Draft Study Material

Small Poultry Farmer

(QUALIFICATION PACK: Ref. Id. AGR/Q4306)

SECTOR: AGRICULTURE

Grade 11

विद्यया ऽमृतमश्नुते

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NCERT

PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
(a constituent unit of NCERT, under MoE, Government of India)
Shyamla Hills, Bhopal- 462 002, M.P., India
www.psscive.ac.in

Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives. The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material. Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material. This material is copyrighted and should not be printed without the permission of the NCERT-PSSCIVE.

Deepak Paliwal
(Joint Director)
PSSCIVE, Bhopal

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STUDY MATERIAL DEVELOPMENT COMMITTEE

MEMBERS

Amitava Bhattacharya, Assistant Professor, College of Veterinary Science and Animal Husbandry, Mathura, Uttar Pradesh, India

Giriraj Goel, Assistant Professor, College of Veterinary Science, NDVSU, Jabalpur, Madhya Pradesh, India

Om Prakash Dinani, Assistant Professor, College of Veterinary Science and Animal Husbandry, Durg, Chattisgarh, India

Ram Chandrakant Kulkarni, Assistant Professor. College of Veterinary Sciences, Udgir, Maharashtra, India

S.H. Mirza, Deputy Director Veterinary Services (Retd.), Government of Madhya Pradesh, India

T. P. Vaidya, Deputy Director Veterinary Services (Retd.), Government of Madhya Pradesh, India

MEMBER-COORDINATOR

Dr. Rajiv Kumar Pathak, Professor and Head, Department of Agriculture and Animal Husbandry, PSSCIVE, Bhopal.

Dr. Kuldeep Singh, Assopciate Professor, Department of Agriculture and Animal Husbandry, PSSCIVE, Bhopal.

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Module 1
Overview of Poultry Farming

Module Overview

Birds domesticated for meat and egg production are included in poultry. Thus, poultry include chicken, duck, Japanese quail, turkey, guinea fowl and emu. The domestication of poultry took place around 4500 years ago when people hatched and reared young birds from the eggs collected from the wild. Such practices evolved into keeping the birds permanently in captivity with improvements in feeding, housing and selective breeding or fast growth, increased egg laying etc. over a period of centuries. As a result, the modern breeds of poultry look quite different from their wild ancestors.

Among the different species reared under poultry, chicken is the predominant species in India. Birds reared specifically for table egg production are known as layers, while those reared specifically for meat production are termed as broilers. However, in recent time government has placed emphasis on Rural Poultry Farming (RPF) and to promote it various government institutions and private hatchery companies have developed dual purpose chicken varieties. The dual-purpose chicken birds may be reared for production of either egg or meat.

Poultry farming has many benefits. As compared to crop production or dairy farming, very less capital is required with less space for poultry production. The government have many financial schemes for poultry entrepreneurs to increase their income. A large untapped supply potential for poultry products both at national and global level exists in our country with faster returns in less time. The various benefits of poultry farming are shown in Fig.1.1.

Learning Outcomes

After completing this module, you will be able to:

- Describe the various opportunities within the poultry industry and understand the roles and functions of a small poultry farmer, including business management, production practices, and market strategies.
- Explain the essential components of a well-designed poultry farm layout and identify the characteristics of a good poultry housing system that promote bird health, productivity, and welfare.

- Discuss the best practices for maintaining cleanliness and hygiene in a poultry shed, including regular cleaning protocols, biosecurity measures, and disease prevention strategies.
- Demonstrate knowledge of the proper procedures for the disposal of poultry waste, emphasizing environmental sustainability, legal compliance, and effective waste management techniques.

Module Structure

- Session 1: Opportunities in the Poultry Industry and the Roles and Functions of a Small Poultry Farmer
- Session 2: Layout of Poultry Farm and Characteristics of a Good Poultry Housing System
- Session 3: Practices Adopted for Maintaining Cleanliness and Hygiene in Poultry Shed
- Session 4: Procedure for Disposal of Poultry Waste

Session 1: Opportunities in the Poultry Industry and the Roles and Functions of a Small Poultry Farmer

History of poultry farming in India

Domestication of poultry dates back to Indus Valley Civilization. During British era, modern poultry farming on scientific lines was started by Christian missionaries. The first poultry farm was established in Etah in 1912. Thereafter, poultry farming gained a momentum during World War II for fulfilling the protein requirements of the armed forces. After independence, steps were taken up to uplift this sector through various Five-Year plans.

Today, India has made a quantum jump in the field of poultry production in the past few decades. This transformation has been possible due to improvements in breeding, health, nutrition, management and processing aspects. The poultry industry has grown largely due to private initiatives and support from veterinary health, feed and equipment industry. Tamil Nadu, Andhra Pradesh and Telangana are first, second and third in poultry population whereas Assam (71.63%) and West Bengal (46.34%) have registered maximum growth in poultry population during the year 2012 to 2019.

Current status of poultry sector in India

Currently, the poultry is one of the fastest growing segments of the agricultural sector in India. Chicken meat is growing at a faster pace than other meat like mutton and pork. During the last ten years, chicken meat production grew at an annual growth rate of 8% compared with mutton (4.9%).

In India, chicken is considered a much healthier source of animal protein. Total chicken population has registered an annual growth of 8% in the last decade. The poultry sector in India is worth around Rs. 80,000 crore (2018-19). Fig.1.2 explains the categories of the poultry sector in India.

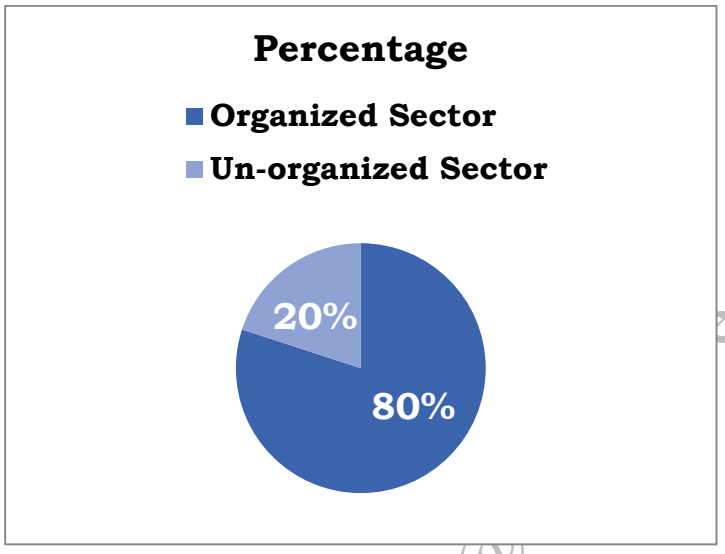


Fig .1.2: Categories of Poultry Sector in India

Unorganized sector

This sector comprises of back yard poultry by farmers and also plays a key role in supplementary income generation and family nutrition to the poorest of the poor. The needs of organized and unorganized sectors are very different.

Organized sector

This sector comprises of commercial poultry which includes layer farming, broiler farming, parent layer and broiler farming.

Roles and functions of a small poultry farmer

Poultry sector has a great potential for providing employment opportunities to the small poultry farmer which are described in Fig. 1.3.

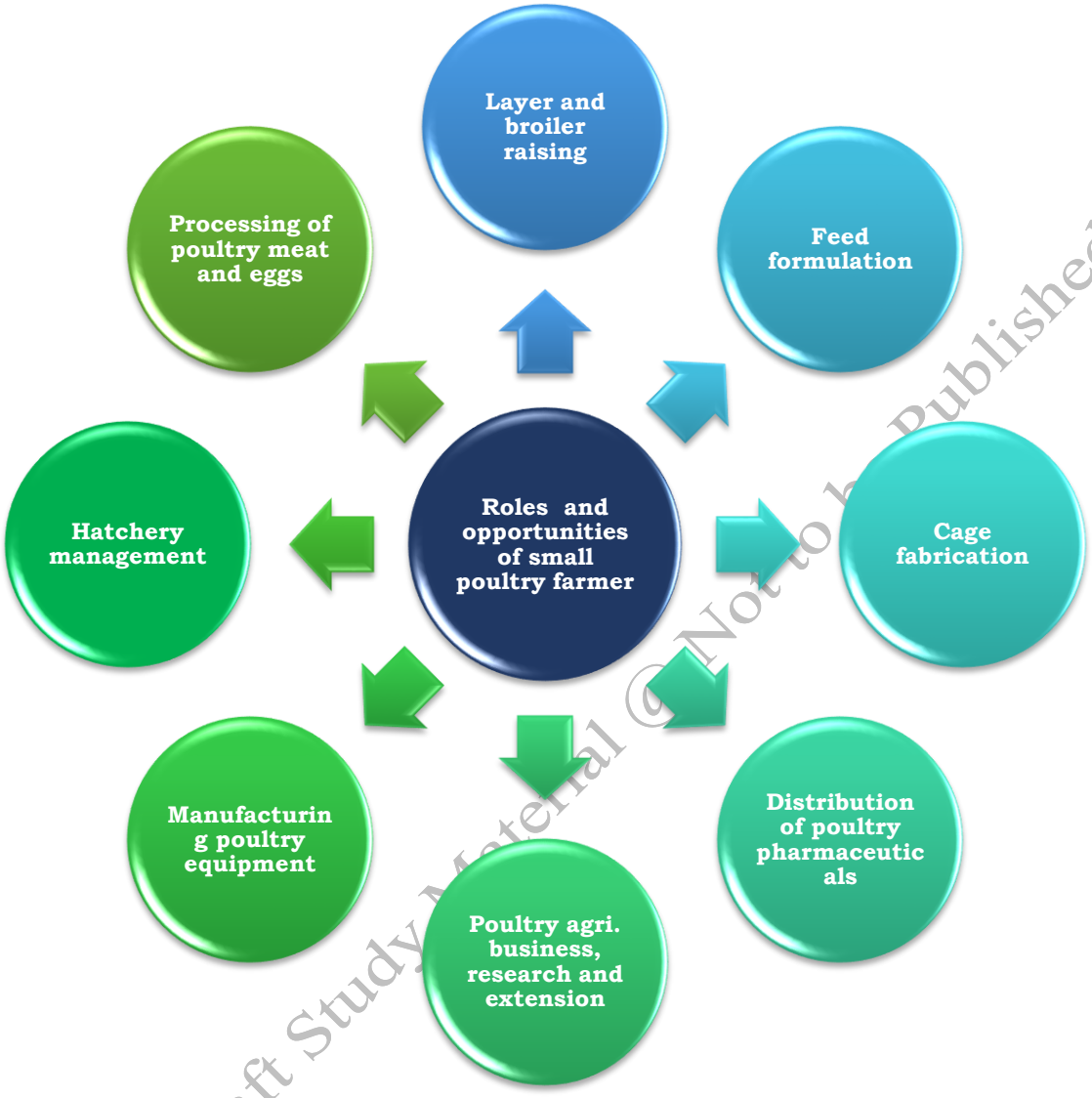


Fig. 1.3: Roles and opportunities for a small poultry farmer

Opportunities and scope in poultry industry

At present, India accounts for a very good share in poultry production and contribution worldwide. This is mainly due to the advances made in genetic improvement, nutrition, disease control and scientific management practices. Indian poultry industry has been growing at the rate of 20-25% during recent decades, faster than any other meat sector in the country.

India is the world's third largest egg producer with an annual egg production of 88.1 billion eggs and 4th largest broiler production with an annual 480 million broiler birds. Poultry development in the country has made great

progress in certain parts of Andhra Pradesh, Punjab, Haryana and Maharashtra, whereas many of the northern and eastern states lag behind in this sector.

However, the demand at present is about 10-15% higher than the supply. The gap in availability and requirement of per capita Indian is shown in Fig.1.4.

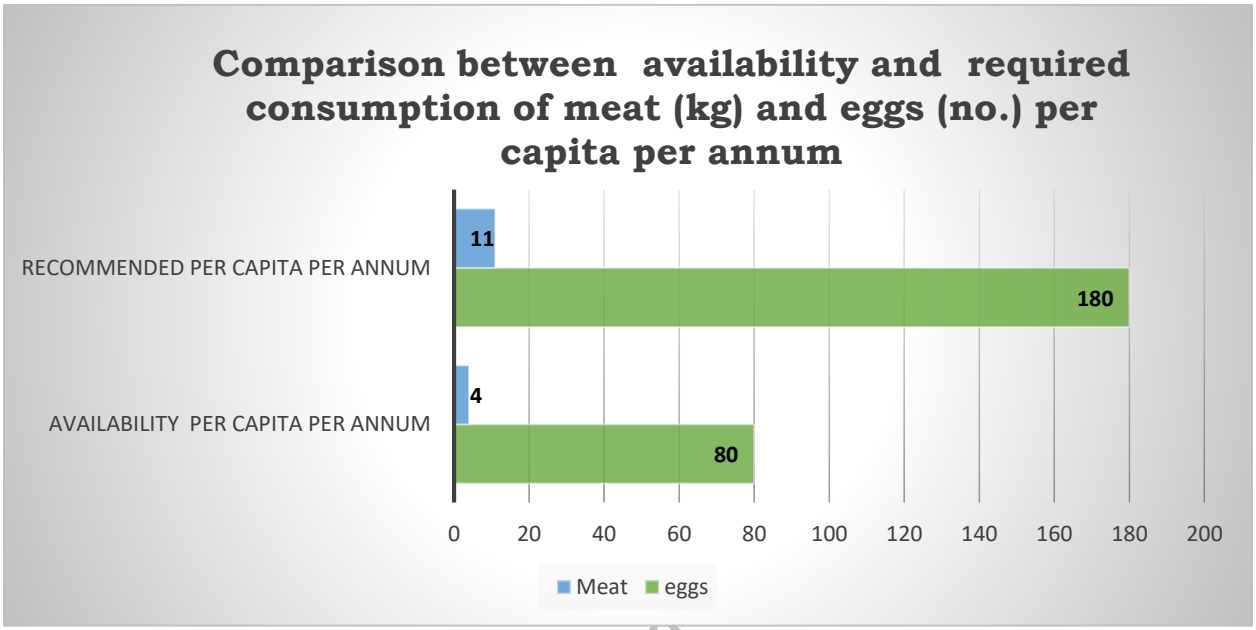


Fig. 1.4: Comparison between availability and required consumption of meat (kg) and eggs (no.) per capita per annum

The above figure iv clearly shows that there is a large gap between supply and demand of poultry products which indicates a huge potential for poultry industry. The leading states in poultry production in the country are given in Table 1.1.

Table 1.1: Leading States in Poultry Production in India (Year: 2020)

States	Poultry Population in million
Andhra Pradesh	161.33
Tamil Nadu	117.35
Maharashtra	77.79
Karnataka	53.44
West Bengal	52.84

Rest of the states	266.45
Grand Total	729.21
Source: https://tinyurl.com/fafnx294	

Roles and functions of the small poultry farmer

Small-scale poultry farming includes rural/backyard poultry farming and/ or small-scale commercial broiler/ layer farming. If poultry is mainly kept in rural/ tribal areas for home consumption of eggs and meat, costs and efforts can be kept to a minimum. But a small-scale poultry enterprise either as a backyard farming or as small-scale commercial broiler/ layer farming, must have a steady supply of improved germplasm, reasonably fair priced quality feed and easy availability of vaccine and medicines in addition to a reliable market for its products. There is evidence that investments in the small-scale poultry farming generate handsome returns and contribute to poverty reduction, employment generation and ensured food security in rural and tribal areas.

A small poultry farmer may start either backyard poultry farming or small-scale commercial broiler and/ or layer farming. Further, a small poultry farmer should have a basic idea of routine management practices to be adopted at a poultry farm, feed ingredients used for preparation of the feed, type of feed to be used and basic health issues. As feed accounts for around 70% of the total cost of poultry production, judicious use of the feed is essential. Further, it's also necessary that vaccination and other biosecurity measures must be adopted to ensure hygiene and sanitation for sustainable production and maximizing profitability.

Activities

Visit a nearby poultry farm recognize and make a note of the basic ingredients used in making poultry feed.

Requirement: Nearby poultry farm, observation note-book, pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note of the ingredients used in making the poultry feed there.
- Discuss with your class mates.

Check Your Progress

Multiple Choice Questions

1. The chicken population registered an annual growth during the years 2010 -2020 of

   (a) 15 % (b) 10 %

   (c) 20 % (d) 8 %

2. Indian poultry industry has been growing at the rate of

   (a) 20-25 % (b) 15 -20%

   (c) 10-15 % (d) 5-10 %

3. India ranks in egg production

   (a) First (b) Second

   (c) Third (d) Fourth

4. The demand of poultry products is higher than its supply by

   (a) 10-15 % (b) 15-20 %

   (c) 20-25 % (d) None of the above

5. In India, out of the total poultry population, the organized poultry sector contributes

   (a) 10 % (b) 20 %

   (c) 30 % (d) 80 %

Fill in the Blanks

1. The poultry industry has grown largely due to ..... with support from.....
2. Chicken raised for eggs are known as.....
3. Chickens raised for meat are known as.....
4. The unorganized sector comprises of.....
5. The organized sector comprises of.....

Mark True or False

1. Chicken is considered much healthy source of animal protein as compared to chapatis.
2. The size of poultry sector in India is around Rs. 80,000 crores.

3. Organized sector comprises of backyard poultry.
4. India is world's second largest broiler producing country.
5. Maharashtra is the leading state in poultry production in India.

Session 2: Layout of Poultry Farm and Characteristics of a Good Poultry Housing System

Efficient housing is one of the important aspects for the successful rearing of poultry birds. As a good poultry house provides the birds protection from theft, wild animals, extremes of weather and diseases. Thereby increases their overall productivity in terms of egg and meat production.

The general principles of layout of a poultry farm

The general principles of layout of a poultry farm are given in Fig. 1.5.

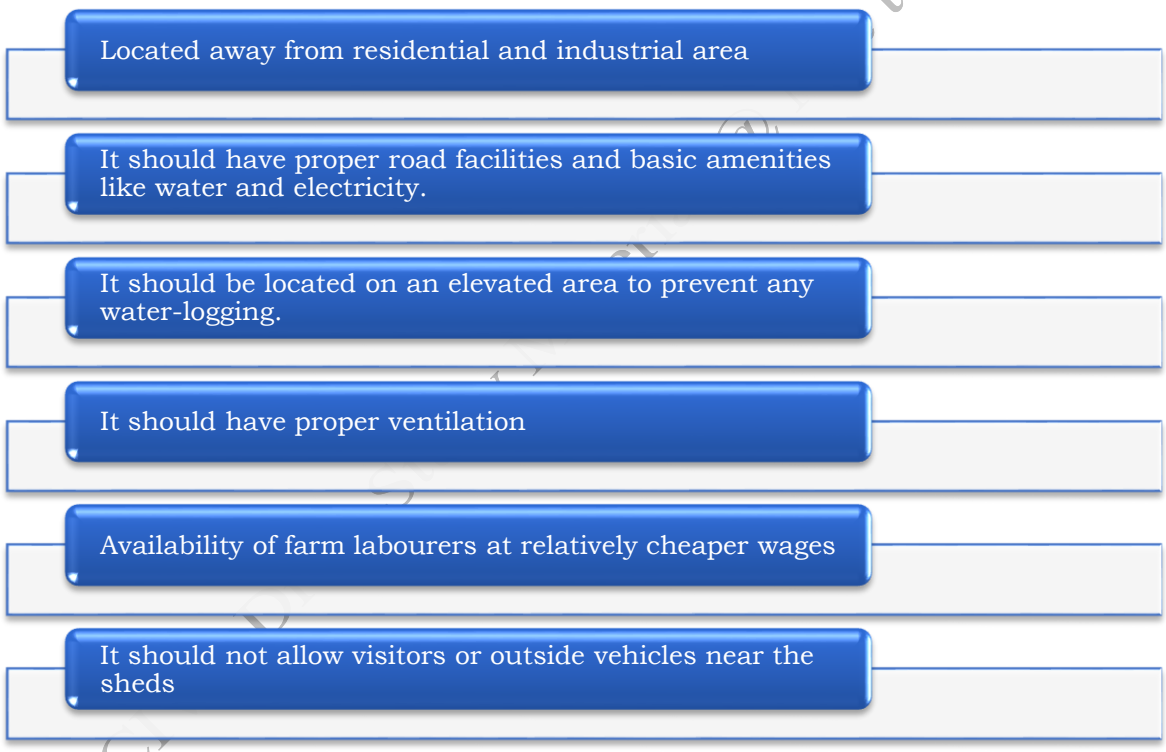


Fig 1.5: General principles of layout of a poultry far

Characteristics of an ideal poultry farm

Characteristics of a poultry farm are given in Fig. 1.6.

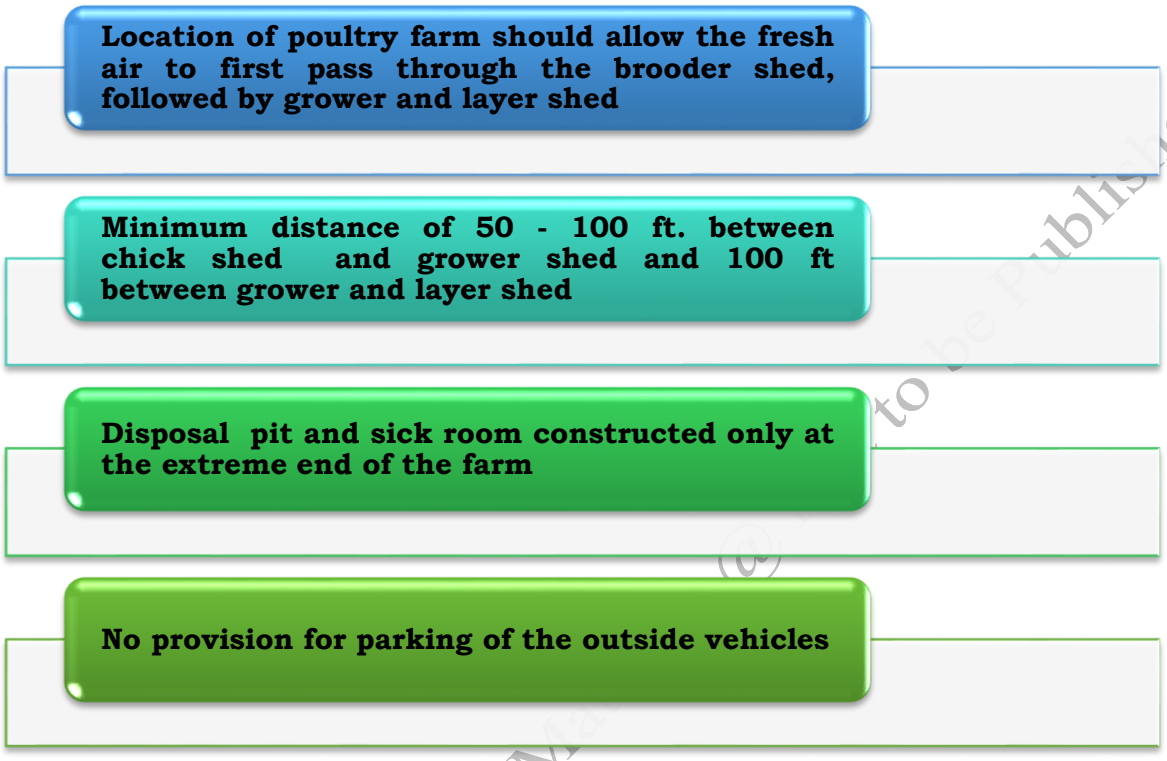


Fig. 1.6: Characteristics of a poultry farm

Type of poultry housing system

A number of poultry housing systems are in use to provide birds with feed, water, protect them from weather, injuries, provide fresh air, provides space for movement for maximum production. The classification of different types of housing systems is given in Fig. 1.7.

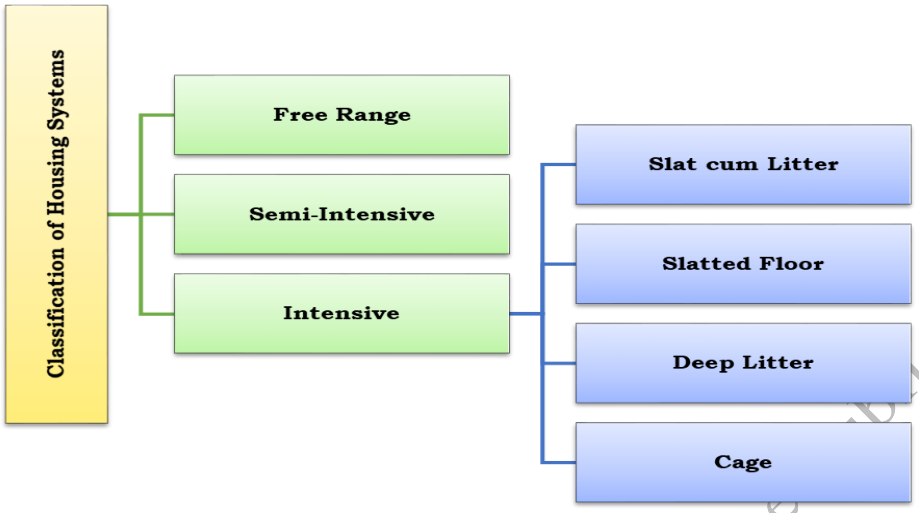


Fig. 1.7: Classification of housing systems

Free range housing system

In this system the birds are allowed to roam freely outside for some time in a day rather than being confined in an enclosure. The salient features of the free-range system and its advantages are as follows:

- This system is adopted only when adequate land is available
- Up to 250 adult birds per hectare of land can be reared.
- All categories of birds can be reared in this system and is most preferred for organic egg production.
- Main advantages are that the feed requirements are less since birds consume fairly good amount of feed from the grassland itself. Apart from this, the fertility of the soil is also maintained through their litter.
- Requires low-inputs and supports rural communities by utilizing the family farm.
- Temporary shelter is also provided.

Semi-intensive housing system

In this system, birds are reared both inside the house and on ground or range (Fig.1.8). Following are the other salient features of this housing system:

- The birds can forage on natural vegetation and insects to supplement the feed supplied i.e., birds are confined to houses in night or as per need and in the day time they are given access to feed on the grassland or natural vegetation.
- A small house is prepared to protect them from inclement weather, predators at night and offer shade in the daytime.
- The feeding and watering facilities are provided in the pen.

Fig. 1.8: Semi-intensive housing system

Intensive Housing System

By an intensive housing system, we mean a housing system where the stocking density of birds is high. It is the most efficient and convenient system for large scale modern poultry production. Four types of intensive housing systems are in use *viz.* deep litter, slatted floor, slatted cum litter and cage. Out of these four systems, deep litter and cage systems (Fig.1.9 & 1.10) are widely used.

Fig. 1.9: Deep litter housing system

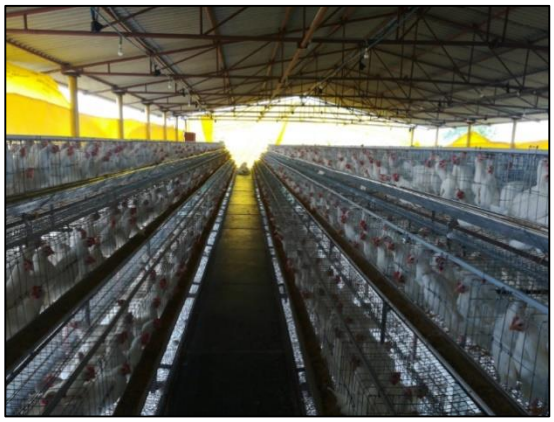


Fig. 1.10: Cage housing system

Deep litter system

In this system, the birds are kept inside the house all the time. Arrangement for feed, water and nest are made inside the house. The birds are kept on suitable litter material of about 3" to 5" depth. The word litter is used for fresh litter

material spread on the floor. Usually, paddy husk, saw dust, ground nut hulls, chopped paddy straw or wood shavings are used as litter material.

Cage system

At present, 75% of commercial layers in the world are kept in cages. In this system, poultry are raised on wire netting floor in small compartments, called cages. The cages are either fitted with stands on floor of house or hanged from the roof. This system is very efficient for laying birds. Feeders and waterers are attached to cages from outside except nipple waterers, for which pipeline is installed through or above cages. Auto-operated feeding trolleys and egg collection belts are also be used in this rearing system. The droppings are either collected in trays underneath cages or on belts or on the floor or deep pit under cages, depending on type of cages.

Characteristics of a good poultry housing system

Besides the selection of an appropriate housing system for birds, it is essential that the chosen housing system should possess the following characteristics as shown in Fig.1.11.

Fig. 1.11: Characteristics of a good housing system

Design and layout of a small poultry farm

A small size poultry farm doesn't require any special design and layout as it involves construction of only one house. The basic design and layout features of a small poultry farm:

1. The sheds should be so located that the fresh air first passes through the brooder shed, followed by grower and layer sheds. This prevents the spread of diseases from layer houses to brooder house.
2. There should be a minimum distance of 50-100 feet between chick and grower shed and the distance between grower and layer sheds should be of minimum 100 meter.
3. The egg store room, office room and the feed store room should be located near entrance to minimize the movement of people around the poultry sheds.
4. The disposal pit and sick room should be constructed only at the extreme end of the site.
5. Layout should not allow visitors or outside vehicles near the birds.

The following Table 1.2 describes the layout of a typical small poultry house

Table 1.2: Parameters of a Small Poultry Farm

Parameters	Characteristic Features
House Orientation (Direction)	As India has a warm climate in maximum part of the year, so the long axis of the house should be in east-west direction so that the direct sunlight over the birds is avoided.
Size	The size of the house depends on the number of birds to be reared.
Length	The length of the house can be of any extent. The number of birds reared and availability of the land determines the length of poultry house
Width	Should have a width not more than 22 to 25 feet in an open sided house in order to allow ample ventilation and aeration at the mid-portion.
Height	The height of the sides from foundation to the roof line should be 6 to 7 feet (eaves height) and at the center 10 to

	12 feet. In case of cage houses, the height is decided by the type of cage arrangements (3 tier or 4 tier)
Foundation	The foundation of the house should of concrete with 1 to 1.5 feet below the surface and 1 to 1.5 feet above the ground level
Floor	The floor should be made of concrete with rat proof device and free from dampness. The floor of the house should be extended 1.5 feet outside the wall on all sides to prevent rat and snake problems
Doors	The door must be open outside in case of deep-litter poultry houses. The size of door is preferably 6 x 2.5 feet. At the entry, a foot bath should be constructed to fill disinfectant mixed with water
Side walls	The side wall should be of 1-1.5 feet height, and generally at the level of bird's back height. This side wall protects the bird during rainy days or chill climate and also provides sufficient ventilation. In case of cage houses, no side wall is needed
Roof	The poultry house may be thatched, tiled, asbestos or concrete one depending upon the cost involvement.
Overhang	The overhang of the roof should not be less than 3.5 feet in order to prevent the entry of rain water into the shed

Lighting in poultry farm

Birds have well defined requirements for optimum effective lighting. Therefore, lighting management is essential in poultry management.

Importance of lighting

Lighting can influence the onset of lay, early egg size and the total number of eggs produced. Lighting needs vary depending upon the type of housing used for the birds. Care is taken to maintain light intensity at the defined levels. Rearing of birds for egg production is associated with the duration and intensity of the light received by the bird daily.

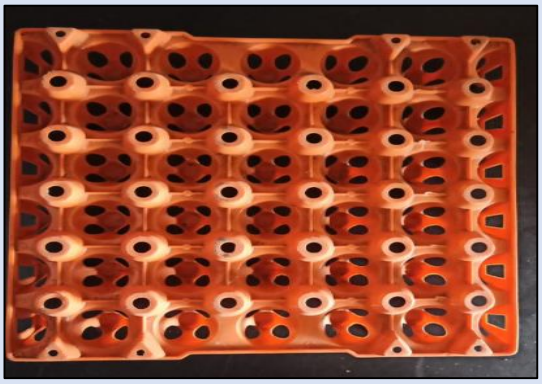
Requirement of light for birds

Grower birds require natural light only. However, for layer birds above 18 weeks of age, a gradual increase of 30 minutes per week is done till light period reaches 16 hours per day. The total duration of light includes 12 hours of day light and 4 hours of artificial light (bulb). A 40-watt bulb fixed at 7 ft. height meets the requirement to illuminate 100 sq. feet area.

Tools and equipment

Good equipment is a pre-requisite for profitable poultry production**.** The equipment varies with kind of birds (meat and egg type) and also with the age of the birds. Some common tools and equipment regularly used in small poultry farms are given in Table 1.3.

Table 1.3: Common Tools and Equipment Used in Small Poultry Farm

1.	*Egg Tray*		Used for collection of eggs and their marketing
2.	*Chick Box*		Used for packing of chicks for delivery to poultry farmers. A chick box can accommodate a maximum of 80 chicks

<table>
<tr>
<td>3.</td>
<td>Brooding Equipment</td>
<td>

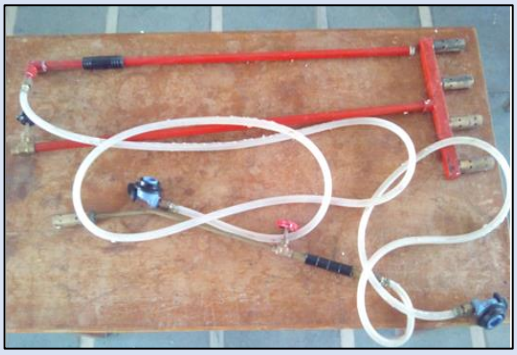
a. Charcoal Brooder

b. Gas Brooder

c. Electric Brooder
</td>
<td>Brooder equipment is used to provide warmth and light during the first few weeks of life. The brooders consist of some heating source, reflectors to reflect the heat and light towards the chicks, light and heat adjustment devices such as stands, thermostats and other accessories, depending on the type of brooder.</td>
</tr>
<tr>
<td>4.</td>
<td>Chick Guard</td>
<td>  </td>
<td>Chick guards are used to restrict the movement of chicks and prevent them from going too far from the heat, feed and water.</td>
</tr>
</table>

5.	*Feeder*	 i. Linear Feeder  ii. Circular Feeder	Feeders supply simultaneous feeding opportunities to all the birds and reduce wastage of feed.
6.	*Waterer*	 i. Manual Waterer	Waterers are of many sizes and shapes and provide clean drinking water to the birds.

		 ii. Bell Waterer	
7.	*Vaccination Equipment (Vaccinator)*		It is used to inject different vaccines in different doses in the birds.
8.	*Beak Trimmer (Debeaker)*		It is electrical equipment used to cut a portion of beak in order to prevent cannibalism among birds.
9.	*Nest Box*		It is used to get clean egg and to avoid floor egg.

10.	*Raker*		It is used to rake the litter material in deep litter system
11.	*Sprinkler*		The sprinklers are used to cool the roof of the house
12.	*Sprayer*		It is used for spraying disinfectants and sanitizer
13.	*Flame gun*		It is used to destroy the external parasites (ticks and mites) residing in cracks and crevices

Activities

Visit a nearby poultry farm and observe its layout and the various facilities available at the farm.

Requirement: Nearby poultry farm, observation note-book, pen

Step by step process

- Go to a nearby poultry farm with your teacher.
- Note down the layout of the farm and dimensions of shed, number of birds and work out space per bird.
- Enlist the materials used for construction of poultry sheds.
- Observe the facilities provided for rearing of birds.
- Enlist the tools and equipment used at poultry farm.
- Discuss with your class mates.

Check Your Progress

Multiple Choice Questions

1. Maximum number of chicks that can be accommodated in a chick box are

   (a) 100 (b) 80

   (c) 70 (d) 90

2. Width of poultry shed should not be more than

   (a) 22- 25 feet (b) 20-23 feet

   (c) 25 -30 feet (d) 15-20 feet

3. The total duration of hours for which light is required by 19 weeks old layer bird is

   (a) 12 hours (b) 14.5 hours

   (c) 16.5 hours (d) 18.5 hours

4. The recommended minimum distance between grower house and layer house is

   (a) 50 feet (b) 30 feet

   (c) 100 feet (d) 80 feet

5. The recommended minimum distance between grower house and chick house is

   (a) 50 feet (b) 30 feet

   (c) 100 feet (d) 80 feet

Fill in the Blanks

1. The recommended direction of long axis in a poultry farm is .....
2. The size of poultry house depends on the ..... to be reared.
3. The floor of a poultry shed should be made of.....
4. The..... is used to restrict the movement of chicks.
5. Brooder equipment are used to provide..... and..... during the first few weeks of chick's life.

Mark True or False

1. In semi- intensive poultry housing system, the birds are reared in cages.
2. The minimum distance between chick and grower house is 20-30 feet.
3. In a poultry farm, the sick room and the disposal pit is located only at its extreme far end.
4. The overhang of roof of the poultry house should not be less than 5 feet.
5. Debeaker is an electrical equipment used to cut a portion of bird's beak.

Session 3: Practices Adopted for Maintaining Cleanliness and Hygiene in Poultry Shed

Various practices are adopted for maintaining the cleanliness and hygiene in poultry shed. These practices are a part of routine farm operations for maintaining the bio-security of the poultry farm.

Routine cleaning practices in poultry farms Certain practices are adopted to maintain cleanliness and hygiene in poultry farms to prevent serious health problems due to pathogens in birds and substantial economic losses to the farmers. Few such common practices are described below in Fig. 1.12.

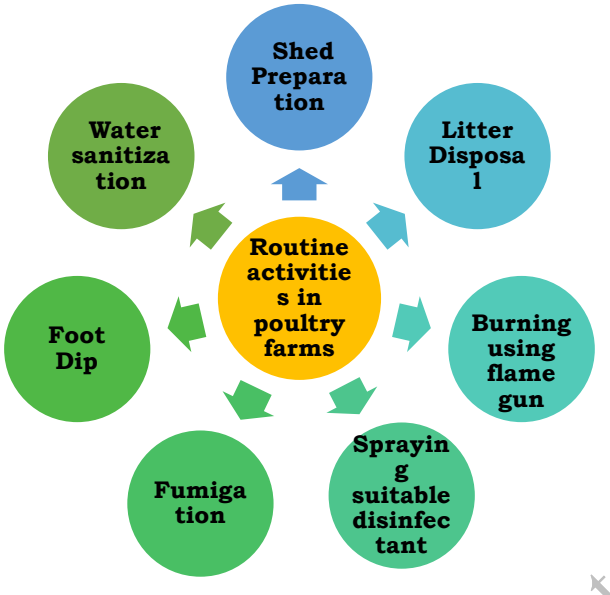


Fig 1.12: Routine cleaning practices in poultry farm

Importance of Temperature, Relative Humidity and Ventilation in Maintaining Health and Hygiene

Environmental attributes *viz.* temperature, relative humidity and ventilation are key factors that determines the productivity and health of poultry birds.

Temperature

Body temperatures of poultry birds ranges from 105-107^{0}F. As birds do not have sweat gland, the heat from the body is lost through conduction, convection, radiation and through panting. Birds are most comfortable with high productive performance at temperature 55^{0}F to 65^{0}F. Panting starts when environmental temperature goes beyond 85^{0}F. When temperature goes above 90^{0}F in poultry houses, panting process is not sufficient to dissipate body heat, so provision for cooling the poultry house is necessary to maintain poultry production.

Humidity

The birds can withstand high temperature but not high humidity. Further, high temperature along with high humidity is more detrimental for poultry birds. Fresh poultry excreta contain about 70 to 80% water. Normally the humidity level inside the poultry house is maintained at 40-50%. During summer, the litter becomes dustier. Hence, there is a chance of respiratory problem in the birds. This problem is solved by spraying water on the litter or installing foggers inside the house. This also helps in reducing the shed temperature during summer. During rainy season or in winter months due to less ventilation, moisture level inside the poultry house increases. High humidity inside poultry

house increases moisture level of the litter. The wet litter creates favorable condition for growth of microbes which increases the ammonia production inside the house. As ammonia level increases above 25 ppm, it irritates eyes of the birds, growth and egg production. The moisture level in the litter is reduced by increasing the ventilation or by adopting good litter management.

Ventilation

Ventilation is the exchange of gases in a building with fresh air from outside. As a result of bird's metabolism, feeding and drinking activities and faecal material decomposition heat, moisture, noxious gases (like carbon dioxide, carbon monoxide, ammonia etc.), dust and microorganisms are produced in side poultry house. Ventilation systems are designed to maintain air quality during cold weather and to regulate temperature during hot weather.

There are two primary types of ventilation: mechanical and natural. Natural ventilation allows air to move in and out of the building. On the other hand, mechanical ventilation uses fans or exhausts to facilitate airflow. Cross ventilation systems are commonly used for effective natural ventilation. Thus, the poultry houses in India are open sided house as shown in Fig.1.13. In large poultry houses, exhaust ventilation system is preferred for effective ventilation of birds reared throughout the year (Fig.1.14).

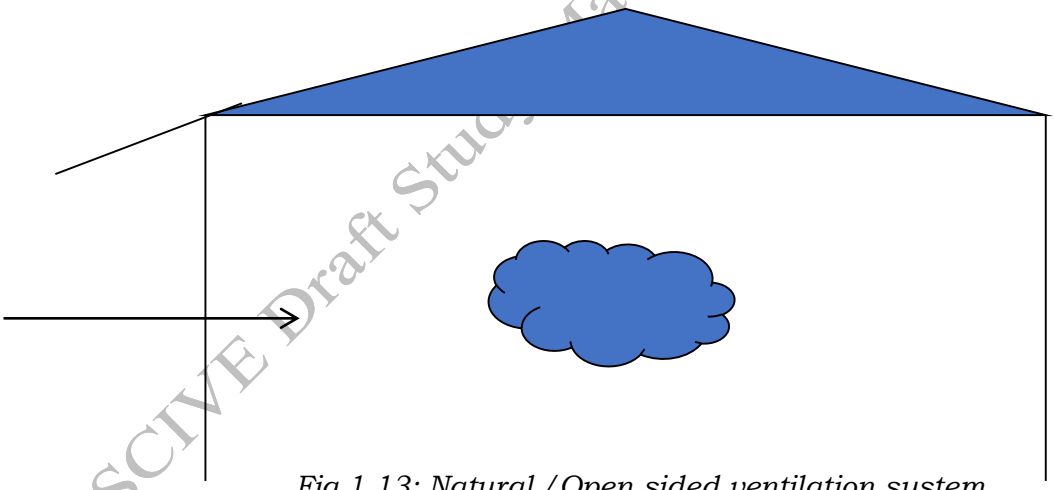


Fig 1.13: Natural / Open sided ventilation system

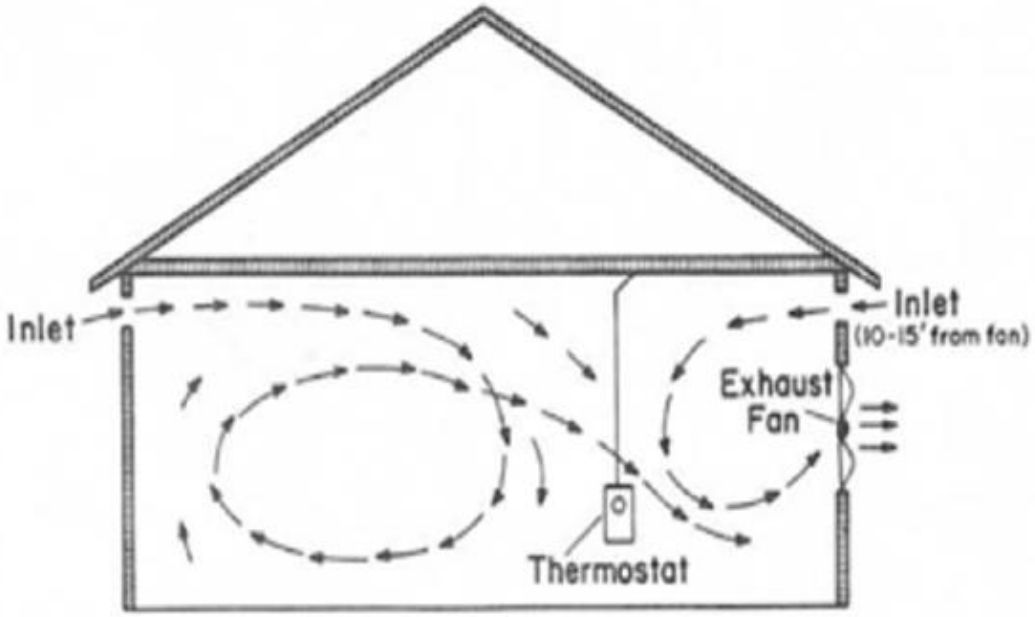


Fig 1.14: An exhaust ventilation system

Use of personal protective equipment in poultry

Personal protective equipment (PPE) is very important in conducting operations as it provides personal safety to the persons associated with poultry farming. The sequence for wearing the PPE is as under Fig.1.15.

Fig 1.15: Sequence for wearing PPE

Similarly, for removing the PPE first of all the shoe covers are removed followed by hand gloves. After this the hands are washed thoroughly and the dangri with attached hook is removed. The disposable protective glass goggles are then removed followed by face mask. All the PPE items are then discarded securely followed by a final hand wash.

Activities

Visit a nearby poultry farm and study procedure for cleaning and sanitizing poultry farm

Requirement: Nearby poultry farm, observation note-book, pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Enlist common disinfectants, water sanitizer and chemicals used for sanitation and fumigation
- Observe the cleaning and sanitizing poultry farm
- Discuss with your class mates.

Check Your Progress

Multiple Choice Questions

1. The normal body temperature of poultry bird is

   (a) 103-105^{0}F (b) 98.4-100^{0}F

   (c) 105-107^{0}F (d) 108-109^{0}F

2. The humidity level inside the poultry shed is maintained at

   (a) 30-40 % (b) 20-30 %

   (c) 70-80 % (d) 40-50 %

3. Birds feel most comfortable at

   (a) 40-45^{0}F (b) 55-65^{0}F

   (c) 65-75^{0}F (d) None of above

4. Painting is initiated at the temperature above

   (a) 80^{0}F (b) 85^{0}F

   (c) 90^{0}F (d) None of above

5. The ammonia level (ppm) in poultry house should be maintained below

   (a) 25 (b) 45

   (c) 55 (d) 75

Fill in the Blanks

1. High humidity inside poultry house ……moisture level of the litter.
2. The moisture level in the litter is reduced by increasing …….
3. Fresh poultry excreta contain……. water.
4. …… and …… are the two primary types of ventilation.
5. PPE is very important in conducting operations as it provides……

Mark True or False

1. Temperature, relative humidity and ventilation play a very important role in maintaining the health and hygiene of the poultry birds.
2. Ventilation is the exchange of air in a building with fresh air from outside.
3. PPE is used by labour at poultry farm for disposal of litter from poultry shed.

4. Ammonia level above 10 ppm, affects eyes, growth and egg production of the birds.
5. There is a proper sequence for wearing and removing PPE.

Session 4: Procedure for Disposal of Poultry Waste

Proper disposal of the poultry waste is essential to maintain hygiene and safety in the poultry farm.

Safety and cleanliness of the birds

Safety and cleanliness play a key role for optimizing production performance in birds. Bio-security is an effective tool to maintain safety and cleanliness. We will discuss about bio-security in Module 2. One of the important requirements to facilitate safety and cleanliness is adoption of the 'all-in/all-out' method for rearing of birds.

Disinfection of the brooders, poultry houses and equipment

Elimination of disease producing microorganism is called as disinfection. For the healthy rearing of poultry birds, disinfection of brooders and equipment is essential.

Disinfectants

The chemicals used for killing pathogenic micro-organisms are known as disinfectants.

Qualities of disinfectants

An ideal disinfectant should possess the following qualities as shown in Fig. 1.16.

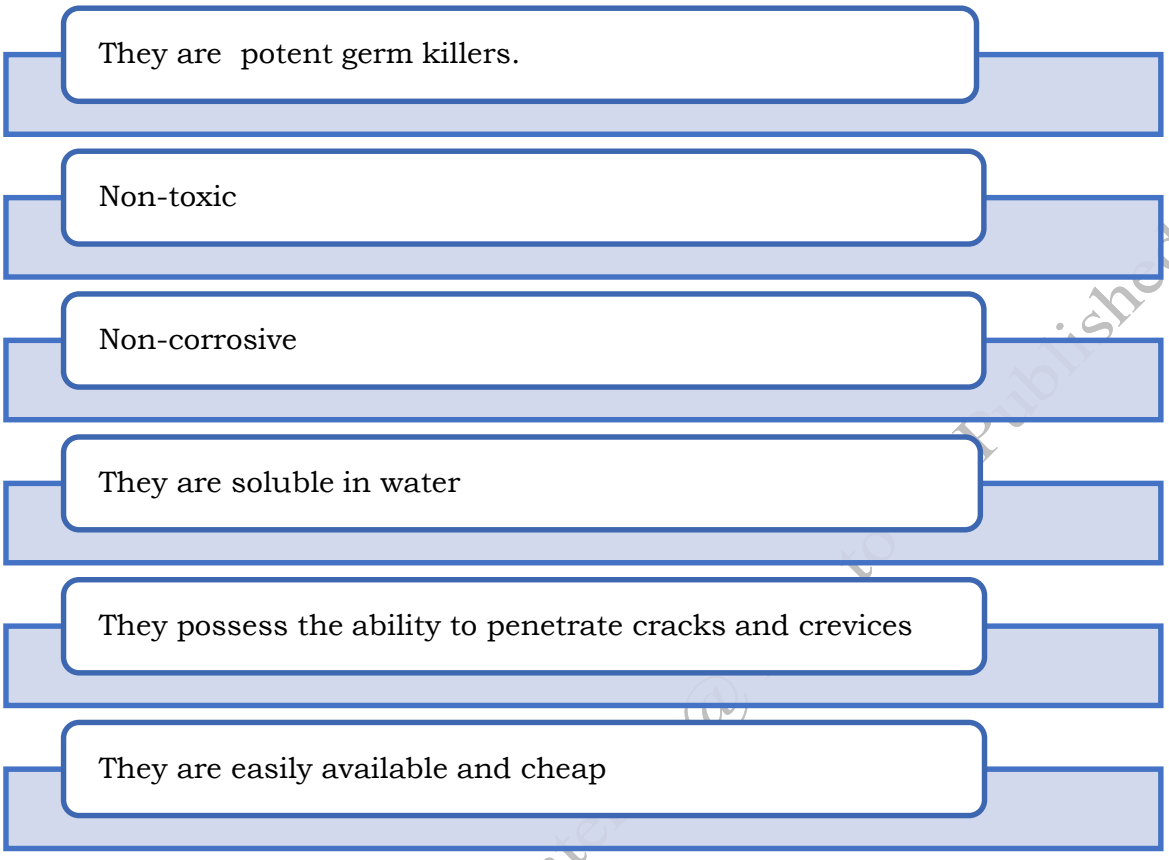


Fig 1.16: Qualities of an ideal disinfectant

Different disinfectants are used for disinfection of equipment and poultry farm. The type of disinfectant used dependents upon the nature of the disinfectant and the object to be disinfected. Fig. 1.17 and Fig. 1.18 depict the classification of different disinfectants and commonly used disinfectants.

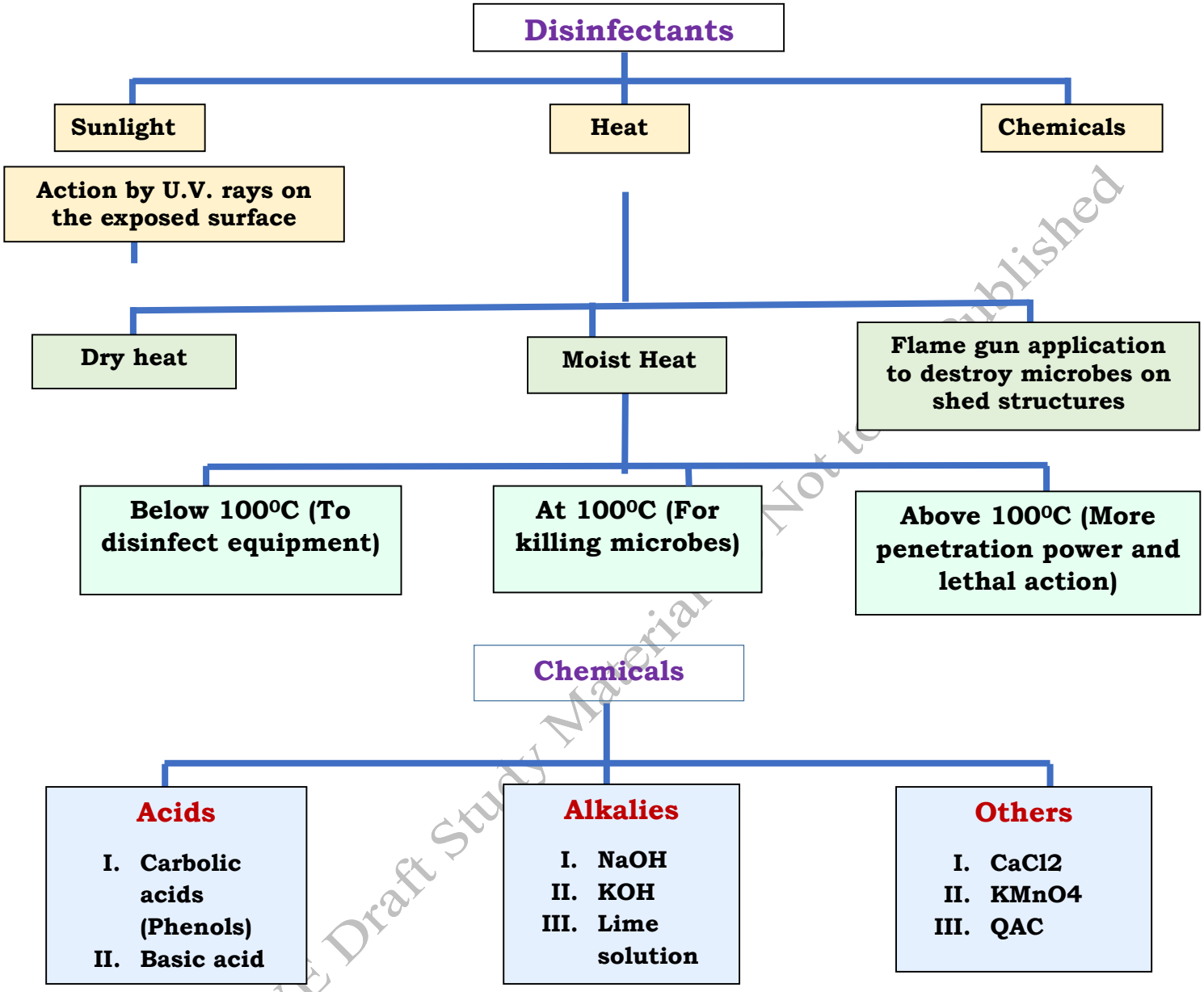


Fig 1.17: Classification of disinfectants

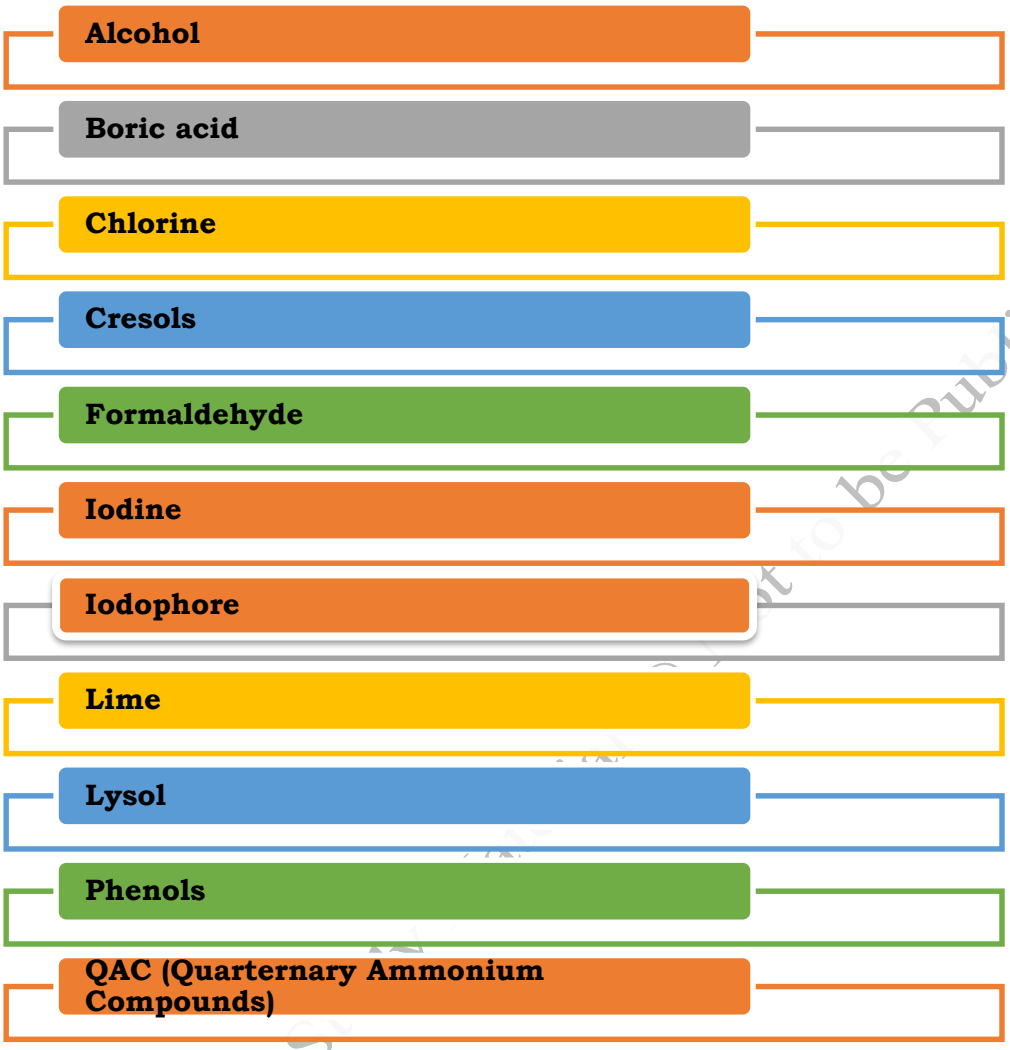


Fig 1.18: Commonly used disinfectants in a poultry farm

Disinfection procedure

For disinfecting any structure or equipment in poultry, the disinfection procedure involves following steps as shown in Fig. 1.19.

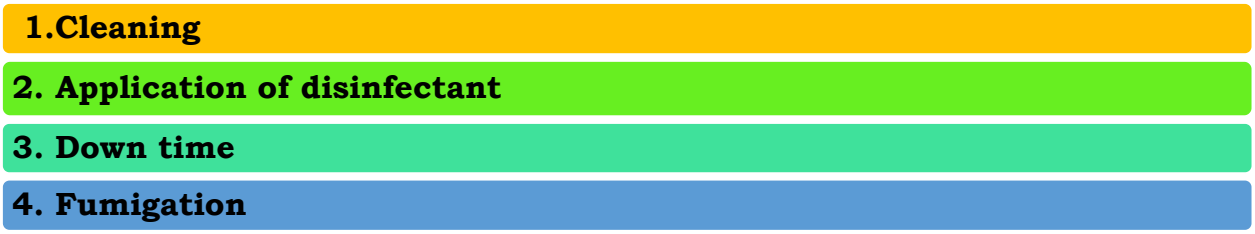


Fig 1.19: Steps of disinfection

1. Cleaning

This is very important step because action of any disinfectant is reduced in presence of any organic matter. During cleaning, scrubbing is done to remove dirt, dust and any other sticky material and finally washed thoroughly with water.

2. Application of the disinfectant

Cleaned and washed apparatus should be sprayed with any of the commercial disinfectants and allowed to dry.

3. Down-time

Down time is the rest period of 1-2 weeks and it is applied to break the life cycle of disease causing organisms by not providing host again immediately.

4. Fumigation

This is the last and final step of utmost importance to kill the existing microbes. This is necessary because it destroys the organisms harboring at such places of structures where the disinfectants cannot reach. Table 1.4 and 1.5 show the cleaning and disinfection procedure for brooders, other poultry equipment and poultry house respectively.

Table 1.4: Disinfection of Brooders and Other Poultry Equipment

Cleaning	Application of disinfectant	Down time	Fumigation
▸ Brooders and other equipment are scrubbed followed by washing with water.	▸ Washing with phenyl water 2ml/l ▸ Further another disinfectant is sprayed to destroy maximum microbes.	▸ 1-2 weeks down time is essential to break the disease cycle	▸ Formaldehyde fumigation is done by keeping all equipment in one room.

Table 1.5: Disinfection of Poultry House

Cleaning	Application of Disinfectant	Down time	Fumigation
▸ Manure is removed. ▸ Spider webs from roof, corners and wire netting are removed. ▸ Floor is soaked, scrapped, scrubbed and thoroughly washed with water under pressure.	▸ Washing with phenyl or lysol water (2-4ml/l) ▸ Flame gun is used to destroy pathogens adhering in angular spaces of wire netting, metal structure, corners etc. ▸ White washing of the walls and floor is done with lime.	1-2 weeks down time is essential to break the disease cycle	▸ Formaldehyde fumigation is undertaken 1-2 days before arrival of new batch of chicks. ▸ Open sides of house are closed with curtains tightly to trap formaldehyde gas for a period of 8-10 hours. ▸ Formaldehyde gas is produced by pouring of formalin on KMnO4 crystals in 2:1 ratio in an earthen pot.

Potential health hazards in poultry farming

Following health hazards can occur in any poultry farm:

Accidental

- Eye and skin irritation from contact with disinfectants, vaccines and medicines
- Burns from hot surfaces such as beak-trimmers
- Sprains and strains due to slip and fall
- Musculo-skeletal problems due to handling of birds, feed bags etc.

Chemical

- Skin and eye irritation due to accumulation of ammonia and exposure to disinfectants, detergents, formaldehyde and pesticides in poultry house
- Respiratory problems due to dust, feathers etc.

Biological

- Poultry workers are at a greater risk of being affected by zoonotic diseases like bird flu and salmonellosis

Waste disposal methods

Various types of poultry waste such as dead birds, hatchery wastes like egg shells and droppings are generated during the entire production process in the small poultry farm. The following methods are adopted for disposal of poultry wastes.

1. Disposal of dead birds

Routine disposal of dead birds is necessary to control spread of diseases in a poultry farm. Dead birds are never thrown in the open space as it may lead to spread of infection. Dogs, cats, wild birds eat the disposed dead birds thrown in the open and thereby these animals act as carrier for disease transmission. Further, infection can also be spread through air. Thus, proper disposal of dead birds is essential and can be done by either of the two following ways:

Burying

- Burying is followed where incineration facility is not available
- Deep pit is dug about 150 feet away from poultry house and water source
- Optimum size for the pit is about 1.8 m^2 and 2.4 m deep
- The pit should be covered with tar paper or plastic
- Carcasses are buried deeply to prevent unearthing the carcass by stray dogs or other animals and birds

Incineration

- It means burning of the dead carcass
- A furnace which is used for burning is called incinerator
- This process involves use of electricity, firewood or oil
- Electrical or oil-fired incineration is the best available technology
- This process results in rapid destruction of carcass
- Incineration is smokeless and odorless burning with minimal air pollution

2. Disposal of bird droppings or manure

Two main types of waste are produced by poultry farm depending on the rearing system adopted:

1. Poultry litter

Poultry droppings are removed from the poultry houses after depopulation of the flock as shown in Fig. 1.20.

Fig 1.20: Waste generated from rearing of poultry

2. Cage system waste

Excreta collected under the cages, spilled feed and feathers in 3-tier (Californian) cage rearing are disposed routinely. Droppings are stored for about 3, 6 or 12 months for their conversion into excellent manure.

Disposal of poultry manure

- **Oxidation ditches:** Aerobic fermentation of manure occurs in open ditches where bacteria decompose organic matter into simple substances which are rich in different nutrients.
- **Lagoons:** A shallow covered pond in which manure along with the liquid waste is dumped is called as lagoons. In this, anerobic fermentation decomposes manure after 2-3 months enriched manure is ready for utilization.
- **Solid disposal:** Manure is stacked in heap which results in heat generation and thereby killing of microbes. The treated manure is later used as fertilizer.

Sanitation and hygiene for disease prevention and control

Sanitation and hygiene include clean equipment, feed, water, poultry house and farm premises.

Hygiene of Poultry house and equipment

- Poultry house are cleaned to remove dirt and dust
- Feeders are scrapped from time to time and cakes are removed to avoid fungus growth for minimizing risk of any toxicity in feed
- The waterers are cleaned to reduce any disease contamination

- The bulbs/lights in poultry sheds are cleaned and checked from time to time for proper illumination and intensity of light
- Cobwebs in houses from all places and corners are removed for proper ventilation and disease-free environment (Fig. 1.21)
- Poultry houses are sprayed with disinfectants to control flies and insects for preventing spread of infection
- Water logging around poultry shed/farm are avoided in rainy season to minimize multiplication of pathogens
- Litter of poultry birds are turned upside down from time to time (Fig. 1.22)
- Litter is treated with ash powder and super phosphate at 4:1 ratio
- Foot bath filled with disinfectant at the entrance of each shed helps in reducing contamination
- Feeding and watering equipment are checked for leakages

Fig 1.21: Removing and cleaning of spider wet litter webs or cobwebs

Fig 1.22: Worker turning the upside down

Sanitation and hygiene for visitors and vehicles

- Do you know how it is ensured that visitors or vehicles entering the poultry farm do not carry any germs with them or what are the protocols for sanitizing the external agents entering the farm. Let us learn how this process of sanitation and hygiene is achieved. Entry of visitors, foreign vehicle is restricted in farm premises. Delivery of eggs, chicks and broilers are carried out at the entrance of the farm. At the entrance, foot bath and vehicle dip ensure disinfection of visitors and vehicles (Fig. 1.23 and 1.24)

- Technical staff and visitors must wear aprons, gum boots

Fig 1.23: Spraying of disinfecting to every vehicle at the entrance of the farm

Fig 1.24: Foot Dips carrying Disinfectant at the entrance of the farm

Monitoring of the poultry birds for optimum growth and livability

Birds are monitored at least two times in a day, once in the morning and then in late afternoon, to see their alertness and activities. Healthy birds are alert and active. Inability to move, eat or drink properly is an indication of illness. Such birds are segregated in a separate place. The dead bird, if any, is removed immediately to check spread of diseases.

Special management and care of birds during extreme climatic condition

Temperature is a major factor affecting poultry birds. During extreme weather conditions, their growth, egg production, and health are severely affected. In order to obtain the optimal growth rate and returns from the birds, ideal temperatures must be provided to the birds within economically feasible limits. A temperature range of 21^0C to 24^0C is ideal for best production of eggs and meat. The important management practices during extreme climatic conditions are displayed in Table 1.6.

Table 1.6: Important Management Practices for Rearing Poultry in Different Season

During extreme Summer	During Winter	During Rainy Season
• Provide birds with ample floor space. • Maintain cross ventilation • Install sprinklers on the roof and foggers inside to cool the house • Thatch is used to cover a roof. • Side walls are covered with gunny clothes that are kept wet by spraying water regularly. • A reflective roof coating (white) can be done for effective cooling of the house. • Withdraw feed prior to the expected time of peak temperature • Additional illumination during natural darkness will encourage feeding • Provide birds with cool drinking water which stimulates both feed and water intake. • Increasing the nutrient density of the diet by adding vegetables oils and amino acids is also recommended.	• Birds are protected from chilly winds. To achieve this, gunny bags are hanged at the point from where the cold air enters. • These gunny bags are hung down as soon as sunlight goes in the evening till the arrival of sunlight next morning. • The gunny bags are fixed in such a way so that one feet area at the top is kept open to expel built up ammonia gas and to provide cross ventilation. • Around 2-4 inches of litter is maintained during winters depending upon age of birds.	• Repair the poultry house before the arrival of the rainy season and clear the ditches and drainages. • The litter is kept 2-3 inches thick and turned over regularly to keep it dry. • Generally clean drinking water supply is affected during rains which may lead to Coccidiosis and E. coli outbreaks. The risk of mycotoxin poisoning and respiratory disease also increases. • Therefore, supply of clean drinking water is to be ensured. • Toxin binder and anticoccidial drugs are added while formulating feed.

• While formulating feed, mix antistress agents like ascorbic acid (Vitamin C), antioxidants (Vitamin E and Se), herbal agents like Tulsi, Giloi, etc. Additionally, it can be given through drinking water. • Provide extra light at nighttime for the birds to encourage them to feed at night. • Provides electrolytes and acidifiers in drinking water • A raised platform system for layers improves ventilation.	• Number of feeders is increased in winter season • Feed is made available to the bird for the whole day.	

Activities

Visit a nearby poultry farm and study potential hazards and waste disposal methods in the farm

Requirement: Nearby poultry farm, observation note-book, pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Enlist important micro-environmental factors and study the methodology used to construct the house to meet requirements
- Enlist potential hazards and factors responsible for these hazards
- Observe the waste disposal methods in the poultry farm and note them down
- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Disinfecting procedure in poultry farm involves

   (a) 3 steps (b) 5 steps

   (c) 4 steps (d) 2 steps

2. A layer bird in cage rearing system produces a total of how many kgs of manure in a year

   (a) 10-12 (b) 8-10

   (c) 15-16 (d) 18-20

3. In deep litter system, the litter thickness in winter is maintained at

   (a) 1-2 inches (b) 2-4 inches

   (c) 6 – 8 inches (d) 10- 12 inches

4. In summer season, vitamin added in drinking water is

   (a) A (b) C

   (c) D (d) K

5. Coccidiosis occurs due to

   (a) Toxins in feed (b) Toxins in water

   (c) Unclean water (d) Summer stress

Fill in the Blanks

1. ..... is adopted to facilitate hygiene and sanitation in poultry farm.
2. ..... is used for killing the infectious organism.
3. An incinerator is a furnace used for ..... dead birds.
4. Poultry house is cleaned to remove dirt and .....
5. In a poultry farm birds are monitored at least ..... in a day.

Mark True or False

1. Cleaned and washed apparatus is always sprayed with commercial disinfectant.
2. After cleaning of shed, a rest period of 1-2 weeks is given to break life – cycle of an organism.
3. A temperature range of 21^0C to 24^0C is ideal for best production of eggs and meat.
4. Number of feeders is increased in winter season.
5. The poultry house roof is painted with white wash to reflect rainy water

Module 2
Handling Poultry Birds in Shed

Module Overview

Proper handling of poultry birds in the shed is a vital pre-requisite in rearing of poultry. It starts when the chicks are brought to the poultry farm and ends with the sale of birds. The fact that poultry birds run fast and sometimes even fly makes them difficult to handle as compared to large animals. Therefore, special handling skills are needed.

Learning Outcomes

After completing this module, you will be able to:

- Describe the techniques for handling and monitoring poultry birds in the shed, including daily care routines, health checks, and behavior observation to ensure their well-being and productivity.
- Explain the procedures of biosecurity to maintain the health and hygiene of poultry birds, including preventive measures, sanitation practices, and protocols to control the spread of diseases within the poultry farm.

Module Structure

- Session 1: Handling and Monitoring of Poultry Birds in Shed
- Session 2: Procedures of Biosecurity for Maintaining Health and Hygiene of Poultry Birds

Session 1: Handling and Monitoring of Poultry Birds in Shed

In this session, various preparations required for placing newly hatched chicks in the brooder are covered. In addition, handling and good management practices for birds to minimize stress is also discussed.

Preparations for placement of newly hatched chicks

Chicks need proper ventilation, feeding, watering and personal care for proper growth and development. In order to ensure that day old chicks grow as fast as possible, there are a number of preparatory steps that are carried out prior to placing them in the brooder house.

In natural conditions, chicks hatch after 2-4 weeks of incubation by the hen. When broody hens are not available or a large number of chicks are to be raised,

artificial brooding is required. Accordingly, the required conditions of temperature and humidity is provided during artificial brooding.

Therefore, brooding is the process of giving extra warmth to the new born chicks. The house used for the brooding of chicks is known as brooder house. Generally, brooding is done either on the ground (deep litter system) or in battery cages meant for young chicks aged up to two-three weeks. The steps involved in preparation of brooder house is shown in Fig. 2.1. Fig. 2.2 shows the newly hatched chicks placed along with brooder.

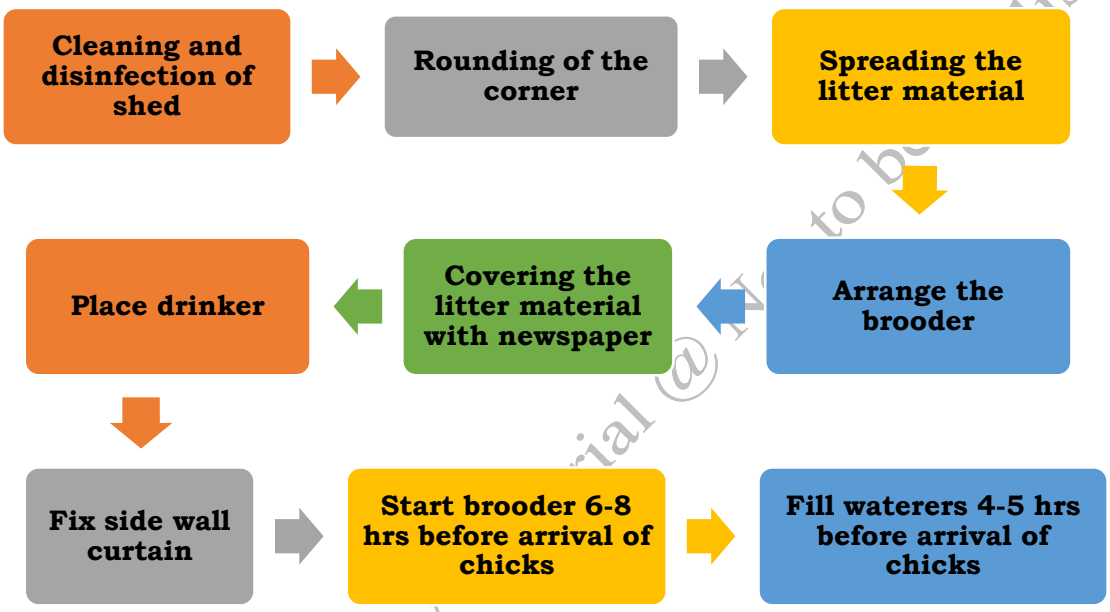


Fig. 2.1: Steps in preparation for placement of newly hatched chicks

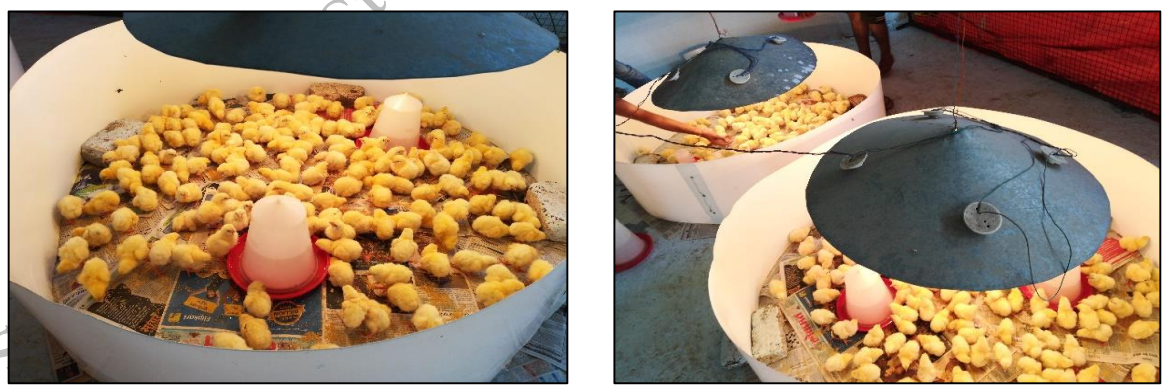


Fig. 2.2: Newly hatched chicks placed along with brooder

Important components of brooding

The following aspects are important for successful brooding:

Arrival of chicks

The steps undertaken after the arrival of chicks in the farm are presented in Fig. 2.3.

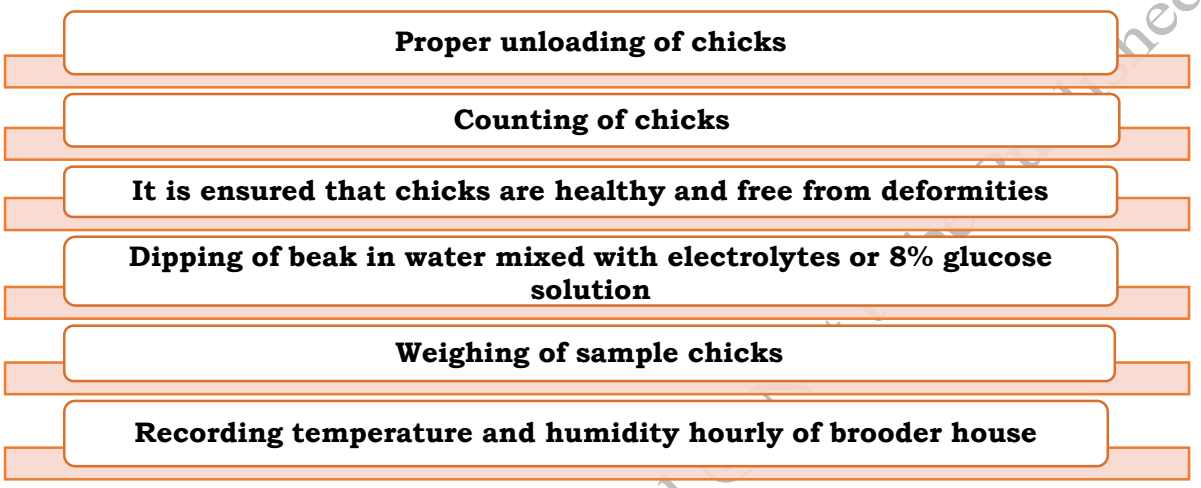


Fig. 2.3: Steps to be taken after the chicks arrive at the farm

Space

To avoid overcrowding, piling, and stunted growth, chicks receive an adequate amount of floor space according to their age as shown in Table 2.1.

Table 2.1: Space Requirement of Chicks up to (0-6 Weeks)

Age in week	Space per chick
1	0.18-0.25 sq. ft
2	0.35-0.40 sq. ft
3	0.45-0.50 sq. ft
4	1.00 sq. ft
5	1.00 sq. ft
6	1.00-1.2 sq. ft

Temperature

Successful brooding is dependent on keeping the brooder house at the right temperature (Table 2.2). During the first week of brooding, temperatures of around 33^{0}C (95^{0}F) are good for chicks, and after that, the temperature is lowered by 2.7^{0}C (5^{0}F) every week until the room temperature reaches 21^{0}C (70^{0}F). Temperature accuracy is judged by the behaviour of the chicks and their distribution under and around the brooder (Fig. 2.4). The chicks huddle near the heat source under the brooder when the temperature is low, and stay away from the heat source, near the chick guard when the temperature is too high. If birds congregate in masses, it indicates that the weather is draughty. If the temperature is favourable, then the birds spread evenly under and around brooder.

Table 2.2: Temperature Required During Brooding

First week	95^{0}F
Second week	90^{0}F
Third week	85^{0}F
Fourth week	80^{0}F
Fifth week	75^{0}F
Sixth week	70^{0}F

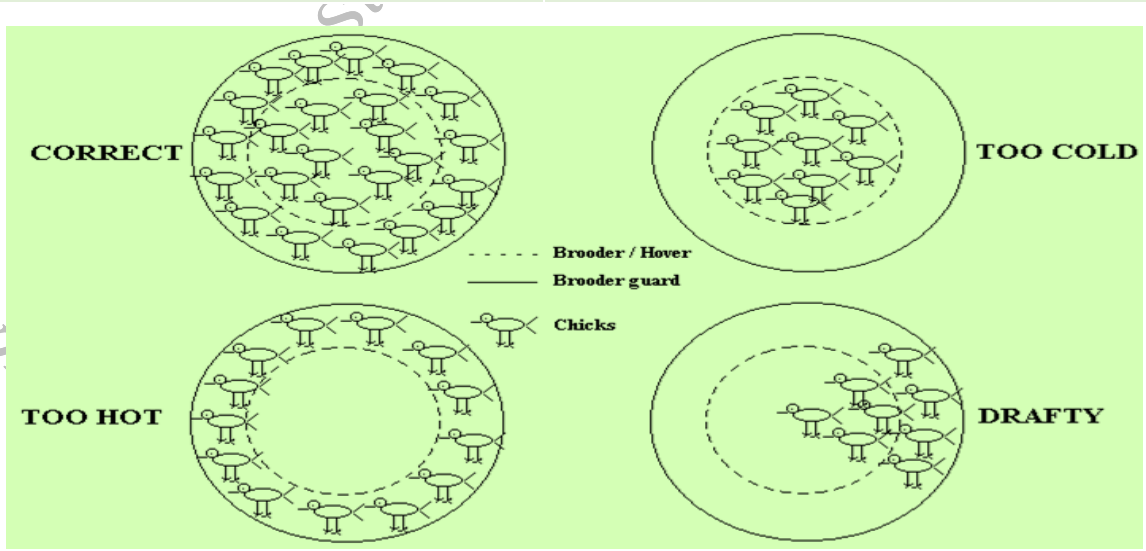


Fig. 2.4: Distribution pattern and behaviour of chicks around brooder under different temperature

Ventilation

Adequate ventilation is very essential in brooder house. High humidity and inadequate ventilation increase the ammonia level in brooder house leading to irritation of eyes and respiratory tract, resulting in lowered performance by the bird. Similarly, more dust in the house causes irritation of the respiratory tract and transmits diseases.

Duration and intensity of light

- A brooding period of 23 hours of light and 1 hour of darkness is required
- Darkness for one hour at a specified time in the day is provided to acclimatize chicks for sudden power failures
- 10 Watts of light bulb per m^2 (about 1 Watt per square foot) is sufficient, with the bulb being positioned at 2.4 m above the floor for achieving the required intensity of light

Feeding and watering

- Initially, chicks are fed on newspaper or on top of the chick boxes for 1-2 days. Thereafter, feed is place in the feeders
- Provide chicks with fresh, clean and potable water
- To combat transit stress, add electrolytes, 8% glucose, vitamins and antistressor agents in water

Litter materials

The material spread on the floor of poultry house with purpose to absorb feacal moisture and to provide insulation from heat transmission is called as "Litter" The most common litter materials used is shown in Fig. 2.5.

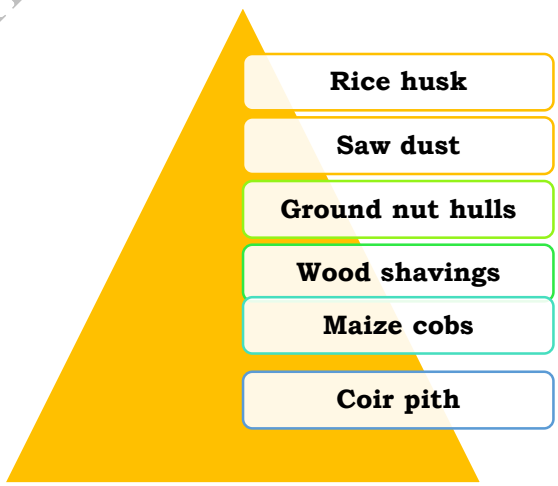


Fig. 2.5: Commonly used litter materials

Litter management

- During brooding, the thickness of litter is 1-2 inches during summer and 2-3 inches during winter
- The litter material and brooding area must be warm at least 4-6 hours prior to placing of the chicks

- Remove the covered newspaper after 3-5 days

Health care

Correct medication and vaccination program is adopted to ensure proper care and growth of chicks. In Module-4, detailed information regarding vaccination schedules has been discussed. Guidance from the local Veterinary Doctor may be sought as and when required.

Handling and good management practices for birds to minimize stress and for improved health and hygiene

When handling birds, ensure that there is no unnecessary stress. Chicks are caught and handled more easily immediately after hatch than at any other time.

An adult duck is caught by its neck or legs. The procedure for handling young chicks is explained in Fig. 2.6 and adult birds in Fig. 2.7.

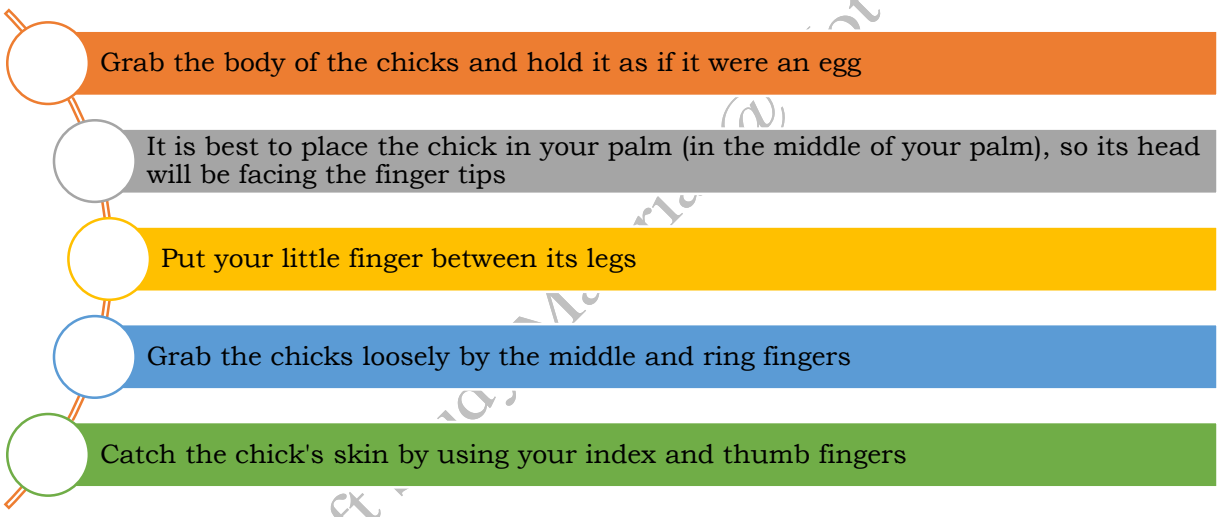


Fig. 2.6: Procedure for handling young chicks

Fig. 2.7: Procedure for handling adult birds

Activities

Visit a nearby poultry farm and recognize and make a note of the handling of birds and different behaviour of birds during normal and stress conditions.

Requirement: Poultry farm, note-book, pen, pencil, eraser etc.

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note of the handling of birds for wing banding, vaccination, sexing, shifting and transportation
- Observe the behaviour of birds during normal and stress conditions
- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. The most common litter material used is

   (a) Saw dust (b) Paddy husk

   (c) Ground nut hulls (d) Maize cob

2. During first week of brooding chicks require temperature around

   (a) 95^0F (b) 93^0F

   (c) 90^0F (d) 98^0F

3. The process of giving extra warmth to the new born chicks

   (a) Grooming (b) Candling

   (c) Brooding (d) Dubbing

4. The house used for the brooding of chicks is known as.

   (a) Layer house (b) Brooder house

   (c) Grower house (d) All of the above

5. Adequate floor space is given to chicks to avoid

   (a) Overcrowding (b) Piling

   (c) Stunted growth (d) All of these

Fill in the Blanks

1. Generally, on first day chicks are provided with ……% glucose solution.
2. The litter and brooder area are warmed at least ……. hours before the arrival of chicks.
3. The temperature of brooder reduced by ……^{0}F every week.
4. Remove the covered newspaper after ……. days.
5. Successful …… is dependent on keeping the brooder house at the right temperature.

Mark True or False

1. Correct medication and vaccination program is adopted to ensure proper care and growth of chicks.
2. It is best to place the bird in its cage with its head first.
3. Coir pith is a litter material.

4. When examining a heavy broiler bird, both hands are used to grasp the two legs.
5. High humidity and adequate ventilation increase ammonia level in brooder house.

Session 2: Procedures of Biosecurity for Maintaining Health and Hygiene of Poultry Birds

The current COVID 19 pandemic has woken us all to the importance of biosecurity measures. It is evident that if proper biosecurity measures are not taken or ignored for example proper disposal of animal wastes, sanitisation of farms, laboratories or places where farm animals or birds are reared, it can prove to be a disaster for the human population in that area and even beyond. Thus, Bio-security is one of the most important components for disease prevention in poultry enterprise.

Meaning of Biosecurity

Bio-security means safety of the living things. Bio-security at the poultry farm includes the measures and different methods adopted to secure a disease-free environment for the growth of birds. By undertaking biosecurity measures, the chances of infectious agents in the poultry farm are reduced.

Impact of diseases and pests on poultry production and management

Various types of pests and diseases cause discomfort and decreases feed consumption, growth, egg production and thereby results in morbidity and in some time mortality also.

Monitoring of the poultry birds to ensure their health and hygiene

The birds in all poultry farms are monitored at least twice a day, once in the morning and again in the afternoon, to ensure that they are alert and active. An illness is characterized by inability to move, eat and drink normally. It is important that the poultry farmer monitors the following aspects as shown in Fig. 2.8.

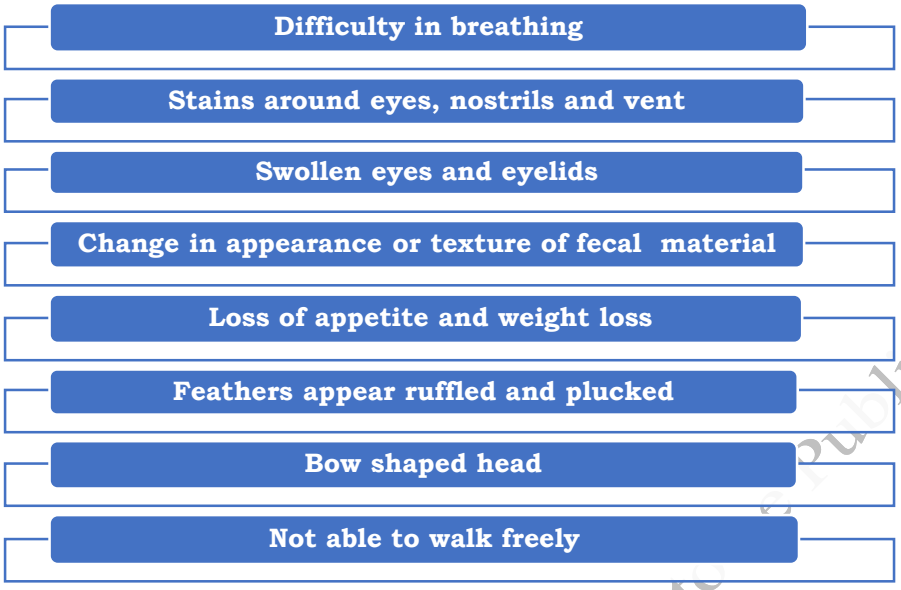


Fig. 2.8: Aspects to be monitored to ensure health

In case a bird is unable to move freely or eat and drink properly, it is removed and kept in a separate enclosure for treatment. Immediately, remove the dead bird from the farm since it can spread disease to healthy birds.

Spread of diseases and their prevention

The various poultry diseases spread through different routes are described in Fig. 2.9.

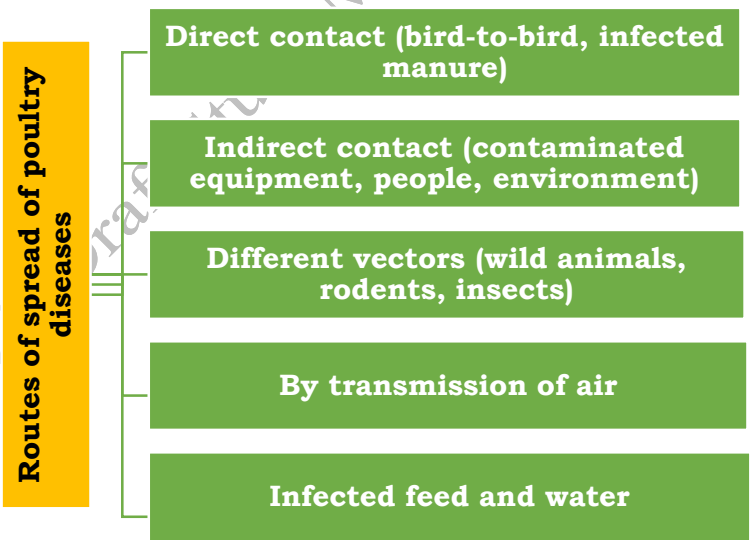


Fig. 2.9: Routes of spread of poultry diseases

After an infectious agent like bacteria, virus, fungi etc. has infected a flock, it persists in the location and gradually forms a reservoir in another living organism (host). Other birds or animals act as reservoirs of these infectious

agents. The diseases are prevented and controlled by adopting the following measures as shown in Table 2.3

Table 2.3: Measures to Prevent and Control Poultry Diseases

Prevention Measure	Details
Vaccination	• There are several poultry diseases that can be prevented by vaccination • Most of the viral diseases are prevented by vaccination • Purchase vaccinated stock and follow a suitable vaccination plan
Controlling parasites	• Make sure birds are checked for external parasites on a regular basis • Apply an approved insecticide to birds with lice or mites if present • If you spray insecticide on sheds and egg nests, make sure it gets into crevices • Check faecal material regularly for worm infestation • Perform deworming regularly • If necessary, consult a veterinarian
Identification and treatment of sick birds	• Regularly check your flock for signs of illness • A sick bird is kept isolated from other birds • Place ill birds in isolation until they have fully recovered • Whenever medication is given, it is important to follow any withholding periods
Separating flocks of different ages	• The risk of disease transfer increases when young birds are introduced to a flock of older birds

	• When introducing new birds to a flock, feather pecking and anxiety in the flock occur • All-in-all-out rearing system is preferable for disease prevention • Always start working with younger flock and finish with the older flock
Adopt bio-security measures	• To prevent nesting wild birds around sheds, there are no trees or dense foliage • Entry restriction signs are placed at entrance of farm • When working inside poultry houses, always secure the door from inside • Provide boots and overalls to visitors and staff • Ensure that dead birds are taken out each day and disposed of properly • Ensure that coops, crates and other poultry tools and equipment are cleaned and disinfected before and after each use • Make sure that the feed, water and litter are free from infectious agents • Spray disinfectants on vehicles entering the premises for feed delivery, fuel delivery etc

Measures to protect the birds from stress and diseases

A successful poultry business relies on an effective diseases' prevention program. Increased production cost can be caused by disease. A disease prevention program may not show immediate returns on investment, but it will be profitable in the long run. Biosecurity, vaccination as well as hygiene are the most important measures for running a successful poultry business.

Stress and its management

All animals including poultry birds experience three forms of stress i.e. physical, emotional and psychological. Stress may also arise from different agents like toxins, pesticides, fungicides, herbicides, dyes, antibiotics and basic synthetic chemicals in the air, feeds, water and cleaning agents. The major causes of stress

in poultry birds are incorrect fat consumption, attack on the immune system of birds and consumption of wrong salts. Stress is also caused by extreme climatic conditions, overcrowding, diseases and discomfort due to excess light, wet litter and poor ventilation.

These different types of stresses can be prevented by adapting good management practices in the farms. After providing a clean and hygienic environment through recommended practices, preventative measures are the next line of defence against disease. The different preventive measures taken to protect the birds from stress and diseases are shown in Fig. 2.11.

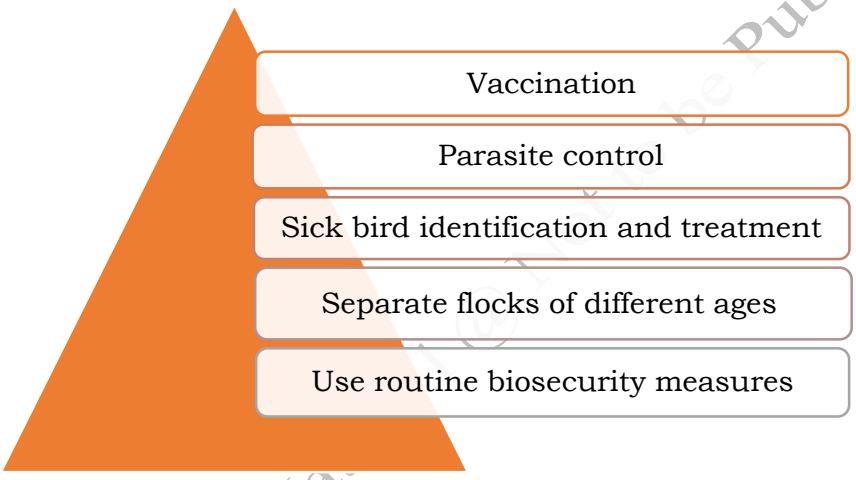


Fig. 2.11: Preventive measures to protect the birds from stress and diseases

Activities

Visit a nearby poultry farm and make a note of the following points

1. Management practices to be followed during extreme summer and winter
2. Steps to prevent disease outbreak
3. Litter management practices

Requirement: Nearby poultry farm, observation note-book, pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note of the management practices to be followed during extreme summer and winter
- Observe and note down the steps to be followed to prevent disease outbreak
- Observe and note down the steps to be followed for litter management

- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. In every poultry farm, the birds are monitored

   (a) Once a day (b) Twice a day

   (c) Thrice a day (d) None of the above

2. The diseases in poultry farm can be minimized by

   (a) Vaccination (b) Biosecurity

   (c) Hygiene (d) All of the above

3. Poultry diseases can be spread by

   (a) Direct contact (b) Indirect contact

   (c) Contaminated feed and water (d) All of the above

4. In birds, stress can be caused by

   (a) Extreme climatic conditions (b) Overcrowding

   (c) Diseases (d) All of the above

5. The performance of birds is decreases by

   (a) Diseases (b) Pests

   (c) Both a and b (d) Only by diseases

Fill in the Blanks

1. Biosecurity at the poultry farm includes the measures and different methods adopted to secure a ..... environment for the growth of the birds.
2. Many poultry diseases can be prevented by .....
3. ..... rearing system is preferable for disease prevention
4. A sick bird is kept ..... from other birds
5. Entry restriction signs are placed at the .....

Mark True or False

1. Biosecurity measures reduce the chances of infections.
2. An illness is characterized by inability to move, eat and drink normally
3. Younger birds can be kept with older birds in the same shed.

4. Daily routine work at poultry farm begins with younger birds and finishes with the oldest birds.
5. Stress in birds is preventable by adopting good management practices at the farm.

Module 3
Feeding Poultry Birds

Module Overview

Feed account for nearly 70% of the cost of poultry production. Feed comprises of different ingredients which are sources of different nutrients viz. carbohydrates, proteins, fats, vitamins, minerals and water. Providing a quality feed is essential for maintaining optimum production and health of the birds.

Learning Outcomes

After completing this module, you will be able to:

- Describe the different forms, feeds, supplements, and additives used for feeding poultry birds, including their nutritional benefits and appropriate usage.
- Explain the procedures for procurement and quality assurance of poultry feed, including sourcing, quality control measures, and ensuring feed safety standards.
- Identify and formulate different types of poultry rations, considering the nutritional requirements of various poultry species and production stages.
- Discuss the best practices for feed and water supply management, including feeding schedules, water quality maintenance, and efficient resource utilization to promote optimal bird health and growth.

Module Structure

- Session 1: Forms, Feed, Supplements and Additives Used for Feeding Poultry Birds
- Session 2: Procedure for Procurement and Quality Assurance of Poultry Feed
- Session 3: Different Types of Poultry Ration and Their Formulation
- Session 4: Feed and Water Supply Management

Session 1: Forms, Feed, Supplements and Additives Used for Feeding Poultry Birds

In this session, you will study about different breeds of chicken. You will also know about the role of nutrients, feed ingredients, supplement and feed

additives. In addition to this, you will also study the various forms of feed, nutrient requirement of various age groups along with feeding and drinking behavior of birds.

Breeds of poultry birds

Poultry includes different species of domesticated birds like Chicken, Duck, Japanese quail, Guinea fowl, Turkey etc. Breed is a group of birds related by descent and breed true for certain characteristics by which breeder is able to recognize them.

Chicken breeds

Chicken breeds reared in our country are either exotic or indigenous. These exotic breeds are mostly reared for commercial purpose due to high egg and meat producing ability. However, they require intensive care and management practices. The indigenous breeds are commonly used for rural and backyard poultry farming. The birds are slow growing and poor egg producer. However, they can sustain harsh climatic condition, good foragers, better immunity and having broodiness. The most commonly used chicken breeds are shown in Fig. 3.1

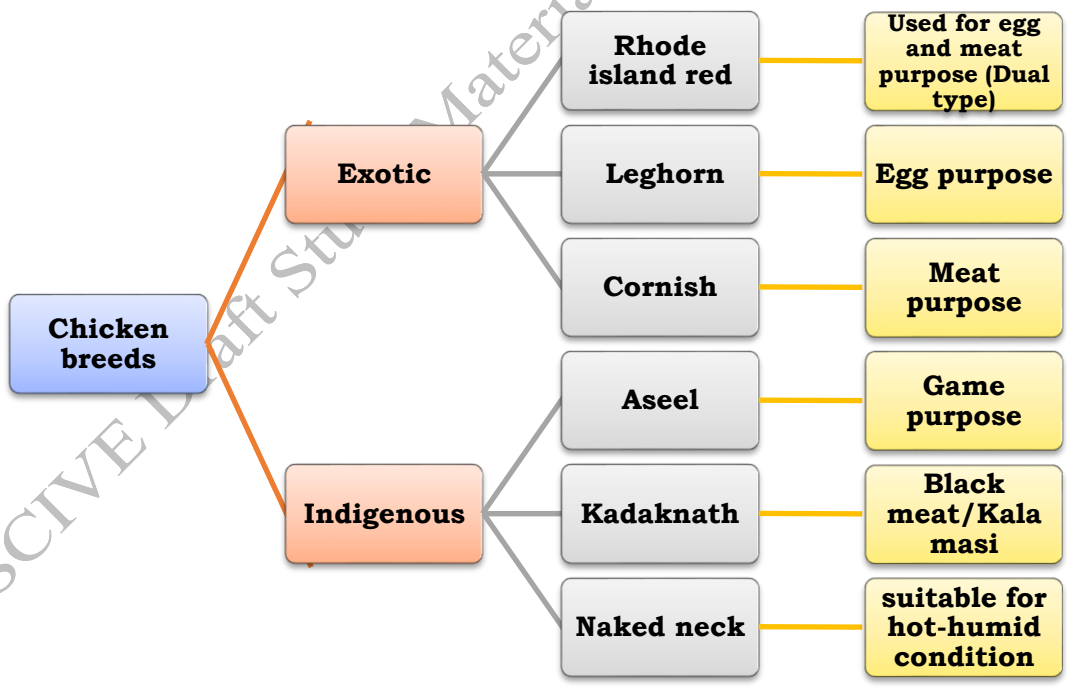


Fig. 3.1: Common chicken breeds

Duck breeds

Duck-These are water fowl and characterized by long beak termed as bill and webbed toe. These are good egg and meat producer. Eggs are larger in size than chicken. Examples are Pekin, Muscovy, Indian Runner, Khaki Campbell etc.

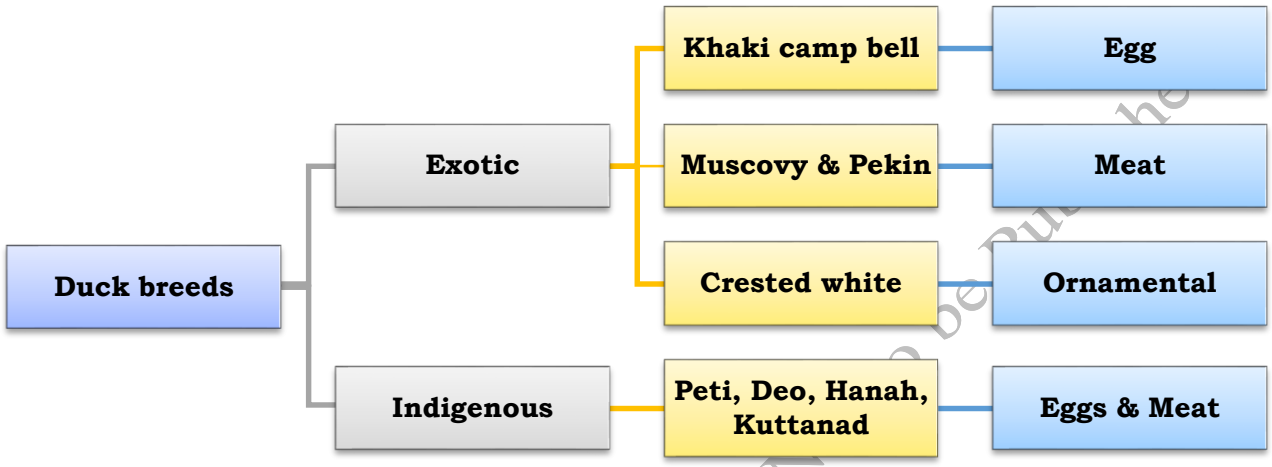


Fig. 3.2: Common duck breeds

Germplasm of other species of poultry

In India chicken is the predominantly species reared followed by ducks. Turkeys, Japanese quails and Guinea fowls are reared in small numbers throughout the country and the important germplasm and utility of these birds are depicted in Table 3.1.

Table 3.1: Germplasm and Utility of Other Species of Poultry

Turkey	Japanese quail	Guinea fowl
Different varieties of turkey are Broad breasted bronze, Belts-ville small white, Black etc.	Different germplasms developed by ICAR-CARI, Izatnagar are CARI-Uttam, CARI-Ujwal, CARI-Pearl, CARI-Sweta etc.	Different germplasms developed by ICAR-CARI, Izatnagar are Swetambari, Chitambari, Kadambari etc.
Turkeys are mainly reared for meat	Japanese quails are reared for egg and meat	Guinea fowls are mainly reared for meat

Role of nutrients, feed ingredients, supplements and additives in poultry ration

Different ingredients are used to prepare different types of poultry feed which contains various nutrients required for their growth and production. These various ingredients are source of different nutrients viz. carbohydrates, proteins, fats, vitamins and minerals. Besides feed supplements like vitamin and mineral supplements are used to prepare a balanced feed. Feed additives are used to increase the palatability, shelf life, availability of different of nutrients and improve the overall performance of the birds. The role of different nutrients is shown in Table 3.2.

Table 3.2: Role of Different Nutrients

Nutrient	Role
Water	• It is the major component of blood and tissue fluids • It removes waste product from the cells • It regulates body temperature and maintains homeostasis
Carbohydrates	• It provides major part of energy
Fats	• Concentrated source of energy. • Structural component of brain tissue
Protein	• Proteins are building blocks of the body • Proteins are essential for growth and immunity
Vitamins	• Required for normal growth, metabolism and normal functioning of the body
Minerals	• Required for structural component of bone • Required for normal metabolism, growth and immunity.

Feed ingredients

The feed ingredients used in preparation of poultry feed are source of energy, protein, fats, vitamins and minerals. Among the major feed ingredients maize is primarily used as energy source whereas soybean meal is primarily used as protein source in poultry feed.

Supplements and additives in poultry ration

The premix used in poultry meets the requirement of vitamins and minerals as feed supplement. These are the nutrients needed to support growth, metabolism and health. Feed additives are non-nutrient which act as growth promoter and to maximise the feed efficiency. Most commonly used feed additives are enzymes, probiotics, prebiotics, acidifiers, anti-oxidants, coccidiostats etc.

Forms of feed

There are mainly three forms of feed which are commonly used for feeding poultry birds. Chicken feed may be used in the form of pellets, crumbs or mash. The different forms of poultry feed are discussed in Table 3.3.

Table 3.3: Different Forms of Feed

Mash	Pellet	Crumbs
• It is formed by grinding readily available feed ingredients in a grinder followed by hand mixing or machine mixing • It is easy to prepare • Selective feeding occurs • Dustiness is a common problem due to fine grinding	• It is formed by subjecting the feed ingredients to compaction in dyes of specific shape under high temperature and pressure • It increases the availability of nutrients to the entire flock and maintains the uniform growth of the flock • It reduces the dustiness and improves the palatability • It discourages choice feeding by the birds	• It is prepared by breaking pellets into smaller particle size • It is used for feeding younger birds for easy digestion and absorption of nutrients • It increases the availability of nutrients to the entire flock and maintains the uniform growth of the flock • It reduces the dustiness and improves the palatability • It discourages choice feeding by the birds

Feed ingredients used for poultry

Maize and soybean meal are the most widely used conventional ingredients in poultry diet. Feed ingredients used for poultry may be classified as energy sources, proteins sources, feed additive and supplements as shown in Fig. 3.3.

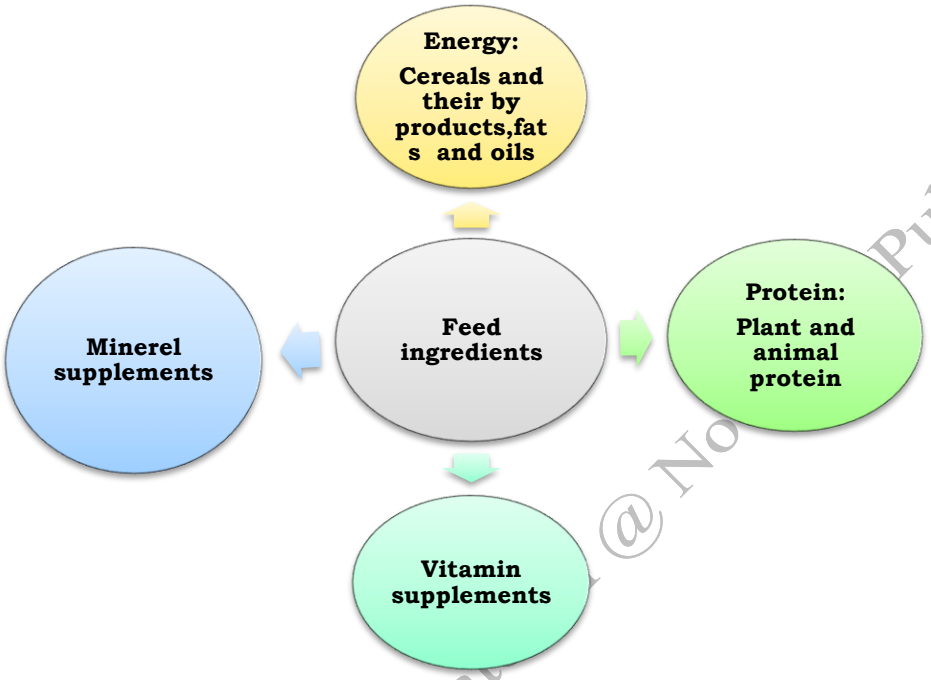


Fig. 3.3: Classification of feed ingredients according to sources of nutrients

Energy Sources

Cereals and their byproducts, fats and oils are most commonly used energy sources in poultry feed. Maize is the most common cereal used in poultry diet. Other cereals used are jowar, bajra, sorghum, wheat, rice and barley. Their inclusion level is 55-70% in poultry feed. Cereal and mill by products are rice polish, de-oiled rice bran and wheat bran whose inclusion level is kept 5-15% in poultry diet. Fats and oils include vegetable and food grade oils and animal origin fat from different livestock species. They are added usually up to 5% in poultry feed.

Proteins sources

Plant and animal protein rich sources are used to supply protein in bird's diet. Most commonly used protein sources of plant origin are soybean meal and groundnut cake and animal origin are fish meal and meat meal.

Minerals

They are inorganic in nature. Mineral mixture as source of essential micro and trace minerals to support metabolism and immunity. Example-Bone meal, Common salt, Dicalcium phosphate, Lime stone powder, Oyster shell, Mineral mixture etc.

Vitamins

They are organic in nature. Vitamins are of two types: fat soluble and water-soluble vitamins. Fat soluble vitamins are A, D, E and K and water-soluble vitamins are vitamin B and C. Vitamins and mineral supplements are nutrients which are together known as feed supplements.

Feed additives

- Feed additives are ingredients used in poultry feed which may or may not have nutritive value but facilitates utilization of other nutrients and improves health and production.
- They also improve physical appearance, consistency, nutritive quality, shelf life of feed.
- Enzymes, toxin binders, prebiotics, probiotics, acidifiers and pH optimizers, antioxidants, phytobiotics, anticoccidials, emulsifiers, flavoring agents, carotenoids etc. are included in feed additives

Nutrient requirements of chicken

The chicken feed is prepared as per guidelines approved by a particular organization and widely accepted and followed. In India, the chicken feed is commonly prepared as per the nutrient requirements prescribed by Bureau of Indian Standards (BIS) as shown in Table 3.4 and Table 3.5.

Table 3.4: Nutrient Requirement of Broilers (BIS-2007)

S. No.	Nutrient	Unit	Pre starter (0-7 days)	Starter (8-21 days)	Finisher (22 days onwards)
1.	*Crude Protein*	Min %	23	22	20
2.	*Metabolizable Energy (kcal/kg)*	Min	3000	3100	3200
3.	*Salt*	Max %	0.5	0.5	0.5

4.	*Calcium*	Min %	1	1	1
5.	*Available Phosphorus*	Min %	0.45	0.45	0.45

Basic nutritional requirement, feeding and drinking behavior of birds

The poultry birds are fed balanced diets to achieve better growth, egg production and feed conversion ratio. A balanced diet is one that supplies all the required nutrients in appropriate quantity and proportion to maintain production performance of the birds. The requirements vary with type of birds, age, production performance, physiological status and environmental factors (temperature, humidity, etc.).

Nutritional requirements and feeding of broiler chickens

Commercial broilers grow at a rapid rate and reaches about 2.0-2.5 kg body weight within 35-42 days of age. Therefore, the requirements of various nutrients are higher for broilers. Broiler chicks are fed *ad-libitum* from day old to age of marketing. Generally, broiler feed is prepared according to specifications prescribed by BIS as shown in Table 3.4.

Nutritional requirements and feeding of layer birds

Layer birds are used to produce table eggs. A balanced feed for layers is formulated as per the specifications of BIS as shown in Table 3.5.

Water requirement of birds

Water consumption in birds increases with egg production and temperature. Birds drink water around twice the amount of feed consumed. However, this requirement varies with the seasonal fluctuations in temperature and humidity. During summer, water consumption increases drastically and is nearly 5-6 times of the feed consumed.

Activities

Visit a nearby poultry farm with your teacher and note down the following points

1. Identify the breed of poultry present in the farm
2. Note down their characteristics of the breeds reared

Requirement: Nearby poultry farm, observation note-book and pen

Step by step process

- Go to a nearby poultry farm with your teacher.
- Observe and make a note of the breeds present there and identify them on the basis of the lesson taught in the class.
- Discuss with your class mates.

Check Your Progress

Multiple Choice Questions

1. Feed in poultry production comprises about how much cost of production
   (a) 55% (b) 70%
   (c) 35% (d) 90%
2. Dual purpose poultry breed is reared for
   (a) Both egg and meat purpose (b) for egg purpose
   (c) For meat purpose (d) None of the above
3. Commonly used form of poultry feed is
   (a) Pellet (b) Mash
   (c) Crumbles (d) None of the above
4. Pre-starter diet for broilers contain
   (a) 18% protein (b) 14 % protein
   (c) 23 % protein (d) 25 % protein
5. The energy content in layer feed phase I is
   (a) 2600 Kcal/kg (b) 2200 Kcal/kg
   (c) 1800 Kcal/kg (d) None of the above

Fill in the Blanks

1. Egg type breed of chicken is.....
2. Black meat breed of chicken is.....
3. Pekin breed of duck is .....type bird.
4. Birds drink water around ..... times the amount of feed consumed
5. Dustiness is a common problem in .....form of feed.

Mark True or False

1. Broiler chicks are fed *ad-libitum* from day old to age of marketing.
2. Maize is the most common energy source in poultry.
3. Soybean meal contains 43-50% proteins.
4. Fats and oils are added usually up to 15% in poultry feed.
5. Soybean meal is primarily used as protein source in poultry feed.

Session 2: Procedure for Procurement and Quality Assurance of Poultry Feed

Feed plays a vital role for maintaining the production and health of the birds. Thus, a systematic procedure has to be followed for procurement of good quality feed ingredients. Poor quality feed ingredients result in not only decreasing the production of the birds but also enhances the feed cost and have an adverse impact on the health of the birds.

Various ingredients are used for preparing feed for poultry birds. The primary ingredients of poultry feed are maize and soybean meal that are used as energy and protein source respectively. In addition, other ingredients are also used in the poultry feed as source of vitamins and minerals. Various feed ingredients used to prepare poultry feed are described in Table 3.6.

Ingredients used for feed production

Table 3.6: Ingredients Used in Poultry Feed

Ingredients		Crude Protein (%)	Energy (kcal/kg)	Utility
	*Yellow maize*	9	3350	• Major ingredient of poultry feed, inclusion level up to 60% • Primary source of energy • Highly digestible • Contain carotenoid pigment

	*Rice*	8	2600	• Source of energy • Used in small quantities in poultry feed if required
	*Soybean meal*	43-50	2400	• Major vegetable protein source, inclusion level up to 30-40%
	*Fish meal*	40-50	2000-2200	• Major animal protein source, inclusion level up to 5-10%
	*Rice polish*	12	2800	• Used as energy source up to 5-12% in feed
	*De oiled rice bran*	13-15	2000	Used as energy source up to 5-12%

	*Lime stone powder*	-	-	• Source of calcium • Contains 34% calcium • Inclusion level 2-8%
	*Dicalcium phosphate (DCP)*	-	-	• Source of calcium & phosphorus • Contains 24% calcium and 14-16% of phosphorus • Inclusion level 1-3%

Feed supplements

Supplements are those ingredients which are rich in one or more nutrients and added to feed to enrich the feed with nutrients. Vitamin premix containing vitamins A, D, E, K and B complex and mineral mixture containing trace minerals Cu, Fe, Se, Zn, Mn, Co, Cr etc. are used as feed supplements.

Feed additives

Feed additives are added in diets to improve feed intake, feed conversion ratio, digestion and utilization of various nutrients, meat quality, health and welfare of birds, keeping quality of feed etc. Some examples of feed additives are liver tonic, coccidiostats, prebiotics, probiotics, feed enzymes, toxin binders etc.

Procurement and storage of feed ingredients and feed

Procurement is the process of purchasing feed ingredients of good quality from the market. The main aim of procurement should be the acquiring the best quality raw materials at minimum prices. The following is the procedure for procurement of quality ingredients from local market.

Steps involved in procurement

1. Purchase is made from reliable and reputed companies or sources.

2. Feed ingredients are checked for their physical appearance viz. colour, texture, size, smell etc. and cost.
3. Feed supplements and additives are procured in properly sealed packs or gunny bags/ containers.

Feed ingredients	**Adulterants**
Maize	cobs
Rice	Stone particles, marble, lime stone
Soybean meal (SBM)	Urea, soybean seed, DORB, Arhar husk
De oiled rice bran (DORB)	Rice husk, saw dust
Fish meal	Salt, urea, sand
Mineral Mixture	Salt, sand, limestone, marble powder

Table 3.7: Common Adulterants in Poultry Feed

Storage

Proper storage of feed ingredients or prepared feed is essential to maintain the quality. The following points are vital to maintain the quality of feed:

- The storage site must be damp proof and rodent proof with provision for air tight arrangement
- There must be provision for proper ventilation
- The bags containing feedstuffs are stored on wooden planks or thick bed of rice or wheat straw
- Bags are stacked slightly away from another stack and the walls of the store to avoid contact with moist surfaces. Fresh feed should not be stored with old feed
- While storing feeds, the ingredients are analyzed for moisture contents, sun-dried if required and then be stored
- There must be separate provision for storage of fish meal, salt, supplements and feed additives
- Each item must be stored with proper labelling including date of purchase and expiry, if any

Cleaning of feed store

- Feed stores are thoroughly cleaned before storage of feed
- Feed store, old gunny bags and transportation vehicles like carts, trolleys, trucks and wagons are thoroughly disinfested at regular interval

Stored feed is examined periodically for dampness and fungal infestation, especially during rainy season

Adulterants and toxic substances in feed

Adulterants

Adulteration is defined as the replacement of pure substance with some cheaper low-quality substance. It occurs during procurement and processing of feed ingredients either intentionally or unintentionally. The list of some common adulterants is detailed hereunder in Table 3.7.

As is the situation of adulteration in human food in our country, similar is the situation of adulteration in the cattle and Poultry field. The accompanying news item given in the box shows the deep concern of the government to address the problem of adulteration in animal feed.

Toxins

Aflatoxicosis is one of the most common mycotoxins in poultry feed. It is caused by Aspergillus and Penicillium species of fungus. The production of aflatoxins can occur either in fields where the crops are grown or during improper storage.

Adulteration of poultry feed is a serious offence!

Kerala has become the first state in India to enact legislation to ensure the quality of cattle and poultry feed. Henceforth, any person found adulterating these items could be slapped with a jail sentence of six months to one year and a fine of Rs 5 lakh. During the first offence, the punishment is suspension of licence for up to six months and a penalty of Rs 25,000 – Rs 50,000. A repeat offence would lead to the cancellation of the licence and a fine of Rs 2 lakh. Yet another violation of the law would lead to the six months to one-year sentence and Rs 5-lakh fine. (Source: https://www.onmanorama.com/)

Toxicity also occurs due to contact of feed with fumigants, pesticides or any other poisonous substance if not handled correctly.

Quality and process control for production of poultry feed

The quality control of the feeds is must at every point starting from procurement of feed ingredients or raw materials to the point of consumption by birds. The objective of quality control of feed has been portrayed in Fig. 3.4.

Fig. 3.4: Objectives of quality control of feed

Factors affecting quality of the feed

There are various factors which affects the quality of the feed. These factors are depicted in Fig. 3.5.

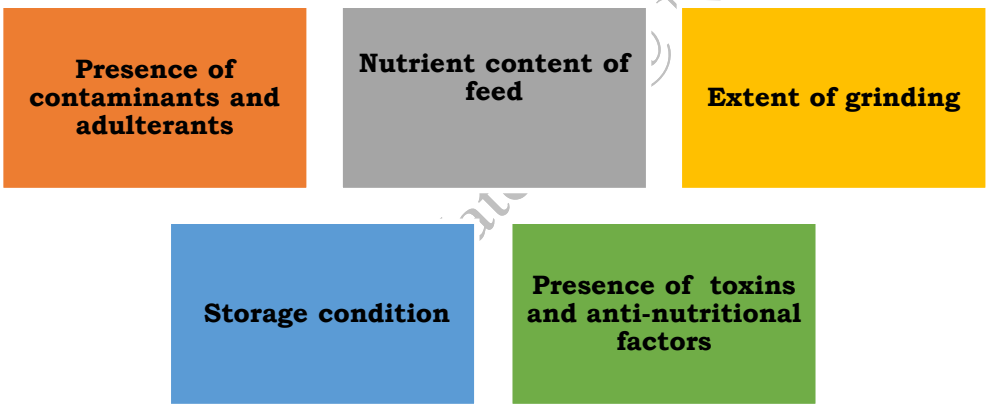


Fig. 3.5: Factors affecting quality of feed

Consequences of improper storage of feed

- Rodent and insect infestation in feed deteriorating the quality and decreasing the quantity of feed
- Mould infestation resulting in production of toxins in the feed
- Rancidity of fats, oils and fat-soluble vitamins resulting in deteriorating the quality of feed

Feed inventory

The inventories of feed ingredients, supplements, additives and prepared feed are maintained and stock levels checked periodically. It gives an overview of the availability of different stock items to prepare balanced feed. A model feed inventory register is depicted in Table 3.8.

Table 3.8: Feed Inventory Register

Ingredient Name:				
Date	**Stock in position (kg/ quintal/ton)**	**Quantity used (kg/ quintal/ton)**	**Balance quantity (kg/ quintal/ton)**	**Remarks, if any**

Activities

Visit a nearby poultry farm and make a note of the basic ingredients used in making poultry feed

Requirement: Nearby poultry farm, note-book, pen etc.

Step by step process

1. Go to a nearby poultry farm with your teacher
2. Observe and make a note of the ingredients used in making the poultry feed
3. Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Yellow maize contains

   (a) 3000 kcal/kg of energy (b) 2500 kcal/kg of energy

   (c) 2800 kcal /kg of energy (d) 3350kcal /kg of energy

2. Fish meal contains

   (a) 40-50 % protein (b) 20-30 % protein

   (c) 10-20 % protein (d) 70-80 % protein

3. The maximum limit of soybean meal used in the poultry feed is up to

   (a) 20-30 % (b) 30- 40 %

   (c) 40- 50 % (d) None of the above

4. What moisture % leads to fungal growth in the feed

   (a) 10 % (b) 13 %

   (c) 5 % (d) 2 %

5. Normal inclusion level of fish meal in poultry diet is

   (a) 2-3 % (b) 20- 25 %

   (c) 5- 10 % (d) None of the above

Fill in the Blanks

1. Soybean meal contains ..... % proteins.
2. Lime stone powder is added as calcium source in the poultry feed up to .....%
3. .....is one of the most common mycotoxin in poultry feed.
4. Storage of feed with above .....% moisture leads to mould growth.
5. .....is the replacement of pure substance with some cheaper low-quality substance.

Mark True or False

1. Poultry feed ingredients contains only protein and energy.
2. Most important animal protein source is fish meal in poultry diet.
3. Most important vegetable protein source is soybean meal in poultry diet.
4. Lime stone powder is a source of calcium and phosphorus both.
5. Aflatoxicosis is caused by virus.

Session 3: Different Types of Poultry Ration and their Formulation

The different types of poultry rations are prepared according to the age and purpose for which the birds are reared.

Types of poultry ration

Broadly there are three types of poultry ration- broiler, layer and breeder. Broiler and layer rations are again sub-divided as per the age of the birds as mentioned in Fig. 3.6.

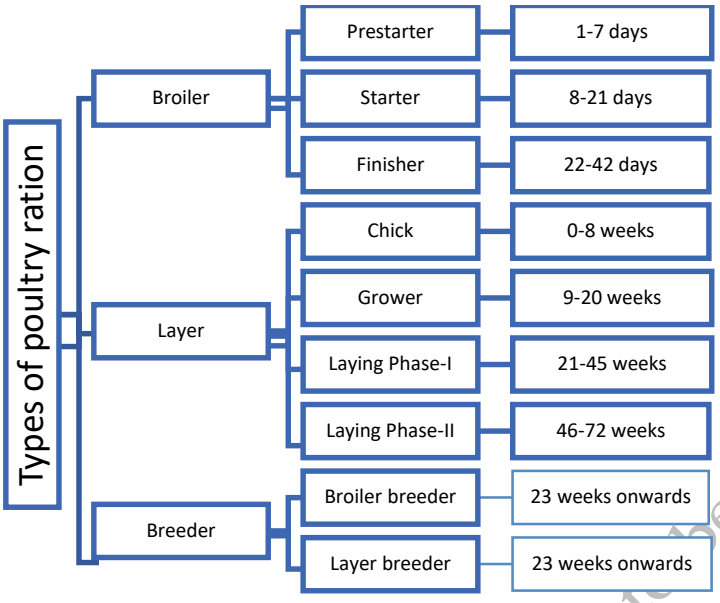


Fig. 3.6: Types of poultry ration

Computation of ration for different age and growth stage of poultry

Computation of poultry ration is done as per the age and production requirement of the birds. The computation may be done by hit and trial method, Pearson's method. Now a days computer software is used to prepare least cost ration using locally available materials.

Methods for feed processing and compounding

The methods of feed processing and compounding are described in Fig. 3.7.

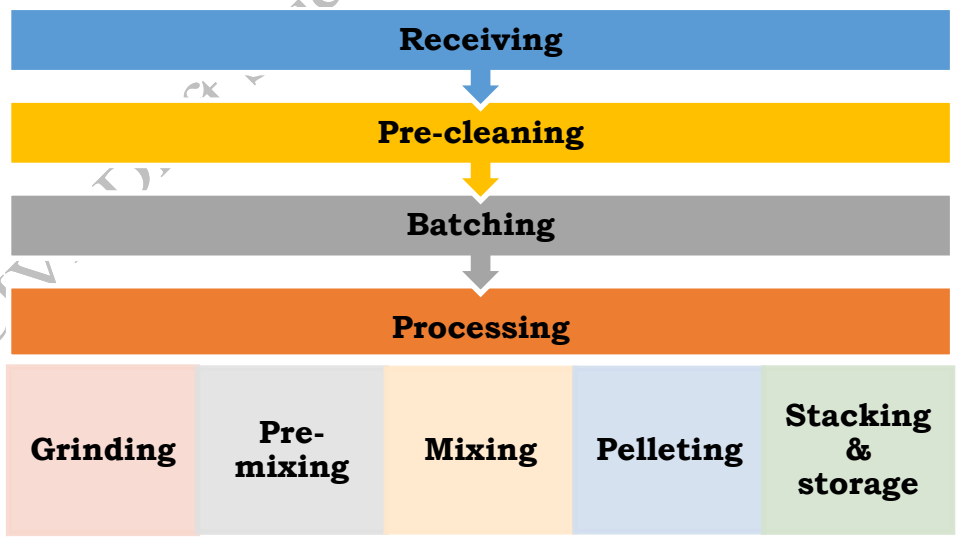


Fig.3.7: Methods of feed processing and compounding

i. Receiving

The first operation in the feed processing plant involves the receiving of raw materials into the plant premises. Feed ingredients arrive in sacks, or other small containers, and in bulk.

ii. Pre-cleaning

Pre-cleaning is a process of removing unwanted material from our ingredients.

iii. Batching

Batching is process of combining each and every material in a proportionate ratio called feed formula.

iv. Processing

Processing includes

1. Grinding: It is used for particle reduction
2. Premixing: It is used for mixing micro-ingredients like amino acids, vitamin and mineral premixes and feed additives
3. Mixing: It is used for mixing the feed ingredients after particle reduction with premix and oil.
4. Pelleting: Pelleting is the mechanical process of increasing the nutrient density of poultry feed with or without application of moisture or steam.
5. Stacking and storage: The prepared feed is packed in sacs/gunny bags, sealed and stored in feed storage room.

Activities

Visit a nearby poultry farm and observe different types of rations being fed to layers and broilers and make a note of it.

Requirement: Nearby poultry farm, observation note-book and pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note of different types of rations being fed to layers and broilers and make a note of it.
- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Pre-starter ration is given to the broiler up to the age of

   (a) 7 days (b) 35 days

   (c) 21 days (d) 28 days

2. Finisher ration is given to broiler up to the age of

   (a) 22 day to marketing age (b) 07 days

   (c) 14 days (d) none of the above

3. Grower feed is given to layer bird from the age of

   (a) 0-8 wks. (b) 9-20 wks.

   (c) Above 20 wks. (d) None of the above

4. Chick feed is given to the bird from the age of

   (a) 0-8 wks. (b) 9-20 wks.

   (c) Above 20 wks. (d) None of the above

5. Laying phase I feed is given to the bird from the age of

   (a) 0-8 wks. (b) 9-20 wks.

   (c) 21-45 wks. (d) 46-72 weeks

Fill in the Blanks

1. The first operation in the feed processing plant involves the ……of raw materials into the plant premises.
2. ……is a process of removing unwanted material from our ingredients.
3. ……is the mechanical process of increasing the nutrient density of poultry feed with or without application of moisture or steam.
4. ……is used for mixing micro-ingredients like amino acids, vitamin and mineral premixes and feed additives
5. ……is process of combining each and every material in a proportionate ratio called feed formula.

True or false

1. For grinding of feed ingredients used mixer is used.
2. Broadly there are three types of poultry ration namely broiler, layer and breeder.
3. The computation of ration may be done by Pearson's method.
4. The premixing process is used for mixing the feed ingredients after particle reduction with premix and oil.
5. Laying phase II feed is given to the bird from the age of 46-72 weeks.

Session 4: Feed and Water Supply Management

The supply of feed and water is a necessary routine activity of any poultry farm. The feed is offered to the birds as per their requirement and physiological status. *Ad-libitum* water will be provided to the birds for all the time to avoid the dehydration.

Space requirement for feeding and watering

The feeding and water space requirements vary according to the age of the birds as mentioned in Table 3.9.

Table 3.8: Feeding and Watering Space Requirements of Birds

Age of the birds	Feeding space (inches)	Watering space (inches)
0-3 wks.	1.0	0.25
3-6 wks.	2.0	0.50
6-20 wks.	3.0	0.75-1.0
20 wks. & above	4.0	1.0-1.25

Placement of feeders and waterers

First feed for chicks in brooder is spread over corrugated paper, chick box lid or on a flat plastic container. After 2 days of age, the feed is supplied in chick feeders. The feeders and waterers in brooder are placed alternatively in cart wheel pattern just like the spokes of the cartwheel. After 3 weeks of age, the chick feeders and waterers are replaced by larger feeder and waterers. The height of the feeder for growing birds is so adjusted that the bottom of the feeder

remains in the line with back of the birds. The waterers are cleaned on regularly to avoid the slime formation and microbial contamination.

Feed consumption rates for layers and broilers

The feed consumption rate varies with age, season, managemental stress, purpose of rearing and health status of the birds. Broilers are offered *ad-libitum* feeding whereas in layers and breeders controlled and restricted feeding are practiced. Young birds consume less feed compared to the adults. Birds consume more feed in winter as compared to the summer. Any type of managemental stress or disease condition results in reduction in feed consumption.

Water consumption rates for layers and broilers

Water provided to the birds is potable, cool and free from microbial contamination, heavy metals and other impurities. In general, birds drink water doubles the quantity of feed consumed. There are various factors which determine the water consumption rate as mentioned below:

- **Water quality:** Excessive amount of salts and minerals adversely affect the water intake
- **Age:** Young birds drink less water compared to the adults
- **Season:** Birds drink more water in summer as compared to the winter
- **Managemental stress:** Managemental stress like inadequate water space and lighting adversely affect the water intake
- **Health status:** Any type of disease condition affects water intake

Activities

Visit a nearby poultry farm and observe different types of equipment used for feeding and watering and make a note of it.

Know about the space required for watering and feeding equipment

Requirement: Nearby poultry farm, observation note-book and pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note of different types of equipment used for feeding and watering and make a note of it.
- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Feeding space requirement for 0-3 weeks old chicks in inch is

   (a) 1 (b) 2

   (c) 3 (d) None of the above

2. Feeding space requirement for 3-6 weeks old bird in inch is

   (a) 3.0 (b) 2.0

   (c) 4.0 (d) None of the above

3. Feeding space requirement for 6-20 weeks old bird in inch is

   (a) 2 (b) 3

   (c) 5 (d) None of the above

1. Feeding space requirement for 20 weeks and above old bird in inch is

   (a) 4 (b) 6

   (c) 10 (d) 8

2. Watering space requirement for 0-3 weeks old chicks in inch is

   (a) 0.25 (b) 1

   (c) 2 (d) None of the above

Fill in the Blanks

1. The feeders and waterers in brooder are placed alternatively in ……pattern.
2. Birds drink ……water in summer as compared to the winter
3. Birds consume …… feed in winter as compared to the summer.
4. ……water will be provided to the birds for all the time to avoid the dehydration.
5. Watering space requirement for 20 weeks and above old bird in inch is…….inches.

Mark True or False

1. First feed for chicks in brooder is spread over corrugated paper, chick box lid or on a flat plastic container.
2. Layers and breeders are offered *ad libtum* feeding.

3. Controlled and restricted feedings are offered in broilers.
4. The ideal ratio of water to feed intake is 2:1.
5. Excessive amount of salts and minerals adversely affect the water intake.

Module 4
Maintaining Health and Hygiene at Poultry Farm

Module Overview

Maintaining the health and hygiene is an important aspect to enhance production and minimize losses due to different diseases in the poultry farm. It's important to understand and recognize the signs and symptoms of diseases that affect birds and accordingly take the necessary control measures. This Module outlines the major health risks in poultry farming practices and prevention and control measures to minimize losses.

Learning Outcomes

After completing this module, you will be able to:

- Identify common poultry diseases, their symptoms, causes, and management practices to effectively control and prevent outbreaks in poultry flocks.
- Explain the importance of vaccines and the vaccination schedule for poultry birds, including the types of vaccines available and proper administration techniques.
- Discuss the factors affecting nutrient requirements in poultry birds, recognize signs of nutritional deficiencies, and implement strategies to ensure balanced nutrition for optimal health and productivity.

Module Structure

- Session 1: Common Poultry Diseases and their Management
- Session 2: Vaccines and Vaccination Schedule for Poultry Birds
- Session 3: Factors Affecting Nutrient Requirements and Nutrition Deficiency in Poultry Birds

Session 1: Common Poultry Diseases and their Management

Meaning of disease and the factors influencing occurrence of disease

Disease is the deviation from normal functioning of the body. Wide variety of factors like micro-organisms, nutritional deficiency, metabolic disorder, toxins, chemical agents etc. cause diseases in poultry.

Although there are many possible causes of disease, it is often a combination of factors that make birds sick which includes infectious agents and environmental factors. Infectious agents include parasites, fungi, protozoa, bacteria, mycoplasmas, chlamydia and viruses etc. Environmental factors include toxins, poor ventilation, vaccination failure, climatic extremes, physical stress, nutritional deficiencies, rodents, pests etc. The factors have been depicted in Fig. 4.1.

Fig. 4.1: Factors responsible for occurrence of diseases

Occurrence of disease in poultry is the result of interaction between disease causing agent, host and environment. This interaction comes under the concept of "One Health". 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 poultry 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. This interaction can be better understood by the figure 4.2.

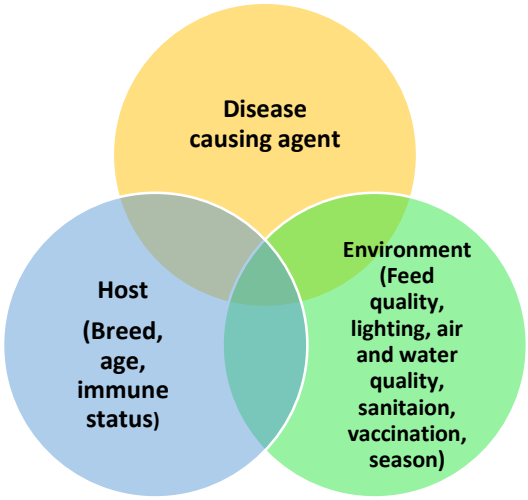


Fig. 4.2: Interaction leading to occurrence of disease

Factors influencing spread of diseases

There are various factors which influence the spread of diseases in birds and these factors are depicted in Fig. 4.3.

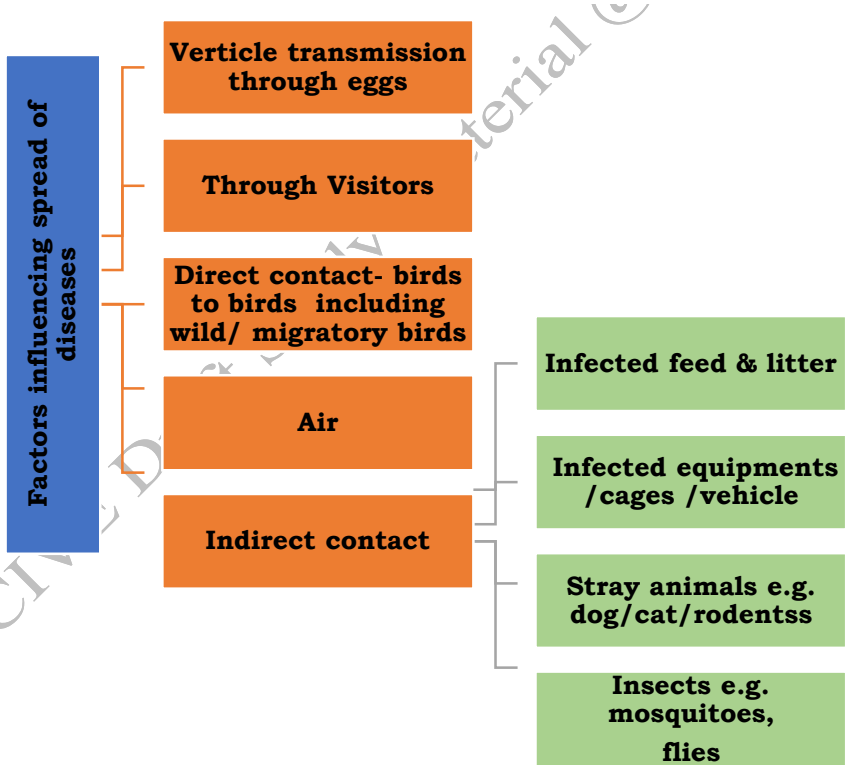


Fig. 4.3: Factors influencing spread of diseases

In many cases the symptoms are not visible in sick birds. Such birds which are 'carriers' also spread diseases like the infected birds to the healthy birds.

Health management in poultry

We know that to maintain health in humans, we need to know about the disease, its prevention, and the early treatment of the disease. The same approach holds good for poultry as well. The salient aspects of maintaining health in poultry birds include the following;

1. **Biosecurity at the farm**: Stringent provisions for adequate biosecurity at the farm gate and all entrances to poultry sheds are required to be in place in the poultry farm.
2. **Adequate feed, water, temperature and ventilation**: Inadequate nutrition and low-quality water supply will give rise to a number of health issues in the birds. Similarly, uncontrolled temperatures and inadequate ventilation is injurious for the birds. The overall record of the feed and water consumption is also reflective of the health management system of a particular poultry farm.
3. **Vaccinations and medications**: A complete record of the vaccinations and other medicines as well as the overall flock health tells about the health management system of the poultry farm from which the needed inferences can be drawn. Last but not the least a good health management system of the poultry farm also maintains a record of birds died or culled each day

Early recognition or detection of disease

- Birds should be monitored at least two times in a day
- Check birds for alertness and activeness
- Check for any symptoms of sickness
- If any bird is not able to move freely, eat and drink water properly, it is removed and kept in a separate enclosure
- The dead bird, if any, is removed from the farm immediately because dead birds are source of infection to healthy birds

Early treatment of disease

If the bird is observed sick, the local veterinary doctor is immediately contacted.

Common poultry diseases

Birds are affected with several diseases that cause heavy losses in poultry farms worldwide. However, some of these diseases occur frequently. Therefore, a fair understanding of these diseases is required for a small poultry farmer

1. Ranikhet Disease (Newcastle Disease)

2. Mareks' Disease
3. Gumboro Disease (Infectious Bursal Disease)
4. Fowl Pox
5. Avian Influenza (Bird Flu)
6. Colibacillosis
7. Infectious Coryza
8. Coccidiosis etc.

Following are some of the diseases of economic importance in poultry farming as shown in Table 4.1.

Table 4.1: Common Poultry Diseases of Economic Importance

Ranikhet disease (Newcastle disease)	
Caused By: *Paramyxo virus* • Birds of all age groups affected • Common in summer but occurs throughout the year • Spread through contaminated water, feed, air and direct contact **Symptoms & gross lesions:** • Dull, distressed • Greenish-white diarrhea • Twisting of neck • Leg paralysis and drooping of wings • Respiratory distress • Shell less/soft shelled eggs	
Prevention and control	By vaccination and following bio-security measures

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Leg paralysis</td><td>Drooping of wings</td><td>Twisting of neck</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Twisting of neck</td><td colspan="2">Greenish-white diarrhoea</td></tr>
<tr><td colspan="3">Marek’s disease</td></tr>
<tr><td> 
Thickening of comb</td><td colspan="2">Caused By: Herpes virus
• Growers affected at 12-16 weeks
• More common during summer
• Spread through aerosol route, contaminated feather follicles etc.
Symptoms & gross lesions:
• Severe weight loss and emaciation
• Diarrhoea
• Paralysis with one leg stretched forward and other retracted</td></tr>
<tr><td>Prevention and control</td><td colspan="2">• Vaccination on day-old age at hatchery
• Good bio-security measure</td></tr>
</table>

	 
Emaciation	Paralysis of legs

Gumboro /Infectious bursal disease	
	**Caused By**: *Birna virus* • Mostly commonly seen in chicks up to 40 days of age • Spread through contaminated feed and water **Symptoms & gross lesions:** • Typical posture of dropping of head with closed eyes • Affected birds become dull and depressed, soiled vent • White diarrhoea
Prevention and control	• Vaccination of chicks and parent stock • Strict bio-security measures with good management practices

Fowl pox

Caused By: *Avipox virus*

Symptoms & gross lesions

Nodular lesions on various un-feathered parts of the body

Prevention and control	• Can be prevented by vaccination • Strict bio-security measures

Pox lesions on comb

Avian Influenza/Bird flu

Haemorrhages on legs

Congestion of comb

Caused By: *Orthomyxo virus*

- Water fowls are natural reservoirs
- Transmitted by contaminated nasal, ocular/faecal discharges of sick birds
- Also transmitted mechanically by insects, rodents and fomites etc.

Symptoms & gross lesions:

- Congestion
- Cyanosis of comb and wattle
- Haemorrhages
- Oedema of legs

Prevention and control	• Strict bio-security measures

	• Restriction on movement of equipment and poultry produce

Colibacillosis (Bacterial disease)
Caused By: *Escherichia coli* • Natural inhabitant of gastrointestinal tract. However, cause disease in stress condition • Transmitted by contaminated feed, water, fomites and hatching eggs **Symptoms & gross lesions:** Distended abdomen, tendency to huddle, ruffled feather, pasty vents, diarrhea, drop in egg production
Prevention and control: • Good bio-security measures • Proper brooding management • Use of water sanitizers

Infectious Coryza (Bacterial disease)	
Caused By: *Haemophilus paragallinarum* • Disease is common in all age groups. Severe in older birds. • Spreading mostly occurs through contaminated drinkers, by direct contact and also by air borne route **Symptoms & gross lesions:** • Nasal and ocular discharge • Swollen face and wattle. • Difficulty in breathing	
Prevention and control	• Good managemental practices reduces the incidences • Vaccination

Coccidiosis (Parasitic disease)	
Caused By: *Eimeria species (E. tenella etc.)* • It affects mostly in 3-6 weeks of age and mostly seen in rainy season • Wet litter condition, overcrowding, poor ventilation favors its occurrence **Symptoms & gross lesions:** • Blood-stained diarrhea • Ruffled feathers • Loss of appetite • Paleness of comb and wattles	
Prevention and control	• Good managemental practices reduces the incidences • Vaccination

Difference Between Healthy and Sick Poultry Birds

Healthy bird	**Sick bird**
• Active and alert • Elevated head and Tail	• Dull and depressed • Tend to sit in an isolated place • Curved posture
• Bright and alert eyes • Bright red comb and wattle	• Shrunken eyes • Pale comb and wattle
• Normal size/weight specific for the strain, age and sex	• Stunted growth/ lower weight
• No lameness or paralysis/ injuries/ deformities	• Paralysis of the legs, wings or neck
• No discharges from the nostrils or eyes	• Sneezing and/or coughing

• No stained feathers around the vent	• Ruffled feathers • Diarrhea • Blood in the faeces
• No swellings	• Swellings of joints /comb/ wattle
• Good feed and water intake	• Unexpected changes in food and water consumption
• Good growth rate and egg production	• Slower growth or a drop in egg production

Beak trimming/Debeaking

Poultry birds have the natural instinct to peck other birds to death. These birds even eat up the protruding flesh of such weaker and pecked birds and may sometimes even not hesitate to kill their fellow chickens. This tendency in birds is referred to as cannibalism. This practice is usually essential for egg-type / breeder chickens to prevent cannibalism and feed wastage. However, it is not required for broilers. Debeaking is done by electric debeaker. In this practice, 1/3 to 1/2 of upper beak is cut and the lower beak is trimmed with cauterization and made blunt.

Age at which debeaking is done

Beak trimming is carried out at various ages depending on the requirement. The most common ages for debeaking of birds are:

- Day-old (most common)
- 5–10 days old
- 12-14 weeks

Process of debeaking

The steps of debeaking have been explained in Fig. 4.4.

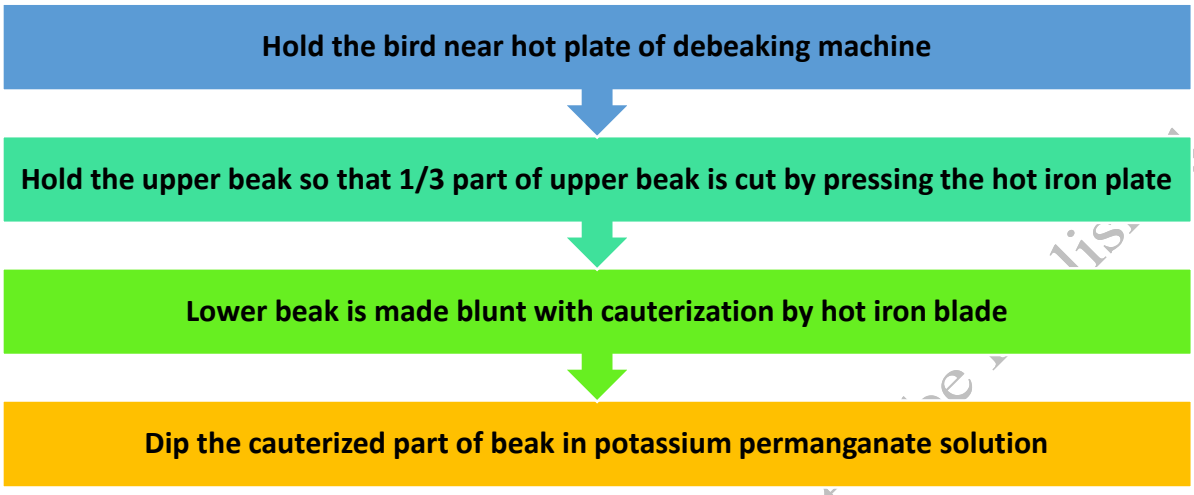


Fig. 4.4: Steps of debeaking

Advantages of debeaking

- Beak trimming is a preventive measure to reduce damage due to cannibalism and thereby improves livability
- It controls and prevents feed wastage
- It allows uniform growth and production in birds
- It controls social hierarchy in the flock and preferential mating in natural breeding system, resulting in higher fertility in hatching eggs

Activities

Visit a nearby poultry farm and observe the possible source of occurrence of disease in the farm and biosecurity measure adopted in the farm and make a note of it.

Requirement: Nearby poultry farm, observation note-book, pen.

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note
- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Fowl Pox is a

   (a) Bacterial disease (b) Viral disease

   (c) Nutritional deficiency disease (d) Protozoa disease

2. Greenish white diarrhoea is a symptom of

   (a) Fowl pox (b) Avian influenza

   (c) Ranikhet (d) Coccidiosis

3. Blood-stained diarrhoea is the symptoms of

   (a) Fowl pox (b) Avian influenza

   (c) Ranikhet (d) Coccidiosis

4. Gumboro disease is occurred mainly in

   (a) Chicks up to 40 days of age (b) 9-10 weeks old bird

   (c) 14-15 weeks old bird (d) None of the above

5. Purple discoloration/Cyanosis of the comb and wattles is the symptom of

   (a) Fowl pox (b) Avian influenza

   (c) Ranikhet (d) Coccidiosis

Fill in the Blanks

1. Occurrence of the diseases in the poultry is the result of interaction between ……, ……. and …….
2. Avian influenza disease is caused by …….
3. Infectious Coryza is caused by …….
4. Signs of the healthy birds are ……comb and ……. eyes.
5. Debeaking is done in the bird to avoid …….

Mark True or False

1. Gumboro is a viral disease.
2. Coccidosis disease is caused by a virus.
3. Infectious Coryza spread through contaminated drinkers, by direct contact and also by air borne route.

4. Dull, depressed, ruffled feathers, drooping wings are the sign of the healthy birds.
5. Debeaking is done in the bird to avoid feed wastage.

Session 2: Vaccines and Vaccination Schedule for Poultry Birds

What is a vaccine?

A vaccine is a preparation that helps the animal's body to become immune to a disease which is caused by certain germs or micro-organisms. The vaccine contains some part of the germ or the poison that the germ produces. It does not make the animal sick, rather helps the animal's body to protect itself from getting diseased in future.

How vaccines are administered?

The administration of a particular vaccine into the fowl's body is undertaken to make it immune to a specific disease. Different vaccines are administered either subcutaneously, intradermal or intramuscularly based on the standard instructions prescribed for that particular vaccine.

Vaccines and their administration

Vaccines are further classified into live and killed which have different routes of administration as explained in the figure 4.5.

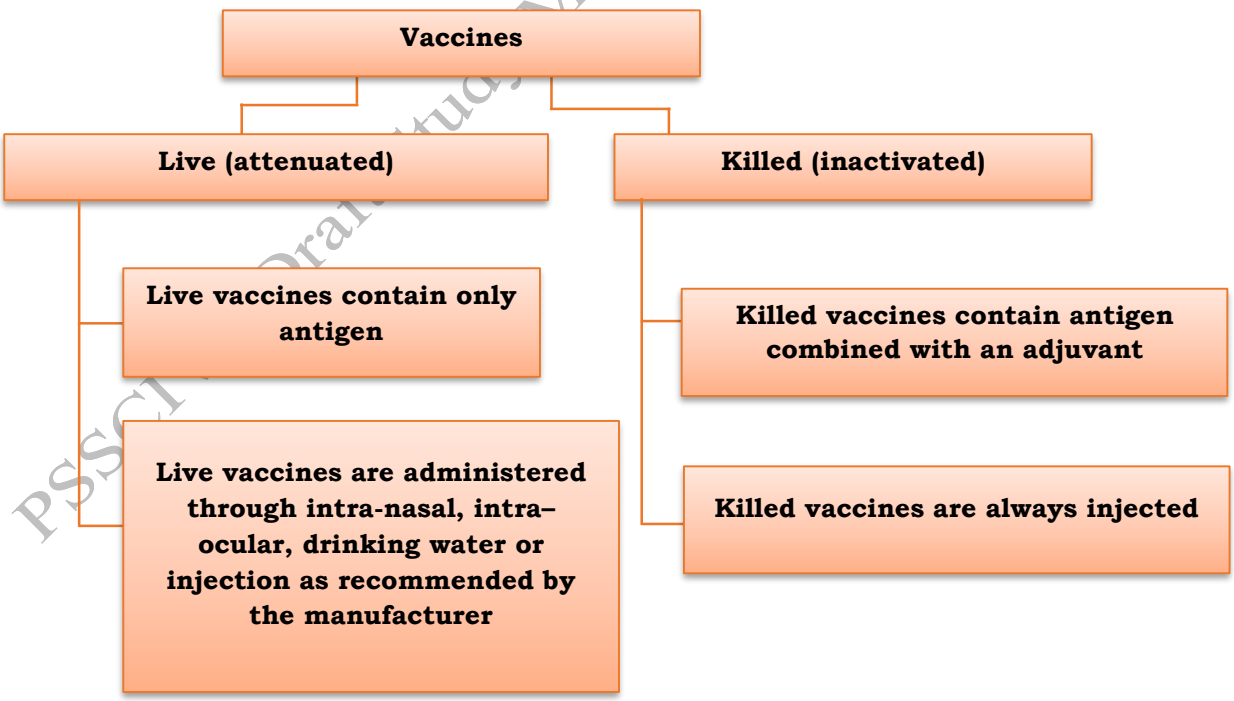


Fig.4.5: Types of vaccines and their route of administration

Handling and storage of vaccines in a poultry farm

Proper handling and storage of vaccine is necessary for successful and efficient vaccination. The different measures taken for safe handling and storage of vaccines have been depicted in Fig. 4.6.

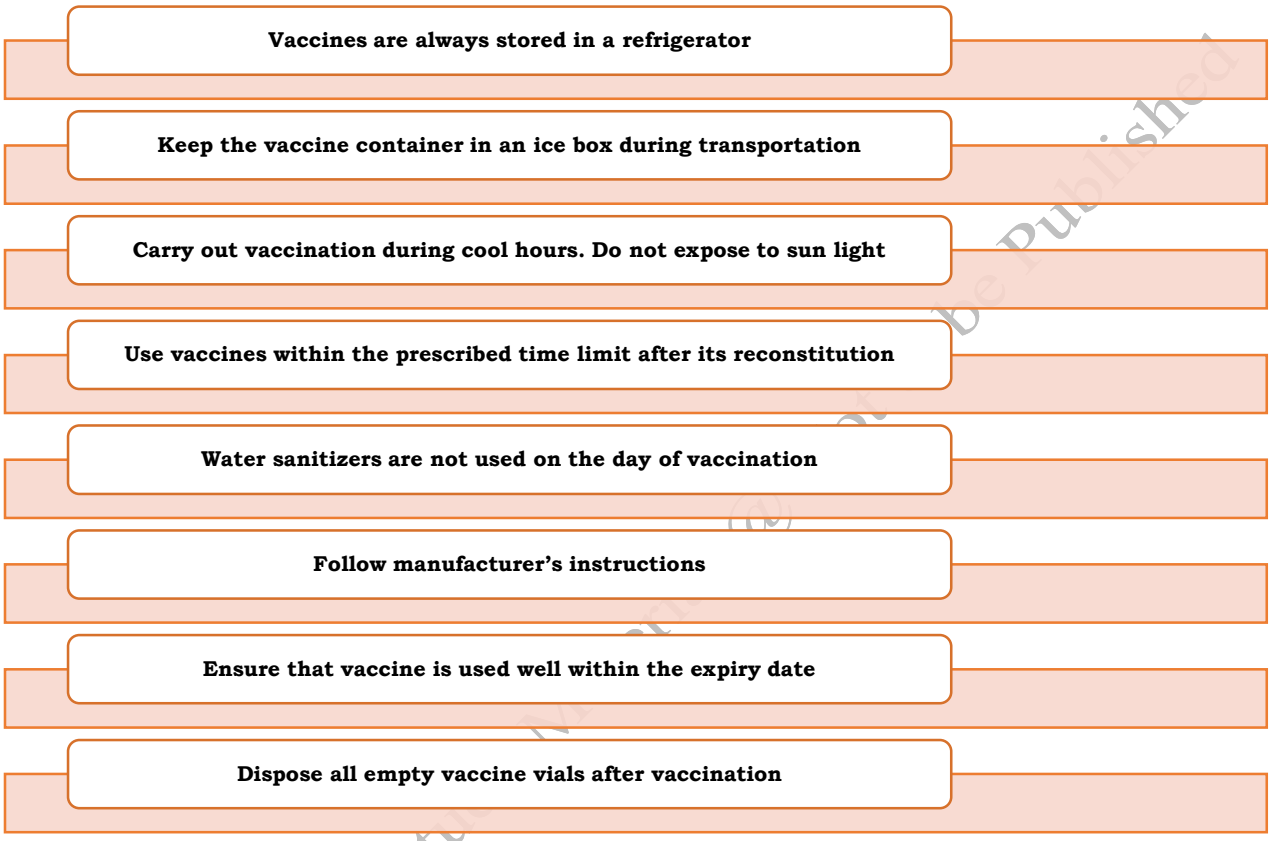


*Fig. 4.6: M*easures taken for safe handling and storage of vaccines

Vaccination schedule for poultry birds

The vaccination schedule for broilers, layers and breeder birds are given in Table 4.2 and Table 4.3, respectively.

Table 4.2: Vaccination Schedule for Broilers

Days	Vaccine	Dose	Route
Day old *(In hatchery only)*	Marek's HVT strain	0.2 ml	Subcutaneous (s/c) injection
5-7	Ranikhet F/B1/Lasota strain	1-2 drops	Intraocular or intranasal
12-14	Gumboro IBD intermediate plus strain	1-2 drops	Intraocular or intranasal or drinking water
19-21	Ranikhet F/B1/Lasota strain	Dose recommended by manufacturer	Drinking water
26-28	Gumboro IBD Intermediate strain	Dose recommended by manufacturer	Drinking water

Table 4.3: Vaccination Schedule for Layers and Breeders

Day	Vaccine	Doses	Route
Day old *(In hatchery only)*	Marek's HVT strain	0.2 ml	Subcutaneous (s/c) injection
5-7	Ranikhet F/B1/Lasota strain	1-2 drops	Intraocular or intranasal
12-14	Gumboro IBD intermediate plus strain	1-2 drops	Intraocular or intranasal or drinking water
19-21	Ranikhet F/B1/Lasota strain	Dose recommended by manufacturer	Drinking water

26-28	Gumboro IBD Intermediate strain	Dose recommended by manufacturer	Drinking water
49	Fowl Pox	0.2 ml	Wing web by lancet
56	Ranikhet R_2B strain	0.5 ml	Intramuscular injection
63-70	Fowl Pox	0.2 ml	Wing web by lancet
Every 2 month	Ranikhet Lasota/B1/F strain	Dose recommended by manufacturer	Drinking water

Vaccination procedures/ methods of vaccine administration

There are four major methods by which vaccines are administered in poultry birds. The details of these methods are described in Fig. 4.7.

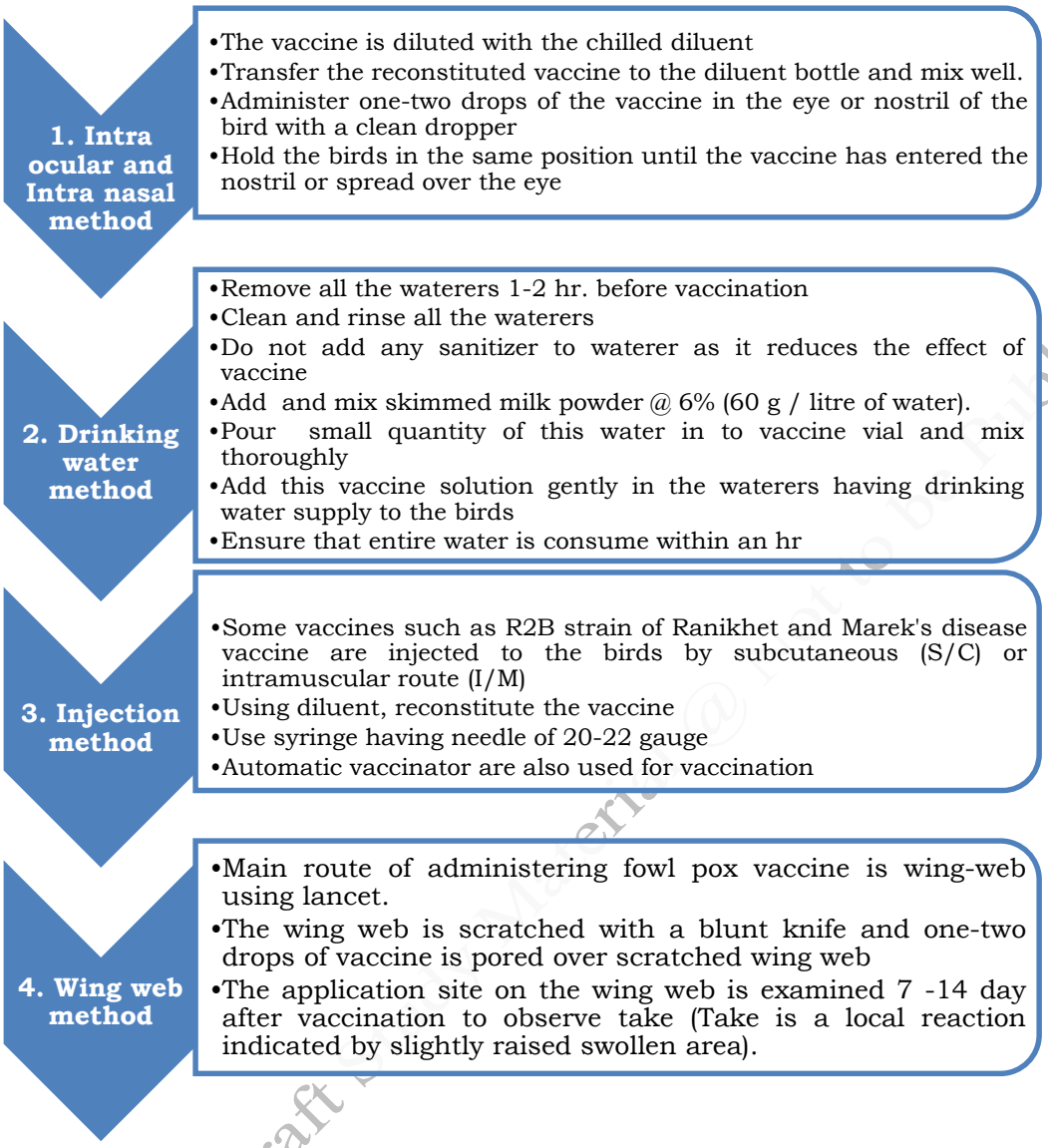


Fig. 4.7: Vaccination methods in poultry

Activities

Visit a nearby poultry farm and observe vaccination schedule adopted at the farm and observe the precaution taken by the farmer during storage, handling and administration of vaccine.

Requirement: Nearby poultry farm, observation note-book, pen

Step by step process

- Go to a nearby poultry farm with your teacher
- Observe and make a note

- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Ranikhet (Newcastle disease) vaccine is administered by

   (a) Injection route (b) Intraocular route

   (c) Intranasal route (d) All of the above

2. Vaccination should be carried out during

   (a) Hot climate (b) Cool hour

   (c) Both of the above (d) None of the above

3. Drinking water method of vaccination, skimmed milk powder should be added @ of

   (a) 60 g / litre of water (b) 8-10 g / litre of water

   (c) 2-3 g / litre of water (d) 10-15 g / litre of water

4. Gumboro first vaccination is done at the age of

   (a) 18-21 days (b) 12-14 days

   (c) 25-30 days (d) None of the above

5. Marek's vaccination is carried out in chicks by

   (a) Subcutaneous injection (b) Lancet method

   (c) Intraocular and drinking water methods (d) None of the above

Fill in the Blanks

1. Vaccine is preparations which contain either the…… or…….
2. Live vaccines contain only……
3. Vaccines are always stored in a……
4. Main route of administration of fowl pox vaccine is …… using ……
5. Marak's vaccination is done…… age in hatchery @……

Mark True or False

1. Killed vaccine consists of antigen combined with an adjuvant.
2. Use of water sanitizer on the day of vaccination is helpful in vaccination.

3. R2B strain of RaniKhet disease and Marek's disease vaccine are given by injection only.
4. To assess success of fowl pox vaccination the "Take reaction" is observed after vaccination.
5. Automatic vaccinator is not used in poultry vaccination.

Session 3: Factors Affecting Nutrient Requirements and Nutrition Deficiency in Poultry Birds

There are different factors affecting nutrient requirements in poultry depending on age, breed, purpose of rearing, season, environment etc. Thus, a balanced feed has to be provided to the birds for maintaining production and health. Deficiency of one or more nutrients may result in nutritional deficiency and metabolic diseases in poultry.

Factors affecting the nutrient requirements of poultry

The nutrient requirements of poultry are affected by a large number of factors which include:

Genetics

Different species and breeds of birds have different average body sizes, growth rates and production levels and utilize nutrients from feed with different levels of efficiency.

Age

Higher amount of feed is required for adult than grower and chick phases.

Sex

Feed requirement is more in male as compared to female of the same age group.

Reproductive state

The stage of egg production in hens and sexual activity in males affects nutrient requirements.

Ambient temperature

Poultry birds have higher energy requirements due to high body temperature and metabolic rate. Feed intake is reduced at higher environmental temperature.

Housing system

The type of housing system influences the level of activity of the birds and therefore their energy requirements. Birds reared in cage system require a slightly lower energy as compared to those reared in deep litter system.

Health status

Sick birds take less feed than healthy birds.

Purpose of rearing

Nutrient requirements vary with the purpose for which the birds are reared. The nutrient requirements of broilers are different from layers and breeders. The energy intake in breeders is restricted to prevent obesity to ensure better reproductive performance.

Nutrient requirements for egg laying chickens and broilers

Because the broilers are reared for meat purpose, therefore the intake of nutrients is adjusted to meet the birds' requirements for increased production of good quality meat. On the other hand, as the layer type of birds are reared for eggs therefore, the nutrient composition of their rations are specifically directed towards production of greater number of good quality eggs.

Diseases caused due to nutritional deficiencies and improper metabolism in poultry birds

The major nutritional deficiencies and metabolic diseases along with their symptoms and preventive measures are comprehensively given in Table 4.4.

Table 4.4: Nutritional Deficiencies and Metabolic Diseases in Poultry

S. No.	*Name of the disease/ Deficiency*	Symptoms	Preventive measures
1.	*Protein deficiency*	• Retarded growth and production • Cannibalism • Ruffled feathers	• Provide recommended quantity of protein in broiler, layer and breeder feed • Add animal protein supplements in feed to provide essential amino acids like methionine, lysine etc.
2.	*Fat deficiency*	• Retarded growth	• Proper balance of fats in the diet

		• Improper functioning of liver • Improper absorption of vitamin A, D, E	• Add fat supplements in feed having essential fatty acids e.g., linolenic acid, arachidonic acid
3.	*Fatty liver syndrome*	• Enlarged liver • Rupture of liver • Pale comb	• Addition of fish meal, choline chloride to feed
4.	*Vitamin A deficiency*	• Weakness • Imbalance in movement • Susceptible to infection • Decrease in egg production and hatchability	• Supplementation of 10000 IU of vitamin A in feed. • Addition of vit A enriched feed supplements in feed
5.	*Vitamin B deficiency*	• Stunted growth • Dermatitis • Mouth lesion • Loss of feathers • Reduced hatchability	• Vitamin B supplements mixed in feed as per the nutrient requirements
6.	*Crazy chick disease* *(Vitamin E deficiency)*	• Paralysis • Imbalance • lack in coordination	• Vit E Supplements 300 IU /kg mixed in feed • Selenium (Se) supplementation in feed.

7.	*Rickets* *(Vitamin D deficiency)*	• Bending of leg • Lack of coordination in movement • Thinning of egg shell	• Vitamin D Supplements in feed • Addition of Shell grit / Di-calcium Phosphate (DCP) / Limestone grit/ Limestone powder in feed
	Metabolic disorders		
8.	*Gout*	• High level of uric acid in the blood • Deposition of urates on the surface of various internal organs and on hock joint • White chalky coating over internal organ • Birds die due to kidney failure	• Reduce the calcium concentration in the diet. • Avoid high level of protein • Increase maize in feed • Give electrolyte in drinking water
9.	*Ascites*	• Accumulation of fluid in the abdominal cavity of birds	• Reduce nutrient density (energy and protein) in diet • Adequate ventilation • Add vitamin E supplement in feed

Activities

Visit a nearby poultry farm and prepare the chart of nutrition deficiency and metabolic diseases make a note of it.

Requirement: Nearby poultry farm, observation note-book, pen.

Step by step process

- Go to a nearby poultry farm with your teacher

- Observe and make a note
- Discuss with your class mates

Check Your Progress

Multiple Choice Questions

1. Rickets is caused by deficiency of

   (a) Vitamin D (b) Vitamin C

   (c) Vitamin E (d) Vitamin K

2. Gout is a

   (a) Metabolic disorder (b) Deficiency disease

   (c) Infectious disease (d) None of the above

3. In comparison to layers, same age broilers require

   (a) More amount of feed (b) Less amount of feed

   (c) Equal amount of feed (d) Not certain

4. Crazy chick disease is caused by deficiency of

   (a) Vitamin A (b) Vitamin B

   (c) Vitamin K (d) Vitamin E

5. Ascites is a

   (a) Infectious disease (b) Deficiency disease

   (c) Metabolic disorder (d) None of the above

Fill in the Blanks

1. ..... amount of feed is required for adult than grower and chick phases.
2. Bending of legs is caused by deficiency of vitamin .....
3. Accumulation of fluid in the abdominal cavity of birds is occurred in .....
4. High level of ..... acid in the blood is found in gout.
5. In case of fatty liver syndrome ..... and ..... are added in the feed.

Mark True or False

1. Feed intake is reduced at higher environmental temperature.
2. Feed requirement is more in female as compared to male of the same age group.
3. Birds reared in cage system require a slightly lower energy as compared to those reared in deep litter system.
4. Calcium concentration is reduced in the diet of birds affected with gout.
5. Cannibalism is not occurred in case of protein deficiency

Answer Key

Module 1: Overview of Poultry Farming

Session 1: Opportunities in the Poultry Industry and the Roles and Functions of a Small Poultry Farmer

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	d	a	c	a	b
Fill in the blanks	Private initiatives & veterinary health services	Layers	Broilers	Backyard poultry	Commercial poultry
True or False	True	True	False	False	False

Session 2: Layout of Poultry Farm and Characteristics of a Good Poultry Housing System

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	b	a	c	c	a
Fill in the blanks	East to West	number of birds	Concrete	chick guard	warmth & light
True or False	False	False	True	False	True

Session 3: Practices Adopted for Maintaining Cleanliness and Hygiene in Poultry Shed

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	c	d	c	b	a
Fill in the blanks	increases	ventilation	70-80%	mechanical & natural	personal safety
True or False	True	True	False	False	True

Session 4: Procedure for Disposal of Poultry Waste

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	c	c	b	b	c

Fill in the blanks	All in/all out method	Disinfectant	Burning	dust	two times
True or False	True	True	True	True	False

Module 2: Handling Poultry Birds in Shed

Session 1: Handling and Monitoring of Poultry Birds in Shed

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	b	a	c	b	d
Fill in the blanks	8	4-6	5	3-5	brooding
True or False	True	True	True	True	False

Session 2: Procedures of Biosecurity for Maintaining Health and Hygiene of Poultry Birds

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	b	d	d	d	c
Fill in the blanks	disease-free	vaccination	All-in-all-out	isolated	entrance
True or False	True	True	False	True	True

Module 3: Feeding Poultry Birds

Session 1: Forms, Feed, Supplements and Additives Used for Feeding Poultry Birds

Answer					
	1	2	3	4	5
Multiple Choice Questions	b	a	b	c	a
Fill in the blanks	Leghorn	Kadaknath	meat	two	mash
True or False	True	True	True	False	True

Session 2: Procedure for Procurement and Quality Assurance of Poultry Feed

Answer					
	1	**2**	**3**	**4**	**5**
	D	A	B	B	C

Multiple Choice Questions					
Fill in the blanks	43-50 %	8%	Aflatoxicosis	13	Adulteration
True/False	False	True	True	false	false

Session 3: Different Types of Poultry Ration and Their Formulation

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	a	a	b	a	c
Fill in the blanks	receiving	pre-cleaning	pelleting	premixing	batching
True or False	False	True	True	True	True

Session 4: Feed and Water Supply Management

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	a	b	b	a	a
Fill in the blanks	cart wheel pattern	more	more	*ad-libitum*	1-1.25
True or False	True	False	False	True	True

Module 4: Maintaining Health and Hygiene at Poultry Farm

Session 1: Common Poultry Diseases and their Management

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	b	c	d	a	b
Fill in the blanks	Disease causing agent, host & environment	*Orthomyxo virus*	*Haemophilus paragallinarum*	Bright red,	Cannibalism

				Bright and alert	
True or False	True	False	True	False	True

Session 2: Vaccines and Vaccination Schedule for Poultry Birds

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	d	b	a	b	a
Fill in the blanks	Killed inactivated microorganism, live attenuated microorganism	Antigen	Refrigerator	Wing-web, Lancet	in day old & 0.2 ml
True or False	True	False	True	True	False

Session 3: Factors Affecting Nutrient Requirements and Nutrition Deficiency in Poultry Birds

Answer					
	1	**2**	**3**	**4**	**5**
Multiple Choice Questions	a	a	a	d	c
Fill in the blanks	More	D	Ascites	Uric	Fish meal and Choline chloride
True or False	True	False	True	True	False

Glossary

Ad-libitum: Feeding food as much as they (birds) want.

All-in-all-out system: A method of rearing broiler birds in which only one batch is available at a given time, and they are of the same age.

Available phosphorus: It is the portion of total phosphorus in the feed which is relatively available for absorption and utilization. Available phosphorus is not associated with phytate content in the diet.

Aeration: Process by which air is circulated through sheds.

Acquiring: To get or come to own something.

Aesthetic quality: Pleasant, positive appearance of a thing.

Aggravated: To make a bad situation worse.

Backyard poultry: Rearing of birds with poor production performance in semi intensive systems.

Brooder house: House used to brood or rear chicks from 0 to 8 wks. for layer or 0 day to 3 wks. for broiler chicks.

Broiler house: House in which broiler are reared up to 6 wks. of age.

Brooder: Equipment which provides warm and safe place for chicks to grow in initial stages.

Coir pith: It is a material that binds the fibers in the coconut husk. It is used as a bedding or litter material.

Crude protein: It is the amount of protein of animal/poultry feed or specific food. Crude protein depends on the nitrogen content of the feed. Crude protein is calculated as total nitrogen content in the feed multiply by a specific factor 6.25.

Controlled feeding: Providing specified quality and quantity of the feed as per requirement during different physiological conditions and age to prevent feed wastage and over fattening.

Commercial poultry: Keeping birds in large numbers in modern amenities as business.

Cannibalism: Act of birds to peck some part of other birds by their beaks.

Crevices: Small narrow cracks or spaces on the surface of walls or floor.

Coop: Enclosure made of wire or metal bars in which birds can be kept.

Consequence: A result or effect, typically a one that is unpleasant or un welcome.

Cob web: Threads made by a spider in order to catch insects.

Congregate: To come together in a group or to crowd.

Ditch: A narrow channel, dug at the side of sheds to hold or carry away water.

De-oiled groundnut cake: Complete oil extracted from a ground nut cake.

Dampness: State of being slightly wet, especially in a way that is not pleasant or comfortable

Fogger: Cooling devices placed inside house to keep the house cool

Feed Conversion ratio: It is a measure of efficiency in converting feed into increased body mass. It is calculated by divide the weight gained by feed intake. Hence a lower FCR means higher profit.

Forage: Food for animal especially when taken by browsing or grazing.

Feeder: A device used for supplying feed to poultry.

Grower house: Houses used to rear layer types of chicks from 9th to 18th week of age.

Host: An organism from which a parasite obtains nutrients and/or shelter

Homeostasis: A property of cells, tissues and organisms that allows the maintenance and regulation of the stability and constancy needed to function properly. It is a healthy status that is maintained by the constant adjustment of biochemical and physiological pathways.

Insecticide: Toxic substances used to kill insects.

Inclement: Unpleasantly cold or stormy weather.

Intra-ocular route: Vaccine administered through eye.

Intra-nasal: Vaccine administered through nostril/nose.

Kilo-calorie (Kcal): It is a Module of energy of one thousand calories. The term used to represent the amount of energy required to raise the temperature of a liter of water one degree centigrade at sea level.

Layer House: House used to keep layer birds over 18 wks. to usually 72 weeks of age.

Litter: Bedding material, used on the floor of deep litter system.

Morbidity: The condition of suffering from a disease.

Metabolizable energy: It is the energy remaining after fecal and urinary energy loss from feed. It represents the energy available for growth, production,

reproduction and for supporting metabolic processes in the body. The energy content of feed ingredient is normally expressed as metabolizable energy.

Overhang: Extended outward part of the roof, providing protection from rain and sunlight.

Overalls: A loose fitting protective garment that is worn over other clothings.

Parent layer/ Broiler farming: Parent birds are the breeder used to produce the layer or broiler chicks to keep at poultry farm.

Pathogen: Usually defined as a microorganism that cause or can cause disease.

Piling/huddling: Baby chicks clump together for safety and lay on top of each other

Procurement: Final act of purchasing.

Prebiotics: It is a substrate for the beneficial microbes that remain undigested in the gastro-intestinal tract by the birds. It is mainly composed of cell walls.

Probiotics: live bacteria and yeast that are good for the digestive system added in feed.

Predator: An animal that kills and eats other animals.

Restricted feeding: Restricted feeding means an actual reduction of nutrient intake below minimum requirement of bird during the growing period.

Rake: Scrapping surface with a long sweeping movement.

Resilience: An ability to recover easily from any misfortune or change.

Sprinkler: Cooling devices spread at the roof of the house to keep the house cool

Sludge: Muddy deposits or sediments.

Straying: To move outside in a limited area.

Subcutaneous: Vaccine administered through injection beneath the skin.

Withholding period: Minimum time required between application of medicines and sale of eggs/birds to the market.

Waterer: An equipment used for supplying water to poultry birds.