Unit 4

Prevention and Control of Infectious and Contagious Diseases

Introduction

In this Unit, we will learn that besides controlling farm diseases and their transmission, it is equally important to know about the agencies involved in the control of animal diseases and the reporting mechanism for outbreak of diseases. You will also learn about the preventive measures to control the spread of diseases in farm animals. You will also learn how the movement of animals is responsible for the spread of animal diseases and the role of 'one health' approach and livestock value chain in animal disease control.

Session 1: Factors Responsible for the Spread of Diseases in Farm Animals

Disease is a condition of discomfort in an animal caused by pathogens like bacteria, virus, parasites (worms) and fungus.

Types of farm animal diseases

Table 4.1 lists some of the bacterial, viral and parasitic diseases affecting farm animals.

Table 4.1: Major bacterial, viral and parasitic diseases in cattle and buffaloes

Bacterial diseases	Viral diseases	Parasitic diseases
Anthrax	Foot and Mouth Disease (FMD)	Tapeworm infestation
Black quarter	Rabies	Hydatid cyst
Tetanus	Plague	Ascariasis
Tuberculosis	Pox	Babesiosis
Colibacillosis	Influenza	Theileriosis

Factors affecting spread of diseases

The following factors, in general, are responsible for the spread of diseases:

(i) *Genetic factors*: Exotic breeds of cattle are more susceptible to various pathogens as compared to indigenous breeds of cattle.

(ii) *Age factor*: Young animals have weak immunity as compared to mature animals and thus get infected with pathogens easily. For example, E. Coli infection is common in one-month old calves.

(iii) Poorly fed and unvaccinated animals easily get infected with pathogens.

(iv) Hot and humid climate and unhygienic farm practices propagate the pathogens at a faster rate.

Routes of disease transmission

Various diseases in farm animals are transmitted through the following routes.

(i) *Respiratory route*: When an infected animal coughs or sneezes, the pathogens are transmitted to other animals. For example, the spread of Influenza happens through the respiratory route.

(ii) *Digestive route*: When grass or water contaminated with dung or secretions of the infected animal is consumed by healthy animals, the disease gets transmitted. For example, Foot and Mouth Disease gets transmitted through the digestive route.

(iii) *Through wounds*: In case of an injury or wound on the animal, some of the pathogens can enter into the body of healthy animals through the wounded part and cause diseases like Tetanus.

Fig. 4.1: Routes of disease transmission in farm animals

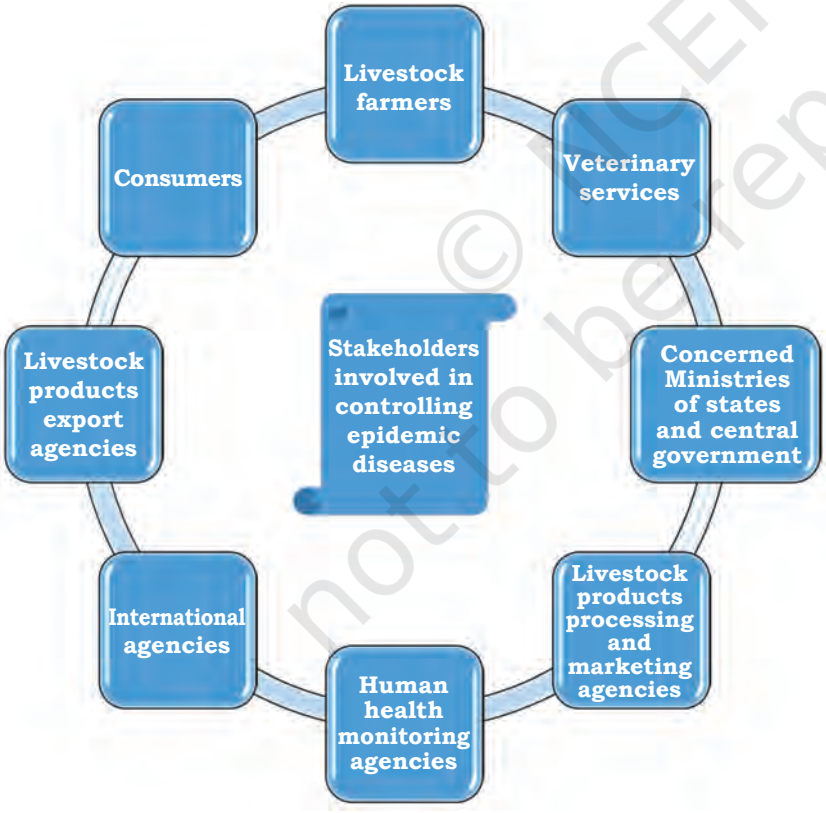

Fig. 4.2: Various stakeholders involved in controlling epidemic diseases

(iv) *Other routes*: Pathogens may transmit diseases among animals through vectors like ticks, mites, fleas, etc. For example, Babesia pathogen spreads through ticks. Some pathogens also spread through the reproductive tract and cause diseases like Brucellosis.

Fig. 4.1 summarises the different routes of disease transmission in farm animals.

Epidemic diseases

Animal diseases pose a big threat to the health of livestock and human beings. They cause economic loss to the farmers by: (a) causing death of productive animals, (b) reducing production of milk, eggs or wool and (c) decreasing fertility and reproductive capability in animals. The diseases that spread very fast and easily across the farms, regions and national boundaries are called epidemic diseases, for example, Foot and Mouth Disease in cattle.

Agencies involved in control of epidemic diseases

A successful programme for control of epidemic diseases is based on effective and efficient veterinary services and participation by farmers and other stakeholders. Such a programme must take into

consideration the culture and customs of producers and their value system along with many other factors. Control of epidemic diseases is a collaborative effort by various agencies and stakeholders like livestock farmer, veterinary services, exporters, etc., as shown in Fig. 4.2.

Trading of animals and animal products between countries and cross-border movement of animals and their products have given rise to the global issue of animal health. The laws and regulations in different countries regarding control measures and prevention of animal diseases are different. Hence, to have uniform standards on monitoring animal health and to minimise the spread of epidemic diseases, the World Organisation for Animal Health (WOAH) was formed. The WOAH is an intergovernmental organisation responsible for monitoring and improving animal health worldwide. A total of 180 countries are members of this organisation.

Measures for controlling outbreak of animal diseases

The chances of spread of animal diseases are greatly reduced if the measures shown in Fig. 4.3 are observed.

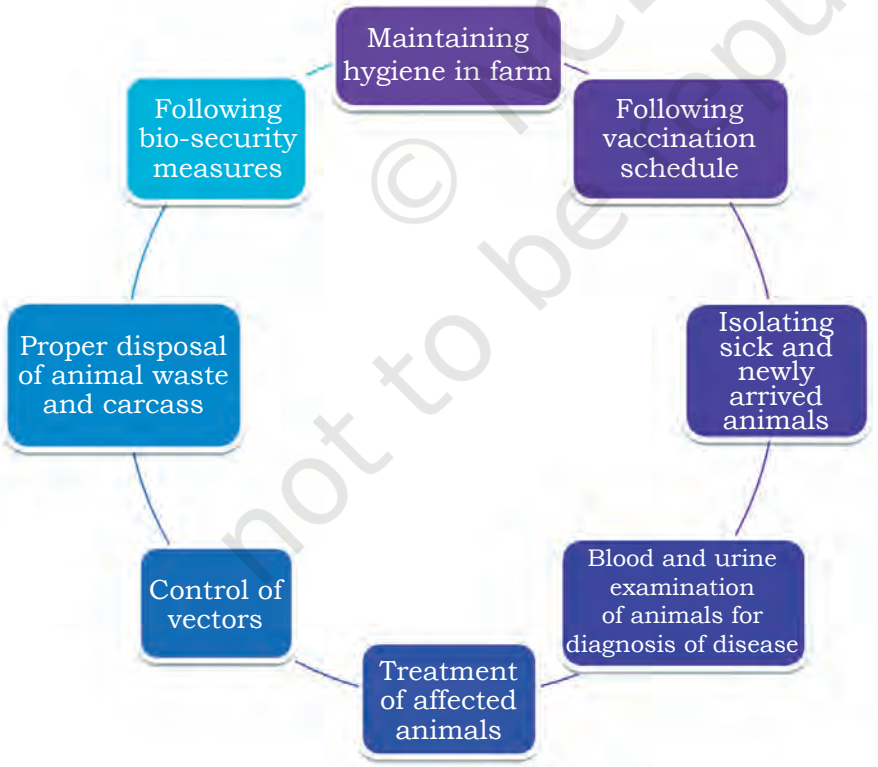

Fig. 4.3: Preventive measures for controlling outbreak of animal diseases

Infectious and contagious diseases

Despite the adoption of all the preventive measures, there are chances that some of the animal diseases may suddenly appear in animal farms and damage animal health in a short span of time. Such a situation is called outbreak of that disease.

Recognising the seriousness of such diseases' outbreak and their immediate control, the Government of India enacted the 'The Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009'. In this Act, some of the diseases have been listed as 'Scheduled diseases'.

Scheduled diseases

The animal diseases which are listed as scheduled disease have a serious impact on the health of livestock, international trade and public health. Anthrax, Bluetongue, Brucellosis, Anaplasmosis and Tuberculosis are some examples of scheduled diseases.

Reporting mechanism in case of epidemics in farm animals

Fig. 4.4 shows the reporting mechanism in case of suspected outbreak of animal disease. It is evident from

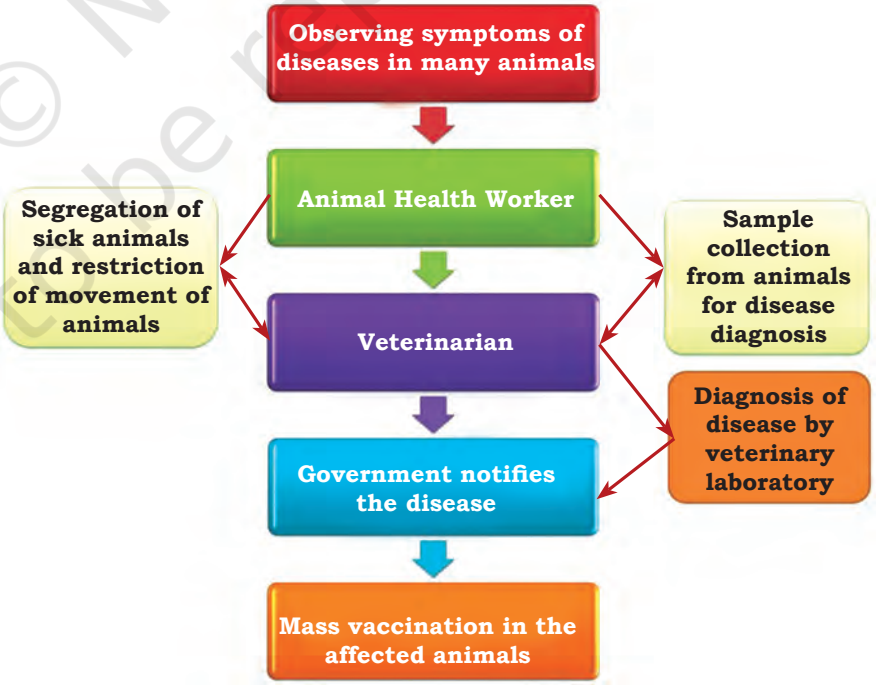

Fig. 4.4: Reporting process in case of outbreak of animal diseases

the figure how vital the role of an animal health worker is in reporting the outbreak of an epidemic as s/he happens to be the first person in this reporting process.

Practical Exercises

Visit a nearby livestock farm.

1. Note down the preventive measures taken by the farm workers in controlling the spread of animal diseases.
2. Search the records of the farm for the past six months and note down the animal disease reporting system followed there.

Check Your Progress

A. Multiple choice questions

1. Babesia pathogen is transmitted by
   (a) digestive route
   (b) respiratory route
   (c) ticks
   (d) wound
2. Which of the following is used for control and prevention of spread of animal diseases?
   (a) Vaccination
   (b) Bio-security
   (c) Hygiene
   (d) All of the above
3. Anthrax is a _____ disease.
   (a) parasitic
   (b) viral
   (c) bacterial
   (d) fungal
4. Which of the following statements is true for Scheduled diseases?
   (a) Listed under schedule
   (b) Impact on international trade
   (c) Impact on the health of livestock and public health
   (d) All of the above
5. In an animal disease outbreak condition, what does an animal health worker do?
   (a) Report to the Veterinarian
   (b) Segregation of suspected case
   (c) Restriction of animal movement
   (d) All of the above

B. Fill in the blanks

1. The international organisation that works for uniform standards for monitoring animal health diseases is _____.
2. The Prevention and Control of Infectious and Contagious Diseases in Animals Act was enacted in the year _____.
3. Diseases which spread fast and easily across farms, regions and national boundaries are known as _____.
4. E. Coli infection is common in young _____.

C. Mark True or False

1. Disease control is the sole responsibility of a veterinarian.
2. Poorly fed animals are more susceptible to diseases.
3. Exotic breeds of cattle are less susceptible to diseases.
4. Mass vaccination of animals is carried out to prevent outbreak of animal diseases.
5. Animal disease control programme is a collaborative effort by the producer, veterinary services, exporters and government agencies.

SESSION 2: DISEASES DUE TO MOVEMENT OF ANIMALS

Mass movement of farm animals

Livestock are moved from one place to another for meeting their requirements for water and feed. Such mass movements of animals are increasing day by day due to market pressures.

Livestock movement on a big scale is a major threat for spread of animal diseases as it spreads the pathogens from one area to another and introduce such pathogens to newer areas. Due to such unquarantined movements of animals on a big scale, the spread of highly contagious diseases of livestock like Foot and Mouth disease (FMD) and Rinderpest are witnessed periodically in our country.

Hence it is essential to record and quarantine the movement of animals to control diseases.

In India, livestock movement happens on a massive scale in the following ways —

(i) *Pastoralism*: Herdsmen along with their families and animals move constantly in search of water and pastures for grazing. Such herdsmen keep a large herd of animals like sheep, goats, cattle or camels with them and move to newer places with their herd.

Pastoralism — A practice still followed by some farming communities in the world where the animal growers move with their flock of animals from one place to another.

Courtesy: https://goo.gl/bJxXzP

(ii) *Trading*: Livestock and their products are taken from one location to another for farming, sale and consumption.

(iii) *Animal fairs*: In our country, animal fairs like the Pushkar Camel Fair and Sonepur Cattle Fair are

Courtesy: https://goo.gl/kxTtY7

Courtesy: https://goo.gl/RU2nzF

Animal trade fair

held for selling and buying of the livestock. These fairs attract large number of buyers, sellers and visitors from all over the country.

Prevention of diseases during animal movement

Observation of the following steps by various stakeholders such as farmers, herdsmen, consumers, traders, local governments, etc., can go a long way in prevention of diseases during movement of animals.

(i) Movement of animals from one location to another, within country and between countries is recorded.

(ii) Only legal movement is permitted. In our country, a large percentage of animals and their products are illegally transported.

(iii) Borders of adjoining countries are fenced to avoid illegal and unquarantined entry of animals.

(iv) All new animals undergo quarantine check-up. Quarantine rules require that the animals are isolated and closely watched for 14 days to rule out diseases and if animals are found infected, they are denied entry.

(v) Only disease-free and vaccinated animals are allowed to enter new areas. To achieve this end, European countries have introduced health cards for individual animals.

Methods for tracking animal movements

Recording of animal movements can be achieved by a combination of the following methods—

(i) *Through check posts*: Interstate and inter-country movement of livestock are recorded at the check posts.

(ii) *Through GIS (Geographical Information System)*: GIS is a cost effective and accurate system of recording animal movements and can be adopted by most nations where mass movement of livestock takes place.

(iii) *Tracking pastoral routes*: Movement due to pastoralism can be tracked and recorded.

The interrelatedness of animals' movement and their tracking for minimising spread of animal diseases is

therefore required to be carefully taken note of. The major methods for controlling spread of diseases due to movement of animals are shown in Fig. 4.5. The major methods of tracking of animal movement are shown in Fig. 4.6.

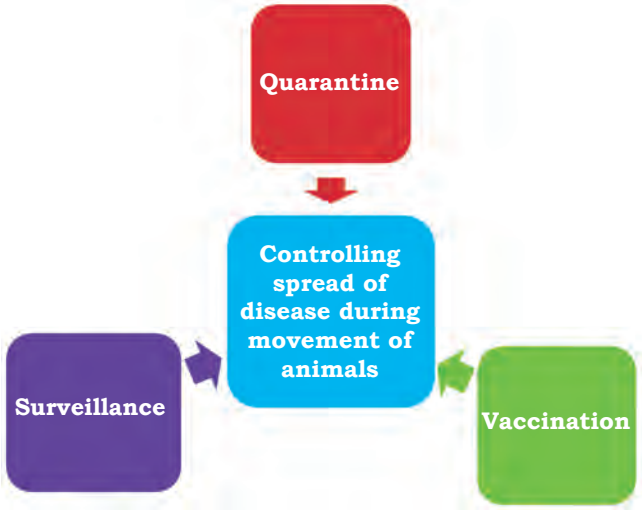

Fig. 4.5: Major methods for controlling spread of diseases during movement of animals

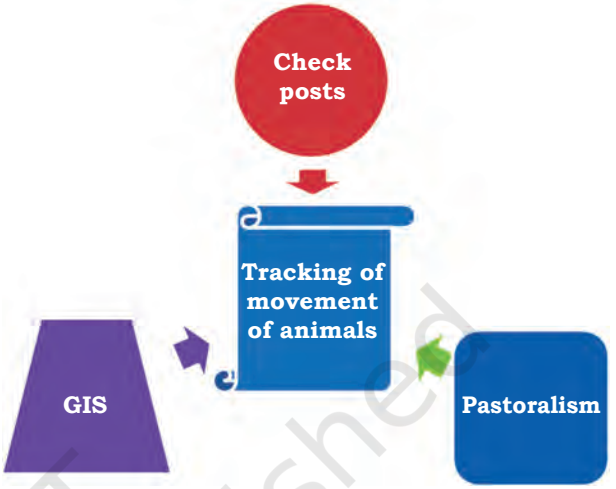

Fig. 4.6: Interrelatedness of animals' movement and their tracking

Fig. 4.7: Movement of a herd of sheep and goat led by a shepherd dog
Courtesy: https://goo.gl/HEdt1c

Practical Exercises

Visit a nearby check post.

1. Note down the recorded animal movement in that check post.
2. Draw suggestive outline of a GIS system for tracking movement of farm animals.

Check Your Progress

A. Multiple choice questions

1. Livestock movement takes place for the purpose of
   (a) trade
   b) trade fair
   (c) nomadism
   (d) All of the above
2. Which of the following is a method used for recording of animal movements?
   (a) Through GIS
   (b) Through check post
   (c) Though tracking nomadic routes
   (d) All of the above
3. Livestock movement is a major threat to
   (a) introduction of new pathogens
   (b) spread of Rinderpest
   (c) emergence of Ebola virus
   (d) All of the above
4. To control the spread of diseases due to movement of livestock, which of the following measures is taken?
   (a) Only legal movement is allowed
   (b) Only vaccinated animals are allowed entry
   (c) Only disease free animals are allowed entry
   (d) All of the above
5. Quarantine check-up prevents the entry of
   (a) healthy animals
   (b) diseased animals
   (c) new infection
   (d) Both (b) and (c)

B. Fill in the blanks

1. Herdsmen and their animals moving constantly in search of water and grazing places is known as _____.
2. Full form of GIS is _____.
3. _____ trade fair is organised at Pushkar every year.
4. Fencing of countries' border prevents _____ entry of animals.

C. Mark True or False

1. Newly arrived animals are not placed for the quarantine check-up.
2. Only disease-free and vaccinated animals are allowed movement to new areas.

3. Movement of animals from one location to another has led to the emergence of new diseases in human beings also.
4. GIS is a cost-effective and accurate system of recording animal movement.

SESSION 3: 'ONE HEALTH' APPROACH AND LIVESTOCK VALUE CHAIN

'One Health' approach

Health of human beings, animal and plant kingdoms and our environment are interdependent. 'One health' is a collaborative effort of multiple disciplines working locally, nationally and globally to attain optimal health for humans, animals including livestock, and the environment. 'One health' means taking care of health of one and all in totality. If the animals carry an infection, it may be transmitted to humans as well as to the environment. Similarly if the environment is polluted, it may adversely affect the health of all living beings. Approximately 75% of the new emerging diseases in humans are transmitted from animals.

Zoonotic diseases

The diseases, which spread from animals to humans and vice versa, are termed as 'zoonotic diseases'. Major zoonotic diseases having economic consequences are Rabies, Anthrax, Tuberculosis, Brucellosis and Nipah. Nipah is a zoonotic disease causing fatality in animals and humans. The disease is caused by fruit bats and has been responsible for many deaths in the state of Kerala in May 2018. Increased population, travelling and encroachment of territories of wild animals by humans are some of the factors responsible for the spread of zoonotic diseases.

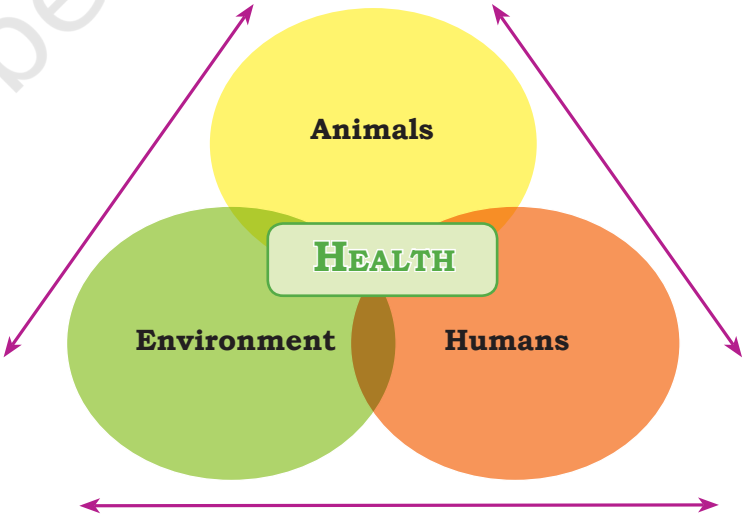

Fig. 4.8: One Health approach showing interdependence of environment, animals and humans

'One health' is a new multidisciplinary approach to control the diseases where experts from the human medicine, veterinary medicine, environmentalists and agriculturalists work for the production of healthy food, healthy animals, healthy environment and healthy human life. Fig. 4.8 illustrates the idea of 'One health'.

Objectives 'One health' approach

The following are the broad objectives of the concept of 'One health'.

(i) To have integration, cooperation and collaboration between human medicine, veterinary medicine and environmental science.
(ii) To expand the scientific knowledge base on interdependence of environment, animals and humans for optimum health.
(iii) To accelerate drug discoveries.
(iv) To improve human and animal health education.
(v) To improve human and animal health.

An example of 'One health' approach

Rabies is a viral disease affecting humans, dogs and farm animals. After the bite of a dog or other wild animals infected with Rabies, humans and animals show violent movements, uncontrolled excitement and fear of water. Further symptoms of Rabies include inability to move body parts, confusion, loss of consciousness and

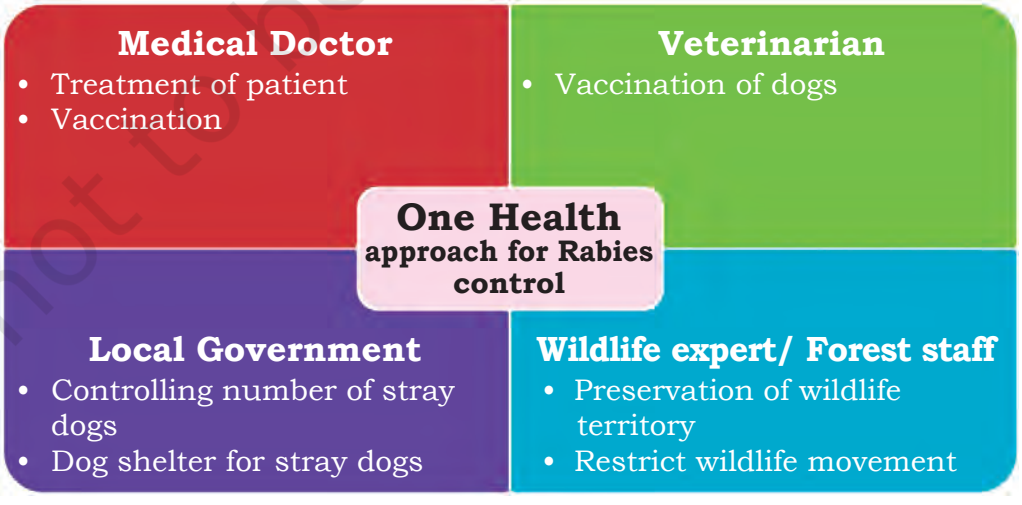

Fig. 4.9: Coordinated action by multiple agencies to control Rabies

finally death. Integrated efforts by the medical doctors, veterinarians and government agencies are required for control and eradication of Rabies. Fig. 4.9 explains the coordinated action by multiple agencies.

You may wonder how the wildlife expert and forest personnel come into the picture to control Rabies. Actually the wild foxes, jackals and bats are the reservoirs for Rabies virus. Therefore, if the wildlife territory is properly preserved with few animals moving towards human population, the incidence of Rabies will be greatly minimised, if not eliminated altogether.

Livestock value chain

Livestock are reared for farming and their products. From the stage of raw animal product to the final consumable product, a number of value addition steps are undertaken to increase profitability of the farmer. These different steps are components of the livestock value chain. This is explained with the example from goat farming. Farmers usually rear goats at the village level and sell them to traders or fatteners at the district level. These goats are then sent to the abattoir for slaughter and dressing of meat. Meat is sold in the market for household/hotel consumption or food processing industry to make various products for export. This shows that a number of steps are carried out at different processing points. A number of people are involved in bringing the product from producers (farmers) to the customers. This chain of activities, processes and groups of people is known as livestock value chain. Fig. 4.10 demonstrates the livestock value chain for goat meat production.

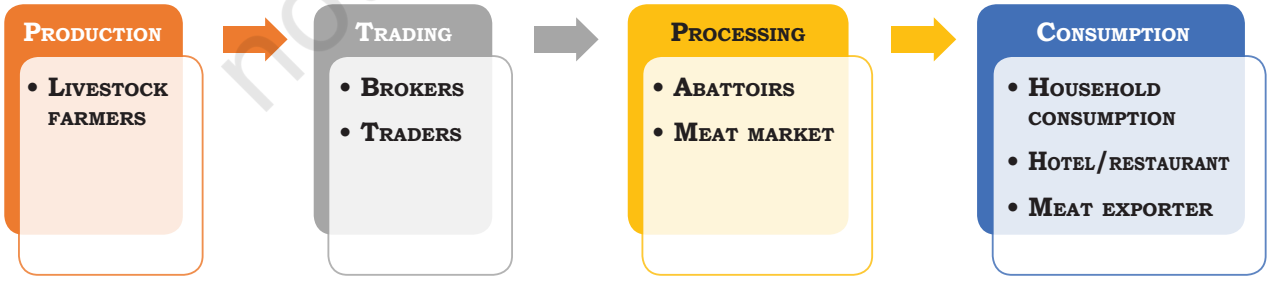

Fig. 4.10: Livestock value chain for goat meat production

Benefits of livestock value chain

(i) It helps to understand the problems and limitations of the market.

(ii) Livestock value chain helps to understand the needs of the market. Farmers can produce the needed product in the value chain and earn much more.

(iii) Usually farmers get only a small fraction of the actual profits when the products are sold through intermediaries. Livestock value chain can help the farmers to earn more by minimising the leverage of brokers and intermediaries.

(iv) Livestock value chain also helps in control of animal diseases. The knowledge of the livestock value chain of a product can help us to identify the animals and population at risk. The disease control measures can be applied to the targeted population at risk.

Practical Exercises

1. Make the livestock value chain for milk production in dairy cattle.
2. Visit a nearby dairy farm and record the value chain of their products from the producer to the consumer.

Check Your Progress

A. Multiple choice questions

1. Which of the following is an advantage of the livestock value chain?
   (a) Farmers can earn more
   (b) Effective disease control programme
   (c) Identification of population at risk
   (d) All of the above
2. 'One health' approach involves the
   (a) medical professionals only
   (b) experts from multiple disciplines
   (c) veterinarians
   (d) environmentalists

3. What is the aim of 'One health' approach?
   (a) To expand the scientific knowledge base
   (b) To accelerate drug discoveries
   (c) To have integration and collaboration between the human and veterinary medicine
   (d) All of the above
4. 'One health' approach is useful for
   (a) control of diseases in animals
   (b) control of diseases in human beings
   (c) safe environment
   (d) All of the above
5. Select the correct sequence of components of a livestock value chain.
   (a) Production, trading, processing and consumption
   (b) Consumption, processing, trading and production
   (c) Trading, processing, consumption and production
   (d) Processing, trading, production and consumption

B. Fill in the blanks

1. Diseases that spread from animals to humans and vice versa are known as _____ diseases.
2. _____ approach means taking care of the health of all in totality.
3. Livestock value chain links the producer to the _____.

C. Mark True or False

1. 'One health' programme is mainly concerned with the health of human beings only.
2. Majority of new emerging diseases in humans are known to be transmitted from animals.
3. Wildlife experts are not a part of 'One health' programme.
4. Tuberculosis can spread from animals to human beings.
5. Human encroachment in territories of wild animals is one of the major reasons for the spread of zoonotic diseases.

SESSION 4: BIO-SECURITY AND DISPOSAL OF FARM ANIMALS

Bio-security

Bio-security means the protection of farm animals against diseases and includes measures designed to protect the animal population against harmful biological or biochemical substances. Bio-security refers to various measures that are undertaken to stop the spread or introduction of harmful organisms to animals, human and plant life. The following bio-security measures are followed in animal farms to control the diseases.

(i) *Restricted access to livestock farm*: A livestock farm is secured by fences or walls to avoid the unauthorised entry of any person. By providing fences and walls, entry of wild animals can also be checked (Fig. 4.11).

(ii) *Provision of footbath*: A footbath of disinfectant like solution of phenol or slaked lime or solution of copper sulphate is kept at the entry and exit points of a farm gate to prevent the spread of pathogens in animals (Fig. 4.12).

(iii) *Use of personal protective equipment (PPEs)*: Animal health workers wear apron, gloves, mask, head mask and gumboots for their safety and security while handling the animals. They need to wash their hands with soap and sanitisers frequently.

Fig. 4.11: Restricted entry in a farm, as a bio-security measure

Fig. 4.12: Footbath at the entry of a farm gate

The following measures must be regularly undertaken in an animal farm to achieve maximum cleanliness—

(i) Cleaning and disinfecting the animal farm periodically is a must. It includes removing the used bedding and waste materials from the farm regularly (Fig. 4.13).

(ii) Dry scrubbing and thorough cleaning of the floors and walls to remove sticking organic matter.

(iii) Wet down the surfaces with detergent and water.

(iv) Scrubing and cleaning the area with fresh water.

(v) Spraying disinfectant (like phenol or bleaching powder) on the surface.

(vi) Cleaning the equipment, feed tubs and buckets with detergent and fresh water.

(vii) In case of a disease outbreak, animal farm is fumigated with formalin and potassium permanganate in the ratio of 2:1.

(viii) Waste generated in the animal farm like manure, feeds, debris, etc., are disposed off by burial or burning.

Fig. 4.13: Farm workers cleaning paddock

Fig. 4.14: Farm worker cleaning shed with water

Culling and disposal of farm animals

Culling

Culling means removal of undesirable animals from the herd. Some of the animals become undesirable due to various reasons like: (a) poor production, (b) poor reproductive ability or sterility, (c) stunted growth, (d) incurable illness, (e) diseases like Tuberculosis, Johne's disease, Brucellosis, and (f) one or more quarters of the udder being non-functional due to chronic Mastitis. Culling is an effective means of disease control in chronically diseased animals.

Disposal of animal carcass

The dead body of an animal is called carcass (Fig. 4.15). An animal carcass is a source of infections, therefore its proper disposal is a regulatory requirement. The following precautions and methods are followed for the disposal of an animal carcass.

Fig. 4.15: Calf carcass after some moments of death

(a) Precautions for carcass disposal

(i) Wear personal protective equipment while handling the animal carcass.

(ii) Avoid direct contact with the dead animal's blood, urine, faeces, etc.

(iii) Avoid contact with the dead animal's parasites like lice, ticks, mites, etc.

(iv) If a carcass for disposal is required to be transported then place it in a plastic body bag and seal it immediately.

(b) Carcass disposal methods

Any one of the following disposal methods can be adopted for the proper disposal of animal carcass.

(i) *Burial*: Burial is a commonly used method. In this method, animal carcasses are disposed in a deep pit, followed by covering it with layers of lime and soil.

(ii) *Burning*: Burning is a well-established procedure where wood or fire beds soaked in kerosene or diesel are kept around the animal carcass and ignited with fire. Care is taken to keep away the vehicles and burning materials from the ignition point.

(iii) *Incineration*: In this method, animal carcasses are incinerated in an incinerator which is a fixed machine fuelled by natural gas or electricity. The whole carcass is burned and reduced to ashes. This method effectively inactivates the pathogens but is quite expensive.

Practical Exercises

1. Visit a nearby livestock farm. Note down the farm cleaning and disinfection procedure practised in the farm.
2. Collect labels of at least two disinfectants used in your surroundings. Note down the active disinfecting chemical in the disinfectants.

Check Your Progress

A. Multiple choice questions

1. A carcass can be disposed by the following method:
   (a) Burial
   (b) Burning
   (c) Incineration
   (d) All of the above
2. Bio-security means
   (a) Security of farm premises
   (b) Personal security
   (c) Prevention of release of pathogens in the environment
   (d) All of the above
3. Bleaching powder is a
   (a) disinfectant
   (b) antibiotic
   (c) antiseptic
   (d) detergent
4. Which of the following is taken care of while disposing an animal carcass?
   (a) Wear personal protective equipment
   (b) Avoid direct contact with the dead animal's blood.
   (c) Avoid contact with the dead animal's parasites.
   (d) All of the above
5. Which of the following steps is involved in cleaning and disinfection of a farm premises?
   (a) Scrubbing and removal of waste
   (b) Cleaning with detergent and water
   (c) Spraying of disinfectant
   (d) All of the above

B. Fill in the blanks

1. Removal of animals from the herd is known as _____.
2. _____ is a fixed machine fuelled by natural gas or electricity used for the disposal of animal carcass.
3. An animal carcass is covered with the layer of lime and soil in _____ method of carcass disposal.
4. _____ is a set of institutional and personal security measures to prevent the release of pathogens and infection in the environment.

C. Mark True or False

1. In case of outbreak of a disease, animal farm is fumigated with formalin and potassium permanganate crystals.
2. Incineration is a cheap method for carcass disposal.
3. A footbath is kept at the entry and exit points of animal farm to prevent the spread of pathogens.
4. An animal farm can allow many visitors.
5. An animal farm need not be secured by fences and doors.

Glossary

Bio-security: *The protection of the environment and health of living things from diseases, pests and bio-terrorism.*

Disease: *A disorder of structure or function in a human, animal, or plant, especially the one that produces specific symptoms.*

Disinfectant: *A chemical liquid that destroys bacteria.*

Epidemic: *An outbreak of an infectious disease that spreads more quickly and more extensively among a group of animals at a particular time.*

Immunity: *The ability of an organism to resist a particular infection or toxin by the action of specific antibodies or sensitized white blood cells.*

Prevalence: *Prevalence is a measurement of all individuals affected by the disease at a particular time.*

Zoonotic disease: *A disease spread between animals and humans or humans to animals.*