

# **Manual on Avian Production and Management**

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**International Book Distributing Co.**

# **Manual on Avian Production and Management**

(For B.V.Sc. & A.H. students as per syllabus of Veterinary  
Council of India)

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## FOREWORD

The purpose of preparation and presentation of this **Manual on Avian Production and Management** appears to provide useful guidelines to the veterinary students for different practical lessons under the pattern of Veterinary Council of India. As such I feel that this manual would be of great help to the concerned students as well as the persons engaged in this field specially for offering training in Poultry Farming.

The contents of this manual have been prepared in simple language and as per the VCI syllabus. All the practical points in Poultry Management have been nicely highlighted in this text. The practical lessons have been organized and presented in such a manner that it can be used as a notebook for all practical purposes.

The efforts of the authors deserve appreciation, and I hope that because of its contents and style of presentation this manual would become quite popular amongst students as well as persons working in the field of Poultry Husbandry. It is my pleasure to recommend this manual to be used by the students and trainees of Veterinary Science and Animal Husbandry.

Dated: Kolkata  
4th April, 2008

  
(Prof. C.S. Chakrabarti)  
Vice Chancellor  
West Bengal University of  
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Kolkata, West Bengal

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## PREFACE

### About this book

- This manual has been prepared strictly on the basis of syllabus framed by Veterinary Council of India, the apex body for veterinary education in India. Such type of VCI syllabus oriented book is rarely available in India.
- The matters are presented in such a way that this manual can be used as a practical notebook.
- Large number of objective questions given at the end of each activity unit (practical lesson) is an additional attraction of the book, as the students can prepare themselves for the short tests as well as external examination under VCI pattern.

### Who will be benefited?

- This manual is primarily meant for the **undergraduate veterinary students** (B.V. Sc. & A.H.) all over India.
- This book will also help the concerned teachers/demonstrators of all veterinary colleges of India for offering this course.

### Acknowledgement

It is our immense pleasure that the book entitled 'Manual on Avian Production and Management' ultimately came to light. The information received from various sources are greatly acknowledged. Our sincere thanks are due to Suneel Gomber, Managing Partner, **INTERNATIONAL BOOK DISTRIBUTING CO.** (Publishing Division), Lucknow for accepting the manuscript and quick publishing the book. We shall be grateful for any suggestion and observation from readers and actual users (both students and teachers), which would help in bringing out a revised and improved version of this title. Suggestions may please be sent at the e-mail: [gnilotpal@yahoo.com](mailto:gnilotpal@yahoo.com).

Authors

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# Activity Unit - 1

Date.....

## Holding and Control of Poultry and Study of External Body Parts

---

### OBJECTIVES

- The knowledge of holding and control of poultry helps to handle the birds properly for various purposes.
- The knowledge of external body parts helps in
  - (a) studying the breed characteristics and identifying breeds of poultry,
  - (b) selection and culling of birds (layer vs. non-layer),
  - (c) identification of sexes (male vs. female), and
  - (d) proper application of poultry husbandry practices.

### REQUIREMENTS

- (i) Live birds (both sexes of chicken), (ii) Catching hook, (iii) Working table, (iv) Note book and pencil.

### PROCEDURE

#### I. Holding and Control of Bird

- The bird is to be caught from the poultry house by putting catching hook to the leg or by grabbing the legs with the help of hand.
- Then it is to be held by grasping the two wings, and be placed on working table after entangling its wings to each other at the base to restrict its movement.
- Then the bird is to be held in such a way that its abdomen rests on the palm of the hand by placing the index finger in between the legs, the thumb around one thigh and the remaining fingers on the other thigh, and the rear part of the bird should be away from the body of the operator to avoid soiling, if any.
- When the bird is lifted in this manner for studying of body parts and other purposes, it will be in comfortable position. If the bird struggles, thighs are to be grasped firmly and it will be under complete control.

## II. External Body Parts of Chicken

The external body parts are to be identified and studied (by uttering the words).

The external body parts of chicken are:

- (a) **Head Region:** Comb, Beak, Nostril, Eye, Ear, Ear lobe, Wattle.
- (b) **Neck Region:** Neck, Neck feather (Hackle), Cape (a feather just after hackle, only present in male).
- (c) **Body:**
  - Back** - Back, Back plumage, saddle (only in male).
  - Breast** - Breast, Breast plumage, Breast bone (keel).
  - Wings** - Wing, Wing front (a feather), Wing bow (a feather), Flight feathers of wing.
  - Abdomen** - Abdomen, Abdominal feather (Fluff).
  - Tail** - Main tail feather (flight feather of tail), Greater sickle feather (only in male), Lesser sickle feather.
  - Legs** - Thigh, Thigh plumage, Hock, Shank, Claw, Toes, Nails, Spur (only in male).

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 1**

**# Indicate the correct answer by putting tick (✓) mark**

1. Finger like projection present at the shank of male poultry is known as  
(a) hackle (b) spur  
(c) cape (d) saddle
2. Which of the following feather(s) is/are only present in case of male chicken?  
(a) cape (b) saddle  
(c) sickle (d) all of these
3. Fluff is  
(a) neck feather (b) wing feather  
(c) abdominal feather (d) none of these
4. Breast bone of poultry is also known as  
(a) hip bone (b) ribs  
(c) keel bone (d) pin bone

**# Exercise**

1. Draw the figure of a hen and label its body parts.
2. Write the precautions to be taken while doing this job.
3. What are the morphological differences between the male and female of chicken?
4. Indicate the body parts of poultry through which different types of vaccines are commonly inoculated.

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## Activity Unit - 2

Date.....

# Study of Species, Breeds and Varieties of Poultry

---

### OBJECTIVE

To become familiar with different species, breeds and varieties of poultry.

### RELEVANT INFORMATION

**Poultry:** Poultry is a common term and it indicates all the domesticated birds which are reared for production of eggs and/or meat for the economic benefits of human beings. The most important poultry species are chicken or fowl, duck, quail, turkey, guinea fowl, peafowl, etc. But the term 'poultry' most often used as synonymous to chicken as it accounts for more than 90% of the total poultry population in India and our poultry industry is mainly chicken oriented.

**Species :** It is a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding, and considered as the basic unit of taxonomy. The important poultry species in Indian poultry industry scenario are -

- (i) Chicken/fowl - *Gallus domesticus* (reared for egg and meat).
- (ii) Duck - *Anas platyrhynchos* (mainly reared for egg and to some extent meat).
- (iii) Quail - *Coturnix coturnix japonia* (mainly reared for meat and also egg).
- (iv) Turkey - *Meleagris gallopavo* (mainly reared for meat).

**Class :** It indicates group of breeds developed in a particular geographical area. The breeds of chicken are classified into four classes, viz., American class, English class, Mediterranean class and Asiatic class.

**Breed :** A group of birds which are similar in shape, size and body conformation, and descendants of common ancestry is known as breed. All the birds of a breed have more or less same genetic makeup with common morphological and physiological setup. The examples of some breeds of chicken are White Leghorn, Rhode Island Red, New Hampshire, Australorp, Sussex, Aseel, etc.

**Variety** : It is the sub-division of a breed distinguished mainly by colour of plumage, type of comb, *etc.* For example, Leghorn breed of chicken has 12 varieties, like white, brown and buff coloured plumage, and single and rose type comb, *etc.*

**Strain** : It indicates a group of birds with some special characters within a breed or variety. It is developed by a breeder by introducing some economic characters like egg size, growth rate, feed efficiency, laying ability, mortality, *etc.* Nowadays strain is more popular than breed concept. For example, Anak-2000, Hubbard, Caribro-91, Vencob, Starbro are some broiler strains of chicken.

### Important Classes, Breeds and Varieties of Chicken/Fowl

Class	Breed	Variety
□ American	• Rhode Island Red	Single comb, Rose comb.
	• New Hampshire	-
□ English	• Plymouth Rock	White, Buff, Barred, Silver pencilled, Partridge, Columbian, Blue.
	• Wyandotte	White, Buff, Black, Silver laced, Golden laced, Silver pencilled.
□ Mediterranean	• Australorp	-
	• Cornish	White, Buff, Dark, White laced, Red.
	• Sussex	Light, Red, Speckled.
	• Orpington	White, Buff, Black, Blue.
□ Asiatic	• Leghorn	White, Buff, Black, Silver, Red, Black tailed, Red Columbian, Rose comb (White, Brown), Single comb (White, Black, Buff).
	• Minorca	Black, White, Buff, Rose comb (Black, White).
	• Ancona	Single comb, Rose comb.
	• Brahma	Light, Buff, Dark.
	• Cochin	White, Buff, Black, Partridge.
	• Langshan	White, Black.
	• Aseel (Andhra Pradesh, Uttar Pradesh, Rajasthan)	Nhurie (white), Peela (golden yellow), Khagar (black), Yakuth (black and red), Chitta (black and white), Subja (white and golden), Reza (light red).
	• Kadaknath (Madhya Pradesh)	-
	• Bursa (Gujarat, Maharashtra)	-
	• Chittagong/Malay (Chittagong hills)	-
• Naked neck (Maharashtra)	-	
Indigenous Fowl of India		

## **Characteristics of Important Breeds of Chicken**

### **White Leghorn**

- Origin** : Leghorn village of Italy. It is a breed of Mediterranean class.
- General appearance** : Small and very compact, small head with well set comb and wattle, long back, prominent breast, tail lowered down, it is the neatest of all birds.
- Plumage colour** : White, evenly distributed over the entire body surface.
- Standard weight** : Cock 2.7 kg  
Hen 2.0 kg
- Skin colour** : Yellow
- Colour of earlobe** : Yellowish white
- Shank** : Yellow coloured, clean.
- Colour of beak** : Yellow
- Egg shell colour** : White
- Commercial importance** : Egg type bird. All the commercial hybrid layers are derived from this breed.

### **Rhode Island Red (RIR)**

- Origin** : It is originated in Rhode Island state of America. It is a breed of American class.
- General appearance** : Long rectangular body, broad and deep breast, flat back, massive look.
- Plumage colour** : Brownish red and well glossed. Main tail feathers and sickle feathers (in male) are black. In females, hackle (neck feather) shows slight black marking at the base.
- Standard weight** : Cock 3.8 kg  
Hen 3.0 kg
- Skin colour** : Yellow
- Colour of earlobe** : Reddish
- Shank** : Yellow coloured, clean.



- Colour of beak** : Blackish  
**Egg shell colour** : Brown  
**Commercial Importance** : Dual purpose for egg and meat. More resistant to diseases than other exotic breeds. Used for upgrading the local/*deshi* stock.

### New Hampshire

- Origin** : It is originated in New Hampshire state of America. It is a breed of American class. This breed is developed from RIR through selective breeding.  
**General appearance** : Less rectangular than RIR.  
**Plumage colour** : Chestnut red. Main tail feathers are black. In females, lower neck feathers are distinctly tipped with black.  
**Standard weight** : Cock 3.8 kg  
Hen 3.0 kg  
**Skin colour** : Yellow  
**Colour of earlobe** : Reddish  
**Shank** : Yellow, clean.  
**Colour of beak** : Yellow  
**Egg shell colour** : Brown  
**Commercial importance** : Dual purpose for egg and meat.

### Australorp

- Origin** : This breed is developed in Australia from Black Orpington. It is an English breed.  
**General appearance** : Very fleshy, body slopes gradually towards tail, deep body, closely feathered, long back, more upright and less massive look.  
**Plumage colour** : Black, plumage is lustrous greenish black in all the sections of the body.  
**Standard weight** : Cock 3.8 kg  
Hen 3.0 kg  
**Skin colour** : White

<b>Colour of earlobe</b>	: Red
<b>Shank</b>	: Black or dark slate coloured, clean.
<b>Colour of beak</b>	: Black
<b>Egg shell colour</b>	: Brown
<b>Commercial importance</b>	: Dual purpose for egg and meat. They can maintain themselves in wet and heavy rainfall areas.

### Light Sussex

<b>Origin</b>	: This breed is originated in Sussex country of England. It is a light variety of Sussex breed of English class.
<b>General appearance</b>	: Deep body with very good fleshing quality, broad shoulder.
<b>Plumage colour</b>	: White plumage with black streaked feathers on neck and tail.
<b>Standard weight</b>	: Cock 4.0 kg Hen 3.0 kg
<b>Skin colour</b>	: White
<b>Colour of earlobe</b>	: Red
<b>Shank</b>	: White coloured, clean.
<b>Colour of beak</b>	: Coloured
<b>Egg shell colour</b>	: Brown
<b>Commercial importance</b>	: Meat type.

### Hybrid Chicken

Nowadays pure breeds of chicken are not generally used for commercial production of egg or meat. First, the pure breeds are replaced by breed crosses, and now breed crosses are replaced by strain crosses. Some important breed crosses and strain crosses of chicken are given below.

#### **Breed crosses :**

1. **Austra - white** : The Australorp male is crossed with White Leghorn female to produce this breed cross.
2. **Rhodo - white** : The Rhode Island Red male is crossed with White Leghorn female to produce this breed cross. White plumage is dominant with occa-

sional blackish feathers.

3. **Sussex - hampshire** : The Sussex male is crossed with Hampshire female to produce this breed cross.
4. **Red- rock** : The Rhode Island Red male is crossed with Barred Plymouth Rock to produce this breed cross. The male progenies are barred and females are black.

#### **Strain crosses:**

##### **1. Broiler strains**

B - 77 (CARI), Caribro - 91 (CARI), Giriraja (UAS, Bangalore), IBB - 83 (UAS, Bangalore), Hubbard, Vencob, Anak - 2000, Chabro, *etc.*

##### **2. Layer strains**

HH - 260 (CPBF, Hessarghata), BH - 78 (CPBF, Mumbai), ILI - 80 (CARI), Kalinga hybrid (CPBF, Bhubaneswar), Carigolden - 92 (CARI), BV - 300, Starcross - 288 (white/brown egg), *etc.*

#### **Breeds of Duck**

Duck breeds are broadly classified into three types, *viz.*,

##### **1) Egg type ducks**

*e.g.* Khaki Campbell  
Indian Runner

##### **2) Meat type ducks**

*e.g.* Aylesbury  
White Pekin  
Rouen

##### **3) Ornamental type ducks**

*e.g.* Call  
Crested White  
Black East India

#### **Characteristics of Important Breeds of Ducks**

##### **Khaki Campbell**

- This breed of duck was developed in England by crossing between Rouen and White Indian Runner. It was developed by Mrs. Campbell, and it has 'khaki' colour. So the name 'Khaki Campbell'.

- The average body weight : Duck 2.0 - 2.2 kg and Drake 2.2 - 2.4 kg.
- Ducks lay about 300 eggs per year with egg size 72.5 g. They start to lay at the age of 18 weeks.
- They do not require water for swimming. So they can be reared under complete confinement, where there is no facility of pond and range land.

### **Indian Runner**

- Body is well carried up in front and shape is as good as that of penguin. The common popular varieties of this breed are white, white - pencilled and fawn.
- The average body weight : Duck 1.5 - 2.0 kg and Drake 2.0 - 2.5 kg.
- They can lay 300 eggs per year. They are good forager and hardy, and they can maintain themselves in all types of climate and localities.

### **Aylesbury**

- It is a good table duck. Plumage colour is completely white and they produce creamy white meat.
- The average body weight : Duck 4 kg and Drake 4.5 kg.

### **White Pekin**

- It is very popular table duck. Its genetic development was carried out in USA but its origin is in China. Plumage colour of this duck is white and they are very fertile.
- The average body weight : Duck 3.5 kg and Drake 4.0 kg.

### **Characteristics of Quail**

- Quail is recently domesticated species of poultry. It is also called 'Bater' in Hindi and 'Titir Pakhi' in Bengali. This bird is first used in Japan for production of egg and meat. So it is known as Japanese Quail (*Coturnix coturnix japonica*).
- Average body weight of quails : Day-old chicks 6 g, adults 150 - 170 g (females 140 - 160 g and males 120 - 140 g). The weight of quail egg is 10 g.
- They start to lay egg at the age of 6 weeks and annual egg production is 260-275. Male : female ratio in breeding stock is 1:3.
- Broiler quails can be marketed at the age of 6 weeks with average body weight of 150 g. The FCR is 3.3 and dressing percentage 70.
- The important varieties of quail are -
  1. **English white** - Feather colour white with or without few black spots.
  2. **British range** - Feather colour dark.

3. **Pharach** (wild type) - Feather colour mixture of black and brown.
4. **Tuxedo** - Feather colour of face, neck and entire ventral surface is white and remaining part is black.
5. **Manchurian golden** - Feather colour golden or light golden.

### **Characteristics of Turkey**

- Turkey is not a popular species of poultry in India, but in western countries turkey is popular for meat production. Small size turkeys are finished around 12 weeks with average body weight of about 4.5 kg.
- Turkeys are not classified as breed. Seven **standard varieties** are being recognised by American Poultry Association. These are -
  1. Broad Breasted bronze (BBB)
  2. Beltsville Small White (BSW)
  3. White Holland
  4. Bourbon red
  5. Black
  6. Slate
  7. Narrang Sett

The recent day's turkeys were developed from North American wild turkey. The varieties of turkey differ in plumage colour, size and meat characteristics, but the shape is common in general. Out of the seven varieties of turkey, BBB and BSW are important from which most of the varieties have been developed.

### **Broad Breasted Bronze (BBB)**

- The origin of this variety of turkey is in England. Plumage colour is black and they are derived from 'bronze' wild turkey.
- Sex determination can be done at the age of 12 weeks. The females are having white tipped black feathers at chest region.
- The body weight at marketing age: females 6-7 kg at 22-25 weeks of age; males 10-14 kg at 27-29 weeks of age.

### **Beltsville Small White (BSW)**

- This variety of turkey is originated in Beltsville area of USA. Plumage colour of this variety is white.
- They are smaller in size. The market weight is 4-5 kg at the age of 14 weeks under standard management practices.

## **REQUIREMENTS**

Live birds of various species, breeds and varieties of poultry; classification charts; projection slides; models, *etc.*

## **PROCEDURE**

- Various species, breeds and varieties of poultry are to be studied by observing and handling the live birds physically.
- If the live birds of all categories are not available, the photographs, projection slides or models may be used for the purpose.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 2**

**# Indicate the correct answer by putting tick (✓) mark.**

1. The origin of Rhode Island Red breed of poultry is  
(a) America (b) Australia  
(c) England (d) Italy
2. The origin of New Hampshire breed of poultry is  
(a) America (b) Australia  
(c) England (d) Italy
3. The origin of Australorp breed of poultry is  
(a) America (b) Australia  
(c) England (d) Italy
4. The origin of White Leghorn breed of poultry is  
(a) America (b) Australia  
(c) England (d) Italy
5. The origin of Light Sussex breed of poultry is  
(a) America (b) Australia  
(c) England (d) Italy
6. The origin of Aseel breed of poultry is  
(a) Italy (b) Spain  
(c) India (d) China
7. The origin of Cornish breed of poultry is  
(a) America (b) England  
(c) India (d) China
8. Which one is a good egg producer?  
(a) Plymouth Rock (b) White Cornish  
(c) Light Sussex (d) White Leghorn
9. Which one is not related with others so far colour of egg shell is concerned?  
(a) Cornish (b) New Hampshire  
(c) Australorp (d) Leghorn
10. Which one is a dual purpose breed of poultry?  
(a) Rhode Island Red (b) White Leghorn  
(c) Cornish (d) Aseel
11. Which one is an egg type breed of duck?  
(a) Indian Runner (b) Pekin  
(c) Aylesbury (d) Crested White

12. Which one is a meat type breed of duck?  
(a) Indian Runner                      (b) Khaki Campbell  
(c) Aylesbury                              (d) Call
13. Which one is not related with others?  
(a) HH-260                                  (b) BH-78  
(c) ILI-80                                      (d) B-77
14. Which one is not related with others?  
(a) Vencob                                      (b) Anak-2000  
(c) Kasila                                        (d) Mychix
15. Which is not a variety of turkey?  
(a) Broad Breasted Bronze   (b) White Holland  
(c) Crested White                      (d) Beltsville Small White

**# Exercise**

1. Distinguish between Rhode Island Red and New Hampshire on the basis of their physical characteristics.
2. Distinguish between White Leghorn and Australorp on the basis of their physical characteristics. Mention their production capabilities.
3. Enlist the important features of Khaki Campbell duck.
4. Name some important hybrid chicken used for meat and egg production.
5. Enlist the important features of quail.
6. Enlist the important features of turkey.



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## Activity Unit - 3

Date.....

# Judging and Culling of Poultry

---

### OBJECTIVES

- (i) To identify the ideal specimens to be considered as true to breed type.
- (ii) To select good breeders as parents for future generations.
- (iii) To cull unproductive birds in a flock.
- (iv) To minimize cost of rearing by culling the non-performer in time.

### PROCEDURE

#### I. Physical Characteristics Method

Judging is practiced on the basis of general appearance and body characteristics of birds for specific breeds and varieties of poultry. Usually chicken attains sexual maturity at 20 weeks of age and judging is done after 26 to 28 weeks of age. Judging is done on the basis of performance, *viz.*, good layer, poor layer and non-layer (which have not started laying eggs).

**Table 3.1: Characteristics to be observed for judging of layer birds**

Characters	Good layer	Poor layer	Non-layer
Plumage	Initially bright, followed by dullness	More bright	Always bright
Comb and Wattles	Large, red	Small, less warmer, Shrunken	Underdeveloped
Eyes	Big, active, bright	Small, dull	Small, dull.
Vent	Oblong, moist, pink	Less oblong, moist/dry, pink	Round, dry, yellow.
Distance between two pubic bones	At least 3 fingers	Less than 3 fingers	Maximum 1 finger
Distance between tip of breast bone and pubic bones	At least 4 fingers, soft, pliable	Less than 4 fingers, not very soft	Rubbery, very hard, maximum 2 fingers

**Table 3.2: Characteristics of birds to be observed for judging good and poor performers (distinguishing features)**

Characters	Good birds	Poor birds
● <b>Head</b>	Strongly feminine in females and masculine in males, well proportioned, square and broad at the top.	Tendency to be masculine in female, crow headed or eagle headed, narrow and tapering at the top.
Comb and Wattles	Full, red, waxy and velvety	Dry, scaly, shrivelled, cold, coarse.
Beak	Stocky and well-curved.	Long, thin and sharp-pointed.
Eyes	Full, bright and alert.	Dull and sleepy
Earlobes	Full, waxy and velvety.	Shrunken, wrinkled and coarse.
● <b>Neck</b>	Short and stocky.	Long and thin.
● <b>Body</b>	Capacious.	Not so capacious.
Back	Broad and straight.	Narrow, pinched and crooked.
Sides	Deep and straight.	Shallow and barrel shaped.
Keel bone	Long and curved.	Short and crooked.
Pubic bone	Wide apart, thin and pliable.	Thick, stiff and close together.
Skin	Thin, soft and oily.	Thick, dry and rough.
Abdomen	Large, soft and free from lumps of fat.	Small, hard and full of fat.
Vent	Full, large and moist.	Small and dry.
Feather	Compact.	Loose.
● <b>Legs</b>		
Shank	Thin and soft in back.	Thick and rounded in back.
Toe-nails	Stocky and well-curved.	Long, thin and sharp-pointed.
● <b>Temperament</b>	Friendly and happy.	Shy, nervous and squakes.
● <b>Appetite</b>		
Crop	Full	Not full.
● <b>Pigmentation</b>	Bleaching occurs as per laying age.	Non-bleaching of body parts.

## II. Score Card Method

Based on general appearance as well as sexes of bird, following score cards are formulated to facilitate judging.

### (a) Score Card For Judging Male Birds

Particulars	Maximum Score	Score Obtained			
		Bird No. 1	Bird No. 2	Bird No. 3	Bird No.4
Head	20				
Neck	5				
Body	40				
Legs	10				
Temperament	20				
Appetite	5				
Total	100				

**Remarks:**

**(b) Score Card For Judging Female Birds**

Particulars	Maximum Score	Score Obtained			
		Bird No.1	Bird No.2	Bird No.3	Bird No.4
Head	10				
Neck	5				
Body	50				
Legs	10				
Temperament	10				
Appetite	5				
Pigmentation	10				
Total	100				

**Remarks:**

**III. Depigmentation as a Tool for Judging Layer Birds**

Depigmentation or bleaching acts as an index in assessing the persistency of egg production. The pigment, xanthophyll is derived from the feed (principally from yellow maize) and stored in different parts of body; the bird loses the pigment as the laying age progresses. At the last stage, *i.e.*, in the last 20 weeks of egg production, when the production is less the pigments reappear in the same order.

**Table 3.3: Order of Depigmentation**

Tissue bleached	Number of eggs
Vent	When first egg is laid
Eye-lids	6-8
Earlobes	9-10
Beaks	11-35
Underside of feet	66
Front of shanks	95
Back of shanks	159
Top of toes	170
Hock joint	180

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 3**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Quality of good layers is/are
  - (a) Quick maturing
  - (b) Lack of broodiness
  - (c) Alertness
  - (d) All of these
2. Removal of uneconomical birds from the flock is known as
  - (a) brooding
  - (b) caponisation
  - (c) culling
  - (d) cannibalism

**# Exercise**

1. Practice judging and selection of good layer birds provided.
2. Practice culling of layer type birds from the flock provided.
3. Highlight the method(s) of judging poultry (layer birds) you have followed in the practical class.

*Judging and Culling of Poultry*

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# Study of the Digestive System of Poultry (Chicken)

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### OBJECTIVE

To develop idea about different parts of digestive system of poultry and their normal functioning needed for efficient feeding management. It also helps in diagnosis of some diseases on the basis of gross changes of different organs of this system.

### RELEVANT INFORMATION

The conversion of complex feed into simple form so that it is easily absorbed in the blood is described as digestion. The digestive tract (or alimentary tract/gastro-intestinal tract) with the help of accessory glands of digestion performs this function.

The digestive system includes the digestive tract and some digestive glands. The digestive tract is a long tube through which feed passes. It begins at the mouth and terminates at the vent. The parts of digestive tract of chicken are: mouth (beak, tongue, mouth cavity, no teeth), oesophagus, crop, proventriculus, gizzard, small intestine (duodenum, jejunum and ileum), large intestine (caeca, colon), cloaca and vent. The primary accessory glands are liver and pancreas.

All these organs and glands are physiologically as well as anatomically linked. Digestion and absorption occur in different stages, each of which being dependent on the previous stage or stages.

### REQUIREMENTS

A post-mortem set and live bird (chicken).

### PROCEDURE

The bird is to be dissected and the abdomen is to be opened. The digestive system is to be exposed for easy understanding.

(The students should see the location of organs by touching to know the

morphology and normal structure.)

### Special Note

#### Specialities of Avian Digestive System

- Poultry are simple stomached animals. They have two types of stomach, *viz.*, proventriculus or glandular stomach (for enzymatic digestion) and gizzard or muscular stomach (for mechanical digestion).
- Teeth are absent in the mouth cavity. They take feed with the help of beak and swallowed. So feed ingredients should be of proper size (710 millimicron). There is a problem of taking powdered feed or whole grains.
- Metabolic rate is very high. They take less time (about 4 hours) to digest feed. High quality feed should be fed to the birds to avoid imbalanced nutrition leading to deficiency diseases.
- Urinary bladder is absent in poultry, and cloaca is the common opening of digestive, urinary and reproductive systems. Urine and faeces mixed together and passed through the cloaca and vent.
- Poultry are unable to synthesize essential amino acids, vitamin B-complex, vitamin K, *etc.* Laying birds require high level of calcium through feed. These points are to be considered for proper feeding of poultry.

#### Post-mortem Lesions of Digestive System in Relation to Some Diseases

Post-mortem lesions in various organs of the digestive system of poultry help in diagnosis of some diseases. Some important and common lesions are outlined below.

- Distended **crop** filled with indigestible materials like feathers, straw, *etc.* – **Impaction of crop.**
- Turky towel-like thickening of crop mucosa along with ulcers – **Candidiasis (fungal disease).**
- Haemorrhages at the tips of **proventriculus**, raised haemorrhagic ulcers along the length of the **small intestine** – **Ranikhet disease.**
- Pin point haemorrhagic spots or grayish spots visible without cutting the **intestine** open – **Intestinal Coccidiosis.**
- Inflammation and haemorrhages in **caeca** – **Caecal Coccidiosis.**



**CLASS ASSIGNMENT ON ACTIVITY UNIT - 4**

**# Indicate the correct answer by putting tick (✓) mark .**

1. Glandular stomach of poultry is  
(a) crop (b) proventriculus  
(c) gizzard (d) none of these
2. Muscular stomach of poultry is  
(a) crop (b) proventriculus  
(c) gizzard (d) duodenum
3. The edible parts of the poultry digestive system are  
(a) gizzard and proventriculus  
(b) gizzard and liver  
(c) liver and proventriculus  
(d) liver and duodenum.

**# Exercise**

1. Indicate different parts of the digestive system of poultry with the help of schematic labeled diagramme.
2. How the knowledge of digestive system of poultry helps in proper feeding as well as diagnosis of certain diseases.

*Study of the Digestive System of Poultry (Chicken)*

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# Study of Reproductive System of Poultry (Chicken)

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### OBJECTIVE

To develop an idea about different parts of reproductive system of poultry of both sexes.

Detail knowledge of female reproductive system of chicken is must to know the physiology of egg formation, and the quality of eggs. The incidence of defective eggs is influenced by the condition of the reproductive organs.

### RELEVANT INFORMATION

#### I. Female Reproductive System:

Female reproductive system of chicken consists of two ovaries and two oviducts at the time of hatching, but in adults generally left ovary and its oviduct are developed and functional. The right one presents as functionless rudiment.

The ovary is located at the dorsal part of abdominal cavity and at the anterior end of left kidney. Ova at different stages of maturity are found in the ovary of a laying hen. Shape of the ovary is just like cluster of grapes, and size varies from 3-5g (broody hen) to 50-52g (laying hen). Oviduct consists of five major parts, viz., infundibulum or funnel (9cm), magnum or albumen secreting portion (33cm), isthmus or shell membrane secreting portion (10cm), uterus or shell gland (12cm) and vagina (12cm). (The measures within parenthesis are in case of laying hen.) The total length of oviduct in case of laying hen is approximately 76cm.

#### II. Male Reproductive System:

Male reproductive system of chicken consists of a pair of testes, vas deferens and papillae or rudimentary copulatory organ.

The testes are oval yellowish-white bodies, located at the anterior end of kidneys. Vas deferens are narrow convoluted ducts arise from the inner boarder of each testis and convey the spermatozoa and seminal fluid from the testes to the cloaca.

Study of Reproductive System of Poultry (Chicken)

Papillae or rudimentary copulatory organ is located at the median ventral portion of the cloaca, and it introduces spermatozoa into the oviduct through the cloaca of the female at the time of mating.

**REQUIREMENTS**

A post-mortem set and live birds (chicken) of both sexes.

**PROCEDURE**

The individual bird is to be dissected and abdomen is to be opened. The reproductive system is to be exposed for easy understanding.

(The students should see the location of all organs and feel them by touching to know the normal structure.)

**CLASS ASSIGNMENT ON ACTIVITY UNIT -5**

**# Indicate the correct answer by putting tick (✓) mark**

1. Approximate length of oviduct in laying hen is  
(a) 33 cm (b) 10 cm  
(c) 76 cm (d) 22 cm
2. Egg albumin is formed in  
(a) Infundibulum (b) Isthmus  
(c) Magnum (d) Uterus
3. Shell membrane is formed in which part of the oviduct?  
(a) Infundibulum (b) Magnum  
(c) Isthmus (d) Uterus
4. Egg shell is formed in  
(a) Ovary (b) Isthmus  
(c) Uterus (d) Cloaca
5. Time taken for formation of an egg is  
(a) 12 hours (b) 16 hours  
(c) 25 hours (d) 21 hours
6. Yellow colour of yolk of '*deshi egg*' is due to presence of  
(a) vitamin A (b) vitamin E  
(c) carotene (d) riboflavin

**# Exercise**

1. Indicate various parts of the female reproductive system of poultry (chicken) with the help of schematic diagramme.
2. Indicate various parts of the male reproductive system of poultry (chicken) with the help of schematic diagramme.
3. How egg is formed in the reproductive system of hen?

*Study of Reproductive System of Poultry (Chicken)*

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# Study of Structure of Egg

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### OBJECTIVES

- (i) The knowledge of the structure of egg is essential for an understanding of fertility, embryo development, egg quality and any disease of the female reproductive organs.
- (ii) Without the knowledge of the structure of egg, its grading and preservation are not possible.
- (iii) It is also important from the marketing angle. It has been estimated that breakage of eggs due to defective egg shell structure ranges between 3 to 6 percent of all eggs handled in India.

### RELEVANT INFORMATION

The egg consists of four main parts, *viz.*, (i) shell, (ii) shell membrane, (iii) albumen or egg white and (iv) yolk.

**Egg Shell:** The shell is the hard outermost covering of an egg. The colour of egg shell may be white or brown depending on the class or breed of chicken. (Poultry breeds of Mediterranean class always lay white shelled egg and breeds of other classes lay brown shelled egg). The egg shell is composed of Calcium carbonate (94%), Magnesium carbonate (1%), Calcium phosphate (1%) and organic matter (chiefly protein, 4%). The shell has numerous pores (about 1700 to 7500) on it which helps in gaseous exchange required for embryo development. The shell is covered by a thin transparent protein coating, called **cuticle**. It gives natural protection to the shell pores. The shell thickness may vary among different avian species (chicken 0.31 mm, duck 0.32 mm, quail 0.13 mm and turkey 0.41 mm).

**Shell Membrane:** Next to shell are two shell membranes, *viz.*, **outer shell membrane** and **inner shell membrane**. Both the shell membranes are attached firmly to each other throughout the egg except at the broader end of egg where **air space** or **air cell** is formed in between the two shell membranes. The depth of the air cell of freshly laid egg is 1-3 mm. The thickness of outer and inner shell membranes are 0.04 to 0.07 mm and 0.01 to 0.02 mm, respectively.

### Study of Structure of Egg

The shell and shell membranes are non-edible parts of an egg and constitute about 11% of total egg weight.

**Albumen or Egg White:** The albumen consists of four layers *viz.*, **outer thin white, outer thick white, inner thin white** and **inner thick white**. The inner thick white layer of albumen is also known as **chalaziferous layer**. Two thick spiral band like structures are emerged from this layer, known as **chalazae**. They hold the yolk in position. The albumen accounts for about 58% of the total egg weight.

**Yolk:** A rounded yellowish coloured material is present at the center of egg, it is called egg yolk. It accounts for about 31% of the total egg weight. The yolk is enclosed by a thin membrane called **vitelline membrane**. A small whitish disc like structure is present on yolk just below the vitelline membrane. It is called **germinal disc** (blastoderm in fertile egg and blastodisc in infertile egg). The diameter of germinal disc is 4.5 mm in fertile egg and 3.5 mm in infertile egg.

#### **REQUIREMENTS**

- (i) A Petri dish or a simple glass plate,
- (ii) A blunt scalpel, and
- (iii) An egg.

#### **PROCEDURE**

An egg is to be cleaned by smooth rubbing with towel and then broken with the help of a blunt scalpel in such a way that a cracked space is formed on the egg shell in the middle of longitudinal axis. Then the cracked space is to be widened with the help of two fingers by stretching the cracked shells outwards and the contents of the egg is to be gently vacated in the Petri dish. Then different parts are to be studied.

#### **Special Note**

##### **Chemical Composition/Nutritive Value of Egg**

Egg contains almost all nutrients in balanced proportion. So, it is called 'a complete planned food of natural origin'. Egg is rich in protein and low in calorific value; this type of food item is mostly preferred nowadays by health conscious people.

Egg protein is an excellent quality protein of high biological value and it is often used as a standard for measuring the quality of other food proteins. [B.V.=  $(N_2 \text{ retained}/N_2 \text{ absorbed}) \times 100$ ; B.V. of egg protein is 95, milk protein 85 and meat protein 70]. The high biological value of egg protein is due to its amino acid make up. Most of the essential amino acids required by human beings are present in egg in balanced proportion.



Almost all vitamins are present in eggs excepting vitamin C. The fat soluble vitamins (like A, D, E) are mainly concentrated in the yolk part and water soluble vitamins (mainly B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>, pantothenic acid, niacin) are present both in the albumen and yolk parts of egg. Egg is very rich in vitamin D content, only next to fish liver oil out of natural sources.

Egg is a very good source of iron and phosphorus. However, other minerals like calcium, magnesium, potassium, sodium, chlorine, sulphur, zinc, copper and iodine are present in lesser extent.

Egg is also known for its fatty acids. The saturated and unsaturated fatty acids and cholesterol are mainly present in the yolk portion of the egg. The cholesterol content of egg is around 500mg/100g edible whole egg, whereas 1500mg/100g yolk. Due to cholesterol content of egg, it is involved in cholesterol controversy in relation to cardiac problems. But a standard chicken egg (58g) contains only 258mg cholesterol, and about 1800 to 2000 mg cholesterol is utilized daily by human body. Besides, other oily vegetarian foods contain cholesterol like material and cholesterol balance is maintained by negative feed back mechanism in the body.

**Table 6.1: Gross parts of egg of various poultry species**

Species of poultry	Total egg weight (g)	Yolk (%)	Albumen (%)	Shell and shell membranes (%)
Chicken	58	31	58	11
Duck	70	35	53	12
Quail	10	32	48	20
Turkey	85	32	56	12

**Table 6.2: Chemical composition of egg of various poultry species (per 100g edible portion, without shell and shell membranes)**

Species of poultry	Water (g)	Protein (g)	Fat (g)	Carbohydrate (g)	Mineral or ash (g)	Energy (Kcal)
Chicken	73.7	12.9	11.5	0.9	1.0	163
Duck	71.0	13.0	14.5	0.5	1.0	189
Quail	74.2	13.1	11.0	1.0	1.1	161
Turkey	72.6	13.1	11.8	1.7	0.8	170

**Table 6.3: Chemical composition of different parts of chicken egg (per 100g edible portion)**

	Water (g)	Protein (g)	Fat (g)	Ash (g)	Carbohydrate (g)	Energy (Kcal)
Whole egg (Albumen +Yolk)	73.7	12.9	11.5	1.0	0.9	163
Albumen	87.6	10.9	trace	0.7	0.8	51
Yolk	51.1	16.0	30.58	1.7	0.58	348

**Table 6.4: Properties of egg of Khaki Campbell duck**

Physical Properties		Chemical Composition			
		Nutrients	Whole egg without shell	Albumen	Yolk
Weight of egg	72.5g				
Shape index	72.0				
Shell thickness	0.32mm	Water (%)	72.06	87.01	45.21
Shell	15.75%	Protein (%)	13.27	9.86	16.69
Albumen	51.14%	Fat (%)	11.00	Trace	33.68
Yolk	33.11%	Mineral (%)	1.08	0.85	2.38
		Cholesterol (mg/g)	-	-	23.85

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 6**

**# Indicate the correct answer by putting tick (✓) mark**

1. A standard chicken egg weighs about  
(a) 48g (b) 58g  
(c) 68g (d) 78g
2. The average weight of a duck egg should be  
(a) 10g (b) 58g  
(c) 70g (d) 95g
3. The average weight of a quail egg is  
(a) 10g (b) 18g  
(c) 70g (d) 150g
4. Egg white is mainly composed of  
(a) carbohydrate (b) protein  
(c) fat (d) calcium carbonate
5. Egg shell is mainly composed of  
(a) carbohydrate (b) protein  
(c) magnesium carbonate (d) calcium carbonate
6. Chalaziferous layer is also known as  
(a) outer thick white (b) outer thin white  
(c) inner thick white (d) inner thin white
7. Chalaziferous layer of egg is a part of  
(a) yolk (b) albumin  
(c) egg shell (d) shell membrane
8. The average protein contents of chicken (meat) and egg are  
(a) 21% and 13% (b) 9% and 10%  
(c) 3.5% and 11% (d) 66% and 70%

**# Exercise**

1. Indicate various parts of an egg with the help of schematic diagramme.
2. Compare and contrast between: duck egg vs. chicken egg, chicken egg vs. quail egg.
3. What is the importance of egg in human nutrition?

Study of Structure of Egg

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## Activity Unit - 7

Date.....

# Evaluation of Quality of Eggs

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### OBJECTIVES

Egg quality means the inherent characteristics of an egg which determines its degree of excellence and which is liked by customers. The producers fetch better price for the quality products and customers always prefer the product of assured quality.

### REQUIREMENTS

Some important egg qualities are egg size, egg shape, shell colour, shell condition, shell thickness and its strength, albumen quality, yolk quality, air cell quality, *etc.* For evaluation of these quality parameters, the requirements are as follows:

- (i) Egg weighing balance (for egg size)
- (ii) Vernier Caliper (for egg shape)
- (iii) Egg candler (for shell soundness; air cell, albumen and yolk qualities)
- (iv) Screw gauge (for shell strength)
- (v) Scale graduated in cm and mm (for depth of air cell)
- (vi) Glass containers (for egg contents, *etc.*)
- (vii) Brine solutions of known specific gravity ranging from 1.062 to 1.090 (for specific gravity of egg)

### PROCEDURES

#### I. External Egg Qualities

##### (1) Egg size/Egg weight

The terms 'egg size' and 'egg weight' are used synonymously. The egg size is measured simply with the help of egg weighing balance.

The standard weights of table eggs of different species are –

Chicken	58g
Duck	70g
Quail	10g
Turkey	85g

## (2) Egg shape

Normal shape of an egg is oval. Slight abnormality in shape of egg (like elongated, flat, round, conical, etc.) is not preferred by consumers, because they thought abnormal eggs are laid by diseased birds. Besides these, the bad shaped eggs are not suitable for hatching purpose.

The egg shape is measured by Vernier Caliper in terms of egg shape index (ESI). The length and breadth of an egg are to be measured to nearest 0.1mm and the breadth-length ratio is to be multiplied by 100 to get the ESI.

$$ESI = \frac{B}{L} \times 100$$

The higher egg shape index indicates round shape and lower index indicates elongated egg. The optimum shape indices of eggs of various poultry species are -

Chicken	74
Duck	72
Quail	78

## (3) Shell colour

The shell colour of egg is very characteristic to the breeds of poultry. The breeds of Mediterranean class (e.g. White Leghorn, Minorca, Ancona) always lay white shelled eggs. The breeds of American class (e.g. New Hampshire) and English class (e.g. Australorp, Sussex) always lay brown shelled eggs. Quail eggs are tinted with different colours. (Nowadays quail strain is produced which lays white shelled egg.) The shell of duck egg is more transparent than chicken egg.

The shell colour is simply observed by visual scoring. The colour of egg, whether white or brown, does not matter but brightness of colour definitely preferred by the consumers. Dull or stained colour of egg shell is not preferred by the consumers.

**Note:** The shell colour of egg has nothing to do with its quality. So it is not included in the USDA egg standards.

## (4) Shell conditions (cleanliness and soundness)

The shell should be clean and sound.

**Shell cleanliness:** It is judged by visual observation. On the basis of degree of cleanliness, the eggs are classified into four groups, viz., clean, slightly stained, moderately stained and dirty.

**Clean egg:** The shell is totally free from foreign material including stains.

**Slightly stained egg:** The shell is free from dirt but having slight stains covering up to 1/16<sup>th</sup> of its surface area.

**Moderately stained egg:** The shell is free from dirt but having moderate degree of stains covering up to 1/4<sup>th</sup> of its surface area.

**Dirty egg:** The shell has both dirt and stains covering more than 1/4<sup>th</sup> of its surface area.

A standard chicken egg (around 58g) has a surface area of about 68.00sq.cm. and its 1/4<sup>th</sup> and 1/16<sup>th</sup> parts mean an approximate area of 4.12cm x 4.12cm and 2.05cm x cm, respectively.

**Shell soundness:** A sound egg means an egg with intact and unbroken shell. An unsound egg may be cracked (having hair line crack on shell), leaking (having crack on shell and shell membranes leading to oozing of egg contents) and smashed (having crushed shell). Cracked egg is of poor quality, and leaking and smashed eggs are considered in the category of loss (according to USDA grading of eggs).

Soundness of shell may be judged by tapping two eggs together near the ear. A clear sound indicates sound shell and dull sound indicates that one or both the eggs may have cracked shell.

The leaking and smashed eggs may be identified by visual observation. For identification of hairline crack on shell, candling is to be done.

**Candling of egg** means viewing through egg by holding it in front of a source of light (or candler) in a dark room. Egg candler is a wooden or metal box closed from all sides except an egg-sized aperture (2.5cm diameter) on one side and has an electric bulb fitted inside the box. Observation is to be taken while viewing through and twirling the egg before the aperture of the candler.

#### (5) Shell strength

Shell thickness, specific gravity of intact egg, percentage of shell present in the egg are important parameters for evaluating the strength of shell. Shell strength is an economically important trait as weak shelled eggs may cause considerable losses during handling and transport for marketing purpose due to breakage.

**Shell thickness:** Shell thickness and shell strength are directly proportional and positively correlated.

Shell thickness can be measured with the help of screw gauge. A piece of egg shell is to be inserted in the screw gauge and reading is to be taken directly from the measuring scale.

Normal shell thickness of chicken egg is 0.30 to 0.50 mm.

**Specific gravity of intact egg:** It can be determined by brine flotation technique. The eggs are to be allowed to float in a series of brine solutions with known

specific gravities ranging from 1.062 to 1.102, with differences of 0.004 between each other. The specific gravity of the solution in which the egg just floats will be the specific gravity of that egg.

The normal specific gravity of chicken egg is 1.062 to 1.090. Higher specific gravity indicates thick shell and *vice versa*, because the specific gravity of inner contents of egg is nearly same in all eggs.

## II. Internal Egg Qualities

Internal egg qualities include conditions of air cell, albumen and yolk. These parameters of intact eggs can be evaluated by means of candling for commercial purpose.

### (1) Evaluation of internal qualities of intact eggs by candling:

By means of candling of eggs, *i.e.*, passing white light through the egg contents shadow is cast by the yolk and air cell.

The shadow indicates about the size of air cell, position of yolk, condition of vitelline membrane and condition of albumen.

Air cell - may be larger or smaller.

Yolk - may be centrally placed or off centered.

Vitelline membrane - weak if shadow of yolk is flattened.

Albumen - if shadow of yolk is darker and it moves freely, there is thinning of thick albumen.

**Normal conditions of these parameters:**

**Air cell** - Height in freshly laid egg is 3.2mm and placed at the broader end of egg.

**Yolk** - Centrally placed; outline invisible, free from blood spot or meat spot (*i.e.*, free from shadow of foreign bodies).

**Albumen** - Clear, thick and completely firm, free from blood spot or meat spot.

### (2) Measuring of the depth of air cell of eggs after breaking

**Air cell depth:** Depth of air cell is to be measured with the help of scale.

Air cell depths of eggs of various ages are -

Freshly laid egg    3.2mm

3 days old egg      6.4mm

8 days old egg      9.5mm

15 days old egg     15.9mm

Depth of air cell up to 4mm is graded as 'A' and up to 8mm as 'B'.



**CLASS ASSIGNMENT ON ACTIVITY UNIT - 7**

**# Indicate the correct answer by putting tick (✓) mark**

1. Optimum shape index of duck egg is  
(a) 74 (b) 72  
(c) 78 (d) 70
2. Optimum shape index of quail egg is  
(a) 10 (b) 60  
(c) 74 (d) 78
3. Optimum shape index of chicken egg is  
(a) 60 (b) 72  
(c) 74 (d) 78
4. Standard weight of table egg (chicken) is  
(a) 72 (b) 68  
(c) 58 (d) 45

**# Exercise**

1. Enlist the parameters of eggs which can be evaluated by means of candling.
2. Enlist the parameters of eggs which can be evaluated simply by means of visual observation.
3. How incubated eggs can be tested with the help of candling?
4. Frame a work sheet for taking various observations in relation to quality parameters of eggs, fill this sheet and make comments on the basis of observations.

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## Activity Unit - 8

Date.....

### Grading of Eggs

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#### OBJECTIVE

To classify eggs into various categories (grades).

Grading of eggs is the sorting of eggs into different categories on the basis of some parameters like weight and internal quality. It aids in facilitating uniform packing and pricing and quality assurance to the consumers. It encourages the production of quality eggs and helps in reducing wastage. Easier market price reporting and easier advertising and establishment of brand names of the quality product are some the other advantages of grading.

#### RELEVANT INFORMATION

Indian standards (BIS/Agmark standards) for various grades of table eggs:

##### 1. Grade designation of table eggs based on weight

Grade	Weight per egg (g)	Weight per dozen eggs (g)
Extra large	60 and above	715 and above
Large	53 to 59	631 to 714
Medium	45 to 52	535 to 630
Small	38 to 44	456 to 534

##### 2. Grade designation of table eggs based on quality

Quality factors	Grade - A	Grade - B
Shell	Clean, sound, unbroken, normal shapes.	Clean to moderately stained, sound but slightly abnormal.
Air cell	4 mm or less in depth, practically regular.	8 mm or less in depth, may be free and slightly bubbly.
Egg white	Clear and reasonably firm.	Clear, may be slightly weak.
Yolk	Fairly well centered, practically free from defects, outline indistinct.	May be slightly off centered, outline slightly visible.

**PROCEDURE**

1. Weight of egg is to be taken with the help of egg weighing balance.
2. Egg shell is to be inspected visually for its cleanliness and egg is to be candled for judging soundness of egg shell.
3. By means of candling of egg the shape of air cell can be known. The depth of air cell can be measured with the help of measuring scale.
4. Firmness of egg white and position of yolk can be judged with the help of candling of shelled egg.

On the basis of above observations, eggs are to be graded on the basis of weight as well as quality factors as laid down in the Bureau of Indian Standards.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 8**

**# Indicate the correct answer by putting tick (✓) mark**

1. As per BIS specification, chicken eggs of '45 - 52g weight group' fall under which of the following grades?  
(a) Extra Large                      (b) Large  
(c) Medium                            (d) Small
2. As per BIS specification, 'large grade' chicken egg falls under which of the following weight groups?  
(a) 60g and above                    (b) 53-59g  
(c) 45-52g                              (d) 38-44g
3. Grading of eggs aids in  
(a) reducing wastage  
(b) facilitating uniform packing and pricing  
(c) quality assurance to the consumers  
(d) all of these
4. As per standards (BIS), market table eggs are graded on the basis of quality parameters as  
(a) A,B,C,D                            (b) A,B,C  
(c) A,B                                  (d) Extra Large, Large,  
Medium, Small

**# Exercise**

1. Frame a work sheet for taking various observations in relation to weight and quality parameters of eggs, fill this sheet and make comments on the grade of eggs.
2. What is the basis of grading eggs in India?

Grading of Eggs

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## Activity Unit - 9

Date.....

# Preservation of Eggs

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### OBJECTIVE

To know the different methods of preservation of eggs for improving keeping quality of this perishable food item.

### REQUIREMENTS

There are various methods for preservation of eggs, and accordingly the requirements are different. So requirements are mentioned while elaborating the individual method.

### PROCEDURE

#### (A) METHODS FOR PRESERVING LESS NUMBER OF EGGS (HOME PRESERVATION)

##### 1. Method -1: Using Earthen Pot

The principle of this method is to keep the eggs in lower temperature. The eggs can be kept in an earthen pot embedded in soil having sand bed, which is sprinkled with water.

This method is being used in the rural areas to preserve the eggs in small number for few days.

##### 2. Method -2: Immersion in liquids

Various liquids like lime water, water glass *etc.* are used to preserve the eggs for a short period.

**Lime water method:** 1 kg of quick lime is taken in a pot and 1 litre of boiling water is added to it. The mixture is brought to room temperature, and 4-5 litres of cold water and 225g of common salt (NaCl) are added to it. After settling down the solution is strained through a cloth. The eggs are immersed in this clear liquid and kept for 16-18 hours. Then the eggs are taken out and dried at room temperature. Eggs can be preserved for 3-4 weeks by this method.

## Preservation of Eggs

The preservative effect of the lime water is partly due to its alkalinity. Besides this, it deposits a thin film of calcium carbonate on the egg shell leading to sealing of the pores.

**Water glass method:** In this method sodium silicate is used instead of lime water. Sodium silicate is also known as water glass, so the name of this method is water glass method.

A solution is prepared by dissolving 1 part of sodium silicate in 10 parts of water. The eggs are immersed in this solution for over night. The eggs can be preserved for about one month by this method.

In this method a thin film of silica (sand) is deposited on the egg shell leading to sealing of the pores.

### **3. Method -3: Oil coating method**

Mineral oil (food grade, and colourless, odourless, less viscous and free from fluorescent materials) is sprayed over the eggs or eggs are dipped in this oil, which forms a thin film on the surface of shell leading to sealing of the pores.

The eggs are to be treated as early as possible after laying to retain better internal quality.

### **4. Method -4: Low temperature method (eggs in refrigerator)**

Few numbers of eggs can be preserved by keeping them in refrigerator for few days for home consumption purpose. But in this method eggs should not be kept for more than 10 days.

## **(b) METHODS FOR PRESERVING LARGE NUMBER OF EGGS (COMMERCIAL PRESERVATION)**

### **1. Method - 1: Cold storage method**

Fresh eggs are to be stored in this method. Keeping period will be more if eggs are oil coated prior to load in the cold store.

The temperature and relative humidity which are to be maintained in the cold store are as follows:

<b>For short-term preservation</b>	<b>For long-term preservation</b>
Temperature: 12.5 - 15.5°C (55-60°F)	Temperature: - 10°C (14 ± 1°F)
Relative humidity: 70-80%	Relative humidity: 80-90%

Oil coated eggs can be preserved for 8 months when stored at 14°C and RH 90%, whereas for 6 months only if eggs are not coated with oil.



**2. Method - 2: Thermo stabilization method**

Eggs are to be immersed in warm water at 54°C for 15 minutes or 56°C for 10 minutes or 60°C for 5 minutes.

This heating process stabilizes the thick portion of albumen which reduces the evaporation of moisture from internal parts of eggs, and such eggs retain their fresh appearance for longer period.

**3. Method - 3: Pasteurization method**

The eggs are to be immersed in warm water at 63°C for 2.5 minutes or 64°C for 1.5 - 2 minutes. This destroys the microbes present on the surface of the eggs. This process is known as pasteurization of eggs.

*NB: Students should practice all the methods of preservation of eggs at the Institute's Poultry Farm.*

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 8**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Mineral oil is used for preserving eggs by oil coating method, because it is
  - (a) colourless
  - (b) odourless
  - (c) free from fluorescent materials
  - (d) all of these
2. The principle of earthen pot method of preserving eggs is
  - (a) keeping eggs in sterilized condition
  - (b) keeping eggs in high temperature
  - (c) keeping eggs in lower temperature
  - (d) none of these
3. Water glass is chemically known as
  - (a) Calcium silicate
  - (b) Sodium silicate
  - (c) Calcium carbonate
  - (d) Sodium bi-carbonate
4. For thermo stabilization of eggs with the object of increasing keeping quality, eggs are to be kept in warmed water at
  - (a) 54°C for 15 minutes
  - (b) 56°C for 10 minutes
  - (c) 60°C for 5 minutes
  - (d) all of these
5. If oil coated eggs are kept in a cold store at 14°C temperature and 90% RH, the eggs will retain its freshness for
  - (a) 8 weeks
  - (b) 18 weeks
  - (c) 8 months
  - (d) 18 months

**# Exercise**

1. What are the methods for preservation of large numbers of eggs? Which method(s) is/are to be employed in your area and why?
2. What are the methods for preservation of small numbers of eggs? Which method(s) is/ are to be employed in your area and why?

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## Activity Unit - 10

Date.....

# Study of Different Housing Systems of Poultry

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### OBJECTIVE

To know the different systems of housing poultry.

### RELEVANT INFORMATION

Generally four types of housing systems are found to follow among the poultry farmers. These are (i) free range or extensive system, (ii) semi-intensive system, (iii) folding unit system and (iv) intensive system. Intensive system is again of two types, *viz.*, deep litter system and cage system.

**Free range system:** It is the oldest method of poultry rearing. Generally very small number of birds (say, maximum 10-12 birds per farmer's family) are reared in this system, though in totality a huge number of birds are reared in this system in our country.

In this system birds are kept free during day time and they take shelter in a house during night. Rearing of birds in this system is apparently profitable as birds find appreciable amount of feeds in the surroundings during day time. This method is not suitable for commercial purpose.

**Semi-intensive system:** This system of poultry rearing is partly free range and partly intensive type. In this system, there is a poultry house followed by a run. The run is a small land surrounded by wire mesh and attached to the poultry house. The birds spend the day time in the run and take shelter in the house during night.

Approximate floor space per bird is 3-4 sq ft for house and 150-200 sq ft for run area.

**Folding unit system:** The general theme of this system of poultry rearing is the same as that of semi-intensive system. Here also, there is a poultry house followed by a run. The whole area of the run is enclosed by wire nettings. But the space requirement is less and the total poultry unit can be shifted from one place to

another. Hence the name folding unit. One can keep small number of birds in this system on the roof of their house with sophistication.

Approximate floor space per bird is 1 sq ft for house and 3 sq ft for run area, *i.e.*, total 4 sq ft per bird. So, folding house unit measuring 20ft x 5ft is suitable for 25 birds.

**Intensive System:** Commercial poultry farming is done only with this system. It is of two types, *viz.*, (i) deep litter system and (ii) cage system or battery system.

**Deep litter system:** This system is widely used for scientific and successful poultry farming. It is very popular for small as well as large units of commercial poultry farms. Birds are kept in large pen up to 250 birds in each house. The floor of the house is covered with dry litter materials up to the depth of 3 inches in broiler and 6 inches in layer house. Rice husk, saw dust, wood shavings, chapped straw, dried leaves, ground nut shells, etc. may be used as litter material as per the cost and availability.

Minimum floor space requirement under this system of management is 1 sq ft per broiler and 1.75 sq ft per layer chicken. However, the floor space may be increased to some extent in the summer months.

**Cage system:** It is the latest system of poultry rearing. Floor space requirement for birds is least in this system. Floor space requirement is 0.5 sq ft per broiler and 0.75 sq ft per layer chicken. Generally breadth and height of the cage are 1 foot and 1½ foot respectively; and the length depends on the number of birds to be kept in the cage. However, it is better not to keep more than 10-12 birds per cage.

The birds are confined in a cage just large enough to permit limited movement and allow them to stand and sit comfortably. The cage is made up of strong galvanized wire and a tray is fixed underneath of the floor for collection of droppings. The feeder and waterer remain outside the cage. The cages may be of different types, *viz.*, Californian type, three-tier or four tier type, *etc.* Initial investment in this system is very high, so this system is not commonly used by the small poultry farmers. However, this system of poultry rearing is very efficient and is being used in case of large commercial production.

## PROCEDURE

Students should see the different types of housing systems of poultry. If all types of houses are not available in the Instructional Farm, study the same using photographs, models, projection slides, *etc.*

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 10**

# Indicate the correct answer by putting tick (✓) mark.

1. The minimum floor space requirement for a layer (chicken) under deep litter system is  
(a) 1.00 sq ft (b) 1.75 sq ft  
(c) 3.00 sq ft (d) 3.75 sq ft
2. The minimum floor space requirement for a broiler (chicken) under deep litter system is  
(a) 1.00 sq ft (b) 1.75 sq ft  
(c) 2.00 sq ft (d) 2.50 sq ft
3. Poor ventilation in poultry house may cause  
(a) accumulation of carbon monoxide  
(b) accumulation of ammonia  
(c) wet litter condition  
(d) all of these
4. A broiler poultry shed of 25ft x 10ft under deep litter system can accommodate  
(a) 125 birds (b) 250 birds  
(c) 325 birds (d) 375 birds
5. Which system of commercial poultry keeping is the best for the rural Bengal?  
(a) free range system (b) semi-intensive system  
(c) deep litter system (d) cage system
6. A cage measuring 60cm L x 60cm W x 25cm H can accommodate  
(a) 10 quails (b) 25 quails  
(c) 50 quails (d) 150 quails
7. A cage measuring 120cm L x 60cm W x 25cm H can accommodate  
(a) 15 quails (b) 25 quails  
(c) 50 quails (d) 100 quails
8. Cage layer fatigue is a problem associated with  
(a) deep litter system (b) battery system  
(c) semi-intensive system (d) folding unit system

# Exercise

1. Compare and contrast between: deep litter system and cage system.

2. Which system of commercial poultry rearing is very popular in rural Bengal and why?
3. What is the basic difference between semi-intensive system and folding unit system of poultry keeping?

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## Activity Unit - 11

Date.....

# Study of Various Equipments of Poultry Farm and Hatchery

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### OBJECTIVES

- (i) To become familiar with different types of poultry farm and hatchery equipments - their shape, size and design.
- (ii) To know the utility and use of the equipments commonly used in poultry farms and hatcheries.

### REQUIREMENTS

- (i) Various poultry farm equipments *viz.*, feeder, waterer, nest, catching appliance, weighing balance, debeaker, brooder, *etc.*
- (ii) Hatchery equipments *viz.*, incubator, egg candler, egg weighing balance, egg tray, chick boxes, *etc.*

### RELEVANT INFORMATION

#### 1. Feeder

Two types of poultry feeders are in use, *viz.*, **trough type** (linear or longitudinal feeder) and **hopper type** (tube or circular feeder).

Four feeders (trays) are usually provided for about 250-300 chicks up to 7 days of age, and then additional feeders (3-4 per 100 birds) are provided.

**Feeder space requirement is as follows:**

In case of broiler farm under deep litter system-

0-2 weeks : 1 inch per bird

3-6 weeks : 2-2.5 inches per bird

#### 2. Waterer (Drinker)

Different types of waterer are in use, *viz.*, plate and jar, water bowl, water trough (linear or channel type), pipeline with nipples, deep water pan with guard grill, *etc.*

Four waterers (drinkers) are usually provided for about 250-300 chicks up to 7 days of age, and then additional feeders (3-4 per 100 birds) are provided.

**Waterer space requirement is as follows:**

In case of broiler farm under deep litter system-

0-4 weeks: 1 inch per bird

5 weeks onwards: 2 inches per bird

One automatic round waterer is sufficient for 50 birds. No bird should have to walk more than 5 feet for a waterer.

Water intake generally increases by 2-3 times during summer months. So, adequate number of waterers is to be provided by introducing more numbers as per needs so that fresh clean drinking water is available always. Generally water space is increased by about 50% in hot weather.

Under normal conditions, chicken of all age groups consume about two times as much water by weight as they eat feed.

### 3. Nest

The nest is provided in the layer house generally under deep litter system of management. It helps in proper collection of eggs as well as production of clean eggs.

Several types of nests are in use, *viz.*, individual nest, community nest, community roll away nest, trap nest, *etc.* they are made up of wooden or steel with sufficient space for birds.

**Individual nest:** One individual nest box measuring 35.5 cm x 35.5 cm x 30.5 cm is sufficient for 4-5 laying hens of commercial flock.

**Community nest:** One community nest measuring 1.5 m x 0.6 m x 0.6 m is sufficient for 50 layers. It is commonly used at commercial layer farm under deep litter system of management.

**Community roll away nest:** It is generally used in case of breeding flock under cage system of management. It helps in clean egg production, but if wrongly installed may increase breakage of eggs.

**Trap nest:** It is used for breeding poultry farm. After entering in the nest box the door is automatically closed and the bird cannot come out. After completion of laying the bird is to be left out manually, and egg is collected and marked for the research purpose.

### 4. Catching appliance

Catching appliances are used to catch the birds with minimum possible stress for

various operations like vaccination, weighing, debeaking, culling, etc. The important catching appliances are catching hook and catching crate / wire panel.

### **5. Debeaker**

Cutting of about 1/3 to 1/2 of upper mandible and trimming of lower mandible for just making it blunt is known as debeaking. This is done to reduce the wastage of feeds and to minimize the chance of cannibalism. This is generally done for egg-type chicken and usually not required for broiler chicken.

Debeaker is used for this purpose. Both manual and electric debeakers are available in the market; however, in commercial layer farm electric debeaker is commonly used.

### **6. Weighing balance**

Weighing balances of various capacities are needed in the poultry farm for weighing chicks and adult birds, feeds, eggs, etc. Special egg weighing balance is also available.

### **7. Egg candler**

It is a wooden or metal box closed from all sides but having an aperture of 2.5-3.0 cm in diameter, and one electric bulb is fitted inside the box.

The egg is held in front of beam of light near the aperture of the candler for proper viewing of egg shell and egg contents. Porosity of egg shell, shape and size of air cell, shadow of yolk, soundness of shell, etc. are observed by candling of eggs. Fertile and /or infertile eggs can also be detected if incubated eggs are candled properly on 5<sup>th</sup> to 7<sup>th</sup> day of incubation.

It is desirable to candle the eggs in dark room.

### **8. Electric bulb**

Electric bulbs are used for light management as well as brooding management under conventional system.

Four 60-watt bulbs suspended 6 inches above the floor are generally provided for 250-300 chicks for brooding management at the initial period.

### **9. Hatchery Equipments**

The important hatchery equipments are incubator, egg trays, tray carts and racks, egg candler, table for trayng eggs, chick boxes.

#### **Incubator**

It may be of two types, viz., combined incubator (setter cum hatcher) and setter and hatcher. In case of chicken egg incubation, eggs are kept in the setter machine

### Study of Various Equipments of Poultry Farm and Hatchery

for the first 18 days and then transferred them to the hatcher machine. But eggs are kept during the total period of incubation in the combined incubator machine. Incubator machines of various capacities are available in the market.

The following parts of an incubator are to be studied along with their functions.

The parts of a common incubator (for hatching of eggs) are-

machine cabinet, contract thermometer for temperature control, contract thermometer for humidity control, dry bulb and wet bulb thermometer ( for knowing temperature and humidity in side the machine), hygrometer (for humidity study, optional), fan, light source in side the machine (an electric bulb), egg turning device, water tank fitted with the machine-cabinet through a special valve, air inlet and outlet, control panel with off-on switch, egg trays, chick boxes/ trays.

The incubator is to be on to see the movements/functions of all the parts of the machine.

#### **Egg trays, chick trays, tray carts and racks**

These are used for handling of eggs for the hatching purposes.

#### **Egg candler**

It is used for candling (testing) of eggs during incubation to discard the infertile eggs and /or dead in shell, if any.

#### **Chick boxes**

These are used for packing of chicks for delivering the same to the poultry farmers. A chick box measuring 2ft x 1ft 6 inches x 6 inches and partitioned in 4 compartments can accommodate 100 chicks in winter and 80 chicks in summer.

#### **PROCEDURE**

The students should study all the equipments, their design, capacity, uses, etc. available in the institution's poultry farm, and note their observations including schematic diagrammes of the equipments.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 11**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Feeder space requirement for a broiler bird (0-2 weeks age group) under deep litter system is
  - (a) 1 inch
  - (b) 1.5 inch
  - (c) 2 inches
  - (d) 2.5 inches
2. Feeder space requirement for a broiler bird (3-6 weeks age group) under deep litter system is
  - (a) 1-1.5 inch
  - (b) 1.5-2 inches
  - (c) 2-2.5 inches
  - (d) 2.5-3 inches
3. Waterer space requirement for a broiler bird (0-4 weeks age group) under deep litter system is
  - (a) 1 inch
  - (b) 2 inches
  - (c) 3 inches
  - (d) 4 inches
4. Waterer space requirement for a broiler bird (5 weeks and more age group) under deep litter system is
  - (a) 1 inch
  - (b) 2 inches
  - (c) 3 inches
  - (d) 4 inches
5. How many chicks can be accommodated in a chick box measuring 2ft x 1½ ft x ½ ft in winter months?
  - (a) 50
  - (b) 100
  - (c) 150
  - (d) 200

**# Exercise**

1. Name the important parts of an incubator and their respective functions in hatching of eggs.
2. Enlist different equipments used in a broiler farm along with their schematic diagrammes.
3. Enlist different equipments used in a layer farm along with their schematic diagrammes.

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# Management of Incubator for Hatching of Eggs

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### OBJECTIVE

To hatch the eggs artificially with the help of incubator.

### REQUIREMENTS

1. Incubator machine
2. Egg candler
3. Eggs to be hatched

### PROCEDURE

The following steps are to be followed properly for successful hatching of eggs.

#### 1. Cleaning and Disinfection of Incubator

The incubator is to be cleaned thoroughly. The interior of the machine is to be washed with 4% solution of washing soda followed by disinfection with phenyl or lysol. Loose fittings of the machine are to be removed, and washed and disinfected separately, and be fitted at their respective places.

#### 2. Fumigation

The incubator is to be fumigated with formaldehyde gas [40% formalin on potassium permanganate ( $\text{KMnO}_4$ )].

Quantity required: 20g  $\text{KMnO}_4$  and 40ml formalin for 100 cubic ft area (1x concentration) for 3-4 hours.

$\text{KMnO}_4$  crystals are to be taken in an enamel bowl and kept at the bottom of the incubator; then formalin is to be poured over it to liberate formaldehyde gas. The enamel bowl should have sufficient volumetric capacity to avoid overflowing during reaction.

Before fumigation thermometers are to be removed as during fumigation excessive heat generation may damage these sensitive parts of the incubator. Air inlet and

outlet are to be closed properly to conserve the fumigated gas inside the incubator. However, it is to be ventilated properly before setting of eggs to remove traces of poisonous gas. Birds or humans to prevent fatal effects should not inhale the formaldehyde gas.

### 3. Testing of Incubator

Before actual setting of eggs, the incubator machine is to be tested for its various functions like maintaining desired temperature and humidity, turning of eggs and ventilation mechanism. The incubator is to be on for at least 24 hours to make sure that it is all right.

### 4. Actual Management of the Incubator

- Adjusting the incubator for all functions according to the manufacturer's instructions and as per requirements specific to a species of bird – like temperature, humidity (dry bulb and wet bulb thermometer), turning mechanism and ventilation.
- Placing of eggs: The selected eggs are to be placed in upright position *i.e.*, with broad end up position.
- All the principles are maintained automatically; so strong vigil is to be kept for mechanical fault, if any.
- After adjusting the incubator and setting of eggs, the machine should not be opened frequently to avoid interference in maintaining temperature and humidity in it.
- For maintaining humidity quantity of water in the respective containers is to be checked daily, and if needed, water is to be poured in the respective containers.

## RELEVANT INFORMATION

### 1. Optimum Conditions for Artificial Hatching of Eggs of Different Poultry Species

#### 1.1 Hatching of Chicken Eggs

Eggs	Weight: 50-55g Storage: 1-3 days (20-25°C / 68-77°F), 4-7 days (15-17°C / 59-62.6°F), 7-10 days (14-16°C / 57.2-60.8°F), >10 days (10-12°C / 50-53.6°F); RH 75-80%; Positioning – air cell upwards.
<b>Setter Conditions</b>	
Temperature	37.5-37.7°C (99.5-99.8°F) Prevent fluctuation of temperature
Humidity	28.3-30°C (83-86°F) wet bulb thermometer; maximum weight loss during incubation 12.6% from initial weight of egg.



Ventilation	Maximum CO <sub>2</sub> level 0.5%, fresh air supply 60-180 m <sup>3</sup> per 1000 eggs per hour.
Turning	45° <i>vice versa</i> . Common practice is once every hour.
Candling	At day 7 and /or at transfer.
Transfer	At day 18.
<b>Hatcher Conditions</b>	
Temperature	37.2-36.9°C (99-98.5°F)
Humidity	30-33.3°C (86-92°F) wet bulb thermometer; humidity is to be increased gradually when piping starts.
Turning	Not required.
Hatching	21 days + hours to dry.
Chick Treatment	To keep the susceptible chicks free from drying out, cooling down and draught.

## 1.2 Hatching of Duck Eggs

Eggs	Weight: 65-70g Storage: 1-3 days (20-25°C / 68-77°F), 4-7 days (15-17°C / 59-62.6°F), 7-10 days (14-16°C / 57.2-60.8°F), >10 days (10-12°C / 50-53.6°F); RH 75-80%; Positioning – air cell upwards.
<b>Setter Conditions</b>	
Temperature	37.2-37.5°C (99.0-99.5°F) Prevent fluctuation of temperature
Humidity	30.3-31°C (86-88°F) wet bulb thermometer; maximum weight loss during incubation 12.6% from initial weight of egg.
Ventilation	Maximum CO <sub>2</sub> level 0.5%, fresh air supply 60-180 m <sup>3</sup> per 1000 eggs per hour.
Turning	45° <i>vice versa</i> . Common practice is once every hour.
Candling	At day 7 and /or at transfer.
Transfer	At day 25.
<b>Hatcher Conditions</b>	
Temperature	37.0-37.2°C (98.6-99.0°F)
Humidity	31-35°C (88-95°F) wet bulb thermometer; humidity is to be increased gradually when piping starts.
Turning	Not required.
Hatching	28 days + hours to dry.
Duckling Treatment	Keep the susceptible ducklings free from drying out, cooling down and draught. Keep them at 30°C during the first day of their life after taking out from the hatcher, and anti-stress medicines (glucose and electrolyte powder) may be provided in the drinking water.

### 1.3 Hatching of Quail Eggs

<b>Eggs</b>	Weight: 10g Storage: 1-10 days at 13-15°C; RH 75%; Positioning – air cell upwards.
<b>Setter Conditions</b>	
Temperature	37.5-37.8 °C (99.5-100°F) Prevent fluctuation of temperature
Humidity	30.3-31°C (86-88°F) wet bulb thermometer; maximum weight loss during incubation 21.5% from initial weight of egg.
Ventilation	Maximum CO <sub>2</sub> level 0.5%, fresh air supply 60-180 m <sup>3</sup> per 10000 eggs per hour.
Turning	45° <i>vice versa</i> . Common practice is once every hour, but once every 3 hours is enough..
Candling	At day 7 and /or at transfer.(But not done in practice).
Transfer	At day 14.
<b>Hatcher Conditions</b>	
Temperature	37.0-37.4°C (98.6-99.3°F)
Humidity	30-33.3°C (86-92°F) wet bulb thermometer.
Turning	Not required.
Hatching	17-18 days.
<b>Chick Treatment</b>	Keep the susceptible ducklings free from drying out, cooling down and draught. Keep them at 34-40°C during the first 3 days of their life after taking out from the hatcher, and decrease it then slowly to 24°C at the end of second week. Anti-stress medicines (glucose and electrolyte powder) may be provided in the drinking water.

### 2. Loading Schedule and Requirement of Breeding Stock

In case of large electric incubator one third of the total capacity is usually loaded every 7 or 8 days.

The number of breeding birds required is calculated as one eighth of the incubator capacity. For example, a 1000 egg incubator would need about 125 breeding birds to keep it full (allowing for average lay in all seasons, and reject eggs).

### 3. Testing of incubated eggs

Incubated eggs are tested by means of candling at two different times during incubation, *viz.*, on 5<sup>th</sup>-7<sup>th</sup> day of incubation (to discard the infertile egg, if any) and again on 18<sup>th</sup> day of incubation (to discard the dead-in-shell, if any and to maintain the business liaison in case of commercial hatchery).

On 5<sup>th</sup>-7<sup>th</sup> day of incubation, spider-like red radiating lines can be seen in fertile eggs and movement of developing embryos is quite visible. At this stage infertile eggs will be clear like fresh eggs but they have bigger air cell.

**On 18<sup>th</sup> day of incubation**, about two third of the egg will show dark in appearance and a pulsating movement will be observable at the edge of the air cell in case of fertile eggs. Infertile eggs with dead embryos at this stage will be less developed.

#### 4. Incubation-related Problems and their Remedial Measures

Sl. No.	Problem	Probable causes	Remedial Measures
1	Early embryonic death (blood ring seen on candling)	Temperature too high or low	<ul style="list-style-type: none"> <li>* To check temperature and humidity control devices.</li> <li>* To ensure proper electric supply in the incubator.</li> </ul>
2	Many dead-in-shell	<ul style="list-style-type: none"> <li>* Poor ventilation</li> <li>* Faulty turning of eggs</li> <li>* Infection, e.g., BWD, etc.</li> <li>* Ill-health of breeding stock including poor nutrition.</li> </ul>	<ul style="list-style-type: none"> <li>* To check the fresh air circulation in the incubator and hatchery room.</li> <li>* To maintain the turning schedule of eggs properly and seriously.</li> <li>* To maintain the hatchery hygiene.</li> <li>* To maintain the disease free and well nourished breeding stock.</li> </ul>
3	Failing to hatch (Piped eggs)	Low level or lack of moisture in the incubator.	To main the humidity requirement inside the machine.
4	Malformed chicks/ducklings	<ul style="list-style-type: none"> <li>* Faulty setting of eggs</li> <li>* Faulty turning of eggs</li> <li>* Temperature too high or low.</li> </ul>	<ul style="list-style-type: none"> <li>* To set eggs properly with broad-end-up position.</li> <li>* To turn eggs properly as per schedule.</li> <li>* To check thermometer.</li> </ul>

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 12**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Production of chicks from fertile eggs is known as  
(a) culling (b) hatching  
(c) brooding (d) deworming
2. Maximum number of eggs that can be hatched by a broody hen is  
(a) 10 (b) 20  
(c) 30 (d) 40
3. Incubation period of chicken egg is  
(a) 17 days (b) 21 days  
(c) 28 days (d) 35 days
4. Incubation period of chicken egg by artificial hatching method (incubator) is  
(a) 7 days (b) 14 days  
(c) 21 days (d) 28 days
5. Incubation period of chicken egg by natural hatching method (broody hen) is  
(a) 7 days (b) 14 days  
(c) 21 days (d) 28 days
6. Temperature during incubation of chicken eggs should be  
(a) 35.5°C (b) 37.5°C  
(c) 39.5°C (d) 41.5°C
7. Relative humidity during incubation of chicken eggs should be  
(a) 50-60% (b) 60-70%  
(c) 70-80% (d) 80-90%
8. The incubation period of quail eggs is  
(a) 15 days (b) 17 days  
(c) 19 days (d) 21 days
9. The incubation period of turkey eggs is  
(a) 17 days (b) 21 days  
(c) 28 days (d) 35 days
10. The incubation period of duck eggs is  
(a) 18 days (b) 24 days  
(c) 28 days (d) 32 days

11. Male-female ratio of parent stock (chicken) for production of hatching eggs should be
  - (a) 1:3
  - (b) 1:10
  - (c) 1:20
  - (d) 1:50
12. Male-female ratio of parent stock (quail) for production of fertile eggs should be
  - (a) 1:3
  - (b) 1:10
  - (c) 1:20
  - (d) 1:50
13. Male-female ratio of parent stock (Khaki Campbell duck) for production of fertile eggs should be
  - (a) 1:5
  - (b) 1:10
  - (c) 1:15
  - (d) 1:20
14. Average weight of a newborn quail chick is
  - (a) 10g
  - (b) 6g
  - (c) 16g
  - (d) 58g
15. For artificial incubation eggs are kept in the setter (in case of chicken) for
  - (a) 3 days
  - (b) 18 days
  - (c) 21 days
  - (d) 28 days
16. Hatching eggs can be preserved for 7 days at a storage-temperature of
  - (a) 2-8°C
  - (b) 16-17°C
  - (c) 25-30°C
  - (d) 37-38°C
17. For successful hatching of chicken eggs, turning of eggs is essentially needed during –
  - (a) the total incubation period
  - (b) the first 18 days of incubation
  - (c) the last 3 days of incubation
  - (d) the first 3 days of incubation
18. For successful hatching of duck eggs, turning of eggs is must during  $\frac{3}{4}$ 
  - (a) the total incubation period
  - (b) the first 25 days of incubation
  - (c) the last 3 days of incubation
  - (d) none of these

**# EXERCISE**

1. Enlist the daily activities during artificial incubation of eggs.
2. Why and how eggs are tested during incubation?

Management of Incubator for Hatching of Eggs

3. What do you mean by 'dead in shell'? What measures are to be taken to reduce the dead in shell cases?
4. How many eggs are to be set to supply 1000 broiler and 1000 layer chicks to the respective farmers?

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## Activity Unit - 13

Date.....

# Sexing of Birds

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### OBJECTIVE

The method of segregation of male and female birds is called as sexing. It is essential for breeder and layer chicks at day old stage.

### PROCEDURE

#### SEXING OF CHICKS

##### (a) Japanese Method or Vent (Cloaca) Method of Sexing

This method was first developed in Japan and considered to be the most popular method of the recent time. The sexing is done on the basis of the genital eminence of the day old chicks.

	Characters	Male	Female
1.	Elasticity of genital eminence	More elastic	Less elastic
2.	Boundary and contour of the genital eminence	Distinct boundary and contour	No distinct boundary or contour
3.	Lusture and colour of eminence	Distinct Lusture	Transparent appearance, colour does not differ from other part of cloaca.
4.	Difference in the position of eminence	Much more outside	Further inside

##### (b) Proctoscope Method

Proctoscope is an optical instrument with an illuminated glass tip which is inserted into the chick's bowel through cloaca, enabling the sexer to view the testicle of the cockerel or the ovary (left) of the pullet.

##### (c) Sex-linked Characters

- (i) **Colour of Plumage:** In this method sex-linked characters are used to identify the sexes of chicks. For example, when a Rhode Island Red male is mated to Barred Plymouth Rock female, all the female progenies will be black and male progenies barred.



- (ii) **Feather Growth:** Slow-feathering and rapid-feathering genes are used in breeding programs so that the sex of day old chicks can easily be determined. Feather sexing is common in layer and broiler parent stock.

### SEXING OF DUCKLINGS

#### (a) Japanese or Vent Method

The colour of the cloaca of day old male duckling appears to be pinker than that of female ones.

#### (b) Sexing of Duck (adult)

	Characters	Male	Female
1.	Squawk (6 weeks of age)	Not so pronounced	Much more pronounced
2.	Tail feather	Turned upside	No such turning
3.	Colour of plumage	More darker (in Khaki Campbell the colour of plumage of neck is bluish black)	Less darker (in Khaki Campbell the colour of plumage of neck is chocolate)

### SEXING OF QUAILS

Day old stage	Day old sexing is possible but it is not practiced due to very small size of birds (each weighs about 6g).
Three weeks of age	Male - Darker cinnamon coloured feathers on the upper throat and lower breast region. Feathers are short and blunt. Female - Lighter cinnamon coloured feathers on that region of the body and a characteristic black stippling. Feathers are long and pointed.
Five to six weeks of age	Male - makes peculiar sound particularly during the night.

### SEXING OF OTHER BIRDS

The vent method is also used for sexing turkeys, guinea fowls, geese, ostriches and emus at day old stage.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 13**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Sexing of day old chicks is an essential operation in which of the followings?  
(a) Broiler farming                      (b) Layer farming  
(c) Both a & b                              (d) None of these.
2. Vent method of sexing at day old stage is not generally done in case of  
(a) chicken                                  (b) duck  
(c) quail                                      (d) turkey
3. When a Rhode Island Red male is mated to Barred Plymouth Rock female  
(a) all the male progenies will be red and female progenies barred.  
(b) all the female progenies will be red and male progenies barred.  
(c) all the male progenies will be black and female progenies barred.  
(d) all the female progenies will be black and male progenies barred.

**# EXERCISE**

1. Why chick sexing is an important operation in a hatchery?
2. How sexing of chicks is done by Japanese method?
3. What do you mean by auto sexing? How is it done in case of poultry?

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## Activity Unit - 14

Date.....

# Brooding of Poultry

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### OBJECTIVE

To know the different activities related to brooding of chicks.

### RELEVANT INFORMATION

Brooding is the care and management of day old chicks during early part of their life (generally up to 4-6 weeks of age or until they are well feathered). They require extra heat at this stage due to their ill developed thermoregulatory mechanism.

The brooder unit consists of the following arrangements.

**1) A brooder with a heating source:** Usually it is a bamboo basket with electric bulbs as source of heat. The height of the brooder should be about 6 inches in the first week. Some times basket is not used and brooding is done on the floor of the deep litter house itself.

**2) Brooder guard:** A cardboard or a metal sheet or wire net may be used as brooder guard. Its height should be about 18-24 inches. It is to be placed around the heat source (hover), generally 2-3 feet away from the edge of the (hover). After the first few days, the area is to be enlarged gradually to provide more floor space, and after 7-10 days it may be removed completely.

A brooding unit with four 60-watt bulbs suspended 6 inches above the floor and a brooder guard of 5 feet radius is sufficient for 250-300 chicks.

**3) Feeders and Drinkers:** Four baby chick drinkers and three brand new egg trays (on which feed could be given) are sufficient for 250-300 chicks. Later, these would require to be increased gradually.

All the equipments should be in place in the brooder house, and brooder should be on at least 24 hours before arrival of the chicks.

**Brooding requirements are proper temperature, ventilation, floor space, appropriate feeders and drinkers.**

Optimum brooding temperature during the first week is 90-95°F, and then the

temperature may be reduced at the rate of 5°F on every successive week, until the room temperature of 60-70°F (21°C) is reached or the chicks are fully feathered. However, chicks' behaviour is to be taken into consideration whether they are getting proper amount of heat or not. Since the temperature in our country varies a great deal, it is advisable to adjust the required comfortable temperature for the chicks as per their brooding behaviour.

Fresh air should be available continuously in the brooding house. But ensure that there is no direct wind or draft that will chill the chicks.

The minimum floor space in the brooder house should be 3-4 inches per chick. However, not more than 500 chicks should be placed under one brooder.

During the first 3 days, feeds are offered on the newspaper or brand new egg tray. Regular chick feeders should be introduced after 3-4 days. Baby chick drinkers should be provided to the chicks.

#### **Few tips for brooding management:**

1. Chicks are to be placed in the brooder gently. Weak chicks should be separated from the others and placed in a separate brooder. They require more heat than other chicks.
2. They should receive fresh water only (and no feed) for several hours. Sugar may be added to this water. An 8% sugar solution containing 1% sodium chloride is usually given for the first 15 hours after the chicks are placed in the brooder.
3. If the chicks are under stress due to long journey or inclement weather conditions, anti-stress medicine (vitamins + electrolytes) may also be added to the drinking water for the first 3-4 days. Zeetress (Indian Herbs, @ 0.5g/100 birds/day), Stressban powder (Zeus Intervetcare, @ 0.5g/100 birds/day), Stresroak (Dabur, @ 5ml/100 birds/day) are some brand name of anti-stress medicine available in the market.

Ensure that all the chicks are drinking water. Few chicks may be taught to drink water, by dipping their beaks.

4. Generally three hours after placing the chicks in the brooder, maize grits (chick maize) are offered on the newspaper or on the brand new egg tray for them. Ensure that all the chicks are eating. Usually from 2<sup>nd</sup> day onwards, usual feed (broiler starter/ chick ration/crums) is given to the chicks.
5. Constant round the clock monitoring is very essential during the first few days.

#### **PROCEDURE**

All the students should observe various activities of brooding management of chicks in the Instructional Livestock Farm (Poultry Section).

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 14**

**# Indicate the correct answer by putting tick (✓) mark**

1. Application of heat to the birds during their early part of life is known as  
(a) culling (b) brooding  
(c) hatching (d) deworming
2. Usually a brooder fitted with 4 bulbs of 60-watt and a brooder guard of 5 feet radius can accommodate  
(a) 100-150 chicks (b) 150-200 chicks  
(c) 200-250 chicks (d) 250-300 chicks
3. How many baby chick drinkers should be provided for brooding management of 250-300 chicks?  
(a) 4 (b) 3  
(c) 2 (d) 1
4. What should be the brooding temperature during the 1<sup>st</sup> week of brooding?  
(a) 90-95°F (b) 85-90°F  
(c) 80-85°F (d) 75-80°F
5. What is the minimum space requirement per chick for proper brooding?  
(a) 1-2 sq inches (b) 2-3 sq inches  
(c) 3-4 sq inches (d) 4-5 sq inches

**# Exercise**

1. What are the brooding house requirements for scientific brooding of chicks?
2. Enlist the equipments (along with their numbers) for brooding 250 broiler chicks under deep litter system.

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# Activity Unit - 15

Date.....

## Feeds and Feeding of Poultry

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### SUB-ACTIVITY UNIT-I IDENTIFICATION OF POULTRY FEED INGREDIENTS

#### OBJECTIVES

1. To become familiar with common poultry feed ingredients.
2. To use this knowledge in evaluation and selection of feed ingredients for preparing a balanced and economic ration.

#### RELEVANT INFORMATION

Poultry feed ingredients are classified as energy rich feedstuffs, protein rich feedstuffs, vitamin and mineral sources, and non-nutritive feed additives. Generally 10-15 feed ingredients are mixed together to prepare commercial poultry feeds.

#### Energy rich feedstuffs

About 45 to 65 per cent poultry feed is constituted by energy rich feed ingredients. The common energy rich feed ingredients are maize grain, jowar grain (sorghum), millets (bajra/pearl millet, ragi), oats, wheat, wheat bran, broken rice/rice kani, rice bran and rice polish, salseed cake, tapioca flour, molasses, *etc.*

#### Protein rich feedstuffs

Protein rich feed ingredients are mainly used to supply protein but at the same time they also contribute some energy. They are divided in to two groups, *viz.*, vegetable protein and animal protein.

The common **vegetable protein sources** are ground nut cake, linseed cake, sesame (*til*) cake, sunflower cake, mustard cake, cotton seed cake, soybean cake, coconut cake, maize gluten meal, guar meal, penicillium-mycelium waste, *etc.*

The common **animal protein sources** are fish meal, meat meal, blood meal, liver residue meal, silk worm pupae meal, poultry hatchery by-product meal, *etc.*

#### Mineral sources

The common mineral sources are common salt, oyster shell (37.4% Ca), lime stone



(37.5% Ca), bone meal (27% Ca and 12.11% P), dicalcium phosphate (23% Ca and 18.1% P), etc. Nowadays various mineral mixtures are commercially available in the markets.

### **Vitamin sources**

The feed ingredients used in the manufacturing of balanced poultry feed generally supply different types of vitamins. However, vitamin mixtures are commercially available in the markets, which may be used as per the requirements of birds.

### **Feed additives**

These are not essentially nutrients, but their presence in feed in minute quantity increases the nutritive value of feed leading to increase feed efficiency, growth and production of the birds. The most common non-nutritive feed additives are antibiotics (*e.g.*, oxytetracycline, chlortetracycline, penicillin, streptomycin, etc.), coccidiostat, antioxidants (*e.g.*, ethoxyquin, vitamin E, etc.), antifungals, anthelmintics, vitamin supplements, antistress medicines, enzymes, etc.

## **REQUIREMENTS**

Fresh and pure samples of commonly used feed ingredients for poultry. (The feed samples should be kept in transparent glass or plastic containers / jars with proper labeling.)

## **PROCEDURE**

Study the characteristics of all feed items individually provided to you and record the observations in terms of their common English and scientific name, colour, odour, texture and bulkiness and class of feed (*e.g.*, grain, cake, by-product, vitamin and mineral source).

NB: Students should know the nutritive value of various poultry feed ingredients and their maximum level of inclusion in the compounded poultry feed. These values are given in Table 15.1 and Table 15.2, respectively for ready reference.

## **OBSERVATIONS**

Characteristics	Feed ingredient No. 1	Feed ingredient No. 2	Feed ingredient No. 3
a. Common Name			
b. Scientific Name			
Colour			
Odour			
Texture and bulkiness			

Feeds and Feeding of Poultry

Characteristics	Feed ingredient No. 1	Feed ingredient No. 2	Feed ingredient No. 3
Class – i. Grain ii. Cake iii. By-product iv. Feed Supplement			
Remarks [Energy rich/protein rich/vitamin/ mineral source]			

Characteristics	Feed ingredient No. 4	Feed ingredient No. 5	Feed ingredient No. 6
a. Common Name b. Scientific Name			
Colour			
Odour			
Texture and bulkiness			
Class – i. Grain ii. Cake iii. By-product iv. Feed Supplement			
Remarks [Energy rich/protein rich/vitamin/mineral source]			

Characteristics	Feed ingredient No. 7	Feed ingredient No. 8	Feed ingredient No. 9
a. Common Name b. Scientific Name			
Colour			
Odour			
Texture and bulkiness			
Class – i. Grain ii. Cake iii. By-product iv. Feed Supplement			
Remarks [Energy rich/protein rich/vitamin/mineral source]			

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Characteristics	Feed ingredient No. 10	Feed ingredient No. 11	Feed ingredient No. 12
a. Common Name			
b. Scientific Name			
Colour			
Odour			
Texture and bulkiness			
Class – i. Grain ii. Cake iii. By-product iv. Feed Supplement			
Remarks [Energy rich/protein rich/vitamin/mineral source]			

Characteristics	Feed ingredient No. 13	Feed ingredient No. 14	Feed ingredient No. 15
a. Common Name			
b. Scientific Name			
Colour			
Odour			
Texture and bulkiness			
Class – i. Grain ii. Cake iii. By-product iv. Feed Supplement			
Remarks [Energy rich/protein rich/vitamin/mineral source]			

## SUB-ACTIVITY UNIT-II

### STUDY OF DIFFERENT TYPES OF FEEDS FOR DIFFERENT CATEGORIES OF POULTRY

#### OBJECTIVES

1. To become familiar with different types of poultry feeds.
2. This knowledge helps in proper feeding management of different categories of poultry.

#### RELEVANT INFORMATION

##### Types of chicken feed

For layer chicken, three types of feeds are commonly used for commercial production of eggs, viz., **chick feed** (0-8 weeks), **grower feed** (9-20 weeks) and **layer feed** (21-72 weeks or during the laying period).

For broiler chicken, two types of feeds are commonly used for commercial production of meat, viz., **broiler starter** (0-4 weeks) and **broiler finisher** (5-6 weeks).

##### Types of duck feed (for layer ducks)

Four types of duck feeds are used for commercial production of duck eggs, viz., **starter feed** (0-2 weeks), **grower feed phase I** (3-8 weeks), **grower feed phase II** (9-20 weeks) and **layer feed** (21 weeks onwards or from point of lay).

##### Types of quail feed

For layer quails, three types of feeds are used, viz., **starter mash** (0-3 weeks), **grower mash** (4-5 weeks) and **layer mash** (6 weeks onwards).

For broiler quails, two types of feeds are used, viz., **starter mash** (0-3 weeks) and **grower mash** (4-6 weeks).

#### PROCEDURE

- Compounded feeds for different categories of poultry are available in the markets in various trade names. Students should observe the general appearance of different types of poultry feeds.
- Students should know the feed requirements for different categories of poultry. As a guide feed requirements for different categories of poultry are given in a special note.

## OBSERVATION

1. Note different types of poultry feeds which are being used in the Institute's Poultry Farm.
2. Note feed requirements for different categories of poultry from the farm records.

### Special Note:

#### Feed requirement for different categories of poultry

##### # Feed requirement for layer chicken

Total feed requirement up to 72 weeks of age is 47.5 kg per bird.

Chick feed (0-8 weeks) - 2 kg

Grower feed (9-20 weeks) - 5.5 kg

Layer feed (21-72 weeks) 40 kg @ 110 g/bird/day.

Feed requirement for layer chicken may vary due to genetic make up of bird (strain variation), feed quality, laying percentage, environmental conditions, system of feeding and other management practices.

##### # Feed requirement for broiler chicken

Total feed requirement up to 6 weeks of age is 3.8 kg per bird (weighed 2 kg each) @ 1.9 kg /kg live weight (maximum).

Approximate weekly feed requirement for a broiler chicken (finished weight 2 kg at 6 weeks of age) is given below.

Age (in week)	Feed consumption (in g)
1	150
2	300
3	500
4	850
5	950
6	1050
Total in 6 weeks	3800g

*i.e.* Broiler starter feed (0-4 weeks) - 1.8 kg and  
Broiler finisher feed (5-6 weeks) - 2.0 kg.

The above figures are only guidelines for feeding broiler chicken. It may vary due to genetic make up of bird (strain variation), feed quality, laying percentage, environmental conditions, system of feeding and other management practices.

**# Feed requirement for layer duck**

Total feed requirement for a layer duck (e.g., Khaki Campbell) from day old stage up to one year

laying period is 62-63 kg (maximum).

Starter feed (0-2 weeks) - 0.37 kg

Grower feed phase I (3-8 weeks) - 4.11 kg

Grower feed phase II (9-20 weeks) - 8.15 kg

Layer feed (21-72 weeks) - 50 kg

These figures are guide only for rearing of laying ducks under complete confinement in intensive system. If the ducks are reared under semi-intensive system with the facility of water source (like pond), feed requirement is very less @ 50-60 g/adult bird/day, because they can manage their feed requirement up to 60% from the range land and pond in terms of insects, food grains, grasses, etc.

**# Feed requirement for quail**

Total feed requirement for a broiler quail up to 6 weeks of age is about 500g with FCE 3.3.

Total feed requirement for a layer quail from day old stage to up to one year laying is about 9.6 kg.

Chick mash (0-3 weeks) @ 4 g/day/bird - 85g

Grower mash (4-5 weeks) @ 18 g/day/bird - 250g

Layer mash (6 weeks to 1 laying year) @ 25 g/day/bird - 9300g

**# Water requirement for layer chicken (age-wise per 100 birds)**

Age (week)	Water requirement (litres/day)
0-3	3.5 - 5.0
4-6	6.5 - 9.5
7-10	15 - 16
11-20	18 - 20
21 and above	25 - 30

**# Water requirement for broiler chicken (age-wise per 100 birds at different room temperature, litres/day)**

Age (Weeks)	10°C	15°C	20°C	25°C	30°C	35°C
1	2.3	2.4	3.0	3.2	3.5	3.7
2	5.0	6.0	6.5	7.4	10.0	16.3
3	6.5	7.8	10.0	12.7	17.2	36.0
4	9.0	11.0	14.0	17.1	27.1	46.2
5	11.4	14.0	18.0	21.4	33.4	55.3
6	14.0	16.5	21.5	25.3	38.7	61.3

### SUB-ACTIVITY UNIT-III

#### STUDY OF FEEDING SYSTEMS OF POULTRY

##### OBJECTIVES

- (i) To become familiar with different systems of feeding poultry.
- (ii) This knowledge helps in proper feeding management of different categories of poultry.

##### RELEVANT INFORMATION

The common systems of feeding poultry are-

- (1) Whole grain feeding
- (2) Grain and mash feeding
- (3) All mash feeding
- (4) Pellet feeding
- (5) Crumble feeding

##### **Whole grain feeding system**

This is also known as cafeteria or free choice feeding system. Feed ingredients (mainly grains) are kept in separate containers and offered to the birds. The birds take the feed ingredients according to their will.

This method is not suitable for commercial purpose. It takes more time and labour to fill different containers with different feed ingredients, and birds may not get all the essential nutrients due to selective feeding leading to deficiency disease(s).

##### **Grain and mash feeding system**

In this system both grains and mash are offered in the same container and allowed the birds to eat. Level of nutrients (like protein) may be increased or decreased easily on the basis of growth, egg production, environmental conditions, *etc.*, but it needs skill and experience. Here also birds may take feed ingredients selectively to some extent leading to deficiency of nutrient(s).

##### **All mash feeding system**

In this system, all the feed ingredients are usually ground to almost uniform particle size (710 milli-microns) and mixed together in the form of mash. This homogenous mixture of feed ingredients *i.e.*, mash is offered to the birds, no other feed ingredients are offered to the birds separately, not even grit. There is

no possibility of selective feeding by the birds.

All species and categories of poultry prefer their diet in the mash form. Generally dry mash is offered to the fowl, but in summer months it is desirable to offer wet mash (mixing with water just before feeding) to increase feed consumption and to avoid wastage by dust. In case of duck, wet mash feeding is the only popular method of feeding.

All mash feeding system is the most popular, and used for commercial poultry production.

### **Pellet feeding system**

Pellets are small cylindrical shaped feeds, made up of dry mash under high pressure. Pellets are of different sizes according to the age of birds. Generally pellets are offered to the chicken/fowl.

Selective feeding is practically nil in this system, and hence all the nutrients including vitamins and minerals which are added in very small quantity are properly received by the birds. There is no choice, so rejection of unpalatable feed ingredients is also not possible. This system avoids the wastage of feed. The only disadvantage of this system is that pellet feeds are costlier than mash (about 10% more expensive). So this system is not generally followed for small scale poultry production.

### **Crumble feeding system**

Crumbles are small and just like broken pellets. Consistency of crumbles is coarser than mash. Crumbles are generally offered to the starting chicken, because pellets are hard and over size during early part of birds' life.

### **PROCEDURE**

Students should observe all types of poultry feeding systems at the Instructional Poultry Farm, and note their observation.



**Table 15.1: Composition of common poultry feed ingredients (moisture free basis, in per cent)**

Sl. No.	Feed ingredient	Dry matter (%)	ME (kcal/kg)	Crude protein (%)	Crude fibre (%)	Ether extract (%)	NFE (%)	Calcium (%)	Phosphorus (%)	Manganese (mg/kg)	Zinc (mg/kg)	Lysine (%)	Methionine (%)
<b>Energy Sources</b>													
1	Maize (grain)	89.5	3309	9.2	2.4	3.9	82.8	0.25	0.4	4.8	12.1	0.18	0.15
2	Jowar (grain)	87.3	2645	10.3	3.6	4.6	78.1	0.18	0.32	16.3	15.4	0.35	0.18
3	Bajra (grain)	89.6	2642	12.7	2.2	4.9	78.2	0.13	0.72	-	-	0.43	0.2
4	Oats (grain)	91.7	2848	14.7	13.5	4.6	60.8	0.11	0.41	42.9	-	0.41	0.21
5	Wheat (grain)	89.8	3045	10.3	2.1	2.6	82.3	0.18	0.43	57	15.6	0.47	0.21
6	Wheat bran	88.9	1069	14.7	11.3	3.8	62.3	0.19	1.12	130	-	0.53	0.09
7	Rice kani	90.7	2345	7.9	1.4	1.7	87.1	0.11	0.48	-	-	-	-
8	Rice polish	91.8	2937	12.7	11.2	13.9	48.6	0.27	1.37	-	-	0.44	0.24
9	Rice polish, deoiled	92.3	2235	14.1	13.8	1.7	53.4	0.37	1.8	-	-	-	-
10	Salseed cake, deoiled	90.4	3096	10.4	3.4	2.9	79.6	0.24	0.16	-	-	0.6	0.38
11	Tapioca flour	-	3000	2.9	10.9	0.7	77	0.58	0.12	-	-	0.6	0.006
12	Molasses	73.6	2400	2.8	-	-	86.3	1.51	0.66	-	-	56.3	-
<b>Protein Sources</b>													
<b>Vegetable</b>													
13	Groundnut cake	91.5	2596	40.9	8.9	7.9	36.4	0.23	0.59	27.7	-	1.24	0.57
14	Linseed ( <i>Tisi</i> ) cake	90.7	1671	29.6	11.1	10.4	42.6	0.48	0.98	43.3	-	-	0.59
15	Sunflower cake	89.1	2230	37.2	11.6	10.9	32.6	0.43	1.14	24.6	-	1.95	1.56
16	Sesame ( <i>Til</i> ) cake	90.7	1882	39.1	4.7	9.3	34.3	2.46	1.42	51.6	107.5	1.14	1.23
17	Mustard cake	91.3	2373	35.1	8.2	14.1	33.4	0.89	1.78	-	-	-	-
18	Cotton seed cake	92.3	1556	25.9	24.4	8.6	33.7	0.52	0.86	22.9	-	1.07	0.41

Sl. No.	Feed ingredient	Dry matter (%)	ME (kcal/kg)	Crude protein (%)	Crude fibre (%)	Ether extract (%)	NFE (%)	Calcium (%)	Phosphorus (%)	Manganese (mg/kg)	Zinc (mg/kg)	Lysine (%)	Methionine (%)
19	Soybean cake	89.9	2694	41.7	6.3	21.2	26.0	0.36	0.9	35.9	-	2.57	0.76
20	Coconut cake	91	1190	22.6	12.5	8.7	49.4	0.23	0.66	59.6	-	0.71	0.32
21	Maize gluten meal	90.3	2705	49.9	2.0	4.2	41.4	0.22	0.35	8.0	-	1.02	1.28
22	Guar meal	89.7	-	42.0	10.9	6.2	35.1	0.54	0.7	-	-	-	-
23	Penicillium mycelium waste	91.8	-	31.9	8.4	6.7	34.5	3.97	1.12	-	-	1.24	0.46
	<b>Animal</b>												
24	Fish meal	93.8	1834	43.1	3.6	4.3	11.5	7.16	1.67	38.9	-	4.17	1.42
25	Meat meal	92.5	2319	56.2	2.2	11.9	8.7	2.68	2.06	10.2	-	4.00	0.84
26	Bone meal	95.5	1044	14.6	2.5	3.1	5.6	27.0	12.11	32.0	447.0	-	-
27	Blood meal	88.8	1420	73.4	0.7	-	-	0.32	0.31	5.8	-	6.34	0.83
28	Liver residue meal	90.9	3000	65.4	1.3	15.8	11.9	0.54	1.35	9.5	-	4.72	1.28
29	Silk worm pupae meal, deoiled	90.5	3000	69.8	3.9	2.2	15.5	0.29	0.58	-	-	3.98	3.07
30	Poultry hatchery by-product meal	93.0	-	56.4	0.9	17.8	10.2	3.95	1.73	-	-	-	-
	<b>Miscellaneous</b>												
31	Lucerne (Alfalfa) leaf meal, dehydrated	91	1777	19.1	21.6	2.8	42.1	1.83	0.45	31.2	17.2	0.85	0.21
32	Berseem leaf meal, dehydrated	89.7	180	15.3	23.5	3.7	42.8	2.6	2.2	-	-	0.66	0.30

Source : Singh, K. S. and Panda, B. (1988) Poultry Nutrition, Kalyani Publishers, Ludhiana.

**Table 15.2: Maximum level of inclusion of common feed ingredients in poultry rations (in per cent)**

<b>Ingredients</b>	<b>Chicks</b>	<b>Growers/Layers</b>
<b>(a) Energy sources</b>		
Maize	60	65
Wheat	50	50
Barley	20	40
Oats	10	20
Jowar (white)	25	40
Molasses	5	10
Rice polish	40	40
Rice polish, deoiled	20	20
Tapioca meal	25	25
Wheat bran	10	15
Salseed meal, deoiled	3	5
<b>(b) Vegetable protein sources</b>		
Groundnut cake	40	40
Groundnut cake, deoiled	20	20
Soybean meal	40	40
Sesame ( <i>Til</i> ) cake	20	20
Linseed ( <i>Tisi</i> ) cake, water treated	20	20
Cotton seed cake, degossypolized	5	5
Mustard cake	10	10
Maize gluten meal	15	15
Sunflower meal	20	20
Coconut meal	5	5
Guar meal	5	5
<b>(c) Animal protein sources</b>		
Fish meal	10	10
Meat meal	5	10
Blood meal	3	3
Silk worm pupae meal	6	6
Poultry hatchery by-product meal	3	3
Liver residue meal	5	10
Penicillin mycelium waste	10	10
<b>(d) Miscellaneous</b>		
Lucerne leaf meal	3	5
Berseem leaf meal	3	5

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 15**

**# Indicate the correct answer by putting tick (✓) mark**

1. Approximate feed requirement of a broiler chicken (live weight 2 kg) up to the age of marketing is
  - (a) 3.8 kg
  - (b) 4.8 kg
  - (c) 5.8 kg
  - (d) 6.8 kg
2. Oyster shells in layer ration supply
  - (a) Fe
  - (b) Ca
  - (c) Vitamin-A
  - (d) Vitamin-C
3. The common mineral source(s) in poultry feed is/are
  - (a) Limestone
  - (b) Oyster shell
  - (c) Dicalcium phosphate
  - (d) all of these
4. Daily water requirement of layer chicken is (per 100 birds) –
  - (a) 10-15 litres
  - (b) 25-30 litres
  - (c) 30-35 litres
  - (d) 50-55 litres
5. Daily water requirement of broiler chicken at the age of 6 weeks in summer months is (per 100 birds) –
  - (a) 2 litres
  - (b) 7 litres
  - (c) 11 litres
  - (d) 30 litres
6. Which system of commercial poultry feeding is most popular in India?
  - (a) grain and mash feeding
  - (b) all mash feeding
  - (c) all grain feeding
  - (d) pellet feeding

**# Exercise**

1. Enlist the feed ingredients commonly used in your institution's poultry farm.
2. Name some brand names of various types of poultry feeds available in the nearby market.
3. What are the systems of feeding and watering birds in your institution's poultry farm?

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# Activity Unit - 16

Date.....

## Poultry Health Management

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### SUB-ACTIVITY UNIT - I

#### GENERAL MEASURES FOR PREVENTION AND CONTROL OF POULTRY DISEASES

##### OBJECTIVE

To maintain the poultry health through prevention and control of diseases.

##### RELEVANT INFORMATION

Disease is the greatest threat to the success of poultry enterprise either through loss of birds or through drop in production. There are many devastating poultry diseases by means of which large number of birds may be affected at a time. Moreover, early diagnosis of disease and line of treatment are very difficult in case of poultry, as it gives practically no time to diagnose a disease and in maximum cases symptoms are overlapping. So 'prevention is better than cure' is more relevant in maintenance of poultry health. Besides this, prevention is cheaper than treatment as nowadays the treatment is very costlier and involves many risk factors.

Various aspects for prevention and control of poultry diseases are:

1. Cleaning and Disinfection
2. Proper housing
3. Proper feeding
4. Stress management
5. Disposal of poultry waste
6. Restriction for visitors
7. Vaccination against dreadful poultry diseases and preventive medication

##### (1) Cleaning and Disinfection

Proper cleaning followed by disinfection of poultry shed and its surrounding areas and poultry equipments are must to prevent the chance of introduction of disease producing organisms in the farm. Cleanliness is very important aspect to maintain the sanitation and hygiene of the poultry farm.

- Poultry house is to be cleaned daily to remove dirt, dust and filth, if any.
- The feeders and waterers are also to be cleaned daily before giving feeds and water in the morning. The feeders should be periodically scraped (once a week) to remove cakes of feeds, if any, in order to prevent fungal growth.
- Electric bulbs in the poultry shed should be cleaned once in a month.
- Cleaning is the prerequisite of disinfection, because presence of organic matter reduces the action of disinfectants. After proper cleaning of poultry houses and poultry equipments *etc.*, disinfectant is to be applied followed by rest and fumigation. Poultry houses and its equipments are thoroughly disinfected between the batches.

Some commonly available commercial disinfectants are phenyl, lime, formalin, bleaching powder, potassium permanganate, caustic soda, Medichlore-S, Aldepol-H *etc.* After application of disinfectant (as per manufacturer's directions), rest is to be given for at least 2-3 weeks to break up the life cycle of disease producing organisms in the poultry house.

The last step is formaldehyde fumigation to kill the remaining organisms. For routine disinfection purpose 20g  $\text{KMnO}_4$  and 40ml of formalin (40%) are required for 2.80m<sup>3</sup> (100 ft<sup>3</sup>) area. In case of disease outbreak and for disinfection of hatchery room, vehicles *etc.* the concentration can be increased to 2 to 3 times as needed.

Note : Uses of various disinfectants

**Phenyl** – For washing of floor, washing and dipping of shoes as 5% solution.

**Lime** – For disinfection of litter, floor and poultry carcass @ 4-7kg/100sq ft. It generates heat, absorbs moisture, and liberates oxygen which destroys coccidia and eggs of parasites and even bacteria, and keeps fungi under control.

**Formalin** – Available as 40% solution of formaldehyde gas, generally used for fumigation of brooder and hatchery along with potassium permanganate. Gas should be allowed to remain for half an hour in the rooms, incubators, brooders, *etc.* Formalin solution (3-5%) can be used for spraying as disinfectant for most bacteria and virus.

**Copper sulphate** - Generally used to destroy fungi. 0.5% solution for destroying fungi on poultry utensils.

**Bleaching powder** – 20% solution of bleaching powder is used for disinfecting floor and poultry equipments (feeders, waterers *etc.*).

**Caustic soda (Sodium hydroxide)** - 2% solution for cleaning of waterers, feeders, metallic fittings, brooders, floor, *etc.* It is to be applied cautiously by gloved hands.

**Fire** - Fire in the form of blow lamp is effective for disinfection of metallic fittings (poultry cages), floor, walls, *etc.*

## **(2) Proper Housing**

It is important for optimum growth and production as well as for proper maintenance of health.

- Overcrowding must be avoided. Optimum floor space and space for waterers and feeders should be provided to the birds. (In deep litter house minimum floor space for broiler is 1sq.ft and for a layer is 1.75sq. ft).
- All-in all-out system of rearing is better than multistage rearing in a single location. All-in all-out method helps to prevent spread of diseases due to cross age infections.
- Poultry house should be kept dry and well ventilated.

In case of deep litter system, the depth (2 inches for chicks and 3-4 inches for growers and layers) and conditions of the litter should be maintained properly.

The relative humidity in the deep litter poultry house should be around 40%, and the moisture content of the deep litter materials should be 18 to 24%. Less than 18% moisture may cause dusty litter leading to respiratory problem. More than 24% moisture may cause accumulation of ammonia in the poultry house leading to irritation to the eyes of the birds, and it also causes dampness in the house leading to many diseases including coccidiosis and worm infestation.

If the moisture content of deep litter is increased, particularly during rainy season, it should be treated with lime powder @ 1kg per 100 sq. ft. floor space.

The waterers should be checked for spillage and leaking of water. It is better to change the place of waterers and feeders daily for proper maintenance of deep litter. Wet litter if any, should be removed and replaced by fresh litter material.

- The design and construction of poultry houses should be made according to the environmental conditions of the particular area.

## **(3) Proper Feeding**

Poultry should be fed properly as per the age, type and production of birds, i.e., the quality and quantity of feeds and proper method of feeding should be maintained for optimum growth and production.

- Two types of feeds are given to the broilers (chicken), *viz.*, broiler starter (0-4 weeks) and broiler finisher (5-6 weeks). In case of layers three types of feeds are provided, *viz.*, chick feed (0-8 weeks), grower feed (9-20 weeks or up to the point of laying) and layer feed (21 weeks or from the point of laying to 72-80 weeks or up to the end of economic laying).
- There are some nutritional diseases occurred mostly due to deficiency of some vitamins and minerals. So these nutrients must be supplied to the birds through the feed. Besides these, poultry feed should contain all other essential nutrients, *viz.*, protein, carbohydrate, fat and moisture as per the re-



quirements for a particular group of birds.

- Feed should be free from microbial contamination. Poultry feeds are very prone to different types of bacterial and fungal contamination, *viz.*, *Salmonella*, *Escherichia coli*, *Mycoplasma*, *Aspergillus*, *etc.*
- Feed ingredients having toxic principles like gossypol, aflatoxin, trypsin inhibitor *etc.* should not be used for preparation of poultry feed. However, after proper processing these ingredients may be used as per recommendation of the Animal Nutritionists.
- Feeds should not be stored for more than 1½ months, particularly when environmental humidity is very high, in order to prevent the fungal growth and development of rancidity, besides the wastage of feeds due to rodents.

#### **(4) Stress Management in Poultry**

In poultry farm, birds are subjected to various kinds of stress. Some stress factors are avoidable and some are unavoidable.

- Avoidable stress factors are overcrowding (giving less floor space per bird), housing excess chicks in brooder to save electricity, improper debeaking, sudden change in feed, poor quality of feed and irregular feeding schedule, inadequate ventilation, improper lighting schedule *etc.* These types of stress can be reduced by improving the management practices.
- The unavoidable stress factors in poultry farm are shifting of birds (from hatchery to farm, or from one house to another like from brooder house to grower house and from grower house to layer house), extremes in weather (heat stress in summer or cold stress in winter), vaccination, deworming and other preventive medication (use of anticoccidials *etc.*), debeaking in layers or breeders and high egg production, *etc.* To minimize the action of these stress factors anti-stress medicines are to be used in proper dose rates. Vitamin C and other vitamins, liver tonic, glucose and electrolytes, *etc.* are used as anti-stress medicines.

#### **(5) Disposal of Poultry Waste**

Various poultry wastes are poultry droppings, dressing waste, hatchery waste and dead birds. Proper disposal of these poultry wastes is essential to prevent the spread of diseases.

- The dead birds should be deeply buried in the soil or fully burnt in the incinerator.
- Poultry droppings are mixed with deep litter materials in the deep litter system of poultry rearing. This deep litter should be maintained properly, and generally after rearing of each lot of birds this deep litter should be removed from the poultry house before introduction of new lot of birds.

In case of cage system of poultry rearing, poultry droppings should be removed daily, and these may be collected in a manure pit and converted into high quality organic manure.

**(6) Restriction for Visitors**

- Foot-bath with disinfectants is to be used at the entrance of poultry farm as well as at the entrance of each house to prevent the introduction of organisms by the movement of working personnels.
- Casual visitors, foreign vehicles *etc.* should not be allowed to enter the farm. Technical persons and some selected visitors/farmers should be asked to make use of foot-bath provided with disinfectants before entering in the poultry house.

**(7) Vaccination and Preventive Medication against Dreadful Poultry Diseases**

- In case of poultry health management 'prevention is better than cure' principle is to be applied more seriously. So proper vaccination schedule is to be followed to develop immunity against killer poultry diseases (Table 16.1, 16.2).
- **Do's and don'ts in vaccination**
  - i) Vaccine itself induces stress to the birds. So use of all available vaccines for a particular bird is not generally recommended, and it very much depends on the incidence of a particular disease in the farm and its surrounding areas.
  - ii) Vaccines should be procured only from reliable sources.
  - iii) The vaccines are to be stored under refrigeration until use at the temperature of 2<sup>o</sup> to 8<sup>o</sup>C, if otherwise not instructed by the manufacturer.
  - iv) Proper vaccination schedule including accurate dose of vaccines and proper age of birds are to be followed preferably as recommended by the manufacturer.
  - v) Expired vaccines and left-over vaccines should never be used.
  - vi) It is desirable to vaccinate the birds during the cooler part of the day, *i.e.*, either in the early morning or in the late evening especially in summer months.
  - vii) Vaccination should not be done to the sick birds. Only healthy birds are to be vaccinated at their recommended ages.
  - viii) It is desirable to provide some vitamins and anthelmintics at least a week before the vaccination to overcome vaccine induced stress.
  - ix) For vaccination through drinking water, birds are to be kept thirsty for a few hours before giving vaccine containing water. Clean and cold drinking water should be used for this purpose and it should be free from chlorine or any drug.

**Table 16.1: Vaccination schedule for poultry (chicken)**

	Age	Disease	Vaccine	Dose and route of administration	Remarks
(1)	1 day	Marek's Disease	HVT MD vaccine	0.2 ml/bird, I/M injection.	Generally it is given at hatchery level, it can be given up to the age of 3 days.
(2)	4-7 days	Ranikhet Disease	RDF <sub>1</sub> or Lasota vaccine	1-2 drops, nasal or ocular route.	Booster dose to be given at 5-6 weeks of age.
(3)	11-13 days	Gumboro Disease (IBD)	IBD/Gumbo ro vaccine	200 doses in 2 litres of drinking water or 1000 doses in 8 litres of drinking water.	Booster may be given at 6-7 weeks of age.
(4)	5-6 weeks	Ranikhet Disease (Booster dose)	RDF <sub>1</sub> vaccine	1-2 drops in eye	In case of broilers it is to be used at 21-23 days of age.
(5)	6-7 weeks	Gumboro Disease (Booster dose)	IBD/Gumbo ro vaccine	Same as Sl. No. 3	-
(6)	7-8 weeks	Fowl Pox	Fowl Pox vaccine	0.01ml/bird, injection at wing web or 1 drop by picking of feathers.	One vaccine is sufficient for bird's life.
(7)	8-10 weeks	Ranikhet Disease	RDR <sub>2</sub> B or Mukteswar strain vaccine	0.5ml/bird, S/C at wing web.	In endemic area, booster dose may be given.
(8)	15-16 weeks	Infectious Bronchitis	IB vaccine	0.5ml/bird, S/C or I/M at wing web.	-
(9)	16-18 weeks	Ranikhet Disease (Booster dose)	RDR <sub>2</sub> B vaccine	0.5ml/bird, S/C at wing web.	-

N.B. Vaccines of Sl. No. 1-4 are given to the broiler chicken as they are generally marketed at the age of 42 days.

**Table 16.2 : Vaccination schedule for ducks**

	Disease	Vaccine	Age of duck	Dose and route of administration
(1)	Duck Plague	Duck Plague vaccine	1 <sup>st</sup> vaccine - 2 weeks, 2 <sup>nd</sup> vaccine - 10 weeks, 3 <sup>rd</sup> vaccine - 24 weeks, then twice a year.	0.5ml S/C injection.
(2)	Duck Cholera	Duck Cholera vaccine	1 <sup>st</sup> vaccine at 2-3 months and 2 <sup>nd</sup> vaccine after 1-2 months of 1 <sup>st</sup> vaccination, then twice a year.	0.5ml S/C injection.

**Table 16.3 : Preventive medication schedule for broiler chicken (0-42 days)**

Age	Medicines/Vaccines
<b>1<sup>st</sup> week</b>	
Day 1	<ul style="list-style-type: none"> <li>• Glucose and electrolyte water (as antistress and energizer)</li> <li>• Marek's Disease vaccine by intramuscular injection at thigh muscle at the recommended dose. (This vaccine is generally given at the hatchery level).</li> </ul>
Day 2-4	<ul style="list-style-type: none"> <li>• Vitamins in morning water and antibiotic in afternoon water.</li> </ul>
Day 5-7	<ul style="list-style-type: none"> <li>• Vitamin A and B-Complex in drinking water.</li> </ul>
5 <sup>th</sup> or 6 <sup>th</sup> or 7 <sup>th</sup> day	<ul style="list-style-type: none"> <li>• RDF<sub>1</sub> vaccine through ocular or nasal drop.</li> </ul>
<b>2<sup>nd</sup> week</b>	
Day 8-11	<ul style="list-style-type: none"> <li>• No medicine/vaccine.</li> </ul>
Day 12-14	<ul style="list-style-type: none"> <li>• Vitamins in drinking water.</li> </ul>
11 <sup>th</sup> or 12 <sup>th</sup> or 13 <sup>th</sup> day	<ul style="list-style-type: none"> <li>• Gumboro/IBD vaccine through ocular drop or in drinking water at the recommended dose.</li> </ul>
<b>3<sup>rd</sup> week</b>	
Day 15-21	<ul style="list-style-type: none"> <li>• Liver tonic in drinking water or feed.</li> </ul>
21 <sup>st</sup> or 22 <sup>nd</sup> or 23 <sup>rd</sup> day	<ul style="list-style-type: none"> <li>• RDF<sub>1</sub> vaccine (booster dose) - ocular drop or in drinking water.</li> </ul>
<b>4<sup>th</sup> week</b>	
Day 22-28	<ul style="list-style-type: none"> <li>• Anticoccidial drugs.</li> </ul>
<b>5<sup>th</sup> week</b>	
Day 29-32	<ul style="list-style-type: none"> <li>• Vitamins in drinking water and liver tonic in feed or water.</li> </ul>
Day 33-35	<ul style="list-style-type: none"> <li>• Liver tonic in drinking water or in feed.</li> </ul>
<b>6<sup>th</sup> week</b>	
Day 36-37	<ul style="list-style-type: none"> <li>• Liver tonic in drinking water or in feed.</li> </ul>
Day 38-42	<ul style="list-style-type: none"> <li>• No medicine/vaccine.</li> </ul>

**Note:** ⊗ Broilers are marketed at the age of 42 days. The above medication schedule may be changed, if necessary, as per suggestion of a Poultry Specialist or a Veterinarian.

## PROCEDURE

Students should be acquainted with each and every step for prevention and control of poultry diseases. The steps are to be demonstrated at the Institute Poultry Farm. Students should record their observations.

### SUB-ACTIVITY UNIT - II

#### ROUTES OF ADMINISTRATION OF VACCINES IN POULTRY

##### OBJECTIVE

To become familiar with different routes for administration of vaccines in poultry.

##### RELEVANT INFORMATION

Different routes of administration of vaccines in poultry are :

1. Oculo-nasal route (drop into eye/nostril)
2. Oral route (in drinking water)
3. Aerosal route (spray)
4. Parenteral route (injection)

##### 1. Oculo-nasal route (drop into eye/nostril)

Some vaccines are applied through eye or nostril with the help of dropper. General dose is 1 drop into eye/nostril. This intra ocular/nasal route is generally used for application of vaccines at the early part of bird's life.

This route is easy to apply and a satisfactory one. Several vaccines which can be applied through this route are available in the market, *e.g.*, Ranikhet disease (F<sub>1</sub>) vaccine, Gumboro vaccine, Infectious Bronchitis vaccine, *etc.*

##### 2. Oral route (in drinking water)

This is a very easy route of administration of vaccines and commonly used. But its effectiveness is not assured all the times. It is better to use this route to condition the birds for stronger vaccines.

The following points are to be kept in mind for application of vaccines through this route -

- Birds should be kept thirsty for a few hours before application of vaccines in the drinking water. But if water is withheld for too long period, birds may fight and splash the medicated water.
- The water should be free from chlorine or any drug.
- Waterers must be thoroughly cleaned and washed with clean water to remove disinfectants, if any.

- It is better to add skim milk powder to water for vaccine administration (@ 2.5-3g/litre). The milk protects the vaccine against residues of disinfectants and adverse pH reaction. Pasteurized whole milk may also be used for this purpose (@ 30-50ml milk/litre of water).

Vaccines which can be applied through oral route are available in the market, *e.g.*, Infectious Bronchitis vaccine, Gumboro vaccine, Ranikhet disease vaccine, Avian encephalitis vaccine, *etc.*

### **3. Aerosal route (spray)**

Vaccines may be used through aerosal route, *i.e.*, by means of spraying within the poultry house when the air is still. Birds inhale the vaccine in the form of dust or spray. This is an easy and very effective method of vaccine administration.

Vaccines which can be applied through this route are available in the market, *e.g.*, Ranikhet disease (Lasota/F<sub>1</sub>) vaccine.

### **4. Parenteral route (injection)**

Some vaccines are applied through parenteral route, *i.e.*, intramuscular injection (I/M) or sub-cutaneous injection (S/C).

Marek's disease vaccine, Fowl pox vaccine, Egg drop syndrome vaccine, Infectious coryza vaccine, Ranikhet disease (R<sub>2</sub>B) vaccine are generally given by means of injection.

S/C injection is generally given at wing web or back of the neck, and I/M injection is generally given at thigh muscle.

## **PROCEDURE**

Students should practice all the routes of administration of vaccines at the Institute Poultry Farm. During practice they may use sterilized distilled water (water for injection) instead of vaccines. They should record their observations.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 16**

# Indicate the correct answer by putting tick (✓) mark

1. Pullorum disease of poultry is caused by  
(a) bacteria (b) virus  
(c) protozoa (d) fungi
2. Marek's disease of poultry is caused by  
(a) bacteria (b) virus  
(c) protozoa (d) fungi
3. Gumboro disease of poultry is caused by  
(a) bacteria (b) virus  
(c) protozoa (d) fungi
4. Star gazing appearance is caused due to deficiency of  
(a) vitamin D (b) vitamin E  
(c) vitamin B<sub>1</sub> (d) vitamin B<sub>2</sub>
5. Broiler birds are commonly vaccinated against  
(a) Marek's disease, Ranikhet disease and Gumboro disease.  
(b) Ranikhet disease, Pullorum disease and Gumboro disease.  
(c) Ranikhet disease, Coccidiosis and Fowl pox.  
(d) Pullorum disease, Infectious Bursal Disease and Infectious Bronchitis.
6. The first vaccine against Ranikhet Disease (RD F1 type) should be given at the age of  
(a) 1 week (b) 3 weeks  
(c) 5 weeks (d) none of these
7. Marek's disease vaccine should be given at the age of  
(a) 3 days (b) 3 weeks  
(c) 3 months (d) 13 weeks
8. Vaccine given to poultry at the age of 4-7 days is  
(a) RDF<sub>1</sub> (b) RDR<sub>2</sub>B  
(c) Fowl Pox (d) IB
9. Quails are commonly vaccinated against  
(a) Ranikhet disease (b) Infectious bronchitis  
(c) Coccidiosis (d) All of these
10. Use of anthelmintic drug against worm infestation is known as  
(a) brooding (b) deworming  
(c) incubation (d) culling

**# Exercise**

1. Enlist the common measures taken in your institute's poultry farm for prevention and control of diseases.
2. Mention the vaccination schedule followed in your institute's poultry farm for various categories of avian species.
3. Make a comparative statement regarding advantages and disadvantages of different routes of medication and vaccination in a poultry farm.



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## Activity Unit - 17

Date.....

# Special Care of Broilers and Layers during Summer and Winter

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### OBJECTIVE

To get acquainted with special management practices during extreme weather conditions to keep the birds healthy and in production.

### RELEVANT INFORMATION

High temperature and humidity produce stress to the birds leading to reduction in feed intake and loss of production, and in extreme weather conditions mortality may result. The most favourable temperature zone in case of chicken is 18-21°C.

### I. SPECIAL CARE OF BROILERS AND LAYERS DURING SUMMER

Summer stress on poultry leads to reduced feed intake, uneconomic feed conversion efficiency, loss of egg production including more numbers of thin shelled and small sized eggs, respiratory distress, loss of immunity and heat stroke.

To combat the ill-effects of summer stress the following measures are to be taken seriously.

#### (i) Housing management

- Height of the poultry shed should be 8 to 10 ft for proper ventilation in the poultry house.
- Planting of shady trees in and around the poultry farm is necessary to reduce the ill-effect of hot summer.
- Distance between the two poultry sheds in the farm complex should be at least 60 ft for proper air circulation.
- East-west direction of poultry shed (length-wise) is beneficial to reduce the direct sun light entering inside the shed.
- Depth of deep litter (in case of deep litter system of poultry keeping) is to be reduced.

- Roof is to white washed (with lime), which will reduce the heat. Thatch type roof is beneficial in the summer months.
- In extreme cases, pedestal or ceiling fans may be used to give comfort to the birds. Water sprinkling over the birds during extreme heat conditions may save the birds from heat stroke.
- About 10% birds of the recommended strength is to be reduced in the poultry house.

**(ii) Water management**

- Chicken will not drink hot water leading to decreased feed consumption and less performance. They generally refuse to drink water at temperature above 38°C (110°F). So it is very important to provide cool drinking water during summer months. To cool the water ice cubes may be added in the water trough.
- In general feed and water intake ratio in chicken is 1:2, but during summer months it may be increased up to 1:4. So more water troughs are to be provided during summer months; and dose of medicines if provided through drinking water should be adjusted accordingly.

**(iii) Feeding management**

- Feeds should be given during the cooler part of the day, *i.e.*, at early morning and at late evening. At noon hours wet mash may be given to the birds to increase the feed intake. However, the feed is to be mixed with water just before offering the same to the birds; overnight soaking of feed is not desirable due to fear of fungal infestation (aflatoxicosis).
- More numbers of feeding troughs are to be provided than normal.
- If possible, the energy content of the compounded feed is to be reduced, and protein, vitamin and mineral contents of the feed are to be increased to some extent, with the help of Poultry Nutritionist. On an average energy of 100-150 Kcal /kg of feed is to be reduced and 2% protein is to be increased in the normal poultry feed.

**(iv) Medication**

- During the noon hours glucose and electrolytes may be given in the drinking water (@8g Glucose + 2g Electral / Electrocion powder per 100ml drinking water).
- Vitamin C may be added in the drinking water (@10mg per bird for 2-3 days; Celin / Cell-C are available as 100mg and 500mg tablet).
- Multivitamin medicines may also be added in the drinking water. *e.g.*, Vimeral or Vitadec @ 1 ml per 20 birds in drinking water for consecutive 7 days.

## **II. SPECIAL CARE OF BROILERS AND LAYERS DURING WINTER**

It is easy to combat winter stress in comparison to summer stress on poultry. Winter stress is severe on poultry when the ambient temperature goes below 10°C. To counteract the ill-effects of winter stress the following measures are to be taken methodically.

- Extra heat is to be provided in the house with the help of electric heater or bulb (just like brooding management).
- Energy content of the feed is to be increased by about 100-150 Kcal/kg of feed.
- Depth of deep litter is to be increased (in case of deep litter system of management).
- About 10% of the recommended strength of birds is to be reduced in the poultry house.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 17**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Poultry (birds) usually refuse to drink water when its temperature crosses
  - (a) 26°C
  - (b) 30°C
  - (c) 38°C
  - (d) 42°C
2. The most favourable temperature zone in case of poultry is
  - (a) 10-16°C
  - (b) 18-21°C
  - (c) 22-28°C
  - (d) 30-36°C

**# Exercise**

1. What is the basic difference between summer and winter stress management in a commercial poultry farm?
2. Enlist the summer and winter stress management practices followed in the Institute's Poultry Farm.

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# Methods of Slaughter and Dressing of Poultry

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## OBJECTIVE

To get acquainted with various methods of slaughter and dressing of poultry. Proper dressing is essential for preparation of quality poultry products.

## RELEVANT INFORMATION

### PART-I: METHODS OF SLAUGHTER OF POULTRY

There are two methods of slaughtering birds, *viz.*,

- (1) *Halal* method and
- (2) *Jhatka* method.

In *halal* method both the jugular veins are severed with the help of sharp knife; and in *jhatka* method head is completely detached. *Halal* method of slaughter is better than *jhatka* method, because the later one leads to poor bleeding and hard picking.

The *halal* method is employed in two ways for slaughtering of birds, *viz.*, *halal* without stunning and *halal* with stunning.

***Halal without stunning*** is nothing but manual killing of birds, and it is commonly practiced for slaughtering chicken on small scale in retail shops.

***Halal with stunning*** is nothing but mechanical slaughtering of birds, and practiced for commercial slaughtering of chicken on large scale. In this method stunning is done before severing the jugular veins. With the help of electric shock stunning can be done.

### PART-II: DRESSING OF POULTRY

Different steps in dressing of chicken are outlined below.

- (1) Procurement, transport and handling of live birds
- (2) Antemortem examination

- (3) Pre-slaughter fasting
- (4) Stunning
- (5) Bleeding
- (6) Scalding
- (7) Defeathering
- (8) Singeing
- (9) Neck slitting and removal of feet
- (10) Evisceration and washing
- (11) Chilling, packing and storage

**(1) Procurement, transport and handling of live birds:** Stress should be avoided or minimum as far as possible to the live birds. Gentle handling is desirable to prevent injuries, broken legs, death, *etc.* Diseased birds should be rejected during procurement process.

**(2) Antemortem examination:** All the birds intended for slaughter must be inspected within 24 hours of their arrival at slaughter house. Only the selected birds are to be subjected for further processing.

**(3) Pre-slaughter fasting:** Pre-slaughter fasting (withholding of feed) of 12 hours is desirable as per prescribed procedure. It is necessary for easy evisceration and risk of contamination during evisceration from intestinal contents if accidentally cut shall be minimized.

**(4) Stunning:** Stunning is essential for humane method of slaughtering birds. With the help of electric current stunning can be done. Current should be of specified volts and for specific time, otherwise birds may be killed during stunning. Stunning of birds can be done by using a voltage of 70V for A.C. and 90V for D.C. Alternately, head of the chicken may be allowed to pass through a 70-100 V electrically charged water bath.

**(5) Bleeding:** Birds should be adequately bled. A sharp cut is to be given within 30 seconds of stunning to sever both the jugular veins with the help of a knife. In case of chicken the bleeding time allowed is 1 to 1½ minutes. Generally one tenth of the body weight of chicken consists of blood, and if 45 to 50% of blood is drained out it is considered as perfect bleeding.

**(6) Scalding:** This technique (*i.e.*, immersing birds in hot water of specific temperature for a particular duration) should be observed for loosening of the feathers. Proper scalding temperature in case of broiler chicken is 58°C for 1 minute and for layer hens and heavy birds 60 ° C for 1 minute.

**(7) Defeathering:** Removal of feathers may be done manually (for small scale) or mechanically (for large scale). Wet defeathering is desirable for smooth and easy



operation. For mechanical picking of feathers a simple mechanical picker (which consists of a revolving drum with rubber fingers against which the birds are held) may be used. After picking of feathers, few small feathers may still be present, which can be removed by gripping the small feather in between the edge of a knife and thumb with pulling it outwards. This removal of small feathers is some times known as pinning.

**(8) Singeing:** After defeathering (*i.e.*, picking and pinning) singeing is done to remove the hair like appendages from the carcass. For this the carcass is to be passed over a flame very quickly without damaging skin; only the small hairs will be burnt. It may be followed by washing of the whole carcass with ample water.

**(9) Neck slitting and removal of feet:** A sharp knife is needed for this. After slitting neck and removing feet the carcass must be shifted to the clean section of the processing unit.

**(10) Evisceration and washing:** All the non-edible internal parts are to be discarded and edible parts are to be retained. A transverse cut is to be made from the rear end of keel (breast) to the front of vent. The viscera are to be pulled out without breaking intestine, gall bladder, esophagus along with crop and trachea. The giblets (liver, heart and gizzard) are to be separated properly. These are edible parts. The non-edible parts like lungs, ovary and oviduct (in female) or testes (in male) are to be removed. Eviscerated birds are to be inspected properly. If selected the birds are to be washed thoroughly with clean and cold water (10-16°C) and kept them for drain. In case of large scale operation draining may be done for 10 minutes while hanging the birds on hocks on the overhead conveyer. The giblets are to be thoroughly washed with clean and cold water; and these giblets and neck portion are to be inserted in the body cavity.

**(11) Chilling, packing and storage:** Chilling of dressed birds is to be done as early as possible to an internal body temperature of 4°C or less. Chilling can be achieved by placing the dressed birds in slush ice (water with ice) and then draining for 5-10 minutes. If they are to be stored the chilled birds are to be packed properly and then stored. The packing material should be colourless transparent and of sufficient strength like polythene bags. The chilled dressed chicken can be stored for 7 days at 2- 4°C or for about 30 days in a deep freeze at -12°C. If dressed birds are to be stored for longer period the chilled and packed dressed chicken are to frozen at -40°C and stored at -18°C up to 6 months.

## PROCEDURE

The students should practice both the methods of slaughter and all the steps of dressing of chicken at the institute's poultry farm. If at the time of practical class it is not possible to practice all the steps, students should see the steps with the help of photograph, or computerized device.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 18**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Which method is better for slaughtering chicken on large scale?  
(a) Halal with stunning      (b) Halal without stunning  
(c) Jhatka with stunning      (d) Jhatka without stunning
2. What is the purpose of scalding in poultry dressing?  
(a) Proper draining of blood  
(b) Loosening of skin  
(c) Loosening of feathers  
(d) None of these
3. What is the purpose of singeing in poultry dressing?  
(a) To remove fat from the carcass  
(b) To remove hair like feathers from the carcass  
(c) To loose the feathers of the carcass  
(d) To bleed completely after slaughter
4. Chilled dressed chicken can be stored for 7 days at a temperature of  
(a) 2-4°C                              (b) 4- 8°C  
(c) 8- 10°C                              (d) 10- 12°C

**# Exercise**

1. What are the methods of slaughtering poultry?
2. Enlist serially the steps for hygienic dressing of poultry?

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# Activity Unit - 19

Date.....

## Essential Poultry Farm Records

### OBJECTIVES

- (i) To keep all data pertaining to a poultry farm in a scientific manner.
- (ii) To help in assessing the performance by utilizing those data.

### PROCEDURE

Depending on the type of farming, the necessary information are to be recorded in a simple but scientific manner either in the form of register or record sheet. Following are some examples of formats used for different operations in poultry farm.

#### Hatchery Register

Incubator:    Date of setting eggs:    Date of candling    Date of  
 1<sup>st</sup>:    hatching:  
 2<sup>nd</sup> :

Sl. No.	No. of eggs set and source	Infertile eggs	Dead in Shell	No. of chicks hatched	Hatchability (%)		Fertility %	Remarks
					On total eggs set	On fertile eggs set		

### Egg Collection and Disposal Register

Year:                      Strain :              Source :  
 Month :

Date	Laying house no.	Eggs collected			Broken	Disposal	Balance
		1 <sup>st</sup>	2 <sup>nd</sup>	Total			

### Mortality Register

Sl. No.	Strain	Sex	Date of death	Cause of death	PM report no.	Book value	Remarks

### Monthly Laying Record Sheet

Date of transferring the flock in layer house :              Strain :                      Vaccination done :  
 Layer house no. :

Date	Deaths	Culled	Feed intake (kg)	Eggs collected			Observations
				1 <sup>st</sup>	2 <sup>nd</sup>	Total	

### Rearing Records for Broilers and Pullets

Strain :    Feed source :  
 Source :  
 Number received :

Date	Age	Deaths	Culled	Balance number	Vaccination / medication	Weekly weight

### Feed Register

Month :    Year :

Date	Opening balance (kg)	Received (kg)	Source	Issued (kg)	Closing balance (kg)	Composition of ration

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 19**

**# EXERCISE**

1. Indicate different types of poultry farm records maintained in your institute's farm.
2. Why farmers are refractory to keep records? Indicate the remedial measures.

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## Economic Indices of Poultry Farm Management

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### OBJECTIVES

- (i) To evaluate the production performances of birds.
- (ii) To assess the financial condition of the enterprise.
- (iii) To suggest the correcting measures for improvement of the economic efficiency of the business.
- (iv) To formulate guidelines for future improvement, planning and expansion.

### PRODUCTION INDICES FOR BROILER BIRDS

**A. Average body weight at market age (6 weeks of age):** It is calculated by dividing the total body weight of a flock by the number of birds at the time of marketing.

Ideal value becomes 1.82 kg

**B. Feed conversion ratio (FCR):** It is obtained by dividing the total amount of feed consumed by the amount of live broiler weight produced.

$$\text{i.e., FCR} = \frac{\text{Total amount of feed consumed}}{\text{Total body weight gain}}$$

A value of less than 2.00 at 6 weeks of age is preferable.

**C. Feed cost per kg of broiler produced:** It is calculated by the multiplication of FCR with cost per kg of feed.

**D. Performance efficiency factor (PEF):** The PEF is derived by dividing the live body weight of the flock by FCR and number of chicks purchased, multiplied with 100.

$$\text{i.e., PEF} = \frac{\text{Total live body weight of the flock}}{\text{FCR} \times \text{no. of chicks purchased}} \times 100$$

The higher the PEF better will be the performance of the flock. A value of 100 or higher is desirable.



**E. Gross margin per unit floor space:** It is calculated by subtracting the total cost of raising (cost of chicks, feed, medication, etc.) from gross income and then dividing the result by the total area of floor space.

$$\text{i.e., Gross margin per unit floor space} = \frac{\text{Gross income} - \text{Total raising cost}}{\text{Total floor area (in sq. ft./sq. m.)}}$$

**F. Production number (PN):** It is calculated as follows -

$$\text{PN} = \frac{\text{Daily growth} \times \text{Survivability (\%)}}{\text{FCR} \times 10}$$

$$\text{where, Daily growth} = \frac{\text{Average final weight/bird}}{\text{Average fattening period}}$$

Survivability % = 100 - Percent mortality.

**G. Broiler performance efficiency score :**

It is calculated based on the body weight, feed efficiency and livability at six weeks of age; giving appropriate score for each of these three traits; based on their relative economic importance.

**Score card to judge the broiler performance efficiency**

Trait	Optimum	Range	Score
(i) Average live weight at 6 weeks of age (kg)	>1.6	1.3 to 1.8	50
(ii) F C R	<2.0	1.8 to 2.1	30
(iii) Percent livability	>95.0	92 to 98	20

A broiler farm should try to attain a minimum score of 70.

**H. Formula for calculating the cost of production/kg live broiler:**

(i) Chick cost = 0.55 x cost of one day old chick = A

(ii) Feed cost = Feed efficiency x cost/kg of feed =B

(iii) Miscellaneous expenditure = 12% of (A+B) = C

Hence, production cost/kg live broiler = A+B+C

**I. Formula for calculating the cost of production/broiler:**

(i) Chick cost = 1.05 x cost of one day old chick = A

(ii) Feed cost = Live weight in kg x Feed efficiency x cost/kg of feed = B

(iii) Miscellaneous expenditure = 12% of (A+B) = C

Hence, Production cost/broiler = A+B+C

$$\text{J. Livability}\% = \frac{\text{Number of birds sold}}{\text{Number of chicks bought (including extra)}} \times 100$$

$$\text{K. Discrepancy}\% =$$

$$\frac{\text{Number of chicks received} - (\text{Mortality} + \text{Number of birds sold})}{\text{Number of chicks received}} \times 100$$

### PRODUCTION INDICES FOR LAYER BIRDS

**A. Percent hen housed production (HHP %):** It is computed as the percentage of dividing the number of eggs of the day by number of birds housed.

(i) HHP% (for one day) =

$$\frac{\text{Number of eggs produced on a day}}{\text{Number of hens housed at the beginning of the laying period}} \times 100$$

(ii) HHP%(for a long period) =

$$\frac{\text{Average number of eggs produced per day during the period}}{\text{Number of birds housed at the beginning}} \times 100$$

**B. Percent hen day production (HDP %)**

$$\text{(i) HDP (\%)(for one day)} = \frac{\text{Number of eggs produced on the day}}{\text{Number of birds on the day}} \times 100$$

$$\text{(ii) HDP (\%)} = \frac{\text{Total number of eggs produced over the period}}{\text{Total number of hen days}} \times 100 \text{ (for a long period)}$$

**N.B. :** Total number of hen days are calculated by adding daily number of live hens over the concerned period.

**C. Feed consumed to produce one dozen of eggs per month:**

$$= \frac{\text{Total feed consumed per month}}{\text{Total dozen of eggs per month}}$$

**D. Feed consumed per hen per day:**

$$= \frac{\text{Total feed consumed}}{\text{Average number of birds per day} \times \text{Number of days}}$$

**E. Feed cost to produce one dozen of eggs per month:**

$$= \frac{\text{Total feed cost per month}}{\text{Total dozen of eggs per month}}$$

**F. Feed cost to egg rate ratio:**

$$= \frac{\text{Feed cost per kg}}{\text{Rate of egg}}$$

If the ratio is less than or equal to 5 then the farm can be considered as economically viable.

**Broiler Farm Performance Record Card**

Card no :		Name of the farm :		Date :	
Address :					
Sl. no.	Flock no.	Date of receiving chicks	Number of chicks (including extra)	Date of selling birds	Mortality%
			FCR	PEF%	PN
			Discrepancy	Gross margin per unit floor space	Average finished weight
			Remarks	Signature	

**Layer Farm Performance Record Card**

Card no :		Name of the farm :		Date :	
Address :					
Sl. no.	Flock no.	Date of receiving chicks	Number of chicks (including extra)	Culling%	Mortality%
			HHP%	Average HDP%	Feed consumed to produce one dozen of eggs/month (kg)
				Feed cost to produce one dozen of eggs	Feed cost to egg rate ratio
				Price of spent hen	Remarks
				Signature	

**G. Percent livability per month:**

$$= \frac{\text{Number of birds at the end of month}}{\text{Number of birds at the start of month}} \times 100$$

**H. Cracked eggs (percent) of a day:**

$$= \frac{\text{Number of cracked eggs}}{\text{Total number of eggs}} \times 100$$

**I. Performance efficiency index (PEI):**

$$\text{PEI} = \frac{K(EP)P}{F}$$

where,  $K = 30 \text{ EW} / \text{BW}$

BW = Body weight

EW = Egg weight

P = Percentage hen day production

F = Feed consumed per bird (g)

**J. Percent culling:**

$$= \frac{\text{Total number of birds culled}}{\text{Total number of birds received}} \times 100$$

**K. Stage break even point:**

It is the stage at which the sum of prices of all inputs and outputs are same. It depends upon (1) Rate of egg production, (2) Prevailing egg price, (3) Culled (spent) hen price, (4) Daily feed intake, (5) Predictable future trends in egg, feed and culled hen prices.

Income : Expenditure

$$= \frac{EN \times EP}{FI \times FC} \times 1.176$$

where, EN = Total number of eggs produced/day by the existing flock.

EP = Selling price/eggs in rupees

FI = Daily feed intake by the flock in kg.

FC = Cost/kg of feed in rupees.

The farmer can retain his/her birds as long as the value is greater than one. A week average value is to be taken into account. Normally the break even point

should be 1.3 times the feed expenditure, *i.e.*, suppose the feed expenditure is Rs. 100.00 then the receipt should be Rs 130.00.

### **PRODUCTION INDICES FOR BREEDER BIRDS**

- A. Number of settable eggs produced per dam
- B. Number of saleable chicks produced per dam

### **EFFICIENCY MEASURE OF BREEDING FARMS**

$$\text{A. Percent fertility} = \frac{\text{Number of eggs fertile}}{\text{Total number of eggs}} \times 100$$

$$\text{B. Percent hatchability} = \frac{\text{Number of chicks hatched out}}{\text{Total number of eggs}} \times 100$$

- (i) on total eggs set
- (ii) on fertile eggs set

### **EFFICIENCY MEASURE OF PULLET FARM**

(Rate of uniformity)

Percent of pullets within 10 percent of average flock weight	Uniformity of rating
85 percent and over	Excellent
80-85 percent	Very good
75-85 percent	Satisfactory
70-75 percent	Fair
Less than 70 percent	Not satisfactory

It is done at 18 weeks of age of flock.

### **EFFICIENCY MEASURE OF UTILIZATION OF FARM LAND**

$$\text{Construction coefficient} = \frac{\text{Total constructed area}}{\text{Total farm land area}} \times 100$$

For an ideal farm, it should be 25 to 35.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 20**

**# Exercise**

1. Calculate the mortality percentage and hen housed egg production in a year from the following data of a commercial layer farm.  
No. of birds at the onset of production: 2000, total egg production in the year: 560,000, total no. of birds died: 76.
2. Calculate the mortality percentage and FCE of the commercial broiler farm.  
No of broiler birds housed: 1200, total feed intake up to 6 weeks: 3904 kg, total no. of death: 25, total live weight up to 6 weeks: 2058 kg.

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## Activity Unit - 21

Date.....

# Evaluation of Techno-economic Feasibility for Starting a Poultry Farm

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### OBJECTIVES

- (i) To judge the availability of basic infrastructural facilities for consideration of starting a poultry farm.
- (ii) To evaluate the technical feasibility for operation of such farm.
- (iii) To consider economic implications in running the farm.
- (iv) To assess and give opinion about the efficiency of proposed enterprise.

### PROCEDURE

Techno-economic feasibility reports are required to be prepared with due consideration of all facets of the proposed enterprise. This can be done as per following proforma.

### TECHNO-ECONOMIC FEASIBILITY REPORT

1. Name & address  
of farmers/promoters :  
(Mention all the names  
and addresses if it is  
partnership farm)
2. Educational qualification of  
all the farmers/promoters :
3. Technical exposure  
(i) Whether the farmer  
/promoter has undergone  
any training in poultry  
husbandry :  
(ii) Whether possess any  
previous experience :



4. Financial background of farmer/promoter
  - (i) Whether he/she/they is/are free from any debt? :
5. Location of the farm
  - (i) The farm site is connected with main road (all weather road) : Yes/No
  - (ii) Distance between farm site and state or national highway :
  - (iii) Distance from nearby city or town :
  - (iv) The site is free from water-logging and away from command area of river : Yes/No
  - (v) Status of land : Leased/Own
6. What is the source of water at site? :
7. Whether electricity is available at the site? : Yes/No
8. What is the distance of nearby hatchery? :
9. Whether the veterinary aid is available whenever required? :
10. Availability of feed
  - (i) Whether availability of year-round supply of concentrate feed from nearby market is assured? :
  - (ii) Whether feed-mixing plants are there in short distances? :
  - (iii) Whether the farmer intend to produce own feed in farm in future? :

11. Whether the equipment required to start a poultry farm are available in nearby town or city? :
12. Whether marketing facilities for birds and eggs are available nearby? :  
If yes, mention the proposed marketing channel :
13. Whether transportation facility is available at cheaper cost? :
14. Whether all biosecurity measures are considered in the proposed project? :
15. Time required for completion of whole project? :  
Give detail work schedule :
16. Whether estimated cost of the proposed project is reasonable? :  
(i) What is the percentage of farmer's/promoter's share in the project proposal? :  
(ii) Whether farmer needs a moratorium for repaying the first installment of loan? :
17. Whether expected net income from the project is sufficient to repay the loan in time, sustain and go for further expansion? :
18. Whether provision for insurance coverage for birds and fixed assets are made in the project proposal? :

19. Provision of expansion of enterprise
- (i) Whether sufficient land is available in the farm site for expansion of enterprise? :
- (ii) What will be the future scope of expansion? :

**Certificate**

The project details, technical programme, marketing potential and the promoter's/ farmer's technical and financial background clearly suggest that this project is technically feasible and financially viable.

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Signature

**Enclosures:**

1. Land documents.
2. Blue prints of the poultry houses.
3. Estimates from the civil engineer for the poultry houses and other structures.
4. No objection certificate from local Panchayat.

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 21**

**# Exercise**

1. Enlist the most important parameters which are to be considered for preparation of the techno-economic feasibility report of a proposed poultry farm. What are the essential documents to be enclosed with this report?

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# Preparation of Project Reports

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### OBJECTIVES

- (i) To know all the technical details of starting a poultry farm.
- (ii) To calculate expenditure for different heads.
- (iii) To understand the assumptions underlying the project.
- (iv) To evaluate the receipts and profitability of the project.

### PROCEDURE (STEP BY STEP)

- I. Working out of technical details and assumptions of the project.
- II. Calculation of non-recurring (capital) expenditure by considering cost of housing, equipment, store, supervisors, quarters, watering facility and land development charges, *etc.*
- III. Calculation of working capital - Capital needed to run the farm upto the project completion period. It includes cost of chicks, feeds and miscellaneous cost *i.e.*, vaccination, medicine, labour, electricity *etc.* as applicable.
- IV. Calculation of total project cost, share of promoter/ farmer and bank finance needed; usually farmer's share will be 25% of project cost excluding cost of land.
- V. Calculation of annual recurring expenditure - It includes cost of chicks, feed, miscellaneous cost, *etc.* in each year.
- VI. Calculation of annual gross return - Here total receipts from all sources of income, *viz.*, egg, broiler, manure, empty feed bags are calculated per year basis.
- VII. Calculation of bank repayment schedule - Here yearly installment of bank loan and interest are calculated.
- VIII. Calculation of net return - It is arrived by subtracting the repaid annual bank loan and annual recurring expenditure from annual gross return.

Here project reports for various categories of poultry are prepared, *viz.*, broiler, layer, duck (free range system), duck (intensive system), quail (broiler type), turkey (free range system) and cockerel (all in all out system). The project cost

may vary depending on the prices prevailing in different localities, but the method for preparation of project reports is same and the following project reports may be taken as guide. (Students should prepare project reports for different categories of poultry taking various strengths of birds.)

### PROJECT REPORT FOR A BROILER FARM

#### Technical details and assumptions

1. House: Open sided, tile roofed, deep litter house.
2. Floor space: Half square feet per bird up to 25 days of age and one square feet per bird there after.
3. Cost of poultry house: Rs. 50/- sq. ft.
4. Other building cost: Rs. 100/- sq. ft.
5. Equipment cost: Rs. 10/- bird.
6. Cost of Medicine, Vaccine, Insurance Labour, Electricity, Fuel, etc.: Rs. 4/- bird.
7. Total number of birds in the farm: 7000
8. Total number of birds per batch (including extra 5%) : 1050
9. Batch interval : 1 week
10. Down time : 1 week
11. Saleable broilers per batch per week : 980
12. Growing period : 45 to 50 days
13. Feed efficiency : 2.22 (average body weight = 1.80 kg)
14. Cost of feed (average cost of pre-starter, starter and finisher feeds) : Rs. 8/ kg.
15. Mortality : 7%
16. Manure production : 4 kg per bird
17. Project completion period : 4 months
18. Bank holiday period: 2 months from completion date.
19. Loan repayment period: 5 years, including holiday period.
20. Bank interest : 15%

#### Farm buildings

- (i) **Orientation of poultry house:** Houses are built east-west with long axis facing north and south, and short axis on east and west.
- (ii) **Construction details:** Houses are constructed with concrete pillars with brick and cement walls, and floor plastered with cement, elevated one foot above the ground level. The inside height at eaves will be about 7'; while at ridge

height will be around 12'. The two long sides are provided one foot high wall with 60° inside slope at top. The partition wall specification is like that of side walls. The remaining 5' height is covered with 1'' G.I. 12 gauge chain link mesh throughout except at the doors. There will be 3' overhang of roofs at eaves. The doors are made up of M. S. angle frame and 1'' x 3'' mesh of 10 gauge thickness, with provision to lock from both sides. The two sides are made up of solid brick wall. Roof structure is built by seasoned wood and tiles.

The house is provided with 3 phase power supply.

(iii) **Other buildings:**

The feed room, store and workers, quarters will have brick side walls to the full height.

(iv) **Specification of farm buildings for the project:**

(A) One shed will be 30' x 120' size outer to outer with 4 pens each of 500 sq. ft. area to accommodate 4 batches x 1000 birds from 0 to 25 days of age with ½ sq. ft. /bird.

(B) (i) One 400 sq. ft. owner/supervision quarters

(ii) 200 x 2 = 400 sq. ft. for two workers quarters

(iii) 600 sq. ft. feed room

(iv) 200 sq. ft. office-cum-store room.

(C) Another shed with 30' x 133.3' outer size, partitioned into 4x1000 sq. ft. rooms to rear 4 batches of broilers from 26<sup>th</sup> day onwards = 4000 sq. ft.

Total area required for birds = 2000+4000 = 6000 sq. ft.

Total area required for other purposes = 400+400+600+200 sq. ft.=1600 sq. ft.

**STATEMENT - I**

<b>Non-recurring Expenditure</b>	<b>Amount (Rs. in lakhs)</b>
1. Cost of 2000 sq. ft broiler brooder + 4000 sq. ft. broiler grower houses @ Rs. 50/- sq. ft.	= 3.00
2. Cost of 1600 sq. ft. feed store, supervisor, workers quarters	= 1.60
3. Land development charges like fencing, provision of gate, farm roads, etc.	= 0.30
4. Cost of deep tube well, water pump, overhead tank and pipeline to all sheds	= 0.70
5. Cost of feeders, waterers, platform weighing scales, wheel barrow, brooders, etc. @ Rs. 10/- per bird for 7000 birds	= 0.70
<b>Total</b>	<b>6.30</b>



**STATEMENT - II**

<b>Working Capital</b>	<b>Amount (Rs. in lakhs)</b>
1. Cost of 1000x7 batches of day old chick @ Rs 10/- each	= 0.70
2. Feed cost for 7 batches at an average of 4 kg/bird x Rs. 8000/tonne	= 2.24
3. Medicine, Vaccine, Insurance, Labour, Electricity, Health coverage, etc. @ Rs. 4/bird	= 0.28
<b>Total</b>	<b>3.22</b>

**STATEMENT - III**

**Total capital investment, share of promoter (margin money), bank finance needed (amount in lakhs of Rs.)**

Sl. No.	Description	Total Capital	Promoter/ farmer share	Bank finance required
1.	Land cost (1 acre)	1.00	1.00 (100%)	-
2.	Non-recurring expenditure (vide Statement I)	6.30	1.57 (25%)	4.73
3.	Working capital (vide Statement II)	3.22	0.80 (25%)	2.42
<b>Total</b>		<b>10.52</b>	<b>3.37</b>	<b>7.15</b>

**STATEMENT - IV**

<b>Annual Recurring Expenditure</b>	<b>Amount (Rs. in lakhs)</b>
1. Cost of 1000 day-old chicks x 52 batches/year @ Rs. 10/- each	= 5.20
2. Feed cost for 52,000 broilers x 4 kg/bird @ Rs. 8/kg	= 16.64
3. Other miscellaneous cost @ Rs. 4/bird	= 2.08
<b>Total</b>	<b>23.92</b>

**STATEMENT - V**

<b>Annual Gross and Net Returns</b>	<b>Amount (Rs. in lakhs)</b>
1. By sale of 980 live broilers per batch x 52 batches x Rs. 35/kg live weight (1.8 kg)	32.10
2. By sale of about 3500 empty gunny bags @ Rs 5/each	0.18
3. By sale of about 200 tonnes of manure @ Rs. 100/tonne	0.20
<b>Total</b>	<b>32.48</b>

LESS : Annual expenditure (statement IV) : 23.92

NET RETURNS (before repayment of Bank loan)  
(32.48-23.92) : 8.56

**STATEMENT - VI**  
(Rs. in lakhs)

Year	Gross receipts A	Expenditure C	Net surplus before loan repayment	O. B. of Bank loan	Interest	Total Bank loan	Loan Repaid B	C. B. of Bank loan	Net profit after loan repayment	Benefit cost ratio $\frac{A-B}{C}$
1	28.36*	23.92	4.44	7.15	1.07	8.22	2.07	6.15	2.37	1.10
2	32.48	23.92	8.56	6.15	0.92	7.07	2.07	5.00	6.49	1.27
3	32.48	23.92	8.56	5.00	0.75	5.75	2.25	3.50	6.31	1.26
4	32.48	23.92	8.56	3.50	0.45	3.95	2.20	1.75	6.36	1.26
5	32.48	23.92	8.56	1.75	0.26	2.01	2.01	nil	6.55	1.27
6	32.48	23.92	8.56	nil	nil	nil	nil	nil	8.56	1.35

\* The annual gross returns during first year will be Rs. 28.36 lakhs as there will be no sales during first 7 weeks period; only 45 batches will be sold instead of 52 batches. Therefore, the net surplus before repayment will be Rs. 4.44 lakhs.

**Certificate**

Certified that this project is prepared by me taking into account the prevailing prices of various farm inputs and outputs and the latest technical and production standards. It appears that this project will be technically feasible and financially viable.

Enclosures : 1. Land ownership document.

2. Farm site map.

3. Blue print and estimates of farm buildings.

\_\_\_\_\_  
Signature

## PROJECT REPORT FOR A LAYER FARM (1+3 SYSTEM)

### Technical details and assumptions

The project is a layer farm, having 20,000 birds at any given time where 15,000 are layers and 5000 are growers in 1+3 batches, *i.e.*, 1 batch of grower and 3 batches of layers. Once in every 20-21 weeks, 5400 new chicks are to be purchased and out of this 5000 are expected to be available at pullet stage. At about 19 weeks of age, about 5000 pullets are to be shifted to layer cages; where they will stay upto the age of 80 weeks after which they will be culled. At a point of time there will be about 14,400 (5000+4800+4600) layers which will lay 11,5000 eggs yearly with 80% production level. There will be down time of one week for each batch of new arrival in respective house or cage. Number of culled hens at 20-21 weeks interval will be 4500. Each pullet will consume 7 kg of feed upto 20 weeks of age and about 110 gm of feed /day during laying period. As such a bird from 0 to 80 weeks of age will consume 53 kg of feed and lay 336 eggs in 420 days and produce around 40 kg of manure.

It will take minimum three months for land development and grower shed construction to receive first batch of chicks, second and third batches will arrive 20 and 40 weeks later. The third batch comes to production 60 weeks after arrival of first batch. Therefore, a minimum of 18 months repayment holiday period is needed. The principal and interest will be repaid in 72 months after 18 months of holiday period, *i.e.*, 90 months.

1. House : (i) Open sided, tile roofed, deep litter house for grower birds.  
(ii) Raised platform cage layer house for layers.
2. Cost of grower house = Rs. 60/sq. ft.
3. Cost of layer house = Rs. 90/sq. ft.
4. Cost of other farm buildings = Rs. 100/sq. ft.
5. Cost of layer cages = Rs. 45/- bird
6. Cost of grower equipment = Rs. 10/- bird
7. Cost of medicines, vaccines, electricity, labour = Rs. 10 to 12 /bird
8. Pullet chicks purchased/batch = 5400 (excluding extra)
9. Average number of batches /year = 2.5
10. Cost of day-old chick = Rs. 15/- each
11. Mortality : 0 to 20 weeks = 8%  
21 to 80 weeks = 10%
12. Cost of feed = Rs. 7/kg  
(average of starter, grower and layer)

13. Average number of saleable eggs/day = 11,500 eggs
14. Average number of spent/culled hens = 11,250 hens  
(2.5x4500 hens)
15. Average egg selling price = Rs. 1.25/egg
16. Average manure production /year = 500 tonnes
17. Average selling price of manure = Rs. 200/tonne
18. Sale price of empty gunny bag = Rs. 5/each
19. Insurance premium = Rs. 4/bird
20. Average number of batches = 2.5/year
21. Feed /bird (0 to 80 weeks) = 53 kg

### **Farm buildings**

(i) **Orientation:** Same as other poultry houses.

(ii) **Grower house :**

The deep litter brooder cum grower house to accommodate 5000-5500 replacement pullets is of 30' width (North to South) and 167' length (East to West); total 5010 sq. ft. with one sq. ft./bird. The two *longs* are provided one foot high wall with 60° inside slope. The remaining height is covered by 1'' eye, 12 gauge G.I. chain link mesh throughout, except at the four doors. The inside height at eaves will be about 7' while at ridge the height will be 12'. The roof at eaves is provided with 3' overhang. The roof structure is supported by 9'' thick concrete pillars. The inside floor is made up of cement, elevated one foot above the ground level.

The 4 doors are made up of M.S. angle frame and 1''x3'' weld mesh of 10 gauge thickness, with provision to look both sides. Two rows of water pipe lines are provided 7'-8' above the ground level throughout the length of the shed, to connect it to automatic waterers.

(iii) **Raised platform cage layer house**

The layer house is 33' wide x 292' long (total 9636 sq. ft.) to accommodate 15,000 layers in 3 divided batches with 0.64 sq. ft./hen. The 3 cage units, one for each batch will be separated by two 10' wide x 33' long platforms with stair case. The platforms are 6' above the ground level. Two store rooms are constructed below the two 10' x 33' platforms to store eggs *etc.* The two sides of layer house on east and west are brick wall type, supported by 9'' thick concrete pillars, with a height 15' at eaves and 23' at ridge. The lengthwise north and south sides are having concrete pillars at 20' interval. The asbestos roof will have ridge ventilation at the center and have 5' overhang at the eaves.

Three platforms, each of 2' width x 290' length will be provided in each shed, which will be supported by 5'' thick 'T' shaped concrete pillars at the bottom at 5' interval.

**(iv) Cages**

Two 'M' type and two 'L' type cages, each of three-tier fixed in between the platforms. There will be 12 'M' and 6 'L' units of cages; of which 4 'M' and 2 'L' units will be allotted to each batch of layers. Each 'M' unit will have 6 rows and L unit have 3 rows of cages. The 'M' units are at the center and the 'L' are near the pillars. Each row will have 52 cage boxes. The size of cage box 20'' length in front, 17'' to 18'' height at front, depth will be 15'' (front to back) in bottom and middle row cages to house 5 hens and depth will be 18'' in top row cages to house 6 hens with 60 sq. inch cage space/hen. The middle row overlaps the bottom row cages and the top row overlaps the middle row cages by 2''. Cage floor gradient will be 7° from back to front. The cage bottom is made up of 1''x3'', 10 gauge weld mesh, whereas top, back and front mesh size will be 2''x3'', 8 gauge weld mesh. The cage partition mesh size will be 1''x3'' -12 gauge weld mesh. The feeders are made up of 24 gauge aluminium sheet and plastic water pipe with two nipple drinkers are there at each cage partition top front portion. Two rows of foggers are provided over each M cage.

The poultry house is provided 3 phase power supply. Compact fluorescent lamps are used in two rows.

**(v) Other buildings**

A rodent and seepage proof warehouse of 40'x20' size for feed storage; supervisor quarter 30'x20'; 30'x20' egg store with 12' height and asbestos roof are to be built. Total = 800+600+600 = 2000 sq. ft.

**STATEMENT -I**

Non-recurring Expenditure	Amount (Rupees in lakhs)
1. Cost of grower house with asbestos roof @ Rs. 60/sq. ft. (5010 sq. ft.) for 5000 growers	3.01
2. Cost of elevated platform, asbestos roof cage layer house @ Rs. 90/sq. ft. (9636 sq. ft.) for 15,000 layers	8.67
3. Cost of other buildings @ Rs. 100/sq. ft. (2000 sq. ft.)	2.00
4. Land development charges, fencing, manure pit, burial pit, farm road and other infrastructure facilities.	0.50
5. Cost of deep tube well, water pump, overhead tank and pipeline to all sheds.	0.70
6. Cost of chick & grower equipments @ Rs. 10/bird for 5000 birds	0.50
7. Cost of layer cages @ Rs. 45/bird for 15,000 birds	6.75
<b>Total</b>	<b>22.13</b>

**STATEMENT -II**

<b>Working Capital</b>	<b>Amount (Rupee in lakhs)</b>
1. Cost of 5400 day old chicks x 3 batches @ Rs. 15/ each + insurance premium @ Rs. 4/each = 5400 x Rs. 19/-	3.07
2. Feed cost for 3 batches upto the point of lay (20 weeks) for 5000 pullets /batch x 3 batches x 7 kg feed /bird x Rs. 7/kg	7.35
3. Miscellaneous cost : 5000 birds x 3 batches x Rs. 10/bird	1.50
<b>Total</b>	<b>11.81</b>

**STATEMENT - III**

**Total project cost, margin money, bank loan required**

Sl. No.	Description	Total cost	(Amount in rupees in lakhs)	
			Margin money	Bank loan required
1.	Land (3½ acre)	5.50	5.50	-
2.	Non-recurring expenditure (Statement I)	22.13	5.53 (25%)	16.60
3.	Working capital (Statement II)	11.92	2.98 (25%)	8.94
<b>Total</b>		<b>39.55</b>	<b>14.01</b>	<b>25.54</b>

**STATEMENT - IV**

**Calender of Loan Disbursement**

Period (Quarter)	Purpose	Amount (Rs. in lakhs)	
		Amount	Total Loan/quarter
1.	• Land development charges	0.38	3.53
	• Chick cum grower shed	2.25	
	• Deep tube well, overhead tank, etc.	0.52	
	• Equipment cost	0.38	
2.	• First batch of chicks	0.78	12.70
	• Feed room & other buildings	1.50	
	• Layer house	6.51	
	• Cost of layer cages	1.69	
	• Feed cost	1.84	
	• Misc. cost	0.38	

Period (Quarter)	Purpose	Amount	Total Loan/quarter
3.	• Second batch of chicks	0.76	
	• Cost of layer cages	1.69	4.67
	• Feed cost	1.84	
	• Misc. cost	0.38	
4.	• Third batch of chicks	0.76	
	• Cages for layer house	1.69	4.64
	• Feed cost	1.84	
	• Misc. cost	0.35	
<b>Total loan released</b>		<b>25.54</b>	<b>25.54</b>

- Repayment holiday = 18 months from the time of starting of farm.
- Repayment period = 72 months (after 18 months holiday period).
- Total repayment period = 72 + 18 = 90 months.
- The entire loan amount along with accrued interest at the rate of 15% will be repaid after the commencement of the project or within 72 months from commencement of full egg production.

**STATEMENT - V**  
**Annual Recurring Expenditure (Amount in Rs. in lakhs)**

Year	Chick cost including insurance premium		Feed Cost	Misc. Cost @Rs. 12/bird/ annum	Total Expenditure
	No.	Cost			
1.	16,200	(3.07)*	(4.90)*+14.70	(1.45)*+0.48	(9.42)*+15.18
2.	10,800	2.05	42.56	2.26	46.87
3.	16,200	3.07	43.68	2.26	49.01
4.	10,800	2.05	43.68	2.26	47.99
5.	16,200	3.07	43.68	2.26	49.01
6.	10,800	2.05	43.68	2.26	47.99
7.	16,200	3.07	43.68	2.26	49.01
8.	10,800	2.05	43.68	2.26	47.99
9.	16,200	3.07	43.68	2.26	49.01

\* Values in parenthesis indicate the working capital. In 1<sup>st</sup> year it is expected that two batches will cover 44 weeks of laying period.

**STATEMENT - VI**

**Annual Gross and Net Returns (Amount in Rupees in lakhs)**

Year	By sale of eggs		By sale of cull hens		By sale of manure		By sale of empty feed bags		Total Gross receipts	Total expenditure	Net Surplus
	No. (million)	Rs. (1.25/egg)	No.	Rs. (Rs.30/hen)	Amount (T)	Rs. (Rs.200/T)	No.	Rs. (Rs.5/bag)			
1	1.41	17.62	-	-	70	0.14	2800	0.14	17.90	15.18	2.72
2	3.90	48.75	9000	2.7	500	1.00	8106	0.40	52.85	46.87	5.98
3	4.19	52.37	13500	4.05	500	1.00	8320	0.41	57.83	49.01	8.82
4	4.19	52.37	9000	2.7	500	1.00	8320	0.41	56.48	47.99	8.49
5	4.19	52.37	13500	4.05	500	1.00	8320	0.41	57.83	49.01	8.82
6	4.19	52.37	9000	2.7	500	1.00	8320	0.41	56.48	47.99	8.49
7	4.19	52.37	13500	4.05	500	1.00	8320	0.41	57.83	49.01	8.82
8	4.19	52.37	9000	2.7	500	1.00	8320	0.41	56.48	47.99	8.49
9	4.19	52.37	13500	4.05	500	1.00	8320	0.41	57.83	49.01	8.82



**STATEMENT - VII**

**Cash flow statement, net profit and benefit-cost ratio (Amount in rupees in lakhs)**

Source of funds	At start	At the end of the year								
		1	2	3	4	5	6	7	8	9
Land cost	5.5	-	-	-	-	-	-	-	-	-
Promoter's funds	-	6.96	1.54	-	-	-	-	-	-	-
Borrowings	-	20.90	4.64	-	-	-	-	-	-	-
Increase in net profit	-	0.63	0.78	2.20	1.82	2.17	1.44	3.02	3.70	8.82
Net assets (cumulative)	5.5	33.99	40.95	43.15	44.97	47.14	48.58	51.60	55.30	64.12
Net surplus (cumulative)		0.63	1.41	3.61	5.43	7.60	9.04	12.06	15.76	24.58
<b>Cash outflow</b>										
Cost of chicks	-	-	2.05	3.07	2.05	3.07	2.05	3.07	2.05	3.07
Cost of feed	-	14.70	42.56	43.68	43.68	43.68	43.68	43.68	43.68	43.68
Misc. cost	-	0.48	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26
Repayment of loan with interest	-	2.09	5.20	6.62	6.67	6.65	7.05	5.80	4.79	-
<b>Total cash outflow</b>	-	<b>17.27</b>	<b>52.07</b>	<b>55.63</b>	<b>54.66</b>	<b>55.66</b>	<b>55.04</b>	<b>54.81</b>	<b>52.78</b>	<b>49.01</b>
<b>Cash inflow</b>										
By sale of eggs	-	17.62	48.75	52.37	52.37	52.37	52.37	52.37	52.37	52.37
By sale of spent/culled hens	-	-	2.7	4.05	2.7	4.05	2.7	4.05	2.7	4.05
By sale of manure	-	0.14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
By sale of gunny bags	-	0.14	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41
<b>Total cash inflow</b>	-	<b>17.90</b>	<b>52.85</b>	<b>57.83</b>	<b>56.48</b>	<b>57.83</b>	<b>56.48</b>	<b>57.83</b>	<b>56.48</b>	<b>57.83</b>
Net surplus	-	0.63	0.78	2.20	1.82	2.17	1.44	3.02	3.70	8.82
<b>Benefit : Cost ratio</b>	-	<b>1.03</b>	<b>1.01</b>	<b>1.03</b>	<b>1.03</b>	<b>1.03</b>	<b>1.02</b>	<b>1.05</b>	<b>1.07</b>	<b>1.18</b>

**STATEMENT - VIII**

**Bank Loan Repayment Schedule (Amount in rupees in lakhs)**

Year	O. B. of loan	Borrowings	Interest	Total	Repayment			C. B. of loan
					Principal	Interest	Total	
1	-	20.90	2.09	24.03	-	2.09	2.09	20.90
2	20.90	4.64	3.83	29.37	1.37	3.83	5.20	24.17
3	24.17	-	3.62	27.79	3.00	3.62	6.62	21.17
4	21.17	-	3.17	24.34	3.50	3.17	6.67	17.67
5	17.67	-	2.65	20.32	4.00	2.65	6.65	13.67
6	13.67	-	2.05	15.72	5.00	2.05	7.05	8.67
7	8.67	-	1.30	9.97	4.50	1.30	5.80	4.17
8	4.17	-	0.62	4.79	4.17	0.62	4.79	-
9	-	-	-	-	-	-	-	-
<b>Total</b>	-	<b>25.54</b>	<b>20.37</b>	<b>45.91</b>	<b>25.54</b>	<b>20.37</b>	<b>45.91</b>	-

**Certificate**

Certified that this project report is prepared by taking into account the latest technical standards and prevailing market prices for various farm inputs and outputs. The report is technically feasible and economically viable.

- Enclosures :
1. Farm site map
  2. Farm buildings blue print  
& estimates from civil engineer
  3. Land ownership document
  4. Quotation for cages *etc.*
  5. Other relevant documents.

\_\_\_\_\_  
Signature

## PROJECT REPORT FOR A DUCK FARM (FREE RANGE SYSTEM)

### Technical details and assumptions

1. Number of layer duck = 200.
2. Number of ducklings (straight run) purchased = 450.
3. Type of duck = Khaki Campbell x Desi cross.
4. Feeds (mostly grains) will be given first one month brooding period and during the scarcity in summer months.
5. Source of feed by foraging mainly.
6. Cost of day-old straight run ducklings = Rs. 8.00 each.
7. Feed required for brooding period = 1.5 kg each.
8. Cost of feed = Rs. 8.00/kg
9. Feed required for dry summer season (2 months/yr) = 2kg/bird/month (part feeding)
10. Selling price of drakes at 2 months of age = Rs. 30/- each.
11. Selling price of eggs = Rs. 1.50/- each.
12. Selling price of culled ducks = Rs. 30/- each.
13. No housing, except a nylon wirenet circular enclosure for night shelter.
14. Replacement stock: Next batch of 450 ducklings are to be purchased six months before the disposal of the old batch.
15. Farmer will look after his own farm.
16. Mortality = average 12%.

### STATEMENT - I

(a) Cost of feeders, waterers, fencing net, egg boxes, etc.	0.02
(b) Cost of 450 day-old straight run chicks	0.036
(c) Cost of feeding (brooding period) (450 x 1.5 x 8)	0.054
(d) Cost of vaccines, medicines and misc. expenditure	0.012
(e) Cost of feeding during summer season (200 x 2 x 4 x 8) [2 years = 4 summer months]	0.128
<b>Total</b>	<b>0.248</b>

### Cost of replacement stock

(a) Cost of feeders, waterers, etc.	0.01
(b) Cost of 450 ducklings (straight run)	0.036
(c) Cost of feeding them up to one month of brooding period	0.054
(d) Cost of vaccination, medication, etc.	0.01
<b>Total</b>	<b>0.11</b>

**STATEMENT - II**

<b>Gross income per batch</b>	<b>(Amount in rupees in lakhs)</b>
(a) By sale of 200 drakes at 8 weeks of age	0.06
(b) By sale of 200 eggs in first year + 180 eggs in second year / dam (200 x 200 + 200 x 180) x 1.50	1.086
(c) By sale of 170 ducks at the end of 2½ years (170 x 30)	0.051
<b>Total</b>	<b>1.197</b>

**Net return** = (Gross income/batch - expenditure/batch) -  
Cost of replacement stock  
= Rs. (1.197 - 0.248 - 0.11) lakh  
= **Rs. 0.839 lakh.**

Net return after 30 months (2½ years) = Rs. 0.839 lakh.

**Net return/month** = 0.839/30 = Rs. 0.027 lakh = **Rs. 2700/-.**

**Benefit: Cost ratio** = 3.34

**CLASS ASSIGNMENT ON ACTIVITY UNIT - 22**

**# Indicate the correct answer by putting tick (✓) mark.**

1. Broiler birds should be kept in the farm for the period of  
(a) 6 weeks (b) 8 weeks  
(c) 10 weeks (d) 12 weeks
2. Recently the feed conversion efficiency of broiler chicken (kg feed required/kg live weight) is  
(a) 4 (b) 3  
(c) 2 (d) 1
3. Egg type chicken are kept in the farm for the total period of  
(a) 20-22 weeks (b) 40-52 weeks  
(c) 72-80 weeks (d) 90-100 weeks
4. A hen starts to lay egg at the age of  
(a) 6 weeks (b) 20 weeks  
(c) 72 weeks (d) 80 weeks
5. A standard chicken egg weighs about  
(a) 48g (b) 58g  
(c) 68g (d) 78g
6. The average weight of a duck egg should be  
(a) 10g (b) 58g  
(c) 70g (d) 95g
7. The approximate feed requirement of a layer (chicken) during its total economic life is  
(a) 3.8kg (b) 8.0kg  
(c) 50.0kg (d) 70.0kg
8. A broiler chicken should have the following characteristic(s)–  
(a) may be of either sex  
(b) soft and pliable breast bone/cartilage  
(c) FCR 1:1.9  
(d) all of these

**# Exercise**

1. Prepare a project report for 1000 layer chicken on deep litter system.
2. Prepare a project report for broiler chicken (6 lots having 1000 birds in each lot per year) on deep litter system.
3. Prepare a project report for 250 layer ducks under semi-intensive system.

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**VCI SYLLABUS ON AVIAN PRODUCTION AND MANAGEMENT**  
**[Course No: LPM-322, Credit Hours: 2+1=3]**

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As per Veterinary Council of India (Minimum Standards of Veterinary Education, Degree Course - B. V. Sc. & A. H.) Regulations, 1993

**THEORY**

Economic importance of poultry, development of poultry industry in India, different breeds and varieties of chicken, ducks and turkeys; terms used in poultry science; how egg is formed - structure of eggs, formation of yolk, albumen and shell; selling of poultry and effect of culling on egg production, incubation or hatching of eggs, natural and artificial breeding, brooders. Season for breeding; different systems of housing of poultry; floor space requirements, constructional details of poultry houses and hatcheries, cost of construction, construction of budget poultry sheds for small, medium and large operators; layout plans for poultry farm of various sizes, poultry equipments: incubators, brooders, debeakers, trapnest, feeder and waterer *etc.* Care and management of chicks, pullets and cockerels, care and management of broilers and layers, feeds and feeding of broilers and layers, poultry farm records; commercial hatcheries and its role in poultry development; random sample tests; preparation of poultry for show; poultry judging; disinfection of incubators, brooders, farm implements and poultry houses. Disposal of poultry wastes. Utility of poultry manure.

Economy in poultry production - cost of production of table and hatching eggs, broiler meat, day-old-chicks. Preparation of project reports for broiler, layers, hatchery, cockerel and Japanese quail farms. Role of avian farms in a mixed farm unit.

Vaccination, deworming, detecting deficiencies and combating them *etc.*

**PRACTICAL**

Handling of poultry. External body parts. Identification of species, breeds and varieties of poultry. Reproductive and digestive systems of chicken. Structure and composition of eggs and meat. Poultry judging, selection and culling of poultry. Candling of eggs for evaluation of quality, presence of blood and meat spots *etc.*, measuring the strength of eggs, grading of eggs. Management of incubators; sexing of chicks and brooding of chicks. Feeders, waterers, trap nests and poultry farm and hatchery equipments. Different systems of housing, layout plans for poultry farms of different sizes. Feeds and feeding of broilers and layers, and systems of feeding. Slaughter and dressing of poultry. Different methods of preservation of

### Appendices

eggs and meat. Health care and management of chicks, ducklings and turkey; care and management of broilers and layers during summer and winter. Record keeping of poultry farm (including accounts). Preparation of feasibility reports for small and medium poultry farms. Preparation of project reports for the same. Model scheme for a large poultry farm.



APPENDIX-2

**REQUIREMENTS FOR CONDUCTING PRACTICAL CLASSES OF AVIAN PRODUCTION AND MANAGEMENT (As per VCI regulation)**

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1. Poultry farm of 1000 birds with a minimum of 200 layers.
2. Model of various systems, pens, cages, runs, equipments, *etc.*
3. Sample stock of various breeds of poultry and other avian species.
4. Hatchery and chick pens.
5. Brooders.
6. Equipments: incubator (hatchery), egg candler, battery brooder, egg grading machine, chick sexing machine, debeaking equipment, trap nest, Vernier calipers, screw gauge, maximum-minimum thermometer, hygrometer, poultry post-mortem set, *etc.*
7. Photographs of different breeds, charts, photographs showing different points of body of various species, models of feeding and watering troughs for different species, samples of feeds, registers/account procedures.

**Note:**

- (i) The above list of requirements will serve as a guide for conducting the classes of this subject. They are not meant to be an exhaustive list and the staff of the Department of Livestock Production and Management (Poultry Section) will use their initiative and experience for equipping their Department.
- (ii) The practical classes are to be conducted at the Livestock Instructional Farm (Poultry Section).

**ANSWER OF OBJECTIVE QUESTIONS**

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**Activity Unit - 1**

- 1.b) spur
- 2.d) all of these
- 3.c) abdominal feather
- 4.c) keel bone

**Activity Unit - 2**

- 1.a) America
- 2.a) America
- 3.c) England
- 4.d) Italy
- 5.c) England
- 6.c) India
- 7.b) England
- 8.d) White Leghorn
- 9.d) Leghorn
- 10.a) Rhode Island Red
- 11.a) Indian Runner
- 12.c) Aylesbur
- 13.d) B-77
- 14.d) Mychix
- 15.c) Crested White

**Activity Unit - 3**

- 1.d) All of these
- 2.c) culling

**Activity Unit - 4**

- 1.b) proventriculus
- 2.c) gizzard
- 3.b) gizzard and liver

**Activity Unit - 5**

- 1.c) 76 cm

2.c) Magnum

3.c) Isthmus

4.c) Uterus

5.c) 25 hours

6.c) carotene

**Activity Unit - 6**

- 1.b) 58g
- 2.c) 70g
- 3.a) 10g
- 4.b) protein
- 5.d) calcium carbonate
- 6.c) inner thick white
- 7.b) albumin
- 8.a) 21% and 13%

**Activity Unit - 7**

- 1.b) 72
- 2.d) 78
- 3.c) 74
- 4.c) 58

**Activity Unit - 8**

- 1.c) Medium
- 2.c) 45-52g
- 3.d) all of these
- 4.c) A,B

**Activity Unit - 9**

- 1. d) all of these
- 2. c) keeping eggs in lower temperature
- 3.b) Sodium silicate
- 4.d) all of these
- 5.c) 8 months

**Activity Unit - 10**

1. b) 1.75 sq ft
2. a) 1.00 sq ft
3. d) all of these
4. b) 250 birds
5. c) deep litter system
6. b) 25 quails
7. c) 50 quails
8. b) battery system

**Activity Unit - 11**

1. a) 1 inch
2. c) 2-2.5 inches
3. a) 1 inch
4. b) 2 inches
5. b) 100

**Activity Unit - 12**

1. b) hatching
2. a) 15
3. b) 21 days
4. c) 21 days
5. c) 21 days
6. b) 37.5°C
7. b) 60-70%
8. b) 17 days
9. c) 28 days
10. (c) 28 days
11. (b) 1:10
12. (a) 1:3
13. (a) 1:5
14. b) 6g
15. b) 18 days
16. b) 16-17°C
17. b) the first 18 days of incubation
18. b) the first 25 days of incubation

**Activity Unit - 13**

1. a) Broiler farming
2. c) quail
3. d) all the female progenies will be black and male progenies barred

**Activity Unit - 14**

1. b) brooding
2. d) 250-300 chicks
3. a) 4
4. a) 90-95°F
5. c) 3-4 sq inches

**Activity Unit - 15**

1. a) 3.8 kg
2. b) Ca
3. d) all of these
4. b) 25-30 litres
5. d) 30 litres
6. b) all mash feeding

**Activity Unit - 16**

1. a) bacteria
2. b) virus
3. b) virus
4. c) vitamin B<sub>1</sub>
5. a) Marek's disease, Ranikhet disease and Gumboro disease
6. a) 1 week
7. a) 3 days
8. a) RDF<sub>1</sub>
9. d) None of these
10. b) deworming

**Activity Unit - 17**

1. c) 38°C
2. b) 18-21°C

Appendices

**Activity Unit - 18**

1. a) Halal with stunning
2. c) Loosening of feathers
3. b) To remove hair like feathers from the carcass
4. a) 2-4°C

**Activity Unit - 22**

1. a) 6 weeks

2. c) 2
3. c) 72-80 weeks
4. b) 20 weeks
5. b) 58 g
6. c) 70 g
7. c) 50.0 kg
8. d) all of these

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