR USE OF SUPERIOR QUALITY SEEDS

Increasing production in limited land area requires the use of superior quality seeds. Improving the quality of seeds by applying knowledge of genetics and plant breeding are being done in a routine manner. By applying the knowledge of biotechnology, superior quality seeds are being produced.

Seeds are being improved to produce:

- high yielding varieties;
- seeds of better and higher nutritional quality like protein quality in pulses, baking quality in wheat, preserving quality in fruits and vegetables, oil quality and quantity in oil producing plants;
- Varieties for disease resistance and pest resistance;
- Varieties for resistance against factors like heat, cold, salinity, frost, draught and water logging.

Disease resistant and pest resistant seeds will not require so much pesticide which will save environmental pollution also will save money which would have gone in the purchase of pesticides.

Plants can be grown under various difficult situations; thereby extending the area of cultivation e.g. dry or saline or water logged areas can be utilized for cultivation.

20.4 MECHANISATION OF AGRICULTURE

Increase in productivity on large areas of land brought the idea of farm mechanization. All the activities associated with agriculture became possible within a short period of time over large acreage of land so that the produce or the harvest reaches the market as quickly as possible with the help of various types of machines. In developing countries agriculture used to be labour intensive but with the increasing migration of rural population to the cities and agricultural labour is gradually became scarce in most areas. To cope up with the shortage of agricultural labour, farm mechanization was the obvious choice for completing agricultural operations. The machines which perform various jobs at the farm are water pump, ploughs, combine harvesters, land levelers, cultivators, power operated tractor sprays, reapers, threshers, trolleys and mechanical pickers etc.

- **Combine harvester** – They are also known as “combine”. It is a large farm machine that both cuts the corn and separates the grains from the ear of the plant. It does the job of cutting or harvesting and threshing, i.e. separating the grains from the ears right in the field.
- **Ploughs** – Plough or till the soil mechanically, turning the soil over there are various types of ploughs available.



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- **Land levelers** – Level the soil after breaking big chunks of soil or clay, and prepare the soil for sowing.
- **Box drill** – Attachment on tractors are used for sowing seeds.
- **Power operated tractor sprays** – They run through the rows of crops, spraying insecticides or pesticides on crops present on either side.
- **Pumps** are simple electrically operated water pumps to supply irrigation water to fields.
- **Threshers** are machines which separate the grains of corn, rice, wheat from the ears or the rest of the plant.
- **Mechanical pickers** which works on the principle of suction, designed to harvest or pick cotton. For picking cotton, plants are defoliated using chemicals.

20.5 NEWER AGRICULTURAL PRACTICES

Modern agriculture includes animal husbandry, poultry farming, apiculture, fisheries and mushroom culture etc. to provide additional food supplements like milk, meat, fish, egg, mushroom etc. In addition to provide nutritional food for the masses, they also reduce load on the consumption of cereals and pulses. Thus modern farmers take up some of these above operations, over and above cultivation of plants.

(a) Poultry farming

Poultry farming is a term used for rearing and keeping of birds such as fowl, duck and hen for egg and meat. Poultry farming has become popular because this is comparatively easy to start and maintain. It gives quick return within one to six month of investments, is easily manageable and required less space and labour. Poultry birds and their eggs are rich source of nutrients.

Indian poultry birds provide good quality meat but produces small sized eggs. They have natural immunity against common diseases as compared to exotic varieties bred abroad.

Common exotic birds are Leg horn, Rhode Island Red, Cornish.

Common Indian breeds are Aseel, Chittagong, Busra.

(b) Mushroom culture

Mushroom culture has become a lucrative method of earning money as well as it provides a nutritious food supplement. Mushrooms are kind of fungus which appear as white tiny balls consisting of a short stem and a cap which opens like an umbrella later. They lack chlorophyll and grow on organic matter or waste materials from farms or factories, useless by-products can be recycled as medium to grow mushrooms for human consumption. Out



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of the large number of mushroom species only some are edible. Some of the edible ones found in India are white button mushroom (*Agaricus bisporus*), paddy straw mushroom and oyster mushroom.

Mushrooms are good source of high quality proteins and are rich in vitamins and minerals. Like fruits and vegetables mushrooms are perishables and require a great deal of attention during storage, marketing and processing.

(c) Apiculture

Apiculture is also known as bee-keeping. 'Apis' means bee. Apiculture or bee-keeping is the art of caring for and controlling colonies of honey bee in large quantity for commercial production of honey. Earlier bee-keeping used to be done by people to produce honey for home consumption but now it has become an important industry.

There are three major advantages of bee-keeping:

- (i) provides honey- a valuable food
- (ii) provides bee wax- which has many uses in industry
- (iii) honey bees are excellent pollinating agents which increase agricultural yields.

Bees produce honey and wax, both of which are valuable marketable commodities but their function as pollinating agents are of great significance in agriculture. Nectar and pollen from flowers form the raw material for honey. Nectar is the sweet secretion of the flowers. It is the raw material for honey. Pollen provides the raw material necessary for the major food of the brood (fertilized egg).

(d) Fish culture and aquaculture

Fishes form an important protein rich diet in many areas of the world. The development of fisheries is therefore one of the most promising industry.

India has a long coastline which is a great producer of marine fish.

Areas where fish are reared commercially are known as artificial fisheries. The fishes are bred, reared and later harvested. The fishery may be a natural water body or an artificial one. A variety of fish may be reared together.

Depending on the nature of water in which fish is reared fisheries can be:

1. **Marine fisheries-** fishing operations along the coastline, e.g. Mackerels, Sardines, Catfish.
2. **Fresh water or inland fisheries-** fish found in rivers, irrigation canals, reservoirs, lakes, tanks, ponds etc. e.g. Rohu, Catla, Mystus.



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3. **Estuarine or brackish water fisheries-** estuaries are where river water and sea water get mixed like backwaters, lagoons, coastal lakes, delta channels. They are more common in Bengal and Kerala. E.g. Mullet, Milkfish, Pearls spot.

There are several other aquatic resources such as molluscs (oyster, mussels, squids, octopus, cuttlefish etc.) and seaweeds which have been exploited for aquaculture. Sea weeds are used for human consumption, as cattle and poultry feed, as manure and for industrial purpose as a source of agar-agar and algin. Thus these newer agricultural practices can become lucrative or profitable business as well as create employment.



INTEXT QUESTIONS 20.2

1. What are the advantages of using disease resistant varieties of seeds?

2. What are the functions of combine harvesters, ploughs and land levellers?

3. Of what significance is the production of seed varieties resistant to salinity, dry or waterlogged conditions?

4. Name three important newer agricultural practices of great value and their advantages

20.6 ANIMAL HUSBANDRY

The branch of agriculture that deals with breeding, feeding and care of domestic animals is called **animal husbandry**.

Animal husbandry is an integral part of modern agriculture as animal sources provide us important food materials like milk, egg, meat etc.

Cows and buffaloes are our chief sources of milk. Milk producing animals are called **milch animals**.

Hens are egg laying animals. Fishes, pigs, hens and goats are our major sources of meat.

Protein intake of our food have increased because people are consuming more animal food resources, yield of animal food products (milk, fish, eggs) have steadily increased in the last four decades.

Animal husbandry plays a prominent role in the rural economy in supplementing the income of rural households.



There are large number of organizations, cooperative societies, universities and national institutes which are involved in research processes resulting in steep increase in the total yield of various animal food resources like milk, fish and eggs.

Breeding of domestic animals is also one of the key elements of animal husbandry.

20.7 MANAGEMENT OF LIVESTOCK

Management of livestock includes proper care of animals, providing them feed and water, shelter and protection against diseases.

(a) Feed for livestock

The food consumed by animals is called **feed**. Cattle feed must be rich in all required nutrients. It should be given according to the age, nature of work and health of the animals. For example a growing calf needs more food than an old cow. Animals require food to produce enough milk and maintain good health.

The feed of the cattle must be rich in food nutrients like carbohydrates, proteins, fats, minerals and vitamins. Cattle feed are grouped into two types of substances:

(i) roughage and (ii) concentrates

(i) **Roughage** includes coarse and fibrous low nutrient materials rich in cellulose. Like hay, fodder (jowar, bajra, ragi, maize) and legumes (berseem, cowpea etc.) constitute the roughage.

(ii) **Concentrates** includes food rich in one or more nutrients. Oilseeds (Binola), oil cakes (khal), cereals, millets, gram and bran.

A large amount of water, roughage and concentrate should be included in an ideal cattle feed.

Leguminous green fodder like barseem, lucern, cowpea etc. are highly nutritious and preferred by cattle and given to them in winter. Some nutritious fodder grasses are elephant grass, Rhodes grass, Sudan grass, Napier grass.

An average cow needs the following feed daily:

1. Green fodder and dry grasses (roughage) : 15 to 20 kg
2. Grain mixture (concentrate) : 4 to 5 kg
3. Water : 32 litres

Cattle population in India constitutes 25% of the world cattle population but the total milk production is about 5% of the world's total milk production. In our country a cow on an average gives about 1.5 litre of milk per day and a buffalo 2.5 litres per day whereas a



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cow in some developed countries produces 8-11 litres of milk per day. Low milk yield in our country is due to:

- poor quality feed
- shortage of feed and fodder
- low milk yielding indigenous breeds

However, milk production in our country has improved in recent years because of improved breeds of cattle and better feeds. Some important indigenous breeds of cows are – Sahiwal, Gir, Tharparkar, Red Sindhi. High milk yielding cows in India developed through cross breeding with exotic (foreign breeds) breeds to produce high milk yielding Jersey, Karan and Swiss (Brown Swiss and Sahiwal), Karan and Fries, (Tharparkar and Holstein) Frieswal (Friesian and Sahiwal), Holstein –Friesian.

Jersey is a breed of the Island of Jersey, USA

Brown Swiss is an original breed from Switzerland

Holstein –Friesian is a breed of Holland

Some important Indian breeds of buffaloes are Murrah, Mehsana, Surti and Jaffarabadi.

(b) Breeding and lactation

A female calf after a certain age is mature enough for reproductive life. For breeding, she is allowed to mate naturally or is inseminated artificially and she gives birth to a calf in ten months. This is the period she enters into a period of lactation and begins to give milk. After 4-6 months, the milk yield is lowered. High yield can be increased by increasing the lactation period. But indiscriminate use of hormones for increasing lactation period. But indiscriminate use of hormones supplied from outside can be harmful for the animal as well as the quality of milk.

20.8 SHELTER MANAGEMENT

Domestic animals must be provided with proper shelter to protect them from rain, heat, cold and disease causing organisms and predators. Animals in good shelters lead a comfortable life which increases their yield or productivity.

An ideal shelter is one, which is:

- clean, dry and well ventilated.
- not crowded.
- provided with clean drinking water and adequate sunlight.
- provided with proper arrangement for disposal of excreta.
- hygienic to prevent outbreak of diseases.
- protected against predators.


20.8.1 Diseases of livestock

Domestic animals are prone to many bacterial, fungal and viral diseases. A weak and diseased animal produces less milk or meat. However, the meat and the milk may be contaminated by disease causing organisms. Some common diseases of livestock have been tabulated below:

Disease	Causal organism	Animal affected	Symptoms
Foot and mouth disease	Virus	Cattle	Blisters on the mouth and foot, excessive production of saliva, loss of appetite, high body temperature, shivering.
Pox	Virus	Cow, buffalo, sheep, goat	Appearance of small nodules and fever.
Dermatitis	Virus	Goat and sheep	Irritation, blisters and eruptions on the skin.
Tuberculosis	Bacteria	Cattle	Infection of udders, lungs, intestine and other parts, swelling of lungs and fever.
Rinderpest	Bacteria	Cattle	Discharge from eyes, nostrils, loss of appetite, constipation followed by severe diarrhoea.
Anthrax	Bacteria	Cattle, sheep, goat, pigs	Swelling of body, fever, reduction in milk secretion.
Salmonellosis	Bacteria	Cattle	Diarrhoea with blood clots and fever
Mastitis	Bacteria	Cattle	Swallow udders, fever, milk becomes watery .


INTEXT QUESTIONS 20.3

- Name three indigenous and three foreign breeds of cows.

- What are the main reasons of low milk yield per day a cow in our country?

- Mention the causal organisms and the symptoms of the diseases like (i) foot and mouth diseases, (ii) Rinderpest and (iii) Anthrax.

20.9 DISPOSAL OF DEAD LIVESTOCK

The foot and mouth disease of cattle is very common, dangerous and contagious disease. The affected animals are slaughtered and the dead ones are buried deep or burned so as to stop the disease from spreading.



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Another dreaded disease is anthrax which spreads easily. Such animals after death must be burnt and disposed off completely. If the bodies are left at a place or allowed to rot, foul smell will pollute the air. The dead bodies may cause danger to other animals and man.

Disease causing organisms after the death of the animals may stay in air, water, and soil. When the animal dies a natural death, its skin, horn, hooves and bones can be used in various useful ways.

Detrimental effect of hormones on livestock and poultry

- Indiscriminate use of hormones used orally or injected may be harmful for the animal as well for the milk it produces.
- Hormone increases amount of milk but their udder enlarge abnormally, so much so that the cows have difficulty in movement and they develop an abnormal goit.
- It also affects their normal physiology of reproduction.
- Oxytocin causes milk ejection from mammary glands in nursing mothers. This hormone also causes uterine contraction, so injection of this hormone for milk release can cause pain and discomfort to the animal.

20.11 CONSEQUENCES OF AQUACULTURE

World's third major food-producing system consists of fisheries. The world's commercial marine fishing industry is dominated by industrial fishing fleets (large factory ships) many latest technologies to catch maximum amount of fish. In fact over fishing take place to such an extent that very little breeding stock (fish population) is left to maintain the special number. Prolonged over fishing leads to commercial extinction when the population of the species becomes so low that it is no longer profitable to hunt them.

Fishing methods such as trawling and drift nets capture everything in their way indiscriminately. Sometimes 70% of the catch is thrown away. This commercial fish catching disturbs non-target marine animals annually. Dredges and trawls also adversely affect the marine habitats. Thus fish populations in the oceans of the world suffer from:

- over exploitation
- habitat destruction
- incidental mortality of non-target species
- pollution

Humans have failed to conserve marine fisheries management to date and focused to maximize the catch of a single target species, disregarding or not caring about the marine ecosystem.

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Environmental Science Senior Secondary Course

Aquaculture offers a potential solution to the depleted ocean fisheries as well as meeting the demand for sea food. Aquaculture is the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Basically aquaculture or fish farming involves cultivating fish in a controlled environment (coastal or inland pond, lake, reservoir) and harvesting them when they reach the desired size. Aquaculture provides protein rich diversified diet for people.

It is fastest growing sector of world food economy and increasing by 10% per year. The vast majority of aquaculture takes place in Asia. However, China is the world leader in this field.

The current “blue revolution” of aquaculture has taken up the shape of an industry with intensive use of resources and has adverse environmental impacts.

Ecological aquaculture (Eco-aquaculture) need to be promoted with a focus on developing aquatic farming system that preserve the environment in which they are suited and can be harvested in a suitable manner. Thus it should be a sustainable fisheries management.

Also aquaculture can provide an important source of livelihood for rural poor, generating income through direct sales of products and employment in fish production, services and processing.



INTEXT QUESTIONS 20.4

1. Mention the harmful effects of infecting hormones in order to increase milk production in cows.

2. Define aquaculture?

3. Which are the main dangers the fish population suffer from?

4. What is the advantage of the system of eco-aquaculture?



WHAT YOU HAVE LEARNT

- ‘Green revolution’ is substantial increase in yield of crop using high yielding varieties of seeds, and providing enough fertilizer and pesticides and good irrigation.



- Prof. Norman Borlaug helped India in bringing in 'Green revolution'.
- Dr. M.S. Swaminathan, internationally renowned Indian Agricultural Scientist and the father of "Green Revolution" in India, made India a food surplus country.
- Indiscriminate and wasteful use of fertilizer causes environmental pollution and cost us money.
- Modern agriculture is an industry, hence it is highly mechanized. Various types of machines are used for managing crops in large acreage of land. Combine harvesters, disc ploughs, threshers, water pumps are very common.
- Poultry farming, apiculture, mushroom culture and fisheries are newer agricultural practices which bring money and employment to the farmers.
- Animal husbandry is a branch of agriculture which deals with proper care and breeding of domestic animals.
- Milk producing animals are called milch animals. The two most popular milch animals are cows and buffaloes.
- Some indigenous (Indian) breeds of dairy cows are Sahiwal, Red Sindhi, Tharparkar, Gir. Some exotic (foreign) breeds of cows are Jersey, Brown Swiss, Holstein Friesian. Some cross breeds of dairy cows are Frieswal, Karan Fries and Karan Swiss.
- High milk yielding breeds of buffaloes are Murrah, Surti, Mehsana.
- Feed of cattle should be rich in carbohydrates, protein, fats, minerals, vitamins and water. It must include large amount of roughage and some concentrates.
- Roughage the low nutrient, fibrous, coarse material rich in cellulose. Concentrates are generally rich in one or more nutrients, provided by cotton seeds, oil cakes, gram, cereals and millets.
- It is very important to provide proper shelter to the domestic animals to keep them in a healthy condition (disease free) so that the milk yield is high.
- Animals are also attacked by diseases causing organisms (Pathogens) like bacteria, virus and fungi. Common diseases of cattle are (i) foot and mouth disease, (ii) anthrax, (iii) rinderpest and (iv) cow pox and (v) tuberculosis.
- Proper disposal of dead livestock is a serious matter especially when the animals die of high infections diseases like anthrax, tuberculosis.
- Indiscriminate use of hormones for increasing milk production causes lot of discomfort and to pain the animals making it difficult for her to even walk.
- Aquaculture (Blue revolution) is a sustainable way of harvesting aquatic edible, crustaceans (lobsters and prawns). It helps to save the oceans or marine ecosystem from getting damaged.

**Notes****TERMINAL EXERCISE**

1. Define green revolution. Which were the two crops specially involved with 'Green Revolution' in the beginning?
2. Which was the wheat variety produced by Dr. M.S. Swaminathan and how?
3. What do the farmers do when the pests develop genetic resistance to certain pesticide?
4. Define pesticides. Mention two advantages of using pesticides.
5. Write brief notes on combined harvester, plough, land levelers, box drill.
6. Name four new areas of agricultural practices. Write a short note on poultry farming.
7. How do you define animal husbandry? Mention the food items that are provided by these animals.
8. Write the names of causal organism and animals affected with the following diseases
Foot and mouth disease
Pox
Tuberculosis
Anthrax
Rinderpest

**ANSWER TO INTEXT QUESTIONS****20.1**

1. Substantial increase of new crop varieties of wheat and rice using large quantities of fertilizers, pesticides and good irrigation.
2. 'Sarabti Sonora' a very desirable variety of wheat produced by mutation Sonara-64 by radiations of x-rays and gamma rays.
3. Fertilizers are substances that are generally applied to the soil to promote healthy growth of plants.
4. Organic fertilizers are environmental friendly and improves and enriches the soil.

20.2

1. Disease resistant plants variety do not require pesticides thus the environment is saved from pollution, also money spent on purchase of pesticides is saved.



2. Combine harvesters – It harvests the crops as well as separates the grains from the ears (threshing)

Ploughs- Turn the soil over which is very important to make the soil healthy and airy before sowing is done.

Land levelers – After ploughing the soil is leveled before sowing is done.

3. Plants can be grown under different situations thereby extending the area of cultivation.
4. Mushroom culture, bee-keeping or apiculture, poultry farming are newer practices which bring money and creates employment.

20.3

1. The indigenous breeds of cows are Sahiwal, Tharparkar, Red Sindhi, Foreign breed are Jersey, Brown Swiss, Holstein-Friesian.
2. Low milk yield in our country is due to: poor quality feed, shortage of feed and fodder, low milk yielding indigenous breeds.
3. Foot and mouth causal organisms virus- Blisters on the mouth, foot, excessive production of saliva, loss of appetite, high temperature, shivering.

Rinderpest causal organism Bacteria- Discharge from eyes, nostrils, loss of appetite, constipation followed by severe diarrhea.

Anthrax causal organism Bacteria- Swelling of body, fever, reduction in milk secretion.

20.4

1. Indiscriminate use of hormones to increase milk production causes extreme enlargement of udders of the animals which results in difficulty of movement and discomfort to the animals.
2. Aquaculture is the farming of aquatic organisms including fish, mollusks, crustaceans and aquatic plants. It is fish farming that is cultivating fish in a controlled environment (coastal or inland pond, lake, and reservoir) and harvesting when they reach desired size.
3. Over exploitation, habitat destruction, incidental mortality of non-target species, pollution.
4. Ecological aquaculture focuses on adequate farming system that preserves the aquatic environment in which they are suited and can be harvested in a sustainable manner.