**COURSE GUIDE**

# ANP 501
# POULTRY PRODUCTION


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**MAIN COURSE**

**CONTENTS** **PAGE**

# MODULE 1 POULTRY PRODUCTION IN THE NIGERIAN ECONOMY

Unit 1 Poultry Industry in Nigeria
Unit 2 Poultry Production Systems in Nigeria – Intensive and Extensive
Unit 3 Poultry Products Utilisation – Fast Foods, Egg Outlets,

## UNIT 1 POULTRY INDUSTRY IN NIGERIA

### CONTENTS



## 1.0 INTRODUCTION

Poultry is the term used to describe group of birds kept for meat and egg (e.g chicken) or reared or hunted for a useful purpose (e.g pheasants). Birds are feathered animals. The group of birds called poultry include the following: Domestic chicken (fowls), Turkey, Guinea fowls, Duck and Geese (also called water fowls), Quails, Pheasants, Ostriches, Pigeons and Doves. The Poultry industry is an emerging agri-business and has established its position as the fastest growing segment in the agricultural sector in Nigeria. With increased acceptance of chicken, egg and meat, the demand for these products is ever increasing. The Nigerian poultry industry is estimated at ₦80 billion ($600 million) and is comprised of approximately 165 million birds, which produced 650,000 MT of eggs and 290,000 MT of poultry meat in 2013. From a market size perspective, Nigeria's egg production is the largest in Africa (South Africa is the next largest at 540,000 MT of eggs) and it has the 2nd largest chicken population after South Africa's 200 million birds.

Poultry sector has tremendous employment potential and would go a long way in reducing unemployment in Nigeria.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- define the term 'Poultry'
- discuss the history of Poultry Production in Nigeria and their challenges
- highlight the prospects of Poultry Production in Nigeria.

## 3.0 MAIN CONTENT

### 3.1 History of Poultry Production in Nigeria

The poultry sub-sector is the most commercialised (capitalised) of all the sub-sectors of the Nigerian agriculture. The types of poultry that are commonly reared in Nigeria are chickens, ducks, guinea fowls, turkeys, pigeons and more recently ostriches. Those that are of commercial or economic importance given the trade in poultry, however, are chicken, guinea fowls and turkeys, amongst which the chickens predominate. The Poultry industry in Nigeria can be divided into three main sections: small, medium and large-scale production with 25% being provided by commercial farms, 15% semi-commercial and 60% from backyard. Each of these systems is associated with features of scale, stock, husbandry and productivity.

Since the onset of the poultry industry in 1956, commercial production in Nigeria has passed through various stages of development- each with its peculiar problems. In the late 1950s, the major problem was convincing the general population that keeping poultry and egg were essential for dietary and economic reasons because sociological attachments of people from egg and broiler production. During the 1960s, the problem shifted away from sociological beliefs to management and disease. Through government intervention and encouragement, poultry production became a hobby, farmers are becoming financially rewarded. Proper management of larger enterprise therefore became a problem along with outbreaks of diseases unknown to producers. The 1970 decade presented problems of production,

management, disease and marketing. Despite these problems, the rapid expansion of poultry industry is a sign that poultry production has a promising future in this country.

The two major events that have been recorded in the industry has been the ban on importation of frozen poultry product in 2003 which deepened the market for poultry product and Avian Influenza of 2007 which affected the industry negatively. The ban has not only created jobs in the industry but also encouraged investment in poultry production. There are few, if any social or religious stigmas attached to the use of poultry meat and egg in human diet. Hence demand is high for live birds and eggs either for consumption or as a gift during festivities.

## 3.2 Prospects and Problems of Poultry Production in Nigeria

The livestock industry sub-sector is an important component of the Nigerian Agricultural Economy; its importance derives from the fact that it is one of the key contributors to national economy. The industry has the potential of increasing the National Gross Domestic Product through:

1. Poultry meat production: boiler production for meat and fast food joints.
2. Poultry egg production: layers production for industries and retail egg sellers.
3. Breeding and hatching of chicks, poults, keets, ducklings etc.
4. Poultry equipment manufacturing.
5. Processing and marketing of poultry products.
6. Feed production.
7. Production of drugs and vaccines.

However, some of the highlighted problems still being faced are:

1. Scarcity and high cost of day-old chicks (DOC), poults, ducklings etc. The cost of purchase of DOC is always very high especially when the festive period is on sight and this eventually affect the total cost of production.
2. Poor quality of birds available for meat and egg production. This is also a major problem faced by the poultry industry because our indigenous breeds have not been genetically improved upon to grow rapidly especially for the meat type to meet the population

increase requirement. Indigenous breeds are also broody in nature and this limit the numbers of eggs laid.

3. Availability and high cost of poor quality feeds. Feed produced for poultry industry comes from combinations of various ingredients which are planted especially in the northern part of the country. Due to the unrest in this part of the country, the production of these crops has reduced drastically which indirectly increased the total cost of production of the feed. Also there is competition between man and poultry industry for grain which makes 70% of the ingredient in formulating feed for poultry, thus resulting in high cost of the feed.
4. Inadequate managerial and technical know-how. The producers of poultry require regular training especially in the management and feed formulation to be able to meet the global trend in production. The use of growth promoter and enzymes usage, vaccination, medication and artificial insemination also require adequate knowledge by the producer.
5. Inadequacy of credit facility to poultry farmers. Farmer require huge collateral to get loans from bank and government policy in relation to subsidy is not always available to practicing poultry farmers
6. Poor marketing, distribution and pricing of poultry products.
7. Poor poultry health care services.
8. Unsuitable poultry houses and poor maintenance of houses.

## 4.0 CONCLUSION

Poultry keeping is ubiquitous in Nigeria's rural areas and is increasingly common among peri-urban and urban households as a way to supplement income and increase access to protein. The commercial sector is comprised of operations at a range of sizes, including large-scale, under automated integrated facilities. Despite Avian Influenza, demand for poultry is rising and is expected to continue increasing as Nigeria's economy grows. At all levels in the sector, the country's poultry farmers have opportunities to expand production in response to rising demand.

## 5.0 SUMMARY

In this course, we have learnt about poultry industry. The various prospect and problems of poultry producers in Nigeria were also highlighted. Despite these various challenges, poultry production still

remain the fastest means of bridging the protein- deficiency gap presently prevailing in the country.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Define poultry and explain the various challenges faced by Nigeria commercial poultry production since 1956.
2. Highlight and explain three prospects and two problems facing Poultry Production in Nigeria.

## 7.0 REFERENCES/FURTHER READING

David, A. M. (2002). *Nigeria Poultry and Products Update*.United States Department of Agriculture.

Odeh, O. (2010). 'Nigeria: Ban on Chicken Import Creates 20m Jobs'. Retrieved November 13, 2012, from All Africa: http://allafrica.com/stories/201011170218.html

Sonaya, E., & Swan, S. (2004). *Small-Scale Poultry Production Technical Guide.* Rome: Food and Agriculture Organisation of the United Nations.

Adene, D.F. &Oguntade,A.E.(2006). *TheStructure and Importance of the Commercial and Village-Based Poultry Industry in Nigeria.* FAO (Rome) Study, October.

# UNIT 2 POULTRY PRODUCTION SYSTEMS IN NIGERIA – INTENSIVE AND EXTENSIVE

**CONTENTS**



## 1.0 INTRODUCTION

About 70% of Nigerians live below the poverty line earning less than the current $2 per capital income. The effect of poverty is therefore felt more among rural dwellers, those with limited education and the unemployed. Parallel to commercial poultry industry, a small-scale poultry production system had been developed and remains part of most rural communities in developing countries. Family poultry are kept under a wide range of conditions, which can be classified into one of four broad production systems.

- free-range extensive
- backyard extensive
- semi-intensive
- intensive.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state types of poultry production systems
- identify the various principles guiding the management and production of poultry
- explain how poultry production is being practiced
- discuss rural family poultry.

## 3.0 MAIN CONTENT

### 3.1 Free-Range Extensive Systems

In Africa, Asia and Latin America, 80 percent of farmers keep poultry in the first two extensive systems. Under free-range conditions, the birds are not confined and can scavenge for food over a wide area. Rudimentary shelters may be provided, and these may or may not be used. The birds may roost outside, usually in trees, and nest in the bush. The flock contains birds of different species and varying ages.

**Fig. 1.1: Free Range Birds**

### 3.2 Backyard Extensive Systems

Poultry are housed at night but allowed free-range during the day. They are usually fed a handful of grain in the morning and evening to supplement scavenging.

## 3.3 Semi-Intensive Systems

These are a combination of the extensive and intensive systems where birds are confined to a certain area with access to shelter. They are commonly found in urban and peri-urban as well as rural situations. In the "**run**" system, the birds are confined in an enclosed area outside during the day and housed at night. Feed and water are available in the house to avoid wastage by rain, wind and wild animals.In the European system of free-range poultry keeping, there are two other types of housing. The first of these is the "**ark**" system, where the poultry are confined overnight (for security against predators) in a building mounted on two rails or skids (usually wooden), which enable it to be moved from place to place with draught power. A typical size is 2 × 2.5 m to hold about 40 birds.

The second type of housing is the "**fold**" unit, with a space allowance (stock density) for adult birds of typically three to four birds per square metre (birds/$m^2$), both inside and (at least this) outside. The fold unit is usually small enough to be moved by one person. Neither of these two systems is commonly found in developing countries.

## 3.4 Concept of Rural Poultry

The term 'rural poultry' or 'family poultry' (FP), as used in most developing countries, is indicative of the traditional low input husbandry of domestic poultry such as chicken, duck, pigeon, quail and guinea fowl that is typically maintained by the rural poor (similar to backyard chicken). A clearer definition of rural poultry was given by Sonaiya in 2007 as the poultry involving any genetic stock; improved or unimproved that is raised extensively or semi-intensively in relatively small numbers (usually less than 100 birds at a time).

The rural poultry or family poultry production serves as an important source of food in rural areas, and a sure way of reducing poverty. Backyard poultry enables the rural poor, including the landless to create an asset base with minimum input. The poultry may range freely in the household compound and find much of their own food, getting supplementary amounts from the householder. Poultry provide a major income-generating activity from the sale of birds and eggs. Occasional consumption provides a valuable source of protein in the diet. Poultry

also play an important socio-cultural role in many societies. Poultry keeping uses family labour, and women (who often own as well as look after the family flock) are major beneficiaries. For smallholder farmers in developing countries, family poultry represents one of the few opportunities for saving, investment and security against risk.

## 3.5 Types of Family/Rural Poultry

The rural poultry production is practiced either as free range or semi-intensive. In the free range type of management, the animals are not provided with any forms of housing or feeding, their survival is only by scavenging. Under this system, the cost of production is low but high rate of mortality due to theft, diseases, accident etc.In semi-intensive management system, the animals feed on household wastes, and confined in an enclosed area outside during the day and housed at night. The mortality of the birds under this system is always lower compared to the free-range or extensive system. The housing system includes those that are built with raffia or more recently rubber cages.

**Fig. 1.2: Raffia Cages**

Poultry meat and eggs were obtained from different poultry specie such as quail, local chicken, duck and guinea fowl. One of the major constraints to this type of poultry production is increase in the number of rural-urban drift in search of better jobs, amenities and good environment. The local chicken farmers have however maintained the flock size from between 1 to 40 for easy management by the elderly who cannot cope with larger flock.Some of the factors responsible for the continuous existence and preference for local chicken were the high disease resistance of the birds, their scavenging ability which make them to survive with little or no proprietary concentrate feed, low production

cost, their high prolific nature and their hardy but juicy meat which is highly preferred by rural dwellers.

## 3.6 Intensive Systems

These systems are used by medium to large-scale commercial enterprises, and are also used at the household level. Birds are fully confined either in houses or cages. Capital outlay is higher and the birds are totally dependent on their owners for all their requirements; production however is higher. There are three types of intensive systems:

- **Deep litter system**: birds are fully confined (with floor space allowance of 3 to 4 birds/$m^2$ within a house, but can move around freely. The floor is covered with a **deep litter** (a 5 to 10 cm deep layer) of grain husks (maize or rice), straw, wood shavings or a similarly absorbent (but non-toxic) material. The fully enclosed system protects the birds from thieves and predators and is suitable for specially selected commercial breeds of egg or meat-producing poultry (layers, breeder flocks and broilers).

- **Slatted floor system**: wire or wooden slatted floors are used instead of deep litter, which allow stocking rates to be increased to five birds/$m^2$ of floor space. Birds have reduced contact with faeces and are allowed some freedom of movement.

- **Battery cage system**: this is usually used for laying birds, which are kept throughout their productive life in cages. There is a high initial capital investment, and the system is mostly confined to large-scale commercial egg layer operations.An intensive system of rearing indigenous chickens commercially is uncommon.

## 3.7 Housing in Intensive Systems

### 3.7.1 Planning

Complete confinement is only advisable where:

- there is good management
- reproduction is spread equally over the year
- land is scarce or inaccessible all year round
- a supply of hybrid day-old chicks is available
- labour is expensive

- parasite and disease control are readily available
- the objective is commercial production.

The reasons for confinement are, in order of priority, to:

- reduce mortality due to predation in chicks under two months of age
- achieve higher daily gain and better feed conversion in growers
- allow better supervision of production in laying hens.

In all confined systems, the location and building design must be carefully considered. The area surrounding the house should be mown or grazed. A good location should meet the following criteria:

- It should be easily accessible.
- There should be a reliable water supply.
- The ground should be well drained.
- It should be at a sufficient distance from residential areas (far enough to protect human health and close enough to provide security for the birds).
- It should be well away from woodland.

**SELF-ASSESSMENT EXERCISE**

i. Clearly differentiate between the free range and intensive system of raising birds.
ii. What is the difference between the free range and the back-yard extensive system of raising poultry.

**Fig. 1.3: Deep Litter House for Poultry**

## 5.0 SUMMARY

It is also important that family poultry production is a sure way of increasing animal protein supply, creating jobs, increasing income, reducing rural-urban drift and eradication of poverty in the rural area.The Poultry system can be grouped into either intensive or semi-intensive system. Each system has different management strategies. For increasing productivity, intensive system of poultry production should be given priority.

## 4.0 CONCLUSION

The semi-intensive and intensive system of poultry production, under good feeding and management practices, results in a high level of performance by the birds.This unit has shown that family poultry production is a substantial source of animal protein for the rural populace. The major obstacle to family poultry production is rural–urban drift in search of education and white–collar jobs.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the different types of intensive system of poultry production.
2. Define Rural Poultry production.
3. Explain the factors responsible for the reduction in reduction in family poultry.

## 7.0 REFERENCES/FURTHER READING

The Poultry Site.(2012). Isiukwuato LG to Establish Poultry Farm.Retrieved November 13, 2012.

http://www.thepoultrysite.com/poultrynews/25692/isiukwuato-lg-to-establish- poultry-farm

Oluyemi, J.A & Robert, F.A (2000).*Poultry Production in Warm West Climate.*(Revised ed). Macmillan Press Ltd, London.

Sheldon, B.L. (2000). *Research and Development in 2000: Directions and Priorities for The World's Poultry Science Community. Poultry Science.*

Sonaiya, E.B. (2007). Family Poultry, Food Security and the Impact of HPAI.*World Poultry Science Journal* .

# UNIT 3 POULTRY PRODUCTS UTILISATION MARKETING AND PROCESSING

## CONTENTS



## 1.0 INTRODUCTION

Bridging the gap between teeming populations and food production is one of the important tasks of developing countries. Expensive staple foods and policy constraints on food import are the major factors worsening the food situation in developing countries. The average Nigerian does not consume enough protein of animal origin, and animal protein is more efficient than plant protein in providing the amino acids necessary for tissue development, repair and function (FAO 1994). In view of this the quality of amino acids in live animal must be preserved in the meat for final consumer. Hence there is the need for proper processing of meat and the processing methods

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- identify reasons for processing chicken and the processing methods
- state the steps involved in processing chicken.

## 3.0 MAIN CONTENT

### 3.1 Reasons for Processing

Broiler's meat is processed for the following reasons

- To provide a product with desired texture, flavour and aroma.
- Transformation of raw meat to products with longer shelf life.
- Increase in volume and improvement of qualities e.g. colour and flavour.
- Enhance marketing

### 3.2 Processing Methods

The processing method include slaughtering, bleeding, defeathering, evisceration and packaging.

#### 3.2.1 Slaughtering

Remove feed from birds at least 2 hours before slaughter so that the intestinal tract clears. The Birds must still have access to cool, clean drinking water, which will reduce carcass dehydration and facilitate plucking. Sever the jugular vein by drawing a long, thin, sharp knife across the throat high on the neck just under the lower bill. Birds killed this way bleed swiftly and completely.

## 3.2.2 Dressing

### 3.2.2.1 Scalding

Once they have stopped bleeding, place birds to be wet plucked in a scalding tank at a water temperature of 60°C for a few minutes — long enough to loosen the feathers without causing flesh discolouration.

**Wet plucking**
Several mechanical pluckers are available; all have revolving rubber 'fingers' that remove most of the feathers. The remaining pin feathers must be removed by hand, by grasping them between the thumb and a dull-edged knife.

**Dry plucking**
This method of plucking eliminates scalding. Poultry processors prefer it because it produces an exceptionally attractive carcass. It is, however, much slower than wet plucking and there is more chance of tearing the skin.

### 3.2.2.2 Waxing

Waxing carcases to remove the remaining feathers is recommended where many birds are to be processed, because remaining feathers are removed quickly and a better carcass appearance results. Waxing carcases to remove remaining feathers is common overseas, and more Australian processors are now using this method. The carcass is covered with molten wax and placed in cold water to harden the wax; when the wax is peeled off the carcase, any feathers come with it. The wax can be used again by remelting it and pouring it through a screen to separate the wax from the feathers. Commercial blended wax can be obtained for this purpose.

### 3.2.2.3 Evisceration

Eviscerate birds on a stainless steel table. Slit the skin on top of the neck to the shoulder blades and remove the windpipe and oesophagus. The neck can be nicked with secateurs and turned back in through the top of the body, or cut through and removed.

Remove the visceral organs from the rear end by slitting from the vent to the end of the breastbone. Then insert one hand high up into the body cavity. With practice, all organs can be removed in one operation. Cut through the hock joint to remove the legs. Eviscerated birds should now be thoroughly washed. Clean and wash giblets, enclose them in sealed packets made of an approved material, and either stuff them into the body cavity through the rear end of the carcass, or pack and sell them separately. The carcass must be labelled either ‘with giblets’ or ‘without giblets’. A dressing-out loss of about 23% is normal with most breeds.

**Fig. 1.4: Processing Method (Automatic Defeathering Machine)**

**Fig. 1.6: Packaging of Dressed Chicken**

**Fig. 1.5: Dressed Chicken ready for Packaging**

### 3.2.2.4Trussing

The most attractive carcass presentation is to pack birds in a patented clear plastic bag which shrinks to the contours of the bird's body. Birds handled in this way require no special trussing. They are placed in the correct-sized bag, and the mouth of the bag is then held under the nozzle of a machine which removes air by vacuum. The end of the bag is twisted to prevent entry of outside air and is sealed with a metal clip. To shrink the bag into the body contours, the carcass is then placed into a shrink tank filled with water at 93°C for a couple of seconds.Chickens and turkeys have to be pre-chilled to keep their flesh white. Place birds to be sold as fresh poultry in ordinary plastic bags, first twisting the wings inwards. The plastic packaging bags can be preprinted in several colours, with trade name, description and other details.

## 3.3 Marketing of Live Poultry

### 3.3.1 Harvesting and Transport Systems

There are many systems for poultry harvesting. The most common method for small scale operations is for broilers to be caught by hand and then carried to the transport by one or both legs. This procedure requires great care as it can cause dislocation of the hip - joint, internal bleeding and even death.

In larger scale operations, herding, sweeping and vacuum systems of harvesting have been developed. In the first, birds are herded into a mechanical handling system by catchers onto a conveyor belt. The birds are then blown into a crate. The sweeping system uses a machine fitted with a central boom and sweeper arms fitted with rotating, foam rubber paddles, which gently sweep the birds onto an inclined conveyor. The vacuum system relies on gentle suction from the floor. Crates are then filled by a mechanical device.Some birds are marketed as individuals but others are contained in crates which are either loose or fixed to the truck or as a module of 4–16 crates carried by fork lift truck to the vehicle.

### 3.3.2 Display and Sales

Poultry products are displayed in several different ways. Whole carcasses are often displayed unrefrigerated at market in the open hung by their legs or on a stall or shop display, particularly in the developing world. This is not to be recommended. Refrigerated products are displayed in shops and other retail units unpackaged or over-wrapped on plastic trays. In some are as meat is sometimes sold from mobile refrigerated shops. Products are usually exchanged for cash at the point of sale. However, poultry producers may have contracts with poultry processing enterprises, local hotels or restaurants where a lump sum payment is made. In developing countries small scale producers may sell by bartering for other consumable items

**SELF-ASSESSMENT EXERCISE**

Highlight and briefly explain the steps involved during dressing of carcass.

## 4.0 SUMMARY

The reasons for processing meat and the processing methods such as slaughtering, bleeding, e.t.c were highlighted in this module.

## 5.0 CONCLUSION

In this unit we have learnt about poultry (chicken) processing, and how it increases the shelf life, quality and enhances marketing of poultry products.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. What are the reasons for processing meat?
2. List the processing methods?

## 7.0 REFERENCES/FURTHER READING

Odeh, O. (2010). Nigeria: Ban on Chicken Import Creates 20m Jobs. Retrieved November 13, 2012, from All Africa: http://allafrica.com/stories/201011170218.html

Jeannette, Beranger (2011).Processing and Marketing Regulations.Research & Technical Program Manager, American Livestock Breeds Conservancy; Marjorie Bender, Research & Technical Program Manager, American Livestock Breeds Conservancy.

# MODULE 2 POULTRY EGG PRODUCTION



## UNIT 1 HATCHERY MANAGEMENT

### CONTENTS

## 1.0 INTRODUCTION

Many changes have taken place in hatcheries in recent years, such as the introduction of computer monitoring and control of the machines, and automation of many day-to-day hatchery operations. Additionally, there is increasing awareness of the role of the hatchery in disease control.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the hatchery requirements
- explain the factors that may affect the hatching potential of eggs.

## 3.0 MAIN CONTENT

The measure of success of any hatchery is the number of first-quality chicks produced. This number expressed as a percentage of all eggs set for incubation is normally termed hatchability. Hatchability is influenced by many factors (Table 1). Some of these are the responsibility of the breeding farm and others are the responsibility of the hatchery. Mating activity is a good example of a factor entirely influenced on the farm. The hatchery cannot alter it, although many other factors can be influenced by both the farm and the hatchery.

**Table 1: Controlling Factors on Farm and in Hatchery**

| **CONTROLLING FACTORS** | |
|---|---|
| **FARM** | **HATCHERY** |
| Breeder Nutrition | Incubation – management of setters and hatchers |
| Mating Activity | Egg Storage |
| Egg Damage | Sanitation |
| Disease | Egg Damage |
| Correct Male and Female BW | Chick Handling |
| Egg Sanitation | |
| Egg storage | |
| Thus, the breeder farm has a major influence on results at the hatchery and it is essential for the farm and hatchery to work closely together. | |

## 3.1 Hatchery Requirements

To operate a hatchery successfully, one requires the following:

### 3.1.1 Hatchery Buildings

Hatchery buildings are usually designed to provide room for holding hatching eggs (Table 2) prior to setting, grading and traying of the eggs; incubating and hatching machines; grading and holding prior to sale. Additional rooms are often provided to cater for fumigation, washing of equipment and showering of visitors.The design and construction of a hatchery must be professionally came out because of the absolute necessity for room temperature and humidity control and regular washing and sanitation for disease control purposes. The size of the incubators and hatchers plus any anticipated future expansion must be used to determine the size of the building. High ceiling of about 3.1m (10ft) are necessary since most hatcheries are built with force-draft ventilation system. Because the interior of the hatchery has to be subjected to regular washing and disinfection, it is important that the inside walls should be covered with a glazed, hard, non-absorbent finish. Tiles are usually used to accomplish this objective. The floors, which must be concrete, should have a glazed finish in additions to making provisions for adequate drainage. Other construction details to provide for ventilation and refrigeration facilities must also be considered.

It is for the same reason that hatchery building should be cited.

**Table 2: Floor space for hatchery rooms**

| Room Type | Per 100 eggs incubators-hatcher ($m^2$) | Per1000 straight-run chicks per hatch ($m^2$) |
|---|---|---|
| Egg receiving room | 0.19 | 1.39 |
| Egg storage room | 0.03 | 0.23 |
| Chick holding room | 0.37 | 2.79 |
| Wash room | 0.07 | 0.55 |
| Storage room | 0.07 | 0.49 |

*Source: Mack O. North, 1984. Commercial Chicken Production Manual*

### 3.1.2 Incubators

An incubator is a machine into which fertile eggs are usually set for hatching. Two types are used commercially: The C*abinet (forced drought)* and *the Flat (table) or still air* **type**

## 3.2 Hatching Eggs Management

Optimum hatchability and chick quality can only be achieved when the egg is held under optimum conditions between laying and setting in the incubator. Once the egg is laid, its hatching potential can at best be maintained, not improved. If mishandled, hatching potential will quickly deteriorate.

Some of the factors that may affect egg hatchability are as follows

1. Use of floor eggs depresses hatchability. They should be collected and packed separately from nest eggs, and clearly identified. If they are to be incubated, they should be treated separately.
2. Prevent hair-line cracks by handling eggs carefully at all times.
3. Place hatching eggs carefully into the setter tray or transport tray, small (narrow) end downward.
4. Take care with egg grading. During the early production period check the weight of border-lined sized eggs to select hatching eggs.
5. Store the eggs in a separate room in which the temperature and humidity are controlled.
6. Keep the farm eggs handling room clean and tidy. Maintain good vermin control in your egg room. Refuse to accept dirty egg containers and buggies from the hatchery, and take care of them while on your premises.

## 3.3 Egg Storage

Eggs should be collected from the farms and transported to the hatchery at least twice a week. There are three storage areas: farm egg room, transport, and hatchery egg room. It is important to match the conditions in each of these situations as closely as possible to avoid sharp changes in temperature and humidity, which can lead to condensation (“sweating”) on eggs or eggs being chilled or overheated. Also, temperature fluctuations must be avoided during transport and storage.

The temperature decrease must be a smooth transition when cooling the eggs from the hen house to the hatchery egg room, and also a smooth transition when warming the eggs from the hatchery egg room to the setter machine.

The main effects of storing eggs are:

1. Storage prolongs incubation time. On average, one day's storage adds one hour to incubation time. This must be taken into account when eggs are set, so fresh and stored eggs should be set at different times.
2. Hatchability is depressed by prolonged storage. The effect increases with storage time after the initial six-day period, resulting in losses of 0.5 to 1.5% per day with the percent increasing as storage extends further.
3. Chick quality will be affected and hence broiler weights can be depressed in chicks from eggs that have been stored for 14 days or more.

Gas exchange can occur through the pores in the egg shell during storage. Carbon dioxide diffuses out of the egg, and its concentration declines rapidly during the first 12 hours after the egg is laid. Eggs also lose water vapor while in storage. This loss of both carbon dioxide and water contributes to the loss in hatchability and chick quality after storage. Storage conditions must therefore be designed to minimise these losses. Most eggs are placed in open-sided cases or farm racks, but some are placed in solid covered cases. Allow covered eggs to cool down and dry thoroughly before casing to avoid condensation and subsequent mold growth.

## 3.4 Setting Eggs

To avoid temperature shock to the embryo and consequent condensation on the shell, eggs should be removed from the egg room and pre-warmed before setting. Ideally, eggs should be pre-warmed in a purpose-built room at around 75-80 °F (24-27 °C) so that all can achieve the desired temperature. Effective air circulation and correct room temperature are essential to achieve the necessary even pre-warming of eggs. Uneven pre-warming increases variation in hatch time – precisely the opposite of the desired effect of pre-warming. Even with good air circulation, it will take 8 hours for eggs on a buggy to reach 78 °F (25

°C), irrespective of their initial temperature. With poor air circulation, it may take twice as long. So the recommendation is to:

- Provide good air circulation around the eggs.
- Allow 6 to 12 hours for pre-warming.

## 3.5 Setting Time

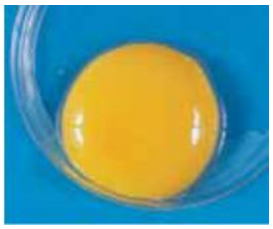
Three factors influence the total incubation time of eggs:

**Temperature of incubation:** normally fixed for any hatchery, but to achieve a desired pull time for chicks, variation in the time at which eggs are set can be modified according to age and size of eggs.
**Age of the eggs:** stored eggs take longer to incubate. You will need to add extra incubation time if eggs are stored over 6 days. (1hour per day of storage)
**Size of the eggs:** larger eggs take longer to incubate.

## 3.6 Setter Operation

The optimum physical conditions for any broiler embryo to grow Successfully are:

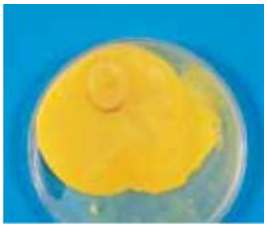
- Correct temperature
- Correct humidity
- Adequate gas exchange
- Regular turning of eggs

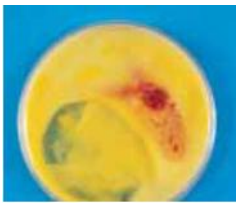


**Infertile**
No development visible.

**Day 1**
Appearance of tissue development

**Day 2**
Tissue very Appearance of blood vessels.






.

Day 3
Heart beats.
vessel

Day 4
Eye pigment

Day 5
Appearance of elbow
and knee

Day 6
Appearance Blood
very visible



Day 7
Comb growth begins
Egg tooth begins to appear.

Day 8
Feather tracts seen.
Upper and lower beak
equal in length

Day 9
Embryo starts to look bird-like.
Mouth opening appears.



Day 10
Egg tooth prominent.
Toe nails

Day 11
Comb serrated
Tail feathers apparent

Day 12
Toes fully formed First few
visible feathers.



Day 13

Appearance of scales.
Body covered lightly with feathers

Day 14

Embryo turns head
towards large egg

Day 15

Gut is drawn into
abdominal cavity visible

Day16
Feather cover complete body
.

Day 17
Amniotic fluid Decreases
Head is between Legs

Day 18
Growth of embryo
early complete
Yolk sac is still on
outside of embryo
Head is under the
right wing.

Day 19
Yolk sac draws into
body cavity.
Amniotic fluid gone
Embryo occupies
most of space
within egg (not in
the air cell)

Day 20
Yolk sac drawn
completely into body
Embryo becomes a chick
(breathing in air cell).
Internal and external pip.

**Fig. 1.7- (Days 1- 20) Development of Chicken Embryo**
**Source: COBB Hatchery Management Guide (2008)**

## 3.7 Temperature

Temperature determines the metabolic rate of the embryo and hence its rate of development. In a multi-stage machine, temperature should remain constant. The optimum temperature for both hatchability and chick quality will differ depending on the type of incubator. Higher or lower temperatures than the manufacturer's recommendations will lead to faster or slower development and consequent reduction in hatchability.

In single-stage incubation, temperature can be altered for the growth of the embryo and increased animal heat production, starting at a higher temperature and reducing in stages through transfer. Incorrect balance in loading multi-stage setters can create major temperature variations.

Partly filled machines may not achieve the correct temperature and prolong incubation, while loading double sets can create overheating problems. Both conditions will adversely affect hatchability and chick quality.

## 3.8 Humidity

During incubation, water vapor is lost from the egg through the pores of the shell. The rate at which this moisture is lost depends on the number and size of the pores (the gas conductance of the shell) and the humidity in the air around the egg. For best hatchability, an egg must lose 12% of its weight by 18 days of incubation. Chicken eggs require a relative humidity of 75 to 80 percent. Due to differences in shell structure and hence gas conductance, when all eggs are incubated under the same humidity conditions, there will be a variation in moisture loss. With eggs from broiler breeders, this variation does not normally have any significant effect on the hatchability. However, when age, nutrition or disease reduces the eggs'quality, it may be necessary to adjust incubator humidity conditions to maintain optimum hatchability and chick quality.

## 3.9 Turning

Eggs must be turned during incubation. This prevents the embryo from sticking to shell membranes, particularly during the first week of incubation, and aids development of the embryonic membranes. As embryos develop and their heat production increases, regular turning will aid airflow and assist cooling (Fig 8).

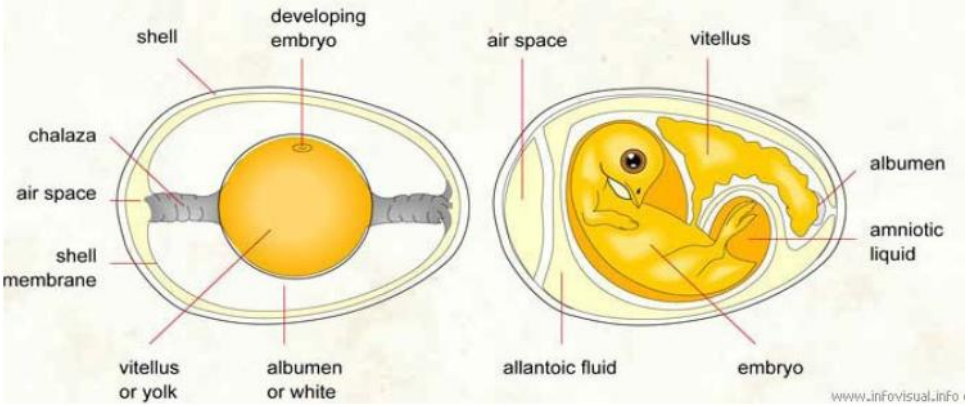



**Fig. 1.8: Interior views of chicken's egg before and after incubation**

## 3.10 Egg Transfer

Eggs are removed from the setter after 18 or 19 days and transferred to the hatcher trays. This is done for two reasons. The eggs are laid on their sides to allow free movement of the chick out of the shell at hatching. It also assists hygiene; large quantities of fluff are generated during hatching and could spread this potential contamination around the hatchery. Transferring too early or too late will result in embryos being subjected to sub-optimal conditions causing lower hatchability. This should be considered in any decision to vary the transfer time. Transfer times will differ according to the different types of setters (18 to 19 days are usually the norm).

1. The transfer operation should proceed smoothly and quickly to avoid cooling the eggs as this will delay hatching.
2. At transfer, eggs may be candled to enable clears (infertiles and early dead germs together with rots) to be removed and counted.
3. Shells are more brittle at this stage because the embryos have withdrawn some of the shell calcium for skeletal development. Therefore, care must be taken when transferring eggs to avoid breakages. Rough handled eggs at this stage may cause ruptures and hemorrhages. Automated transfer equipment enables this task to be carried out more gently than a manual system.
4. Ensure the hatcher trays are properly washed and allowed to dry before eggs are transferred. Eggs in wet trays will cool down while the water is evaporating in the hatcher. Hatchers must be dry and up to proper temperature prior to transfer.
5. Dispose of ‘rots’ and ‘exploders’ in a container of disinfectant.
6. In-ovo egg injection systems are now available, which may be considered for Mareks protection and administration of other vaccines. Manufacturers’ recommendations for use must be followed.

## 3.11 Operation of Hatcher

### 3.11.1 Ventilation and Humidity

Air supplied to the hatcher fresh air plenum should be 17cfm per 1000 eggs (28.7 Cubic meters per hour). From point of transfer to pipping, airflow and humidity in the hatcher should be maintained the same as in the setter. Moisture is important during the hatching process to ensure the shell membranes remain soft and pliable so that the chick can escape

unhindered. When pipping starts, the moisture level will rise causing the wet bulb temperature to also rise. At this point, the damper will require adjustment to maintain this level. Additional moisture may be required from the spray system. A few hours before takeoff the damper is opened to increase air supply for the chicks

### 3.11.2 Temperature

Hatcher temperatures are usually slightly lower than those of the setter to reduce the risk of overheating.

### 3.11.3 Chick Pull and Processing

Chicks are ready to be taken off when most of them are dry and fluffed up, with a few (about 5%) still having some moisture on the backs of their necks. A common mistake is to allow chicks to spend too long in the hatchers so they dehydrate excessively. Dehydration of chicks may result from incorrect adjustment of setting time for egg age or excessive weight loss during incubation. Similarly, if they are “green”, e.g., not yet ready, check setting times and also check for opportunities for the eggs to have become cooled down in incubation, reducing the rate of development. Upon pulling chicks, they have to be separated from their debris, graded into first quality and culls, and counted into boxes. Some hatcheries carry out additional operations such as:

- Sexing, primarily using feather-sexing with broilers but also Vent sexing with breeding stock
- Vaccination, sprayed or injected, using hand or automatic vaccinators
- Beak conditioning

During processing, chicks must be held in a controlled environment that prevents overheating or overcooling. They must not be overcrowded in the boxes or while on conveyers. To reduce weight loss from the chicks, maintain the correct humidity in the chick holding areas. Aim for 23 °C (73 °F) with a relative humidity of 65 - 70%. Avoid rough handling of chicks in manual operations and when equipment is used. Equipment must be correctly and regularly maintained.Clean all equipment thoroughly after each hatch. All chick contact areas such as conveyers and carousel must be easily accessible for cleaning.

## 3.12 Feather Sexing of Broiler Chicks

Enormous benefits have resulted from the ability to sex day-old chickens, not only for hatcheries but for the industry in general. The procedure has reduced the cost of rearing chickens by 50% which in turn has reduced labour and feed expenses. The advent of feather sexing has allowed the meat chicken industry (broilers) to separate males from females for a quicker turn around.

### Feather Sexing

Feather sexing isn't hard, but it requires that the chickens be bred to show their sex in differences in the feathers as chicks. Male chickens in these breeds have longer wing pinfeathers than the females do, which makes them relatively easy to tell apart. Most chickens do not have these traits bred into them, and the chicks are identical to all but the skilled eye of the pro- chicken sexer.

### Vent Sexing

Vent sexing is performed by examining a day old chick's vent for the presence, or lack of, the formation of a male sex organ. The chick is held upside down to perform the examination. "Experts" are 95%+ accurate at this method. "Non-professionals," after being taught the basics of vent sexing, can easily achieve an accuracy of 60-70%.

## 3.13 Hatchery Waste Disposal

These eggs, together with the eggshells that remain after pulling chicks, constitute hatchery waste. Legislation in some countries now prohibits the incorporation of hatchery waste into by-product meal due to the risk of spreading pathogenic organisms. There are very few profitable outlets for this material and most hatcheries will have to dispose of this as waste.

1. Unhatched eggs from the hatcher tray should be macerated to destroy any unhatched embryos. Pipped eggs and cull chicks should be destroyed using carbon dioxide gas or other locally acceptable procedure.

2. Macerated debris can be augured into a bin or trailer, or removed by vacuum into a sealed storage hopper. This should be disposed of according to local practice and environment constraints.

## 3.14 Chick Transport

Specially designed vehicles must be used to control the chicks' environment throughout the journey from hatchery to growing farm.

1. The minimum ventilation rate needed to satisfy adequate oxygen is 20 CFM (34 m3/hr) per 1000 chicks during winter weather, and twice this amount during hot weather. The vehicle should be equipped with an auxiliary heating system but may use fresh ambient air for cooling. If summer air temperatures exceed 86 °F (30 °C), cooling equipment is required.
2. The vehicle cab should have a display showing the temperature within the load to enable the driver to adjust air vents for cooling.
3. Chicks should be held at an in-box temperature of about 90 °F (32 °C) that can usually be achieved by a vehicle air temperature of 75 °F (24 °C) with plastic boxes or 71 °F (20 °C) with cardboard boxes.
4. Chicks delivered in plastic boxes require greater care to prevent overheating or chilling than those in cardboard. Ensure the vehicle has adequate heating and cooling to handle plastic boxes.
5. Boxes must be correctly stacked and spaced to allow free air movement around them. Each row of boxes should be locked with a bar running the full width of the vehicle to prevent any movement during the journey.
6. The vehicles can be provided with a rear plastic curtain to help retain heat while chicks are being unloaded.
7. Chick delivery drivers must be well trained and conscientious. Each driver should start the day with clean clothing and should change into fresh coveralls/footwear for each delivery. It is preferable for drivers not to enter the poultry house.
8. Power wash delivery vehicles with detergent/disinfectant on each return to the hatchery. Vehicles should carry a disinfectant spray so that the wheels can be cleaned between farms if delivering to more than one location in a day.
9. Chick boxes returning to the hatchery represent a high health risk. They must be kept separate and thoroughly washed and disinfected before re-use.

## 3.15 Maintenance

As hatcheries become larger and more automated, the need for preventative maintenance becomes crucial. Below are some suggestions:

1. Obtain manufacturers' recommendations for routine servicing and maintenance.
2. Perform a thorough inspection and cleaning at least once a year on multistage setters.
3. Have a spare machine to enable essential repairs to be carried out when necessary.
4. Keep a stock of regularly required spare parts and maintain an accurate inventory of items purchased and used.
5. Make sure staff that operates setters and hatchers are properly trained and familiar with their operation and have a procedure to follow in the event of machine failure.
6. Ensure adequate safety precautions are adopted. Provide the necessary guards and safety switches. Ensure all working practices comply with safety legislation.

**SELF-ASSESSMENT EXERCISE**

i. List five factors that may affect hatching potential of egg.
ii. Highlight four ways of maintaining hatchery.

## 4.0 SUMMARY

In this lecture, we have examined briefly the hatchery requirements and hatching egg management. Egg setting operation and the conditions of the setter and hatcher are the key factor that determines a successful egg hatching. Hourly developmental stages of egg were also highlighted. During transportation of the chicks, especially designed vehicles must be used to control the chicks' environment throughout the journey from hatchery to growing farm because this is considered as a vital aspect of hatchery process.

## 5.0 CONCLUSION

The measure of success of any hatchery is the number of first-quality chicks produced. Optimum hatchability and chick quality can only be achieved when the egg is held under optimum conditions between laying

and setting in the incubator. Therefore, the need for preventive maintenance of the hatchery becomes crucial.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Explain how temperature and humidity affect incubation.
2. List four Preventive Measures a farmer with a hatchery need for effective performance of its Hatchery.
3. List some conditions necessary for chicks during transportation.

## 7.0 REFERENCES/FURTHER READING

*COBB Hatchery Management Guide*(2008)**.** Cobb-Vantress Inc.Siloam Springs Arkansas.72761, US**.**

Extension Bulleting, (1998).*Hatchery Management Practices in Poultry.Agricultural Extension and Research Liason Services*.Ahmadu Bello University Zaria

Nico, Van Wageningen& Johan,Meinderts (1990).*Hatching Eggs by Hen or Incubator*.Agrodok 34, CTA Pub. Agromisa. P.O BOX 41 6700aa Wageningen, the Netherland.

MacK, O. North (1984).*Commercial Chicken Production Manual*,(3rd ed.). The AVI Publishing Company, Inc. Westport, Connecticut.

# UNIT 2 PULLET FARM MANAGEMENT

## CONTENTS



## 1.0 INTRODUCTION

A hen can lay only one egg per day and there are days when there is no egg production. The reasons for this Laying Schedule relate to the hen's reproductive system. A hen's body begins forming an egg shortly after the previous egg is laid, and it takes 26 1/2 hours for an egg to form fully. So there are shifts in the times of daily egg production. For example if the hen lays at 8.00am today, tomorrow, it lays at 10.30am, then 1.00pm etc. Thus eggs are not laid every day but in batches during the day time (between 8.00am and 5.00pm). Because a hen's reproductive system is sensitive to light exposure, eventually the hen

will lay too late in a day for its body to begin forming a new egg. The hen will then skip a day or more before laying again.

If one plans to start, or has started raising chickens for egg production, one needs to understand flock production capabilities. Such as: how to gauge the number of eggs the flock can produce and be aware of the variables that affect egg production. One should be able to identify which hens are laying and determine why one hen may not lay. By having a good grasp of these factors, success of the flock can be assured.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state why birds will not lay everyday
- explain the nutritional requirement of laying birds at every stage
- manage laying birds from day-old to the stage of production.

## 3.0 MAIN CONTENT

A layer is a commercially viable egg producing bird. The egg is in great demand because of its nutritive value, easy and quick preparation time and as co-ingredient in a wide variety of dietary preparations (house-hold and commercial). Hence Layer Farming has gained importance as the fastest growing industry in the livestock sector.Also, hens in a flock do not begin to lay on exactly the same day, nor do they continue laying for the same length of time. The flock comes into production quickly, peaks, and then slowly reduces the level of production. The length of time that a flock will produce eggs varies as well. Many home flocks produce eggs on and off progressively for three to four years. Each year, the level of egg production is lower than the previous year. Also, egg size increases and shell quality decreases each year.

Both the number of eggs you can get from a flock and the number of years a flock will produce eggs depend on several variables as follows:

- Breed

- Management of pullets prior to lay
- Light management
- Nutrition
- Space allowances.

**Breed**

Some commercial breeds of chickens have been developed specifically for egg production. The commercial White Leghorn is used in large egg production complexes, but these birds typically do not produce well in home flocks. They are simply too flighty. Moreover, they lay white-shelled eggs. People purchasing eggs from small flocks often prefer to buy brown-shelled eggs, even though no nutritional differences exist between brown-shelled eggs and white-shelled eggs.Breeding companies also have developed commercial layers for brown-shelled egg production, with some bred specifically for pasture poultry production. In addition, many hatcheries sell what are called sex-link crosses. These specific crosses allow the hatchery to sex the chicks at hatch based on feather colour. As a result, the number of sexing errors is reduced, so you are less likely to get an unwanted rooster.

Some people prefer a flock that is composed of different breeds. Such a flock can produce eggs having a selection of shell colours. Many dual-purpose breeds, such as Plymouth Rock and Rhode Island Red, lay eggs with light brown shells. Obviously, you can choose from several breeds. When making your decision about which breed or breeds to rise, keep in mind that commercial-type hens may give you a higher level of production initially, while other breeds tend to lay for more years.

**Pullet management**

It is important to manage pullets correctly, especially in the areas of nutrition and light management, because correct management will affect the level and quality of egg production once the birds start to lay. If the pullets come into production too early, they may have problems with prolapse, which can cause health problems across the flock. Also, the hens may lay smaller eggs throughout the production cycle. When raising pullets from day-old chicks, brood the chicks as you would any other type of chick. For future laying flocks, keep in mind that light management is important from brooding through all laying periods.

If you purchase pullets ready-to-lay, you should ask how the pullets were raised with regard to nutrition and light management so that you

can adjust your subsequent management of the flock accordingly. For example, you may have to delay light stimulation if the hens are too small.

**Light management for year-round production**

Chickens are called long-season breeders, meaning that they come into production as days become longer. That is, they start producing eggs when there are more hours of light per day. Typically, day-old chicks are kept on 23 to 24 hours of light per day for the first few days to make sure that they are able to find food and water, especially water. After that time period, you should reduce the number of hours of light per day. If you are raising the birds indoors, you can give them just 8 hours of light per day. If you expose them to outdoor conditions, you are limited by the number of hours of light per day in your area. When the pullets are ready to start laying, slowly increase the light exposure until they are exposed to about 14 hours of light per day.

This exposure should stimulate the flock to come into play. To keep the flock in lay year-round, you will need to maintain a schedule of at least 14 hours of light per day. You can increase the amount of light slowly to 16 hours per day late in the egg production cycle to help keep the flock in production. For most flock owners, this strategy involves providing supplemental lighting. Using a light with a stop/start timer, you can cause the light to come on early in the morning before sunrise and in the evening before sunset to ensure that the length of light exposure for the flock totals 14 to 16 hours. Also, you can get a light sensor so that the light bulb does not come on when natural daylight is available. By using such a device, you minimize your electricity use. The supplemental light you provide does not have to be overly bright. A typical 60-watt incandescent light bulb works fine for a small laying flock

**Nutrition**

Chickens of any type and age require a complete, balanced diet. Feed mills assemble the available ingredients in combinations that provide all the nutrients needed by a flock in one package. Some producers mix complete feeds with cheaper scratch grains, but doing so dilutes the levels of nutrients the chickens are receiving, and nutrient deficiencies can occur. Nutrient deficiencies can adversely affect the growth of pullets and the level of production of hens.

It is also important to feed the specific feed tailored for the type and age of the chickens you have. For example, do not feed a “meat-maker” type diet to growing pullets or laying hens as it will not meet their nutritional needs. Likewise, do not feed a layer diet to growing chickens. The diet of a laying hen is high in calcium, which is needed for the production of eggshells. This level of calcium, however, is harmful to non-laying chickens. Some hens have a higher need for calcium than others. It is always good to have an additional source of calcium available. Oyster shell, usually available in feed stores, is an excellent calcium supplement for a laying flock.

**Space allowances**

To produce effectively, laying hens must have adequate space. The amount of floor space required by a flock depends on the size of the chickens (which is related to the breed of chicken chosen) and the type of housing used. A minimum of 1.5 square feet per hen is recommended, with 2 square feet per hen being the most commonly used space allowance. Larger allowances are required for some of the larger breeds. To make use of the entire housing facility can be incorporated. The hens will sleep on the perches at night, keeping them off the floor. The use of perches also helps concentrate much of the manure in a single location for easier cleaning of the poultry house. Moreover, chickens have a desire to perch, so providing for this behaviour contributes to animal welfare.

If you provide outdoor space for your chickens, the amount of outdoor space needed depends on the quality of the space. If your goal is to maintain a pasture, you will require more area than you would need if simply providing outdoor access for a small backyard flock. An allowance of 2 square feet per hen typically is recommended for simple outdoor access. If you do provide your flock with outdoor access, be aware of predator possibilities from both the ground and the air, and provide the hens with the protection they require.

## 3.1 Identification of Laying Hens

To determine which of your hens are laying, it is important to know more about the type of hens you have. For many breeds, hens that are good layers do have large, bright red combs and wattles. For other breeds, the combs and wattles are of normal colour during the laying period but fade after the laying period. For hens with yellow pigment in the skin, such as Rhode Island Red and Plymouth Rock, the level of

pigmentation is a good indication of where the hens are in the production cycle. Hens lose the yellow pigment in a specific order. The colour fades first from the vent; then the face (beak, eye ring, and earlobe); and then the feet (shanks, toes, and hock). An additional method for identifying laying hens involves evaluating the level of fat in the abdomen and the abdominal capacity as measured by the distances between the pubic bones (abdominal width) and between the pubic bones and the tip of the keel, or breast bone (abdominal depth). The lower the level of fat and the larger the abdominal capacity, the more likely that the hen is laying.

**Fig. 1.9: Cage Sytem of Layer House**

Layer poultry farming means raising egg laying poultry birds for the purpose of commercial egg production. Layer chickens are such a special breeds of hens, which need to be raised from when they are one day old**.** They start laying eggs commercially from 18-19 weeks of age. They remain laying eggs continuously until they are 72-78 weeks of age. They can produce about one kg of eggs by consuming about 2.25 kg of food during their egg laying period. For the purpose of producing hybrid eggs layer, consider the various characteristics of cock and hen before

breeding. There are various types of highly egg productive layer breeds available throughout the world.

## 3.2 Layer Breeds

According to the nature and colour of egg, layer hens are of two types.

- **White egg laying hens:** These types of hens are comparatively smaller in size. Relatively eat less food, and the colour of egg shell is white. Isa White, Lehman White, Nikchik, Bab Cock BV-300, Havard White, Hi Sex White, Sever White, Hi line White, Bovanch White etc. are some popular white egg laying chickens.

- **Brown egg laying hens:** Brown egg laying hens are relatively larger in size. They consume more feeds, compared to white egg layers. They lay bigger eggs than other laying breeds. Egg shell is brown coloured. There are many types of brown layer available. Among those Isa Brown, Hi Sex Brown, Sever 579, Lehman Brown, Hi Line Brown, Bab Cock BV-380, Gold Line, BablonaTetro, BablonaHarko, Havard Brown etc. are very suitable for commercial layer poultry farming.

## 3.3 Keeping Chicks for Layer Poultry Farming

During the first weeks after birth, many chicks do not readily drink water due to transporting them from one place to another. So you have to make adequate water drinking systems in their brooder house, and you have to train them for drinking water. Mix 5% glucose with water, so that they can easily get energy. Provide them any type of high quality multivitamins by mixing with water. Multivitamins and electrolyte are very effective when you transport chicks from a long distance. It reduces tiredness and lack of water, and helps to make the chick grow normally.

### 3.3.1 Vaccination and its Importance for Layer Poultry Farming

Vaccination program is a must for chicks, so as to keep them free from all types of diseases. The main advantages of poultry vaccination are listed below.

- Timely vaccination results in disease resistance power in the body of chick.

- Help to keep the hen free from infective poultry diseases.
- Disease prevalence will be less.
- Mortality rate will reduce.
- And low Mortality Rate = More Production = More Profit.

There are many types of poultry vaccines are available for layer hens. Marex, Ranikheth, Gamboro, Bruchaities, Bosonto, Salmonela etc. are used for layer chickens.

**Before vaccination:**
You have to maintain some rules before vaccination.

- Hold the chickens with great care.
- Vaccinate the chickens without any strain.
- There is no need to vaccinate the sick hen.
- Wash the Vaccination Equipment with hot boiled water or germicide medicine/antiseptic.
- Do the vaccination program in cold weather condition.
- Preventive Vaccine is always applicable to healthy birds. Never vaccinate an infected bird.

## 3.4 Egg Production for Layer Poultry Farming

Egg production in a layer poultry farm depends on the care and farm management. If in farm take good care of your birds and manage them properly, then the production and profit will be high.

- Within the first 20 weeks of age, about 5% of hens start laying eggs.
- About 10% birds start laying at their 21 weeks of age.
- When they reach 26 to 30 weeks of age, they produce highly. Although, it may be different depending on their strain.
- After laying a maximum number of eggs, they usually stop laying for a few days.
- And after this period, their egg production might reduce slowly.
- Egg laying rate and size of eggs increases gradually.
- The hens grow till their 40 weeks of age.
- Weight and size of eggs increases till their 50 weeks of age.

### 3.4.1Method and Importance of Debeaking

Debeaking of laying hens is very important. The main benefits are listed below.

- Debeakin helps to reduce mutual fights.
- It helps to prevent food waste.
- Debeak chicks at 8 to 10 days of age.
- Debeak growing chicken at their 8 to 12 weeks of age.
- Debeak chicks 0.2 cm from their nose.
- Debeak 0.45 cm in the case of growing chickens.
- Debeak both upper and lower lips.
- Use block chick trimming machine to debeak.

Do not debeak two days after or before vaccination, after or before using some medicines like sulfur. Do not debeak if the hen has a strain, and during adverse weather conditions and if the hen start laying eggs.

Serve the chicken water mixed with Vitamin "K" three days before debeaking. Wash the debeakin instrument with antiseptic. Test the edge and temperature of blade. You have to be careful, and don't damage their eyes and tongue. Debeaking should be carried out in cold weather. Debeaking process should be carried out by an experienced technician. After debeaking, serve layers in a deep pot. Provide them some extra energy-enriched feed.

## 3.5 Water Management for Layer Poultry Farming

Chickens' health depends on the supply of pure, clean and fresh drinking water. You have to provide adequate water according to the demand of your laying hens. For purifying the water, mix Aquacure. Determine a suitable place to keep the water pot inside the poultry house. Supply cold water during the summer season and hot weather, and slightly hot water in cold weather or winter season.According to with the age and species of chickens, providing the right feed can control the weights of chicken. Use sufficient calcium, phosphorus, vitamins, amino acids and other mineral substances in their feed. For purifying water use Aquacure. If you follow the methods mentioned above, then you can make better profit from your layer poultry farming business.

## 3.6 Layer Farm Sequence

A standard procedure is followed for the **Layer Farm Sequence.** This procedure starts when female chicks are raised into pullets for commercial egg production. This stage is called 'rearing', and there are several common rearing systems. Some farms raise layer chicks on a

litter floor in a shed similar to a meat chicken shed. Other pullets are either finished off or reared entirely in wire-floored cages.

### 3.6.1 Brooding for Layer Poultry Farming (Day-old to 8 weeks)

When a hen sits still for a prolonged period without feeding or drinking normally, she is said to be 'broody'. This is a normal process during which the hen stops producing eggs in order to incubate a nest full of eggs. When the eggs hatch the hen then cares for the chicks by keeping them warm and finding feed and water for them. Modern strains of chicken have been selected not to go broody so that more eggs are laid over a period of time.When rearing chicks commercially the aim is to do the same thing as the hen. The stage of life when chicks need some additional heat is called the brooding stage. It lasts up to six weeks, depending on the temperature of the environment until the chicks can control their body temperature themselves. From day-old they usually receive chick starter feed which aims to ensure they have plenty of protein (19%) and energy for body growth.

### 3.6.2 Growing (9 to 20 weeks)

Once chicks can control their body temperature they still need to be protected from climate extremes. At this stage they receive pullet grower feed which is less expensive and contains only 15% to 17% protein and 7% less energy than the starter feed.

- The birds should be transferred to the grower house at 9 weeks of age
- The Waterer and Feeder should be adjusted as per the need of the birds
- Grower Mash should be fed to the birds
- Ensure there is cross ventilation
- De-beaking may be carried out as necessary
- Vaccinate Birds as scheduled
- Check feed intake and body weight at regular intervals
- Provide light for 12 hours a day
- Cull runts, unproductive and undesirable pullets as early as possible.
- Isolate diseased pullets.

**Moving**

Pullets are usually moved into their laying quarters, at 16-18 weeks of age, before they reach sexual maturity. This ensures that they are settled in before egg production begins. Handling birds at any time must be done with care to avoid injury. As pullets mature into laying hens they are fed a layer ration designed to enable them to perform best.

### 3.6.3 Adult Layer (20 to/up to 78 weeks)

Adult hens are the real workers of the industry. For best performance they need to be fed carefully and kept in a house at 21-28$^{o}$C. This means that hen houses are designed to keep as near as possible to this temperature year round. The hens are checked regularly to monitor their health and medicines may be administered as needed. Tinted egg strains usually require less feed (105g feed/hen/day) than brown egg strains (120g feed/hen/day).The quality of feed provided to hens may be varied for the level of production. Hens can need more nutrients just before and during their peak production than at other times. This is called phase feeding. It can be economical to adjust rations for such high demand periods.

## 3.7 Egg Collecting and Grading

Mechanical collection of eggs is common in modern layer farms. It takes about 26 hours for each egg to develop and each hen lays an egg a little later each day. This is not an exact thing and most eggs are laid in the morning. Eggs should be collected regularly and transferred from the hen house to an egg room where they are graded or checked for weight and for damaged shells. A sample of eggs is often broken open to check internal quality. Eggs are packed into cartons for 12 eggs or trays of 30 eggs for sale. Prices vary with egg size, so eggs must be separated on the basis of egg weight. This is done automatically by a machine called an egg grader.

## 3.8 Marketing for Layer Poultry Farming

Eggs are stored in a cool room at about 13$^{o}$C and transported in an insulated truck. Unfortunately, many shops selling eggs do not store them under ideal conditions. In the home and shop situation, it is best to store them at normal refrigerator temperature (4-6$^{o}$C). Marketing

involves a range of prices, depending on the different sizes of egg, different brands, or other differences which attract particular buyers. Free-range and fat modified eggs are among the varieties available.

**SELF-ASSESSMENT EXERCISE**

i. Write short notes on the different stages of a layer with their respective durations.
ii. Give a short description of the two types of layer birds.

## 4.0 SUMMARY

Laying Birds production has been discussed fully in this unit. Factors that are important in effective production, signs of non-productive birds, vaccination and grading and marketing of eggs are all involved in the production chain.

## 5.0 CONCLUSION

A layer is a commercially viable egg producing bird. Egg is in great demand because of its nutritive value, easy and quick preparation time and as co-ingredient in wide variety of preparation (household and commercial). Hence layer farming has gained importance as the fastest growing industry in livestock sector.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Highlight three importance of debeaking in laying birds.
2. List four ways of identifying productive laying birds.
3. Highlight five benefits of vaccinating laying bird.

## 7.0 REFERENCES/FURTHER READING

Aboluwade, A. (2012, April 1). *Northerners Consume 50% Of Eggs Produced In Nigeria.*Retrieved November 20, 2012, from Punch Nigeria:

http://www.punchng.com/business/agric-economy/northerners-consume-50-of-eggs-produced-in-nigeria-%E2%80%A2-some-smugglers-of-frozen-chicken-preserve-them-with-chemical-used-in-preserving-corpses

Akinwumi, J., Okike, I., & Rich, K. M. (2010).*Analyses of the Poultry Value Chain and Its Linkages and Interactions with HPAI Risk Factors inNigeria.*

DFID, FAO, RVC, Rural Development Research Consortium, International Food Policy Research Institute, International Livestock Research Institute.

Anderson, L., &Gugerty, M. K. (2010). Poultry Market in West Africa: Nigeria. Evans School of Public Affairs, University of Washington.

# MODULE 3 POULTRY MEAT PRODUCTION



## UNIT 1 BROILER CHICKEN PRODUCTION AND MARKETING

**CONTENTS**



## 1.0 INTRODUCTION

Broilers are birds which have been selected for fast growth so as to be ready for the market at about eight weeks. Broilers are usually reared on Deep Litter (Fig 18). There have been reported cases of production on cages but with consequence of breast blisters which reduce the bird's market value. If cages are used, the floor should be covered with soft material. The attainment of market weight of broilers depends mostly on the quantity and quality of feeds.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain broiler production and all factors necessary for consideration during production.

## 3.0 MAIN CONTENT

### 3.1 Management of Broilers

The management of broilers includes brooding, which has being fully discussed in unit 2 Module 4. The Brooder House must be well ventilated and the stocking density high. The intensity of light should be low as broilers require light only to see their feed. A high light intensity will depress growth rate. Feeding must be adequate to prevent cannibalism in the flock.

Broiler rations are of two types – broiler starter mash (fed from day old to about 4-5 weeks) and broiler finisher (fed from about 4-5 weeks to market weight). A batch system of broiler production is recommended. This is known as “All in All out” system. The production schedule should be such that the whole house can be cleared in between batches to prevent the build-up of disease organisms.

**Fig. 1.10: Deep Litter System of Broiler Production**

## 3.2 Feeding of Broilers

Broilers are male and female birds reared for meat. Broilers when properly fed and cared for, are ready for the market between 6 and 8 weeks age. The speed of attainment of market weight of 2.5-3.0kg live weight depends mostly on the quantity of feeds.

## 3.3 Supply of Nutrients

**Energy**

Broilers require energy for growth of tissue, maintenance and activity. Carbohydrate sources, such as corn and wheat, and various fats or oils are the major source of energy in poultry feeds. Energy levels in diets are expressed in Mega Joules (MJ/kg) or Kilocalories (kcal/kg) of Metabolizable Energy (ME).

**Protein**

Feed proteins, such as those in cereals and soybean meal, are complex compounds that are broken down by digestion into amino acids. These amino acids are absorbed and assembled into body proteins that are used in the construction of body tissues, e.g. muscles, nerves, skin and feathers. Dietary Crude Protein levels do not indicate the quality of the proteins in feed ingredients. A good protein quality diet is based on the level, balance and digestibility of essential amino acids in the final mixed feed. Higher levels of digestible amino acids have been shown to improve profitability by increasing broiler performance and processing yield.

**Macro minerals**

The provision of the correct levels of the major minerals in the appropriate balance is important for high-performing broilers. The macro minerals involved are calcium, phosphorus, sodium, potassium and chloride.

**Calcium and phosphorus**: Calcium in the diet of broilers influences growth, feed efficiency, bone development, leg health, nerve function and the immune system. It is vital that calcium is supplied in adequate quantities and on a consistent basis. Phosphorus, like calcium, is required in the correct form and quantity to optimise skeletal structure and growth.

**Sodium, potassium and chloride**: These minerals are needed for general metabolic functions. Shortages can affect feed intake, growth and blood pH. Excess levels of these minerals result in increased water intake and subsequent poor litter quality.

**Trace minerals and vitamins**

Trace Minerals and Vitamins are needed for all metabolic functions. Appropriate Vitamin and trace Mineral Supplementation depends on the feed ingredients used and local circumstances. Due to differences in vitamin levels of various cereals, the level of supplementation of some vitamins must be modified. Accordingly, separate recommendations are usually made for some vitamins, depending on the cereals (e.g. Wheat versus maize) used in diet.

**Enzymes**

Enzymes are now being routinely used in poultry feeds to improve digestibility of feed ingredients. In general, enzymes that act on carbohydrates, proteins and plant-bound minerals are available.

**Two types of feed are usually fed:**

**a.** **Broiler Starter Diet**: These diets contain between 22 and 24% crude protein and an energy content of 3000 Kcal/kg. The feed is usually fed from day-old up to four weeks of age.

**Grower feeds**

Broiler Grower Feed is generally fed for 14 to 16 days following the Starter. Starter to Grower transition will involve a change of texture (maintaining the crude protein and energy value) from crumbs/mini-pellets to pellets. Depending on the pellet size produced, it may be necessary to feed the first delivery of Grower as crumbs or mini-pellets.

**b. Broiler Finisher Diets**: These diets contain 20% Crude Protein and Energy content of 3000 kcal/kg to 3200 Kcal/kg. This diet should be fed from 25 days of age up to 8 weeks of age. Broiler Finisher Feeds account for the major volume and cost of feeding a broiler. It is therefore important that feeds are designed to maximize financial return for the type of products being produced. Finisher Feeds should be given from four to five weeks until processing.

## 3.4 Environment

Nitrogen and Ammonia emissions can be reduced by minimizing excess Crude Protein levels in the Feed. This is achieved by formulating diets to balanced recommended levels of digestible essential amino acids, rather than to minimum Crude Protein levels. Phosphorus excretion rates can be reduced by feeding closely to the bird's requirement and utilizing phytase enzymes. Birds must be protected from poor ventilation and extremes in temperature. The house should be constructed with their length parallel to wind direction.

## 3.5 Litter Quality in Broiler House

Litter quality directly affects the health of the bird. Lower moisture levels in the litter help to reduce respiratory stress by reducing the amount of ammonia in the atmosphere. Good quality litter will also reduce the incidence of foot pad dermatitis.With suitable management, health and environmental practices, the following nutritional strategies will help to maintain good litter quality:

- Avoid excessive levels of Crude Protein in diets.
- Avoid high salt/sodium levels, as this will increase bird water intake and cause wet litter.
- Avoid using poorly digestible or high fiber feed ingredients in the diets.
- Provide good-quality feed fats/oils in the diet, as this helps avoid enteric disorders which produce wet litter.

## 3.6 How to Improve Feed Efficiency on a Broiler Farm

The efficiency of feed utilisation is a very important factor for consideration by a poultry farmer that wishes to stay in business. The following measures should therefore be taken to improve efficiency for feed utilisation by flock managers

Reduce feed spillage by attendants during feeding.

- Provide well design feeders with "lips".
- Do not fill feeders more than ½ full.
- Control rats, as they contaminate and waste feeds.
- Ensure that the feeders are hung such that the levels of the feeder should be about.

level with the back of the hens.

- In a given flock, provide adequate feeding space such that at least 75% of the birds must be able to feed at once.

## 3.7 Water Supply

A chicken consumes two to three times as much water as the feed it consumes. Therefore, when water supply to the flock is restricted, feed intake drops and consequently egg production declines. It is therefore essential to provide all poultry flocks with fresh, cool and clean water at all times (A*d libitum*).

- Provide adequate number of drinkers of correct sizes for the age of the flock.
- Wash drinkers daily.
- Serve fresh cool water and clean the drinkers at least twice a day – mornings and evenings.
- Place drinkers on raised platforms to minimize water wastage and contamination.

**Floor spacing**
The following space requirement is recommended for broiler
Space Requirement

| | |
|---|---|
| a. Day-old to three weeks | 9.14 cm/chick |
| b. 3 weeks to 4 weeks | 15.24 cm/chick |
| c. 5 weeks to Market Age | 30.48 cm/bird |

**Feeding space**

| | |
|---|---|
| a. Day-old to 4 weeks | 2.5 cm/bird |
| b. 4 weeks to 8 weeks | 5 to 6.5 cm/bird |

**Watering space**

| | |
|---|---|
| a. Day-old to 4 weeks | 0.5 cm/bird or two 3.79L drinking fountains/100 birds |
| b. 4 weeks to 8 weeks | 0.6 to 1 cm/bird or two 7.57L drinking fountains/100 birds |

## 3.8 Housing Systems

Broilers can be housed on deep-litter, slatted or wire floor or cages. However, cage, slat and wire floor rearing of broilers are not as popular as litter floor rearing, due to problems like breast blisters, leg weakness and higher initial investment.

**Rearing systems**
The systems of rearing refer to either single batch at a time (all-in all-out system) or multiple batches of brooding and rearing of broilers

## 3.9 Vaccination Schedule

| S. No. | Age | Vaccine | Route of Administration |
|---|---|---|---|
| 1 | First day | Marek's (at hatchery) | S/C at neck |
| 2 | 5-7th day | RDV F1 | I/O or I/N |
| 3 | 14th day | IBD Vaccine | I/O or I/N |
| 4 | 21st day | RDV LaSota | Drinking Water |
| 5 | 28th day | IBD Vaccine (Booster) | Drinking Water |

## 3.10 Marketing

A proper market survey is essential as that will enable the farmer to identify the current and emerging markets where broiler mean can be sold at a better price.

Marketing activities include among other value adding, grading, quality, promotions and packaging. A proper utilisation of these activities is essential as that will lead to selling large volumes of products as quickly as possible resulting in the farmer making a lot of profit.

**Value adding**: In broiler production, processes that need to be performed within the business aimed to add value to the product before selling are: slaughtering, cutting chicken portions, grading, weighing and packaging. It is advisable that farmers process their meat products within the business and before selling, because the product will attract better prices than relatively unprocessed meat.

**Quality:** The final performance of broiler meat in the market depends on the quality of the chicks. Therefore, farmers should provide the flock with proper feeding, good ventilated houses and proper handling during the growth stage to ensure good quality meat. It is important for farmers to ensure that chickens are always alert, have uniform weight and no deformities on placement which are results of good management practices. In addition; chicken should be sold when it is still fresh from that farm, or after culling

**Promotions:** Advertising is essential for the success and growth of any Poultry business as it will help farmers to identify and attract potential customers as well as build good relationship with them. Therefore, farmers should promote broiler products well so that they make them appear to be different from others and that will increase the demand for their broiler products

**Packaging:** Packaging is important, not necessarily for protecting the product but for the profitability of poultry business. Targeted packaging will increase sales.

**SELF-ASSESSMENT EXERCISE**

i. Explain four ways of enhancing the marketability of broilers
ii. List two nutritional methods of maintaining litter quality.

## 5.0 SUMMARY

Broiler production is considered in this unit. The Principles guiding the management and production were discussed. Possible ways of increasing efficiency in the Broiler Farm was also discussed.

## 4.0 CONCLUSION

Broilers birds are fast growing birds; they are ready for the market at about 8 weeks. Broilers are usually reared on Deep Litter. The birds are fed either Broiler Starter or Broiler Finisher Feed depending on their age. Eighty percent of the energy content of the feed is obtained from Grains (Maize). To increase productivity feed utilisation by the birds must be enhanced, water must be supplied *Ad-libitum* and litter properly managed.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Highlight five measures of improving efficiency in Poultry Farm.
2. Write briefly on the types of feed and the key nutrient supplied used during Broiler Production.

## 7.0 REFERENCES/FURTHER READING

Sonaiya, E.B. (2007). Family Poultry, Food Security and the Impact of HPAI.*World Poultry, Science Journal*.

CTA. (1990). *Small-Holder Rural Poultry Production - Requirements of Research and Development.* Thessaloniki, Greece.

FAO. (1980). Survey and Feasibility Study, Livestock Sector, Nigeria.*Terminal Report*, FAO/UNDP Project NIR/75/038.

# UNIT 2 OTHER MEAT POULTRY SPECIES- TURKEY, GEESE, OSTRICH

## CONTENTS

## 1.0 INTRODUCTION

Poultry industry is an emerging agri-business it has established its position as the fastest growing segment in the agricultural sector in Nigeria. With the increased acceptance of chicken, egg and meat, the demand for these products is ever increasing. However, there is need to understand the management and production of other Poultry species apart from chicken, (meat type and egg type) to be able to feed the teeming population of Nigeria.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- list other species of poultry
- state the production principles of different kinds of poultry birds such as: Ostrich, Turkey, Guinea fowl etc.
- explain the Nutrient Requirements of the different kinds of Poultry Birds.

## 3.0 MAIN CONTENT

### 3.1 Turkey Production

Turkeys (*Meleagrisgallopavo*) are native to the New World. They have been regarded as ‘’traditional thanksgiving’’ and Christmas fare since the Pilgrims hunted wild turkeys to grace their tables on the first Thanksgiving Day.

#### 3.1.1 Housing

The main reason to provide housing for birds is to provide protection from the weather. Housing also provides protection from predators, reduces the spread of pathogens and provides protection from vandalism. Additionally, housing enables the separation of birds according to age for easy management. In the case of small flocks, simple structures may be built using locally available material. For commercial production, turkeys are raised under intensive conditions similar tothose of broiler chickens.

#### 3.1.2 Factors to Consider in Constructing a Commercial Turkey

**House include**:
**Orientation**: The orientation of the building with respect to the sun and prevailing winds is important. An east-west orientation is preferable, as it minimizes heat gain in summer. The house must be constructed in such a manner that it takes into account the prevailing winds to enhance drying of manure or litter.

**Width**: The house should be no more than 10 m wide. Widths greater than 10 m have difficulties with ventilation, especially if open-sided houses are used for rearing.

**Length**: Any length could be used.

**Distance from other poultry houses**: The house should be a reasonable distance from other houses to minimize disease spread.

**Topography**: The topography should be high and level with no abrupt slopes. A relatively level area requires less site preparation, thus reducing construction costs.
**Drainage**: A porous soil and gentle slope will enhance dryness.

**Floors**: Solid floors are preferred over earth floors as they are durable, easy to clean and disinfect.

**Type of house**: Poultry houses can be open-sided (rely on natural ventilation) or environmentally controlled (temperature and ventilation are controlled). Open-sided houses are cheaper to construct and maintain than environmental houses.

### 3.1.3 Preparing for Arrival of Poults

The poultry house should be cleaned and disinfected and left unoccupied for at least 14 days prior to poult placement. Also, equipment such as feeders, drinkers, brooders etc. should be cleaned and disinfected. Fresh litter (straw, wood shavings etc.) should be spread over the floor area and brooder guards/rings set up. Wood shavings are the common litter. Litter provides insulation from the floor and will soak up moisture from the droppings. It also helps to prevent damage to the birds' legs due to slipping on slippery surfaces. The depth of the litter should be 8 to 10 cm. Feed and clean water should be provided before poults' arrival. Feed may be placed in flat surfaces such as egg flats or box lids to encourage poults to feed. The producer should introduce poults to water by dipping their beaks in the water immediately they are placed on the floor. Poults may be encouraged to drink and feed by hanging bright 100 watt bulb 1 m above litter level. Furthermore, poults may be encouraged to eat by placing feed in small silver-coloured trays, and to drink by

placing coloured marbles in the drinkers. The heat source should be on 24 hours before the arrival of poults.

### 3.1.4 Brooding

The term brooding refers to the period of the poult's life extending from one day-old to about 6 weeks of age. Poults are usually placed in brooder rings for the first 5 to 6 days. From 7 days to 5 weeks of age depending on the sex of the bird, they are given from 0.9 to 1.4 $m^2$ (1 to 1.5 square feet) of floor space per bird. During this time, the poult needs supplemental heat, special starter feed, and protection from exposure to disease. One way of reducing disease infestation is to separate the brooding phase from the growing and reproductive phases.

#### 3.1.4.1 Brooder Guards/Rings

In the early stages of brooding, it is ideal to confine newly hatched poults to a smaller space to keep poults close to brooder stoves for heat, feed and water for the first 5 to 7 days of age or longer in colder weather. Brooder guards usually consist of a 30 to 45 cm wide strip of hard board which has been cut to an appropriate length in order to form a ring 2.4 to 3.6 m in diameter. It is set up in the pen where the chicks are placed, and is removed once they are a few days 1 old and have started jumping over it. The size of the guards is increased as poults get older to give them enough room to move about or to move away from brooder as temperature gets higher than they can tolerate.

#### 3.1.4.2 Brooder Stove Arrangement and Temperature

Usually, each brooder has three drinkers and at least three feeders. As mentioned earlier, to encourage day-old poults (DOP) to start eating and drinking, three to five clean egg flats or some newspapers may be placed around each brooder with feed sprinkled on each one. Drinkers are placed next to the feeders. Depending on the season, brooders should be adjusted in such a way that it provides a comfortable environment for the poults. The height of the brooder stoves may need to be increased slightly each day after 2 days of age. Brooders in curtain type buildings do not have to be raised often, but need to be adjusted to keep poults from roosting on them and burning their foot pads. The temperature for DOPs should be around 35 °C, as DOPs need plenty of heat. This

temperature should be reduced by 1 °C every three days until a temperature of 21 °C is reached. Temperatures are used only as guides because the best way to adjust the temperature for the comfort of the poults is to observe their behaviour, if poults crowd near the heat source and chirp loudly, it means the temperature is too low. If they move well away from the heat source and start panting, they are too hot. Ideally they should be fairly quiet and spread evenly under and around the heat source.

### 3.1.5 Lighting

Constant lighting at a fairly high intensity (20-50 lux) is required to aid poults in getting used to their new environment as well as to find the water and feed. Light intensity is lowered to 5 lux after about 5-7 days. At this light intensity it is nearly impossible to read a newspaper in the shelter. The lower light intensity helps to minimize cannibalism. After 3-7 days, lighting programs that reduce the number of hours of light a day during the growing period can be used to reduce the incidence of various metabolic diseases and lame birds when raising broilers or turkeys. Reducing day length to 8-12 hours per day, even having lights on only during natural day light hours should help reduce the number of lame and diseased birds. If continuous light is used, an hour of darkness should be provided daily to prevent crowding and piling up in corners (causing suffocation) when a power failure occurs. Birds raised for egg-laying purposes should be provided a maximum of 8-10 hours of light daily until they are sexually mature and produce eggs, which is usually at 20 weeks of age.

**Fig. 11: Turkey Production**

### 3.1.6 Nutrition and Feeds

During the first week of brooding, small amounts of feed should be provided in feed trays, box lids, egg flats and/or spread on newspapers on litter to encourage them to feed. Also, placing feed and water close together in the first few days of brooding assists the chicks to eat and drink, thus reducing mortality due to starvation. However, after a few days feed should be placed immediately adjacent to drinkers to prevent wet feed and dirty water.

### 3.1.7 Debeaking (beak trimming)

Poults should be debeaked in order to control feather picking and cannibalism, especially if they are raised in confinement. Debeaking is carried out at 10 days of age to prevent cannibalism.

### 3.1.8 Desnooding

The removal of the snood or dew-bill (the tubular fleshy appendage on top of the head near the front) is referred to as “desnooding”. It helps to prevent the head injuries from picking or fighting and may reduce the spread of erysipelas should this disease get started in the flock. The snood can be removed at one-day-old by thumbnail and finger pressure. After about three weeks, it can be cut off close to the head with sharp, pointed scissors.

### 3.1.9 Toe Clipping

Toe clipping or removal of toenails is usually carried out at the hatchery, but toes of turkeys as old as five weeks can be clipped when turkeys are debeaked. Toe clipping can improve the grade of processed turkeys. Turkeys in large groups, especially when excited, often step on each other causing scratches or skin tears on the backs and sides. The problem is aggravated with increased flock sizes and densities, especially when turkeys are reared in confinement. The most common form of toe clipping involves cutting the inside and middle toe (front) on each foot. Toes can be cut with surgical scissors, a nail clipper or a modified hot-blade debeaker.

### 3.1.10 Nutrition and Feeds

Nutritional requirements of growing turkeys and breeders have been extensively researched. The modern turkey nutritionist uses formulas developed by scientific research and modifies these to meet the needs of a particular strain of turkey. A turkey diet containing 24% and 28% crude protein (CP) should be fed until 8 weeks of age. Ideally, a diet containing 28% CP should be fed for the first 4 weeks of life and thereafter CP reduced to 24% for the next 4 weeks. The protein level is further reduced to 20% and fed until marketing age. A conventional feeding program for turkey toms (males) is given in Table 3.

**Table 3: Nutrient Requirements of Turkeys According to Age**

| Diet | Age | CP | ME | Meth. | Meth&Cys | Lys | Ca | Av.Phosphorus |
|---|---|---|---|---|---|---|---|---|
| Starter 1 | 0-2 weeks | 28.00 | 2850.00 | 0.70 | 1.10 | 1.70 | 1.40 | 0.80 |
| Starter 2 | 2-4weeks | 26.00 | 2950.00 | 0.62 | 1.00 | 1.60 | 1.30 | 0.70 |
| Grower 1 | 4-8weeks | 23.00 | 2050.00 | 0.60 | 0.90 | 1.45 | 1.20 | 0.60 |
| Grower 2 | 8-12weeks | 20.00 | 3150.00 | 0.55 | 0.82 | 1.30 | 1.10 | 0.50 |
| Developer | 12-15weeks | 18.00 | 3225.00 | 0.50 | 0.79 | 1.00 | 0.90 | 0.45 |
| Finisher 1 (female) | 12-16weeks | 16.00 | 3300.00 | 0.45 | 0.65 | 0.90 | 0.90 | 0.45 |
| Finisher 2 (male) | 15-18weeks | 16.00 | 3350.00 | 0.40 | 0.62 | 0.80 | 0.80 | 0.40 |
| Finisher 2 (male) | 15-20weeks | 16.00 | 3250.00 | 0.38 | 0.60 | 0.75 | 0.90 | 0.40 |

CP – crude protein; ME – Metabolizable energy: Meth – methionine; Cys – cystine; Ca – calcium; Av. Phosphorus – available Phosphorus.
Source: Leeson& Summers (1997)

**Table 4: Growth Rate, Feed, and Energy Consumption of Large-type Turkeys**

| Age | Body weight | Body weight | Feed consumption per week | | Cumulative feed consumption | | ME consumption per week | |
|---|---|---|---|---|---|---|---|---|
| | (kg): M | (kg): F | (kg): M | (kg): F | (kg): M | (kg): F | (Mcal): M | (Mcal): F |
| 1 weeks | 0.11 | 0.11 | 0.10 | 0.10 | 0.10 | 0.10 | 0.30 | 0.30 |
| 2 weeks | 0.27 | 0.24 | 0.20 | 0.17 | 0.30 | 0.27 | 0.60 | 0.50 |
| 3 weeks | 0.58 | 0.47 | 0.45 | 0.39 | 0.75 | 0.66 | 1.1 | 0.80 |
| 4 weeks | 1.0 | 0.70 | 0.61 | 0.46 | 1.36 | 1.12 | 1.7 | 1.2 |
| 5 weeks | 1.5 | 1.1 | 0.70 | 0.60 | 2.06 | 1.72 | 2.3 | 1.6 |
| 6 weeks | 2.0 | 1.6 | 0.86 | 0.76 | 2.92 | 2.48 | 2.9 | 2.1 |
| 7 weeks | 2.6 | 2.1 | 1.08 | 0.89 | 4.00 | 3.37 | 3.5 | 2.6 |
| 8 weeks | 3.3 | 2.6 | 1.30 | 1.04 | 5.30 | 4.41 | 4.1 | 3.1 |
| 9 weeks | 4.0 | 3.1 | 1.51 | 1.18 | 6.81 | 5.59 | 4.8 | 3.6 |
| 10 weeks | 4.7 | 3.7 | 1.78 | 1.34 | 8.59 | 6.93 | 5.2 | 4.1 |
| 11 weeks | 5.5 | 4.3 | 1.99 | 1.47 | 10.58 | 8.40 | 5.7 | 4.6 |
| 12 weeks | 6.3 | 4.8 | 2.25 | 1.59 | 12.83 | 9.99 | 6.3 | 5.1 |
| 13 weeks | 7.1 | 5.3 | 2.51 | 1.70 | 15.34 | 11.69 | 7.1 | 5.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 weeks | 8.0 | 5.8 | 2.66 | 1.75 | 18.00 | 13.44 | 7.8 | 5.8 |
| 15 weeks | 8.8 | 6.3 | 2.89 | 1.82 | 20.89 | 15.26 | 8.4 | 6.1 |
| 16 weeks | 9.7 | 6.7 | 3.05 | 1.92 | 23.94 | 17.18 | 8.8 | 6.4 |
| 17 weeks | 10.5 | 7.1 | 3.13 | 2.03 | 27.03 | 19.21 | 9.6 | 6.7 |
| 18 weeks | 11.3 | 7.5 | 3.27 | 2.07 | 30.34 | 21.28 | 10.2 | 6.9 |
| 19 weeks | 12.1 | 7.8 | 3.43 | 2.15 | 33.77 | 23.43 | 10.9 | 7.1 |
| 20 weeks | 12.8 | 8.1 | 3.60 | 2.23 | 37.37 | 25.66 | 11.6 | 7.3 |
| 21 weeks | 13.5 | | 3.71 | | 41.08 | | 12.5 | |
| 22 weeks | 14.2 | | 3.82 | | 44.90 | | 12.9 | |
| 23 weeks | 14.8 | | 3.94 | | 48.84 | | 13.2 | |
| Source: Leeson& Summers (1997) | | | | | | | | |

### 3.1.11 Health Management

It appears that turkeys are rather susceptible to diseases, indicating that they require a much higher level of management and skill than for other domestic fowls. There are four primary causes of disease: genetics, nutrition, environment and infection.

### 3.1.12 Diseases

Some common diseases of turkeys include Blackhead, Newcastle Disease (NCD), Erysipelas, Fowl Cholera, Fowl Pox and Haemorrhagic Enteritis.

### 3.1.13 Blackhead Disease [Histomoniasis]

Blackhead disease, or more correctly, histomoniasis, is primarily a disease of young turkeys. Chickens are more resistant to the effects of the infection but may act as carriers of the disease-causing organism. Histomoniasis is caused by a microscopic protozoan called HistomonasMeleagridis. The name blackhead is a poor descriptive term because the heads of the birds infected with this parasite are not dark. The protozoan causes considerable damage to the liver and ceca of infected turkeys, and the untreated birds usually die.

#### 3.1.13.1 Signs

A decrease in feed consumption and loss of weight may be the first signs observed. Sick birds appear dull and depressed, and often stand by themselves with dropping trails, ruffled feathers, and a sleepy appearance. Sulphur colored yellow droppings may be observed. If birds are not treated, or if treatment is delayed, mortality may be very high. Birds dying of histomoniasis have characteristic enlarged livers with circular depressed areas and enlarged ceca containing a rather dry cheesy material. Recovered birds may show swollen hard and scarred livers at the time of slaughter.

#### 3.1.13.2 Treatment

The drug Dimetridazole can be added to the drinking water or feed to control outbreaks of histomoniasis. Other drugs occasionally are used for treatment but are better used as preventatives. Sick birds should be isolated from the main flock and treated separately. Dead birds should be burned or buried deeply. All equipment used by an infected flock should be thoroughly cleaned and disinfected.

#### 3.1.13.3 Prevention and Control

The protozoa-causing blackhead may remain infective within the eggs of the cecal worms in the soil for nearly three years therefore each flock of new turkeys should be raised on new uncontaminated ground. Young turkeys should never be reared near older turkeys or with chickens that may carry the infection. In addition to domestic chickens, various wild

birds such as pheasant and grouse may serve as reservoirs of infection for domestic turkeys.

The periodic moving of feeders, waterers, and roosts will help prevent the local build-up of infective organisms. Good sanitation and litter management will help prevent transmission of the cecal worm as well as the blackhead organism. Many histiostats or preventative drugs are available and they are commonly included in commercial turkey rations. Because of the very serious nature of blackhead in turkeys, it is advisable to develop a regular program of preventative drug treatment.

### 3.1.14 Haemorrhagic Enteritis

Hemorrhagic Enteritis is an acute gastrointestinal disorder affecting young turkeys. In its most severe form, it is characterised by depression, bloody droppings, and substantial mortality.Hemorrhagic enteritis is geographically widespread and considered endemic in areas where turkeys are raised commercially. The usual route of infection is oral, and virus is often introduced onto previously uninfected premises via personnel or equipment contaminated withinfectious faeces. Turkey poults aged less than 4 weeks are resistant to infection due to age-related resistance or, the presence of maternal antibody. The virus may survive under moist conditions in litter beyond the refractory period. Large quantities of virus are shed in the faeces facilitating rapid spread of disease. Morbidity usually approaches 100%. In addition to good biosecurity, prevention hinges on the use of vaccines which are administered in the water at 4-5 weeks of age.

### 3.1.15 Erysipelas

Erysipelas occurs sporadically in poultry of all ages. Turkeys are susceptible regardless of sex or age. Outbreaks usually occur suddenly, with a few birds being found dead followed by increasing mortality on subsequent days. Mortality may range from less than 1% to 50%. The causative agent is Erysipelothrixrhusiopathiae. The organism is shed in faeces from infected animals and contaminates the soil, in which it may survive for long periods depending on temperature and pH. The onset of cold and rainy weather is associated with disease occurrence. Poultry, as well as other animals, may be carriers and shed the organism without showing clinical signs of disease.

In addition to causing mortalities, the disease reduces the fertility status of toms. Marketing losses may also result from condemnations or downgrading of carcasses due to the evidence of septicaemia or lack of finish. Erysipelas is controlled by vaccination using both inactivated and live vaccines.

### 3.1.16 Biosecurity

Biosecurity is utilisation of measures which can stop or slow down the introduction and spread of infection into or between components of production systems. It includes managing people, equipment, pests and their potential for carrying diseases into a flock. Biosecurity must be a priority to control infectious disease and minimize introduction of pathogens into flocks.

Biosecurity measures include:

- ✓ allow only necessary visitors to production sites;
- ✓ install fence enclosures;
- ✓ control movement of workers and equipment between shelters, production sites and age groups;
- ✓ provide foot baths, showers and protective clothing at strategic points;
- ✓ reduce microbial load on trucks and equipment by washing and disinfecting at critical times;
- ✓ locate production sites strategically in relation to other production sites and movement of poultry to minimize transfer of disease causing organisms;
- ✓ control rodents and wild birds effectively, both of which are potential disease vectors; and
- ✓ confine pets away from commercial poultry.

Immediately following depopulation, the buildings and equipment should be thoroughly cleaned and disinfected before new birds are introduced. Manure should be removed and disposed of at least 1 km away from the production sites. Mortality disposal should also form part of the biosecurity protocol.

### 3.1.17 Marketing

Traditionally, Turkeys are sold at Christmas and Easter as big birds, ranging from 2.5 to over 5.0 kg in size (dressed weight). However, this requirement is gradually changing as families prefer to buy smaller one-meal birds all year round. It is, however, apparent that sales of turkey meat are high at the end of the year.Hens are marketed between 14 and 16 weeks of age. At this age hens will typically weigh from 6.67 to 7.98kg. Toms are often marketed between 17 and 20 weeks of age and will weigh 11.97 to 14.65kg. Market age is determined by the product being produced. Most integrators produce both whole bodied and further processed products.

About 70% of all turkeys grown are further processed. For this market, the industry prefers to grow toms, because their larger weight is advantageous. However, many hens are also further processed even though the unit cost is higher with the lighter weight. About 16% of all turkeys are processed for the whole body market. A larger proportion of hens are sold as whole body due to the preference for further processing the larger toms. About 14% of all turkeys produced are processed as parts. In the past, parts like wings and drums were often sold at greatly reduced prices.

## 3.2 Ostrich Production

The Ostrich, a flightless bird that belongs to the Ratite family and originated from Africa, is the world's largest living bird. When fully grown, the ostrich weighs approximately 204.12kg and stands eight-feet-tall. Ostrich production can be adopted by small scale and part–time farmers with adequate investment capital because land and husbandry requirements are minimal.The ostrich is a very adaptable animal, one that can thrive in many different environments. In the wild, the ostrich may not reach sexual maturity until age four or five years, but in captivity two to three years is normal with the female likely to reach sexual maturity earlier than the male. The male, which may in some cases stand nine to ten feet tall and weigh in excess of 90.72kg, displays black and white feathers. The color of the feathers is much brighter during mating season. The hen is somewhat smaller than the male and the feathers are more gray and drab.

The ostrich is the largest known bird and some scientists believe that the present bird developed from ancestors that were capable of flight. The ostrich of today cannot fly, but does run well and is capable of speeds of 50 miles per hour with strides of 15 feet (for very large bird the stride may be 20 feet or more). The feet of the ostrich have only two toes, the only bird that does. It has been said that the ostrich may hide its head in the sand, but this seems to be a myth. Instead the birds crouch very low to the ground and extend their neck and head along the ground in an attempt to blend into the surroundings. The bird does not always run and hide and is capable of kicking with a force of as much as 226.79kg per square foot. The kick of the ostrich is usually forward and down, so approaching an aggressive bird from the back or side may be safer. Animals may be more docile if their head is covered with a sock or cloth sack.

### 3.2.1 Establishing

An ostrich operation can be established in several ways.

- The producer can purchase and incubate eggs. This method is lowest in cost, but also highest in risk. Ostrich eggs are white and easily candled; their fertility can be guaranteed once incubation is started. However, a sound knowledge of ostrich egg incubation is required for a successful hatch.

- The producer can purchase chicks more than three months old (the highest mortality rate is from one day to three months). Although more expensive than purchasing eggs or hatchlings, the purchase of chicks at this age will probably prove more cost effective because the mortality rate is greatly reduced after the age of three months.

- The producer can purchase yearlings or young adults. While yearlings are more expensive than chicks, yearlings should be productive within two years.

- The most costly method is the purchase of proven breeders, pairs of birds that have produced fertile eggs together. This method of buying will allow production to begin in the next season.

### 3.2.2 Egg Production

Egg production will begin when the female is sexually mature (usually at approximately two years of age) and if she is mating with the male. Egg production will likely begin about five to ten days after the first mating. The male usually scratches out a crude nest in the dirt and the female will then deposit the eggs in the nest. The number of eggs varies widely with 15 to 20 being considered normal. Removing the eggs from the nest encourages the female to produce more eggs. The eggs usually weigh about 1.25kg and take 42 days to hatch.

### 3.2.3 Incubation and Brooding

Under natural conditions both the male and female sit on the eggs. The hen usually sits during the day and the cock usually sits at night. The incubation process takes about 42 days to complete.

### 3.2.3.1Artificial Incubation of Eggs

Most producers prefer to use artificial incubation rather than natural incubation to hatch eggs. When eggs are collected, they should be stored in a cool place until incubation begins. A temperature of 55 to 65° F and a humidity of 75 percent are suggested for storage of the eggs. Daily turning of the eggs and setting within five to seven days is also necessary to maintain maximum hatchability. Eggs which need cleaning can be carefully sanded to remove any adhering dirt. In the case of extremely dirty eggs, washing can be an alternative as long as clean wash water is used and the temperature should be at least 10 degrees warmer than the eggs (do not use hot water).

The incubator should be tested for at least 12 hours prior to placing eggs inside. In this way, the temperature control can be properly adjusted before the incubation process starts. It is important that the incubator be cleaned and disinfected prior to use. The appropriate temperature for incubation of ostrich eggs is 100° F. Eggs should be positioned with the large end up, and if possible, at a 45 degree angle. Positioning eggs on the side is also acceptable. The eggs should be turned at least twice daily (up to eight times per day is better) until the 39th day. Egg should be marked on each side (perhaps with an X or 0) to ensure that all eggs are turned. Ostrich eggs seem to yield better results at humidity of 25 to 40

percent. Eggs can be candled to determine fertility after about two weeks. Once identified, infertile eggs should be removed from the incubator. After the 39th day the eggs can be moved to a hatcher if desired. When hatched the chicks will appear mottled yellow-brown. The chicks can safely go without feed for a few hours after hatching since they receive nourishment from a portion of the egg yolk that is drawn into the body prior to hatching. As soon as the chicks are dry they can be removed from the incubator or hatcher and transferred to the brooding area.

### 3.2.4 Brooding

The brooding period is a very critical time and can be a time of high mortality if proper management is not used. The brooding area should always be clean and sanitary and have protection from the weather. A source of heat should be provided for the brooding area. Chicks will need access to temperatures of approximately 90° F for the first 10 to 14 days. The temperature can be reduced a few degrees each week until the chicks can survive without supplemental heat. (A few days or a few weeks depending on environmental temperatures.) Chicks will usually demonstrate the need for more or less heat by their actions. If they huddle close to the heat source additional heat may be necessary, while if they are grouped as far from the heat as possible, less heat and more fresh air may be needed. Maintaining the brooding area at a uniform temperature rather than having just one heat source may be preferred since the likelihood of chicks getting too far from the heat and getting chilled is minimized.

The floor of the brooding area should not be slick because chicks may slip and leg damage (spraddle legged) can result. Slick material such as plastic, newspaper, or cardboard should not be used to cover the floor. Usually the floor should be covered with some sort of absorbent material such as wood shavings, straw, rice hulls, or clean sand. Producers should be aware that gastric impactions may become problems since ostrich chicks are prone to eat large quantities of these materials. To prevent this problem it may be desirable to cover the litter with something like burlap or a similar material. After about two weeks this covering can be removed, but the chicks still need to be watched to be sure they are not eating the litter. Throughout the time when litter is used it should be stirred to encourage drying and any wet caked litter

removed from the pen or house. A rake or pitch fork can be used for small areas, but for large areas a roto-tiller may be necessary.
When birds are old enough to be moved outside, the pen areas should be managed like those for other types of animals and should be well drained and clean. Even older chicks and young adult birds are prone to eat almost anything, so range or pen areas should be free of trash and litter, small rocks, or other material that could become a problem if eaten. In addition, the birds will need some type of shelter at night and during extremely cold weather.

### 3.2.5 Mating

It is advisable to keep the males and females separated prior to pairing for mating. The birds will likely be more docile and easier to control. At the time of pairing, the ostriches should be kept in a pen or paddock away from other birds. The pen should be fenced with a smooth wire fence approximately five to six feet high. The pair will likely prepare a nest which will consist of a shallow depression in the ground. If for some reason, the pair does not make a nest or if no eggs are produced, another pairing should be tried. A second pairing is sometimes helpful if the hen stops laying. Some producers have been successful with breeding pens with one male and two to four females. If this program is used, extra time may be required to determine if all females are mating and laying eggs. If no eggs are being produced by some of the females, a change in the breeding pens may be necessary.

### 3.2.6 Nutrition

As with any livestock, the nutritional needs of ostriches are different at different stages of development

**Hatchlings** – hatching to two days of age. Provide water and start chicks on a good quality turkey or game bird starter ration containing at least 26 percent protein. Chicks should receive continuous light. The first week after hatching it is imperative that the yolk sac be completely absorbed. Running seems to help the chick absorb the yolk sac. This is the most difficult stage in raising ostriches. Chicks will eat anything and tend to eat too much. Clogging together (i.e sleeping on one another) is the most common reason for motarlity.

**Chicks** – two days after hatch to approximately six months of age. Feed a good starter crumble either from the ratite rations developed by feed companies or a regular chicken starter with at least 26 percent protein. Chicks should receive the starter crumble ration at all times during the first three weeks. After the first three weeks, feed all they can consume in two, short (20 minutes), daily feeding periods. Alfalfa pellets should be available on a continuous basis. Vitamins and electrolytes for poultry should be added to the drinking water at the recommended level for the first two to three weeks of age.

**Yearlings** – six months to approximately 18 months of age. Use a commercial ratite grower feed or a turkey-broiler grower feed. Protein should be 24 to 26 percent and fiber should be 11 to 12 percent when the birds are not on grass.

**Adult** – when the birds are sexually mature. Use a layer ration or a breeder ration from a commercial feed company and supplemental alfalfa pellets or cubes. Pellets or cubes are less wasteful and easier to feed than hay. Always have clean water available to all birds at all stages of development. Waterers should be rinsed daily and scrubbed with soap and water every three days. Grit is also essential to an ostrich diet. Small stones or commercial grit is best.

### 3.2.7 Housing and Fencing

Each pair of ostriches should be considered individually, but the following recommendations can be used as guidelines for fencing, pen size, and shelter. Ostriches require high tensile or mesh fence that will not allow them to get their heads or legs caught. Ostriches can be quite aggressive and will bite or nip. They will reach over, though, and under any type of fence if possible, and can hurt themselves if their necks or legs get caught. Ostriches can grow to more than eight-feet-tall, so the fencing should be at least six-feet high around a recommended running area of one to three acres. Ostriches need shelter from the extreme cold of winter and heat of summer. The shelter is best placed inside the fenced area where ostriches will have free access. The design of the shelter can range from a plywood three-sided building to a small barn that can be heated if necessary. A shelter measuring 20 feet by 20 feet is adequate for a breeder pair.

### 3.2.8 Managing for Health and Productivity

Ostriches have developed unique characteristics in order to adapt and survive. These characteristics make ostriches different from other birds in terms of management and nutrition. To ensure ostriches are healthy and productive, appropriate management is important. Consider the following:

- When changing from one feed to another, do so gradually over a ten-day period.
- Make certain your birds get enough exercise. Exercise helps to prevent leg problems and decrease the incidence of impactions.
- Minimize moving birds from one location to another, either within the same production unit or to another.
- Carefully check pens for and remove any object that can be picked up and swallowed.
- Mixing grit with feed may help to decrease the incidence of impactions.

## 3.3 Goose Production

The rearing of geese can be a profitable enterprise on a farm. Goslings can be purchased directly from a licensed hatchery at day old. Improved crosses of geese are available that give better results in terms of weight gain and feed conversion efficiency than the traditional breeds. Goose meat is a luxury priced food when compared with any of the other poultry meats.

### 3.3.1 Brooding

Brooding is the management practice by which young poultry are subjected immediately after hatching and for geese, this is considered to be the first three weeks of life. The most important aspect of brooding is to provide extra heat so that there will be no temperature shock when the newly hatched goslings are moved from the incubator to the area where they will be brooded and grown. To ensure that the temperature in the brooding area is stable, it is important that the heat sources be turned on

at least 24 hours before the goslings arrive (Fig 12, 13).Success in raising geese depends to a large extent on the care and attention the young birds receive during the brooding period. Frequent management checks to make sure that the goslings are comfortable and have enough feed and water is one of the surest ways of raising healthy goslings.

Almost any building can be used for brooding geese providing it is dry, clean and free of draughts and vermin. It is important to remember that the colder the ambient temperature of the room or building where the goslings are being brooded, the more heat will be required from the localized brooder heat source to maintain the temperature where the birds are located. Any brooder heat source that can be used for chickens can be used for goslings with the recommendation, depending on ambient temperature, that the number of goslings does not exceed one-third to half the number of chicks.

Energy sources may include electricity, oil, coal, natural gas, propane or other organic fuel. Normally the areas where the brooder heat sources are located will have a protective guard placed around them to reduce draughts and to ensure that the goslings will not stray from the heat source. This guard need only be in place for the first 2-3 days of the brooding period. A circular area is preferable for this purpose as it prevents the goslings from crowding into a corner.


**Fig. 12: Newly Hatched Goslings with Feed, Water and a Protective Guard(Source: Buckland, 1995)**

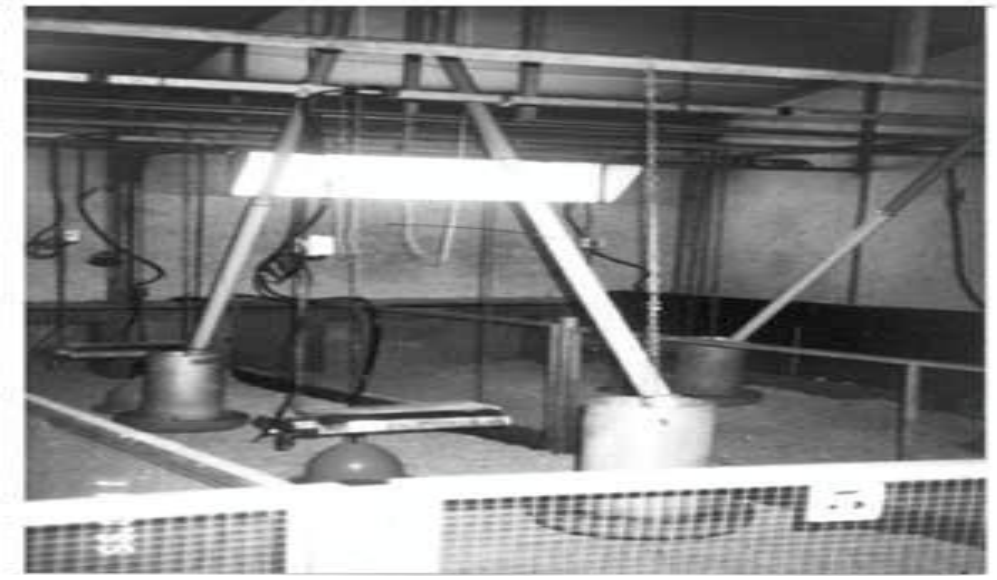


**Fig. 13: A pen with automatic feeders, drinkers and an electric heat source ready to receive goslings.** (Source: Buckland, 1995)

When goslings arrive, the temperature at bird level directly under the heat source should be 36-37°C which can be reduced to 32-33°C at the end of the first week and to 23-25°C by the end of the second week. After the third week, no further additional heat source should be required unless the ambient temperature in the building is below 20°C.
The best guide to deciding when to reduce the temperature and when to remove the brooding heat source is the behaviour of the goslings. If they are too cold, they will be huddled together close to the heat source and if they are too warm they will be far away from the heat source as for other poultry birds.

The goose has the fastest initial growth rate of birds kept for meat production (table 5). This rapid growth rate, combined with the fact that they are susceptible to overcrowding, means that it is very important that geese have adequate space during the brooding period. On average, maximum density per square metre should not exceed 14-20 birds during the first week, 7-14 birds during the second week and 4-5 birds during the third week.

Even during the brooding period when the goslings are two weeks of age, they can be let out to graze, provided the weather is warm and it is not raining. This can reduce the building space requirements per gosling. Goslings should not be permitted out in heavy, cold rain until about five weeks of age, since before that they do not have sufficient feather cover to protect them.

Almost any material can be used as a source of bedding for goslings e.g. straw, wood shavings, rice hulls etc. provided the material is dry, highly absorbent and that it is not easily compacted. These points are important for goslings as their droppings are moist and they tend to spill water onto the litter. For these reasons, it is recommended that the water be placed on wire mesh or on plastic or wooden slats which are supported by a frame to prevent spilled water from wetting the litter

**TABLE 5: Growth Rate of Goslings from Hatching to three weeks of age**

| | Male | Female |
|---|---|---|
| Egg Wt | 170.1 | 170.1 |
| Hatching wt (g) | 104.9 | 104.3 |
| 1 week wt (g) | 307.9 | 295.9 |
| 2 week wt (g) | 800.0 | 755.8 |
| 3 week wt (g) | 1513.0 | 1365.5 |

(Source: Willin, 1995)

The watering space recommended during the brooding period is a minimum of 2 cm per bird and this can be provided by either a circular drinker or a linear drinking trough. Goslings require 1.5 cm of feeder space per bird which can be provided either with a double-sided linear feeder or with a circular feeder. For the first 24 hours after hatching, it is advisable to provide additional, more accessible feed to ensure that all goslings start to eat immediately. This feed can be put in egg trays which are placed on the litter in the brooding area for easy access.

During the brooding period, a waterfowl starter ration in the form of either crumbles or small pellets is recommended and should be fed *Ad libitum*. These starter rations normally have a crude protein level of between 16.0-18.0 percent and a metabolisable energy level of between 2600-2900 kcal ME/kg (table 6). If a goose starter ration is not available then a chicken starter ration of similar protein and energy levels can be used. Mash feed can also be used if neither crumbles nor pellets are available. In many low-income and food-deficient countries, where feed mills do not exist, farmers must use the local sources of nutrients to provide essential nutrients such as ground cereals and chopped fresh grass. Such feeding systems, however, are usually protein deficient and can lead to very slow growth. If it is possible, the diet should be

balanced with a supplement high in protein content such as soybeans, cotton seed or peanuts.

The total feed consumption for goslings, depending on breed, for this initial three week period will be between 2.5-2.7 kg of starter ration. Goslings will consume between 7-8 litres of water during this period. If the goslings have access to high quality forage (ryegrass, white clover, cabbage, or even nettles) during the three week brooding period, this could reduce their intake of the complete ration by as much as 20 percent.

When the goslings are three weeks old, it is possible to restrict their feed intake up to 75 percent of A*d libitum*. However, where a higher level of restriction must be exercised because of a shortage of either a starter ration or mixed grains, then every effort must be made to provide the goslings with young tender forage either through direct grazing or by cutting and carrying the forage to them. Fresh kitchen and/or garden waste may also be used during this period. If the goslings are required to graze, then any starter ration or mixed grains should be fed at night so that during the day the goslings will be hungry. This will increase their forage intake. If feed restriction is practised at this young age, it is very important to keep a close watch on the goslings to see that they remain in good health.

| | Ration 1 | Ration 2 |
|---|---|---|
| **Energy (Kcal ME/kg)** | 2600 | 2800 |
| **Crude Protein (%)** | 15.8 | 17.0 |
| **Amino acid** | | |
| Lysine | 0.89 | 0.95 |
| Methionine | 0.40 | 0.42 |
| Sulphur Amino acid | 0.79 | 0.85 |
| Tryptophan | 0.17 | 0.18 |
| Threonine | 0.58 | 0.62 |
| **Mineral (%)** | | |
| Calcium | 0.75 | 0.80 |
| Total Phosphorus | 0.67 | 0.70 |
| Available Phosp. | 0.42 | 0.45 |
| Sodium | 0.14 | 0.15 |
| Chloride | 0.13 | 0.14 |

**Table 6: Recommended dietary energy, crude protein, amino acid and mineral levels for Goslings during the brooding period of three weeks**
**(Source**: Leclercq et al., 1987).

### 3.3.2 Growing

After the brooding period geese can be grown to market weight under either intensive confinement conditions, extensive range-type conditions or a mixture of the two. The growing facility need not be sophisticated since these birds are not demanding - a simple shelter should be adequate. The most important factor is to ensure that the goslings are warm during the brooding period and protected from sun, heavy rain and predators, especially during the night. In hot countries, a wooden shelter is sufficient for this purpose.

The growing of geese in confinement permits greater control of the environment (Fig 14). Although this has a number of advantages, it does not, however, capitalise on the goose's natural capacity to consume and utilise large volumes of forage. When they are grazing, geese consume not only grass, but also insects, snails, worms, etc. which can provide about 10 percent of their total protein intake. Furthermore, the strong legs of the goose combined with its aquatic tendencies means it can travel long distances if required to consume forage both on land and in the water. Finally, the production of geese on extensive pasture type conditions eliminates the need for expensive housing and equipment and requires only drinkers, feeders, fencing and shelters for shade.

Because of the relatively high cost of the buildings and equipment needed when raising geese under confined conditions, geese are normally brought to market weight as quickly as possible. Broiler type geese can go to market at 8-9 weeks of age at a body weight of 4.0 kg and heavy type geese can go to market at 12-14 weeks of age at a body weight of 6.0 kg. This means that geese produced under these systems are generally not plucked during the growing period

**Fig. 14: Geese in Floor Pens being Fattened for Market**
(*Source*: Buckland, 1995).

Geese grown in confinement are generally raised on deep litter which is considered the classical system of poultry production. However, they may also be grown on a raised floor of wooden slates, plastic slats, heavy wire mesh or expanded metal without exhibiting any of the problems of breast blisters etc. so common with chicken broilers grown under these systems. The advantages of the raised floor systems are:

- approximately twice as many birds can be housed per square metre;
- the droppings pass through the floor to a pit or the ground below;
- any water spilled from the drinkers passes through the floor and does not cause any problem
- the risk of parasite infection is reduced.

With the deep litter system, the drinkers should be located on a wire or slatted area so that spilled water does not wet the litter. One practice is to have one third of the floor space elevated with wire mesh or wooden or plastic slats to accommodate the drinkers.Under intensive confined conditions, geese should receive 15 cm of feeding space per bird. If at any time restricted feeding is practised, irrespective of the system used, it is vital that sufficient feeder space is provided so that all birds can eat at the same time. If this is not done, the more timid birds will simply not get any feed as it will be all gone by the time they get to the feeder.

The watering space per bird should be about 5 cm per bird. Drinkers must be of a durable nature and should not be large. A drinker 20 cm square and 10 cm deep to contain about 3 cm of water is recommended

by some producers, while both commercial hog and cattle drinkers have been reported to work very well with geese. It is important that the drinker does not spill a lot of water. When automatic drinkers are not available, it is possible to use any ordinary container, but it must be filled often to provide abundant fresh water. It is useful to adapt the containers so that the birds cannot bath in them.

The type of feed generally fed during the growing period is a pelted waterfowl growing ration ranging from 10-13 percent crude protein with a metabolisable energy level of 2 700-2 900 kcal ME/kg. If such rations are not available then a chicken broiler or a chicken roaster ration of similar nutrient density can be used. While the recommendation is to use a pelted or crumbled feed for growing geese, in many parts of the world these are not available and, in such cases, the rations can be fed as a mash.The main advantage of growing of geese for meat under extensive conditions is the goose's unique ability to utilise high-fibre feeds and thus use a variety of types of forage. This ability holds true whether the geese are kept under well-managed pasture systems or under less structured scavenging systems.

Under extensive management conditions, geese will generally reach market weight at a later age than under confinement. In fact, the age at which geese go to market may not depend on their ability to grow, but rather on whether:

- the birds are to be plucked before they go to market
- the birds are to meet a particular market demand at a particular time.

Providing geese with access to good quality pasture during the growing period, even without any form of feed restriction, can result in substantial savings with respect to grain consumption. Restricting the feeding of grain in any form while geese are on pasture is a very popular practice and one that is recommended. Depending on the level of restriction, it is a practice that can ensure the maximum use of available forage or any other feedstuffs. Almost all kinds of grain can be used in combination with pasture feeding.

The greater the level of feed restriction, the more forage the geese will consume and the less selective they will be in what they eat. If necessary, geese will travel considerable distances to obtain forage. The

level of feed restriction that is practised will depend on a number of factors. For example, if there are no alternative energy-protein sources available, then the level of restriction will be severe and the dependency on foraging and/or scavenging will be high. Under these conditions, the geese should be monitored closely, particularly if severe restriction is begun prior to three weeks of age. If the quality of the local forage is low and there are no other supplementary feeds, then there may be a need to cut and carry forage to the geese.

This forage should be of the highest possible quality. If good forage is available, then even with small amounts of grain, high quality geese can be produced. The only difference is that they will be ready for market at an older age and the carcass will be leaner than that produced by a high grain (energy) ration. Even when available grain is not a constraint, it may be desirable to restrict grain intake to maximise the use of any available forage, and a restriction of between 0.5-1.0 kg of grain per goose per week is recommended. However, to achieve the desired market weight and have adequate fleshing, it is recommended that the geese be fed a complete ration for the last 2-3 weeks before killing.
When planting a pasture specifically for geese, it should be noted that they will eat almost any grass or clover species although they do not like alfalfa as much as other clovers. One pasture mixture that has been recommended in Great Britain consists of Perenial Ryegrass (*Loliumperenne L.),* Timothy (*Phleumpratense L.*) and White Clover (*Trifoliumrepens L.*). Stocking densities for geese on pasture are around 150 geese per hectare depending on the quality of the forage and how fast it is growing. Geese like new growth, so pasture management should be practised and it should include rotation and clipping.

To summarise, the management of geese under extensive conditions both in managed pastures and under extensive scavenger situations is, in many respects, similar:

- the behavioural characteristics of geese lend themselves to extensive management systems because they have a natural tendency to flock and at the end of a day will return home on their own accord;
- it is very important that geese are provided with a natural or man-made shelter to provide protection from the sun;
- they must have water available at all times and feeders must be built so that the feed remains dry in case of rain;

- if predators are a problem, fences and secure housing at night must be provided.

### 3.3.3 Marketing

The market is specialised and should be secured before investing in a goose enterprise. Geese will be presented ready to cook. They can be humanely killed by stunning and dislocation of the neck or by cutting the carotid artery. Dry plucking is slow and tedious but gives a good finish when combined with wax plucking. Wet plucking is fast and efficient but the birds will have a short shelf life.

## 3.4 Guinea Fowl Production

Guinea fowl belongs to the pheasant family. The bird is commonly found in the Western, Central and Southern parts of Africa. The name "Guinea fowl" is derived from the Guinea coast of Africa, which is where the birds are believed to have originated. In West Africa, the grey breasted and helmeted varieties are common in the areas bordering the Sahara. In Nigeria, many household in the north keep guinea fowls, and the meat and eggs are very popular. The flesh is white and delicate with distinctive game flavour and the carcasses weigh between (0.5-1.0kg) at ten weeks, which make them suitable table birds for the small family.

### 3.4.1 Advantages of keeping Guinea Fowl

- The guinea fowls are always more capable of coping with the effects of dry weather conditions prevailing in the Northern Guinea Savanna and the Sahelian ecological zones than other domestic poultry.
- Guinea fowls are apparently free from the poultry diseases that are worrisome to most farmers and scientists.
- In many urban homes, the guinea fowl meat is used as substitute for game birds. The flesh of young guinea fowl is tender and has a fine flavor resembling that of white game.
- The guinea fowl egg commands premium market prices because of the gammy flavor and has better storage ability than the chicken egg. The egg shell does not crack easily due to thickness. The eggs are believed to enhance virility and sexual potency.
- Guinea fowls with their eggs are used for scientific research, notably in physiology studies.

- The birds are less expensive to buy by a beginner and are less of financial risk to maintain on the farm.
- The over 50 million semi-domesticated guinea fowls in Nigeria constitute about 25% of the entire domestic poultry population in Nigeria, making it a variable source of animal protein which is socially acceptable.

### 3.4.2 Varieties of Guinea Fowl

**1. Pearl variety**

This guinea fowl has a purplish gray plumage, regularly dotted or splashed with white. The bird is so handsome that the feathers are often used for ornamental purposes. The pearl variety of guinea fowl is the most popular in this country.

**2. The grey breasted variety**

This guinea fowl has gray or white breast feathers with the plumage like that of the pearl variety. These two varieties are the most common guinea fowls in Nigeria and do have great potential for commercial production in the poultry industry because of their wide acceptability.

**3. The Lavender Variety**

This guinea fowl also resemble the pearl variety, but the plumage is light gray or lavender regularly dotted with white markings.

**4. The White Variety**

This variety like the name indicates has a pure white plumage. Its skin is lighter in color than that of the pearl variety. The pure white color of this variety is definitely advantageous with respect to minimizing heat stress during the excessive heat period.

### 3.4.3 Production Systems

The systems of keeping guinea fowls like in the other poultry species refer to the extent to which the birds are allowed access to green runs (pasture) and exposure to sunshine. The different management systems for raising guinea fowls are as below:

### 1. Extensive (free range) system

This system of guinea fowl management is the most common in Nigeria, and suitable for those farmers with lot of land and fields for pasture. In this management system, the birds are not confined and thus are free to fend for their won feed and roost, as well as ridding the field of insect pests and weed seeds. Because the birds find their own food and shelter, the management is almost at no cost to the farmer. However, the free range management system cannot be practiced on an intensive commercial scale as the birds could easily revert to the feral state and might not be easily caught when needed. Also, on free range, the birds are exposed to climatic conditions which often result in heavy losses, predatory beast, parasites and infectious diseases. This system of production is therefore not recommended for intensive commercial scale but for the small scale back-yard production.

### 2. Semi intensive system

This system requires a permanent housing with attached fenced runs or pasture. They should be in the minimum, two pasture area. The birds should have access to each plot in turn while the other pasture is rested and the number of birds raised depends on the amount of land available. This method is particularly suitable where land is limited and small holder farms. Under the semi intensive system, disease condition could be common and therefore requires close monitoring and control. At the present levels of guinea fowl production in Nigeria, this system seems suitable and is therefore recommended.

## Intensive System

This is the system which is used commercially and involves confining the birds indoors either in battery cages or on deep litter within a large controlled environment. The food and water requirement of the birds are made available all the time.In Nigeria, rearing guinea fowl on the deep litter at commercial level of production is common. The deep litter system consists of solid buildings with suitable litter materials such as wood shavings, dry maize cobs and chopped straw. The system affords effective insulation of the birds from outside atmospheric conditions while perches are provided for the birds as from the fourth week of age.

This system is recommended for large scale commercial guinea fowl production, because it allows high stock density, efficient management of resources and labour resulting in high production output.

### 3.4.4 Mating

Guinea fowls are naturally seasonal breeders because of their monogamous characteristics and so, for a commercial breeding program, artificial insemination will be of great advantage. However, for the small scale farmer who keeps the birds on the range, the practice of keeping fewer number cocks in a flock is better. This is because the cock often prepares the nests for a group of guinea hens that flock with him. This is why it is common to find 20 to 30 eggs in a single nest during the egg producing season in the wild. The nests are usually located in well hidden places making it difficult for the farmer to locate the nests when many males are kept. Such eggs also may be of poor fertility due to the monogamous tendency of the males. Once the egg nests are located, farmers are advised to leave at least three newly marked or dummy eggs in the nest during each collection to encourage the guinea fowl hen to continue using the same nest during the breeding next season.

In the wild, reproductive pairs are established during the rains, the pairs and their offspring merge together with others to form larger group at the end of the breeding season. Thus, in improved husbandry program, efforts should be made to ensure continuous breeding and elimination of permanent pair bonds between reproductive adults.

### 3.4.5 Egg Production

Guinea fowls come into play at about 25 to 28 weeks of age and will continue to lay for about 8 months producing between 150-160eggs during the first laying period. The second laying period may start at 12 to 14 weeks after the end of the first and may last for 4 to $5^1/_2$ months producing slightly higher number of eggs than that produced during the first cycle. The egg production efficiency however depends on breeding stock and management.Egg collection should be done daily but do not disturb the hens while they are laying. Guinea fowl eggs are smaller that chick eggs. They weigh between 35 to 40 grams as compared to between 45 to 55 grams in the chickens. The eggs collected should be stored in cool dry place.

## 3.4.6 Egg Incubation

Guinea fowls are not particularly good mothers and the eggs are best hatched under broody chicken hens naturally or by artificially incubation using incubators.

### 1. Natural incubation

The incubation period of guinea fowl egg is between 26 to 28 days. The natural incubation method is commonly used by farmers with small flocks. The chicken hens are usually used because they are more adaptable than guinea fowl hens which are too wild to be set anywhere except in the nests where they have become broody. From 12 to 15 eggs may be set under a guinea hen while 20 to 28 eggs can be set under a large chicken hen. Hens should be treated against lice before they are set. Also ensure adequate food and water for the broody hens.

### 2. Artificial incubation

The artificial method of incubation is by the use of machine called incubator. The incubators which are of different type have in-built devices for the production of controlled heating at recommended temperature, controlled humidity level and egg turning device.
Recommended temperature and humidity of the air within incubators are about the same for both guinea fowl and turkey eggs. Temperature level of 38$^{o}$c with 58% humidity for the first 3 weeks is recommended but the temperature should be lowered to 36$^{o}$c while the humidity is raised to 75% for the last week in the incubator. Each egg should be turned at least 4 to 5 times daily for the first 24 days of incubation. Kerosene incubators are recommended for rural farmers who keep small flock and have no access to electricity.

## 3.4.7 Keets Brooding

Brooding of keets could be carried out by the natural method or by artificial brooding.

a) **Natural brooding of keets**
Guinea fowl are not highly reputed for the care of their young ones. It will be necessary to separate the newly hatched keets from their

mothers. Guinea hens are likely to take keets through wet grass and lead them too far from the home. The common practice is to give out newly hatched keets to a broody chicken hen to raise. A large chicken hen will brood as many as 25 keets. For the first 2-3 days, the hen and the keets should be confined to an enclosure, after that time, they should be allowed to range. However, shelter should be provided at night to keep out predatory animals.Keets raised by natural method will usually leave the brooders house from the age of 6 to 8 weeks and will begin roosting at night in a nearby tree in the open air. But if they have been accustomed to going into the house at night in company of the chicken mother hen, they are so trained and will not be so difficult to catch when they are wanted for the market.

b) **Artificial brooding**

The newly hatched keets may be raised with the same kinds of brooders and brooding houses as are used for chicken or turkeys. The recommended brooding methods and temperatures are similar to those used for chickens. Artificial brooding using electric bulbs can be started at a temperature range of 34-40$^{o}$c from the first three weeks. This should be reduced under the brooder to 30-35$^{o}$c between four and six weeks and 28-32$^{o}$c as from 7-8 weeks. Thereafter, heating can be discontinued except during the cold season. These temperatures can be attained using 12 by 60 watt bulbs per 50m floor space or 18 by 40 watts bulb at about 15cm above the floor. Kerosene lamp could also be used as a cheap and readily available source of producing warmth for young guinea fowls.

The brooder house should be constructed to provide both warmth and adequate ventilation for the keets and located where there should be the least disturbance, which could cause losses due to pilling up as a result of frights.

Overcrowding should be avoided and any form of disturbances e.g. noise, too frequent visits and sight of other animals. Corner guards are useful to prevent piling up while pinioning of wings helps to reduce flightiness.

### 3.4.8 Housing

Commercially, guinea fowls are kept confined in suitably adapted buildings on a 75mm litter of wood shavings. Adequate ventilation is important because the droppings are much drier than those of other poultry and this leads to a dustier atmosphere and therefore to an increased risk of respiratory diseases. Overstocking should be avoided.

### 3.4.9 Rearing Pen

- The floor of the rearing pen should be cemented and slightly slopped to facilitate easy cleaning and washing
- Dwarf walls (1m high) made of block or dried brick or mud are adequate.
- On top of the wall should be a chicken wire mesh of 2.5m high supported by wooden frames.
- Ventilation holes should be made into the walls but with movable cover of plank to regulate heat.
- Roof could be made of asbestos to ensure cooling.
- Perches may also be provided.

### 3.4.10 Space Requirement/Stock Density

Floor space requirement of about 0.06 m should be allowed per bird from day old till maturity. Stocking density is at the rate of 100 birds per 55-65 m. a stocking rate of more than 16 birds per meter is overcrowding and can result to heavy losses. Up to 50% of the entire flock could be lost through such over stocking. Over-stocked birds also look unthrifty and do not normally grow well.It is also advisable not to under-stock as the birds especially when young tend to wander far away from source of heat, food and water which often cause death due to starvation. In order to ensure optimum performance, rearing size should not exceed a thousand birds.Equipment for rearing of guinea fowl are the same with that of chickens which include drinkers, feeders and the nest boxes while lighting devices are optional.

### 3.4.11Feeds and Feeding

In the wild, guinea fowl's diets are naturally rich and include grass seeds, crop wastes and about 60 species of insects. In the villages, free range guinea fowls feed along with the local chickens and scientists tend

to believe that the nutrient requirements of guinea fowls are similar to those of the chickens.However, in captivity, adequate feeding of birds with balanced diet is very important for the production of fast growing healthy guinea fowls. The guinea fowl being a range bird could be allowed access to the pasture with good fresh plants e.g. stylo, tridax and water leaf.

Guinea fowls have relatively small crops and therefore needs feeding more frequently than other poultry. Commercially, guinea fowls are fed much the same as turkeys. Also, a broiler type ration is known to support good body weight gains in guinea fowls. However, some coccidiostat additives in poultry rations are toxic to guinea fowl if they exceed certain levels. You should check this point with your feed supplier before giving your birds such rations.For rapid growth rate, it is recommended to start guinea fowls on high protein diets containing 25%-26% crude protein and about 3200kcal/kg for the first 6 weeks of life. Between 6-12 weeks of age, a diet containing 20% crude protein and 3200kcal/kg is best. Above 12 weeks of age till market size is attained, the protein levels in the diets may be reduced to 18% (table 7, 8).

The feed intake of guinea fowl is between 25-30g, 50-60g and 70-80g per bird per day between the ages of 0-6, 6-12 and 12-16 weeks respectively. Feed consumption record of guinea fowl is apparently high because of the tendency to waste the feed due to their manner of scooping and picking of the feed. This feed wastage could be minimized by feeding the required feed twice daily rather than *Ad libitum* and using deeper feeder for adults. Feed in pelleted form can also solve the wastage problems. Clean water should be made available always. It is also advisable that finely chopped tender green leaves be scattered a little on guinea fowl rations. Feeding the guinea fowl on range in late afternoon has the advantage of making them to return to their coop (shelter) at night.

**Table7: Feed and Feeding Requirement for Broiler Guinea Fowl.**

| Age (weeks) | Protein (%) | Energy Value Kcal/ Kg | Amount of Feed needed per day (g) | Lysine | Methionine | Methionine + Cystine | Ca | P |
|---|---|---|---|---|---|---|---|---|
| 0-5<br>5-8<br>8-12 | 25.5<br>20<br>18 | 3200<br>3100<br>3100 | 25-30<br>50-60<br>70-80 | 1.38<br>0.99<br>0.79 | 0.55<br>0.42<br>0.33 | 1.00<br>0.88<br>0.66 | 1.00<br>0.90<br>0.80 | 0.39<br>0.35<br>0.33 |

**Sources: Tewe (1983).**

**Table 8: Nutrient Levels for Breeders**

| Age (Weeks) | Protein (%) | Energy Kcal/Kg | Amount of Feed Needed (g) | Lysine | Methionine + cystine | Ca (%) | P (%) |
|---|---|---|---|---|---|---|---|
| 1-6<br>6-28<br>Breeder | 22<br>14.0<br>17-18 | 3000<br>2800<br>2800 | 25-27<br>55-60<br>70-80 | 1.20<br>0.65<br>0.90 | 0.81<br>0.59<br>0.59 | 0.70<br>0.60<br>2.70 | 0.40<br>0.35<br>0.55 |

**Sources: Offiong (1983).**

However, as from the ages of 8-10 weeks, rearing guinea fowls on free range may be combined with confinement if the birds are pinioned or wind clipped. Two fenced range or pasture areas on either side of the fixed building with tender and fresh greens are highly recommended. The two fenced range conditions will allow pasture grazing rotation and reduce the incidence of diseases.

## 3.4.12 Feeder and Drinker Requirement

In intensive method of production, few hours (2-3 hrs) before the newly hatched keets are received on the farm, feed should be placed on pieces of paper or flat trays, while drinkers should be placed around to get the birds familiar with them. The drinkers should be filled with clean cool

water and positioned about 1m from the wall but away from sources of heat. Coloured feeders and drinkers are preferred. Red colour is favoured because it attracts the keets. Drinking spaces of 1cm, 1.5 cm-3.0 cm and 3.0 cm-5.0 cm per bird should be allowed for the first 4 weeks, 5-12 weeks and 12-16 weeks old respectively (Table 9).

**Table 9: Feeder and Drinker Requirement per 100 birds**

| Age (weeks) | Drinker Requirement | Feeder Requirement |
|---|---|---|
| 0-4 | 2 by 4 liter size | 2 by 1.2m size |
| 4-8 | 4 by 4 liter size | 3 by 1.2m size |
| 8-16 | 4 by 4 liter size | 4 by 1.2m size |
| 16 and above | 6 by 6 liter size | 5 by 1.2m size |

**Source: Offiong (1983).**

## 3.4.13 Health Care and Management

It is generally believed that guinea fowls are more resistant to parasitic infestations than the domestic chickens. However, with high stocking density, on large intensive farms, there could be occasions when ailing guinea fowls are noticed on the farm. Often, it is nothing serious but there is the chance that it could be. It is therefore important to be able to recognize general and specific symptoms and develop the 'stockman eye' which will help spot any unusual behavior in the birds at an early stage.

The major parasites that have been reported infecting guinea fowls in Nigeria are such like*Heterakisspp*and *Ascaridiagalli* while *Eimeriaspp*are the most important gastro-intestinal protozoan parasites. It is also known that *A. galli, Heterakisspp*and*Eimeriaspp* are responsible for deaths especially among the young ones. The practice in most farms, with considerable success had been to treat guinea fowls with the same drugs as those recommended for the treatment of other poultry particularly chickens. However, in Nigeria, no viral disease has been incriminated in local guinea fowls.In guinea fowl, like other domestic birds, prevention is obviously better than cure and you can avoid diseases a great deal by good sanitary conditions. This can be attained by the following health management practices.

a) **Cleanliness**

Ensure that all feed and drink containers are kept clean. Clean stock house regularly and place fresh litter in nest boxes. This litter material replacement could be carried out monthly along with a clean surrounding and proper drainage systems.

b) **Adequate feeding**

The issue of a balanced diet cannot be over emphasized in the management of guinea fowls. They should be allowed access to fresh, clean water at all times. For guinea fowls on pasture, the principle of rotational grazing should be applied to avoid overgrazing and access to fresh greens.

c) **Action against lice, mites and other pests**

Houses, perches and nest boxes should have regular dusting with powder to control infestation. Treat the birds and pay particular attention to the areas under the wings, at the back of the head and around the vent.

Also, sick and decaying dead bodies should be removed as soon as they are observed while veterinary attention should immediately be drawn to any disease condition.

## 3.5 Quail Production

Quails by some distribution are classified as “game” or “hunting” birds and as such, the quails’ requirements are different from that of chicken

On a commercial scale, raising quail has not attracted the interest of the investors because of the lack of data particularly with regards to feeding. Many people who go into quail raising are usually hobbyist who are not income conscious.

### 3.5.1 Breeds of Quails

- Japanese Seattle
- Silver
- Negro
- Japanese Taiwan/ Chinese Quail
- Tuxedo

### 3.5.2 Selection of Stock

It is best to start with quail pullets about 30-35 days old. Some of the pointers in selecting quails are:

a) Body conformation
   1. The feathers should be tidy and neat
   2. Avoid buying those with streak or white or black feathers- these could be signs of inbreeding

b) Choose birds with uniform size. A mature (60 days old) Japanese Quail (*Coturnixjaponica)* would have an average weight of 120g. However, a 30-35 day old bird would only average 100g. The American quail (*Coturnixconurnix)* however weigh heavier at 220g for the mature bird and 200g for the 30-35 days old.

c) Record the parent stock
   1. Size of eggs
   2. Laying efficiency- a 65% average laying efficiency within 300 days laying period is desirable
   3. Growth rate/ body weight.

### 3.5.3 Size of the Flock

The size of the initial stock totally depends on the financial capacity of the person. However, it is not advisable to start big. Quails are not easy to raise and a beginner should first get the necessary experience before going into large scale. Quails multiply rapidly and therefore expansion will not be a problem. A beginner can start with 10-15 pullets.

### 3.5.4 Management

### 3.5.4.1 Housing and Equipment

One of the advantages in raising quail is the relative small space that is required. Commensurately, the cost of putting up a cage is less. The materials commonly used in making quail cages are:

1) Plywood
2) ¼ inch mesh wire
3) 1” by 1” lumber to serve as frame work

For the different stages of growth in the quail’s life, space requirement varies. This is true as in the case of other fowls and even life stock animals. The following (table 10) will help guide the raiser in determining the space required for quails.

**Table 10: Space requirement for quail at different stages of growth**

| | Japanese (per bird) | American (perbird) |
|---|---|---|
| 1. Chick stage (1-15daysold) | $2^{1}/_{2}$" by $2^{1}/_{2}$" | $2^{1}/_{2}$" by $2^{1}/_{2}$" |
| 2. Growing stage (16-35 days old) | 3" by 3" | $3^{1}/_{2}$" by $3^{1}/_{2}$" |
| 3. Laying stage (36 days old and above) | $3^{1}/_{2}$" by $3^{1}/_{2}$" | $4^{1}/_{2}$" by $4^{1}/_{2}$" |

Since quails are not efficient feed converter, they should not be raised for broiler production.

Layer cages should not be too high preferably a 5" and 6" height can accommodate the Japanese and American breed, respectively. Providing too much space will encourage too much movement thereby increasing the risk of injuries.

## 3.5.4.2Brooding Management

### Temperature

During the first five days, the temperature requirement of the quail chick is 95$^{o}$ F. This may be reduced to 90$^{o}$ F on the 6$^{th}$ day down to 85$^{o}$F on the 10$^{th}$ day after which the quail birds will have developed enough feathers to keep their body warm under ordinary room temperature.To ensure better circulation of air in the brooding box, air vents should be spread over the screened portion of the brooder especially during the first 10 days. This will help to conserve heat in the brooder. Five or six layers of clean and dry newspaper should be used to cover the mesh wire flooring during the first 10 days.

This practice is necessary because it will not only help conserve the heat inside the brooder box but more importantly, cleaning and removal of quail manure (which is carried out on every other paper) is facilitated by just rolling the topmost layer of paper. After the 10$^{th}$ day, all the papers are removed from the feeding through covered with$^{1}/_{4}$ mesh wire (to avoid too much spillage) will be used. Water in the drinking fountain should be changed daily and care must be exercised to avoid spilling of

water over the paper to prevent unnecessary dampness.Gas lamp or electric bulb may be used to control the temperature inside the brooder. The brooder box must be cat and rat proof. With proper feeds, enough water and optimum temperature maintained, the mortality of quails can be kept at 5%-8% during the brooding stage which usually last up to 15 days.

### 3.5.4.3 Rearing Management

After the fifteenth day, the birds are transferred to the growing cages. During the growing stages, it is not advisable to expose the birds to more than 12 hours of light. For smaller operation, a brooder/ grower box combination can be constructed but the space requirement of the birds should be observed.Only birds which are healthy and with uniform size should be transferred to the growing cages. The small ones should be disposed. The average mortality from the start of the growing period up to 35 days is 1%- 4%. On the $35^{th}$ day, the male birds are already discernable by the dark brown color of the breast feather. At this stage, the female birds can be segregated and transferred to the laying cages. Approximately 40% of the total population can be chosen as layers on the assumed 50/50 male/female ratio. The remaining birds can be fattened up to 60 days before they are dressed and sold as broilers. During the 25 days fattening period, the light should be restricted to 6-8 hours a day. This practice will improve the quality of meat.

### 3.5.4.4 Layer Management

On the average, quail starts laying after 45 days from hatching. The production cycle lasts for 300-320 days and within this period, the laying efficiency should be maintained at 65%. Some of the major considerations when managing layers are;

a) Feeding- this will be discussed separately
b) Water- like any other bird, quail needs a lot of fresh and clean water. Whenever possible, flowing water should be maintained except when there is supply problem in which case, water should be replaced daily and the watering trough must be cleaned every day.
c) Culling- for large scale operation, it is advisable that massive culling be carried out regularly, preferably on a quarterly basis or even once every four months. Birds that have physical defects

should be removed including those that have grown fat or are sickly and are not laying eggs. This latter condition is manifested by the size of the vent and the conformation of the abdominal parts.

d) Removal of Waste- because of the high protein content of the quail feeds, quail manure has high ammonia content which will cause discomfort for the birds if not removed daily. Removal of the manure can be facilitated by placing a manure receptacle or receiver under the cage.

e) Light- laying quails may be given extra light up to midnight. This will allow the birds to consume the feed in the trough. Furthermore, the weaker birds in the group will have enough time to eat after the dominant ones have eaten their share.

f) It is not advisable to mix the male birds in the laying cage except when fertile eggs are to be produced. If there is an intention of producing fertile eggs for further replacement, the male should be kept in separate cage and should only be mixed with the layers at the time fertile eggs are to be produced at a ratio of 1:6 and 1:3 for the Japanese and American breed respectively.

g) Quail birds are very sensitive to high salt level in the feeds. The optimum level of this mineral should be kept at 0.7% and in no case be more than 1%.

### 3.5.4.5 Feeding Management

The major cause of failure in quail raising is the faulty feeding practice employed by the raiser. Most of the quail raisers today feed commercial chicken feeds to quails. This is an erroneous practice and it should be corrected. The protein requirements of chicken and quails are different and as such, the use of chicken feeds in quail raising is not advisable. Below is a comparison of the crude protein requirement of chicken and quail (table 11).

**Table 11: Comparison of the Crude Protein Requirement of Chicken and Quail**

| | Quail | Chicken |
|---|---|---|
| Chick stage | 28% | 21% |
| Grower stage | 24% | 16% |
| Layer stage | 26% | 15% |

From the above information, we can clearly see the mark difference in the primary requirement of both birds. Quail cannot survive on chicken feeds for a long time. If ever they will survive, the mortality rate will be

very high sometimes reaching up to 70% from day old to 45 days. Moreover, the growth of the birds is very uneven and the survivors will not be efficient layers. The productive laying period for quails fed with chicken feed does not go beyond six months.

Another disadvantage of feeding chicken mash to quails is the very occurrence of molting which affects severely the egg production.
The claim that mixing quail feeds with higher protein is expensive and not economical is baseless. The advantages of giving the right ration far outweigh the cost of giving chick feeds. These advantages can be summarized below:

1. Mortality rate can be kept low with good feed:
   5-8% from 1-15 days
   1-4% from 16-35 days
   8-12% from 36-360 days
2. Production:

a) Laying efficiency can be easily maintained within the average range of 63%-68% for a period of 300-320 days. It is not rare to get laying efficiency of 80%
b) Eggs are bigger and more nutritious.
c) For breeders- fertility and hatchability are high.

These things when quantified and taken together would positively refute the claim that feeding quails with higher protein content as recommended here is costly and economical.

The feed consumption of quail at different stages is shown in table12

**Table 12: Feed Consumption of Quail at Different Stages**

| | Japanese | American |
|---|---|---|
| Chick stage | 7 grams/day (per bird) | 10grams/day |
| Growing stage | 17 grams/day (per bird) | 32grams/day |
| Laying stage | 23 grams/day (per bird) | 45grams/day |

During the first 15 days, the feeds of the birds should be grounded to a fineness enough to pass an ordinary window screen wire.

Like chicken, quails are affected by abrupt changes in feeding. Hence, it is not advisable to change feed abruptly.

### 3.4.5.6 Maintaining Health

There is no known morbid disease of quails. While they suffer from some respiratory disorders, these do not spread fast and the mortality rate is very low. Hence, it is not difficult to maintain the health of the birds. Regular cleaning and disinfection program however should be followed. Cages and broiler boxes including the incubator and hatchery trays can be cleaned with water and dried under the sun. Spraying with disinfectant follows. Vitamin premix can also be added to the feeds or drinking water to promote growth and improve the laying performance.

**SELF-ASSESSMENT EXERCISE**

i. Enumerate 4 advantages of keeping guinea fowl.
ii. Explain the two types of incubation in guinea fowl production

## 4.0 SUMMARY

The term Poultry is used for a group of birds including Chicken, Turkey, Ostrich, Guinea Fowl, Ducks, Goose, Quail, Pheasant, Pigeon and Doves. The management and production system of some of these poultry species starting from the housing (location, dimension and orientation and preparation), brooding methods, nutrient requirement of each class, and health management were fully discussed in this module. Litter management (i.e controlling ammonia in the poultry house) and biosecurity measures are also important for any successful poultry production.

## 5.0 CONCLUSION

For successful poultry production, the management and production of these poultry species which include housing, brooding methods, health management, feeding, litter management and most importantly, biosecurity are very important.

## 6.0 TUTOR-MARKED ASSIGNMENT

1 List the factors to be considered in constructing a commercial turkey house
2 What is desnooding?
3 What is the crude protein and energy requirement of turkey at:
   a. 2 – 4 weeks
   b. 8-12 weeks
   c. 12- 15 weeks
   d. 15-20 weeks
4. List 2 diseases of turkey, their signs and treatment
5. Write short note on the brooding of ostrich
6. Highlight the breeds of quail.

## 7.0 REFERENCES/FURTHER READING

Anon, 2004. Best Management Practices for Turkey Production. National Turkey Federation, Washington DC. 3.

Arrington, L.C., 1980. Market Turkey Management-Brooding. North Carolina Regional Extension Publication #115.

Bolla, G., 2005. Raising turkeys.Agfact A5.0.9 (Fourth edition).

Ensminger, M.E., 1992. Poultry Science (Third Edition). Interstate Publishers, Inc. Danville, Illinois, USA. 329-356.

Leeson, S. & Summers, J.D., 1997.Commercial Poultry Nutrition (Second Edition).University Books, Guelph, Ontario, Canada. 302.

Saskatchewan Agriculture and Food, 2000.General brooding and rearing.

Scott, H.M., 1940. Turkey Management.Circular 200. Agricultural Experimental Station, Kansas State College of Agriculture and Applied Science. 20-21.

The Merck Veterinary Manual, 2006. < http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/202900.htm&hide=1>

Voris, J.C., 1997. California turkey production. Poultry Fact Sheet No. 16c.University of California.

Voris, J.C., McMartin, D. & Bradley, F., 1998. Animal Care Series: Turkey Care Practices (Second Edition). University of California, Davis. 11-12.

Joe Berry (2012).Ostrich Production. Oklahoma Cooperative Extension Fact Sheets http://osufacts.okstate.edu

FAO (2011) Goose Production. FAO Animal Production and Health paper 154

National Agricultural Extension and Research Liason Service (2008).The Production of Guinea Fowl in Nigeria. Extension Bulletin Ahmadu Bello University Zaria Nigeria.

Tewe, O. O., 1983. Replacing maize with plantain peels in diets for broilers. Nutr. Rep. Int., 28 (1): 23-29

Willin, E.S. (1995). Geese for Meat Production *ww.fao.org/DOCREP/005/Y4359E/y4359e0b.htm*

# MODULE 4 EGG FORMATION AND MORPHOLOGY



## UNIT 1 EGG SCIENCE AND TECHNOLOGY

### CONTENTS



## 1.0 INTRODUCTION

The formation of an egg is a remarkable process that takes just over a day, from ovulation to oviposition. The reproductive system of the hen consists of the ovary, the organ where the yolk develops, and the oviduct where the egg is completed. The ovary is attached to the back about halfwaybetween the neck and the tail. The oviduct, a tubelike organ

approximately 26 inches long, is loosely attached to the backbone between the ovary and the tail. During the process of formation, the egg will have to pass through different sections from Oviduct to uterus. When the egg is laid, certain deformities could be observed which could either be attributable to formation process or nutrition of the hen.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the processes involved in egg formation
- state various egg deformities and their causes
- explain the male and female reproductive systems of a chicken.

## 3.0 MAIN CONTENT

### 3.1 Process and Organs of Egg Formation

Ovulation is the release of an ovum from a ruptured follicle. The ovum drops into the ovarian pocket and within a few minutes is captured by the infundibulum. Ovulation generally occurs about a half an hour after the previous egg has been laid. Fertilization occurs in the infundibulum, which stores sperm for seven to fourteen days following insemination. Formation occurs as the egg travels down the oviduct and is encased in the various layers that make up a chicken egg.

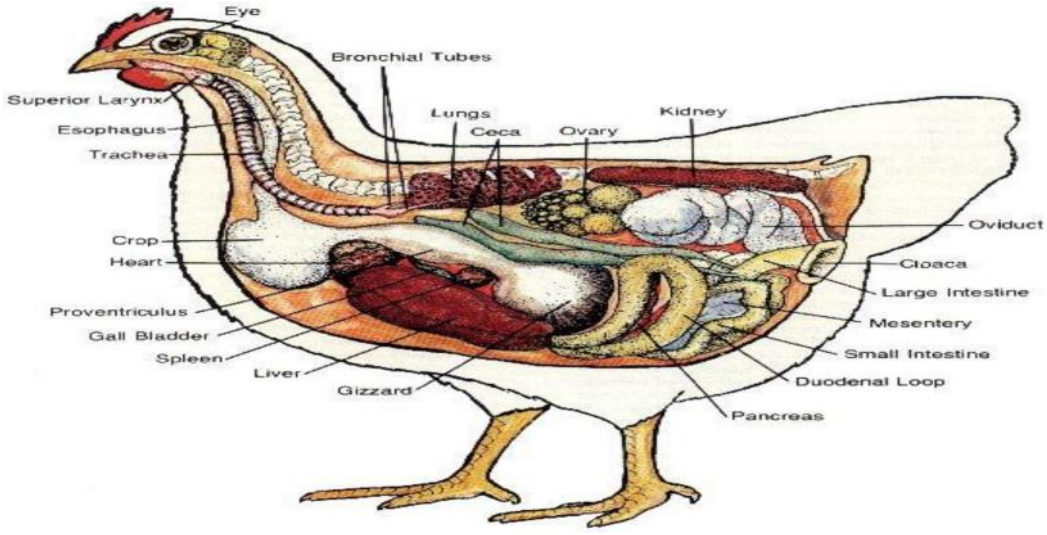



**Fig. 15: Model Showing the Internal Organs of the Female Chicken**
**Source:** Jacquie Jacob et al (2011)

**3.1.1 Ovary:** A female chick is born with a fully formed ovary containing several thousand tiny ova, or future yolks. These begin to develop, one at a time, when the pullet reaches sexual maturity. Each yolk is enclosed in its own sac or follicle.

The follicle contains a highly developed system of blood vessels which carry nourishment to the developing yolk. At ovulation the follicle ruptures to release the yolk into the oviduct. A double-yolked egg is the result of two yolks being released at the same time. Rupture occurs at the stigma line, in the area of the follicle which has no blood vessels.

**3.1.2 Oviduct:** This term refers to the system that receives the ovum (or yolk) from the ovary and produces an egg, which is then laid. The entire oviduct is actually one organ with many parts and it is bout sixty-five centimeters long.

**3.1.3 Infundibulum:** This is a funnel-shaped structure at the top of the oviduct that captures a mature ovum shortly after ovulation. This is where fertilisation, if it occurred, would take place. After about 15 minutes, the yolk passes along to the magnum

**3.1.4 Magnum:** This is a glandular structure made up of layers of circular muscles that carry the ovum along. It produces the majority of the albumen. Here, in approximately 3 hours, the albumen is deposited around the yolk as the albumen is formed, the yolk rotates, twisting the albumenousfibers to form the chalazae

**3.1.5 Isthmus:** The next site of activity is the isthmus where the two shell membranes are formed in about 1 1/4 hours.

### 3.1.6 Uterus

The egg has now reached its full size and shape, It passes along to the uterus to acquire, after 19-20 hours, the egg acquires salt and water before calcification occurs, forming the calcium carbonate shell and its color during the last 5 hours. After a few minutes pause in the vagina, the uterus inverts through the vagina, the cloaca (the. junction of the digestive, urinary and reproductive systems) and the vent to release the egg outside the hen's body.

Laying of the egg is known as oviposition. An egg has 2 ends, the large or broad end and the narrow or small end.
During formation the egg moves through the oviduct with the small end first. Just before laying, it is rotated and laid large end first. A young hen lays small eggs. The size of the egg increases as the hen gets older.

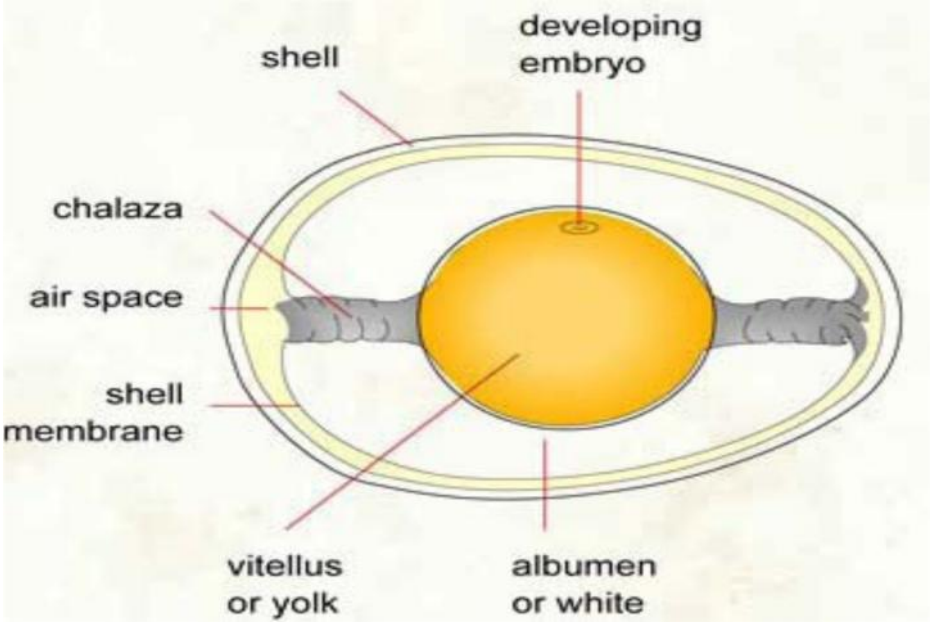



**Fig. 16: The Chicken Egg**
**Source:** Jacquie Jacob et al (2011)

## 3.2 Egg Deformities

Occasionally an egg will be laid without a shell. It looks like a water balloon. The shell membranes were placed on the yolk and egg white, but it somehow slipped past the "shell mechanism" and the shell wasn't deposited. The occurrence of the occasional shell-less egg is not necessarily an indication of any health problem. If the incidence increases, however, there may be a deficiency of calcium, phosphorus and/or vitamin D. If the condition persists a poultry nutritionist should be consulted before calling a veterinarian. Infectious Bronchitis and Egg Drop Syndrome have been known to cause an increase in shell-less eggs.

**3.2.1 Body Check**: This occurs when the shell becomes damaged while still in the shell gland and is repaired prior to being laid (Fig 17). There will be ‘thin spots’ in the shell or ‘ridges’ will form. The shells of

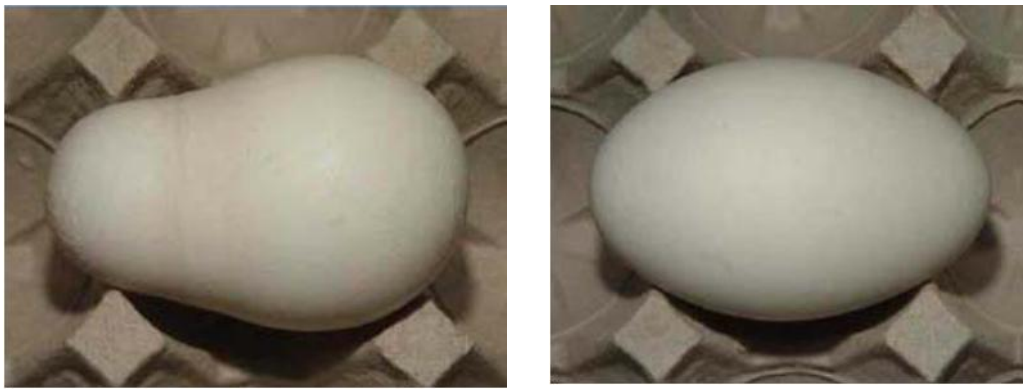
such eggs, though not cracked, are weaker than 'normal' eggs and should not be used as hatching eggs

A. Body check B. Thin spot C. Ridges

**Fig. 17:Poor Exterior Egg Quality Related to Shell Texture**

**3.2.2 Abnormal shape:** This is another category of problems that causes egg deformities (fig 18). Such eggs do not fit well into a typical egg carton or are more likely to break during transport, so they are removed during egg inspection and do not normally appear in eggs sold in the store.

To be considered a hatching egg, the egg should be a typical 'egg shape.' Abnormally shaped eggs should not be used as hatching eggs. Eggs should be trayed and incubated large end up and narrow end down.



A . Pear-shaped egg B. Football-shaped egg

**Fig. 18: Examples of Abnormally Shaped Eggs**

## 3.3 Avian Reproductive System

The avian reproductive system is very different from that of mammals. Birds are able to produce multiple offspring and tend to their needs for only a short period of time. The amount of time they devote to caring for their offspring depends on whether they are precocial or altricial, with the latter requiring more post-hatch parental care.

**Precocial**birds are well developed when hatched and are able to get up and walk around on their own very quickly. This includes most of the domestic poultry species - chickens, ducks, turkeys, etc. The exception is pigeons.

**Altricial**birds are still underdeveloped when they hatch and require a considerable amount of
parental care before they are able to get up and survive on their own. This would include pigeons and passerine birds (i.e., perching).

### 3.3.1 The Female Reproductive Organ

The female reproductive system of the chicken is divided into two separate parts: the **ovary**and the **oviduct** (fig 19). In almost all species of birds, including chickens, only the left ovary and oviduct are functional. Although the embryo has two ovaries and oviducts, only the left pair (i.e., ovary and oviduct) develops. The right typically regresses during development and is non-functional in the adult bird.

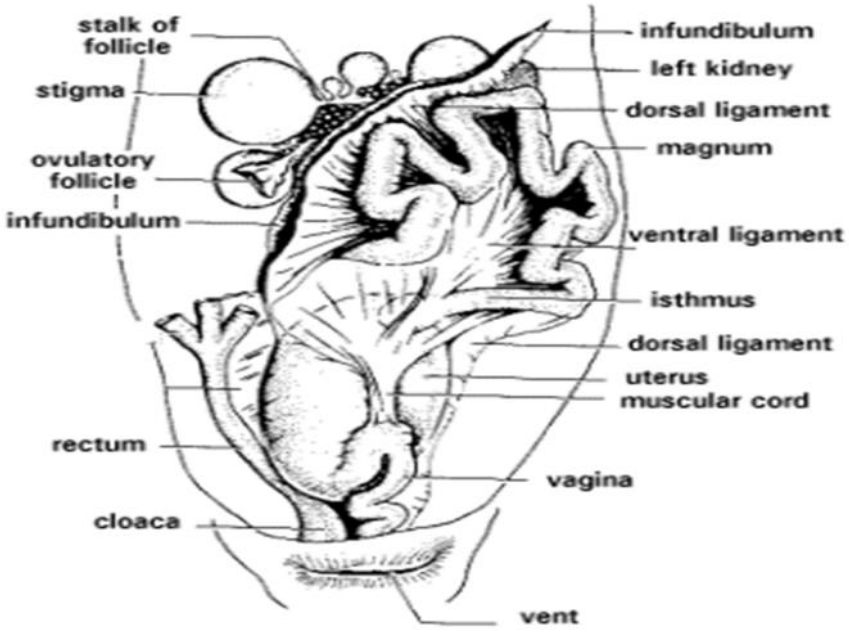



**Fig. 19: Female Reproductive System of a Domestic Bird**
(Source Linda Pesek (1999)

The **ovary** is a cluster of developing yolks or **ova** (Fig 20)and is located midway between the neck and the tail of the bird, attached to the back. The ovary is fully formed when pullet chicks hatch, but it is very small until the chicks reach sexual maturity. At hatch, pullet chicks have tens

of thousands of potential eggs (i.e., ova) which theoretically could be laid. Most of these, however, never develop to the point of ovulation. So the maximum number of eggs a hen can lay is determined when she hatches since no new ova are added once the chick has hatched. Each ovum (singular form of ova) starts out as a single cell surrounded by a vitelline membrane. As the ovum develops, yolk is added. The color of the yolk comes from fat soluble pigments called xanthophyllscontained in the hen's diet. Hens fed diets with yellow maize, or allowed to range on grass, typically have dark yellow yolks. Hens fed diets with white maize, sorghum, millet or wheat typically have pale yolks. The color of the yolks from these hens can be 'improved' by the addition of marigold petals to provide the desired level of xanthophylls in the yolk

**Fig. 20: Ovary of Female Chicken**
**Source:** Jacquie Jacob et al (2011)

The female reproductive system is sensitive to light exposure, especially the number of hours of light in a day. The release of the next ova typically occurs 30-75 minutes after the previous egg has been laid. If the egg was laid too late in the day the next ovulation will wait till the next day and the hen will have a day when she does not lay an egg because LH is released only in the dark.

Birds lay eggs in clutches. A clutch consists of one or more eggs laid each day for several days, followed by a rest period of about a day or more. Then another egg or set of eggs is laid. Clutch size is species- and breed-specific. For commercial egg layers clutch size is typically quite large. Clutch size, as well as the numbers of clutches laid in a laying cycle, will vary with species, but the principle is the same.
A hen will produce double yolked eggs. This phenomenon can be related to hen age but genetic factors are also involved. Young hens

sometimes release two yolks from the ovary in quick succession. Double- yolked eggs are typically larger in size than single yolk eggs. Double-yolked eggs are not suitable for hatching. There is typically not enough nutrients and space available for two chicks to develop to hatch. It has happened, but it is rare. It is rare, but not unusual, for a young hen to produce an egg with no yolk at all. Yolkless eggs are usually formed when a bit of tissue is sloughed off the ovary or oviduct. This tissue stimulates the secreting glands of the different parts of the oviduct and a yolkless egg results. Even rarer is an egg within an egg. This occurs when an egg that is nearly ready to be laid reverses direction and moves up the oviduct and encounters another egg in process of being put together. The results is that the first egg gets a new layer of albumen added and two 'eggs' are encased together within a new shell. Such eggs are so rare that no one knows exactly why they happen. Another egg problem that is commonly noted is blood and meat spots. Blood spots are normally found on or around the yolk (fig 21). The main cause is a small break in one of the tiny blood vessels around the yolk when it is ovulated. High levels of activity during the time of ovulation can increase the incidence of blood spots. Meat spots are usually brown in color and are more often associated with the egg white. They are formed when small pieces of the wall of the oviduct are sloughed off when the egg is passing through. In commercial operations, eggs with blood or meat spots are typically identified during candling and removed. It is rare, therefore, to see these eggs in stores. The incidence is higher in brown shelled eggs, and it is harder to identify them when candling the darker colored shell

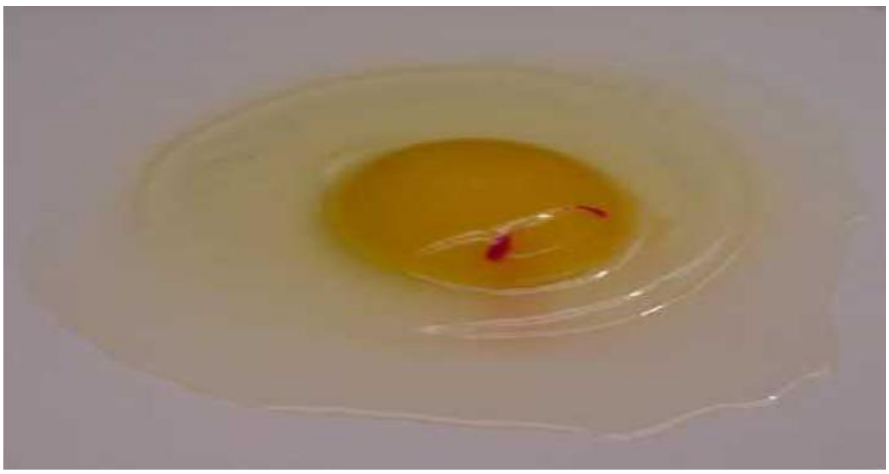


**Fig. 21: An Egg with a Blood Spot on the Yolk**

### 3.3.1.1 Factors that Stimulate Reproduction in Birds

1. Day length or photoperiod plays an important role in birds that are seasonal reproducers. Environmental light stimulates neural receptor which, in conjunction with an internal circadian cycle, enables the bird to respond to the most favourable time for reproduction. As day length increases, the ovaries and testes of most temperate species increase in size and undergo development.
2. Temperature and humidity influence reproduction in many free ranging species. In areas where the climate is stable and dry and day length is constant, rainfall may trigger reproductive behaviour.
3. In the budgie male, vocalization triggers reproduction by stimulating ovarian development and ovulation.
4. In colony breeding species, such as budgies, the presence of other breeding birds is a reproductive stimulus. Auditory as well as visual contact stimulates reproduction.
5. The availability of a suitable nest and nesting material plays an important stimulus for breeding in some species such as finches and cockatiels.
6. Biologic clocks, known as circannua cycles, control the release of hormones that regulate reproduction, metabolism and behaviour.

In the male, FSH initiates seasonal growth and development of the seminiferous tubules in the testes and spermatogenisis. LH promotes the production of testosterone, the male hormone responsible for the production of secondary sexual characteristics and behavior.

## 3.3.2 The Male Reproductive Organ

Male birds have two functional bean-shaped testes located within the body, just above the kidneys (Fig 22). This is in contrast to many female birds in which the right ovary regresses, leaving just one functional left ovary. The testes grow in size as the bird reaches sexual maturity. In seasonal breeders, the testes enlarge during the breeding season and often change colour - from yellow to white in most birds. Immature or inactive testes are yellow in colour due to the accumulation of lipids. During the onset of breeding, the testes change to a white colour due to the increase in the size of the seminiferous tubules. The testes are covered by a very thin tunic membrane. The bulk of the testis is composed of numerous convoluted seminiferous tubules. Sperm cells

are formed in the tubules. Sperm formation occurs more rapidly in birds as compared to mammals.

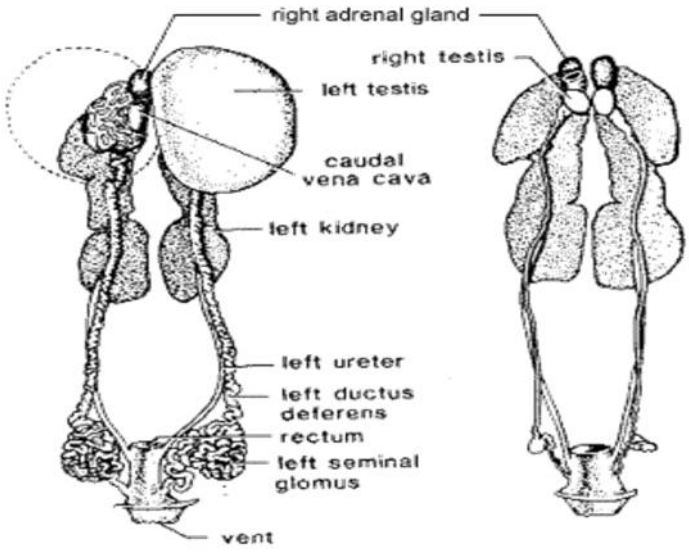



**Fig. 22: Male Reproductive System of a Bird**
**Source : Linda Pesek (1999)**

The testes also produce the male hormone testosterone. This hormone is very important in stimulating growth of the male reproductive tract, the development of secondary sexual characteristics such as courtship behaviour and aggression and, in chickens, the bright red combs and bright red wattles.

Once the sperm leave the testes, it travel through a small tube, known as the epididymis. The avian epdidymis is very small in the bird and is not divided into three parts, the head, the body and the tail as in mammals.
Sperm then enter the *Ductus deferens* a long narrow tube that travels next to the ureter and enters the cloaca. The ductus is densely packed with sperm during the breeding season. It takes from one to four days for the sperm to travel from the testes to the end of the ductus. Sperm undergo maturation in the male reproductive tract.
The spermatazoon is composed of an acrosome, a head and a tail. The acrosome contains an enzyme which enables the sperm to penetrate the egg.

**SELF-ASSESSMENT EXERCISE**

Highlight the sections of the female reproductive sections that egg will have to pass through and the time involved before being laid

## 5.0 SUMMARY

The formation of an egg is a remarkable process that takes just over a day, from ovulation to oviposition. For proper chick formation, deformed or abnormal egg should not be taken to hatchery.
A female chick is born with a fully formed ovary containing several thousand tiny ova, or future yolks which developed into full egg when the pullet reaches maturity. The male and female reproductive systems of birds are regulated by the hypothalamus- pituitary-gonadal axis which produces a gonadotropin-releasing hormone (GnRH) that stimulates pituitary gland production of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which regulate ovarian and testicular function. Factors that stimulate reproduction in bird were highlighted.

## 4.0 CONCLUSION

The process of egg formation goes through Infundibulum, Magnum, Isthmus, Uterus and through vaginal, cloaca and the vent to be released outside the hen's body. It takes about 25-26 hours before an egg can be fully formed.

The reproductive system of the hen consists of the ovary, the organ where the yolk develops, and the oviduct where the egg is completed. The male and female avian reproductive systems are regulated by the hypothalamus-pituitary-gonadal axis. The hypothalamus produces a gonadotropin-releasing hormone (GnRH) that stimulates pituitary gland production of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which in turn regulate ovarian and testicular function.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Briefly but concisely summarise what happen at each stage of egg formation
2. Explain 4 factors that stimulate reproduction in birds
3. Differentiate between Precocial and Altricial birds

## 7.0 REFERENCES/FURTHER READING

Mickey A. Latour, Ryan Meunier, and Jessica Stewart (1998).The Process of Egg Formation**.**Cooperative Extension work in Agriculture and Home Economics, state of Indiana, Purdue University,and U.S. Department of Agriculture. U.S.

http://www.nutrecocanada.com/docs/shur-gain---poultry/egg-formation-and-eggshell-quality-in-layers.pdf

https://www.extension.purdue.edu/extmedia/as/as-525-w.pdf

# UNIT 2 MANAGEMENT AND FEEDING OF CHICKS, GROWERS, LAYERS AND RATION FORMULATION

**CONTENTS**



## 1.0 INTRODUCTION

Day-old chicks are purchased from hatcheries. The ways these chicks are managed during their first week of arrival determine their survivability. Laying hens are chickens selected for table egg production and have a smaller body frame and body weight than chickens grown for meat. Some commercial hybrid egg producing chickens produce up to 300 eggs per year. They have a mature body weight of 1.8 to 2.0 kg. For birds to perform maximally, feed balanced in quantity and quality

cannot be over emphasised. Ration can be defined as the total amount of feed given to the animals on daily basis while Feed formulation is the process of quantifying the amounts of feed ingredients that need to be put together, to form a single uniform mixture (diet) for animal that supplies all of their nutrient requirements. It is one of the central operations of the animal industry, in view of its role in ensuring good nutrition. Feed costs account for more than 70% of the total production costs for most types of poultry, so it is important that returns are maximised through use of adequate diets.

Different Species, Strains or Classes of animals have different requirements for energy (Carbohydrate and fats), proteins, Minerals, and Vitamins in order to maintain its various functions like body maintenance, reproduction, egg production, milk production and meat production

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain how to manage broiler from day old to market
- discuss the nutritional requirement at every stage of live of birds and
- explain the different methods of feed formulation.

## 3.0 MAIN CONTENT

### 3.1 Management of Chicks at the Brooder Stage

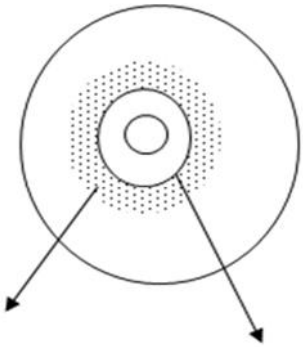
This is the most critical period for chicks and at this period more death can occur than in the later stages. Before the arrival of the chicks, the brooder house must be thoroughly cleaned, disinfected and dried. The house isolated as much as possible with a footbath of disinfectant kept at the entrance to the house. The brooder guards should be installed about 36 cm high. This keeps the chicks confined to the brooder areas and result in their eating and drinking faster. During the first few days, the feeders should be half filled with chick’s marsh. This is to minimize feed wastage. Initially the chicks can have their beaks dipped into the water to help them to drink and reduce early dehydration and mortality.

Where automatic feeders and drinkers are used, these must be introduced to them as soon as possible.

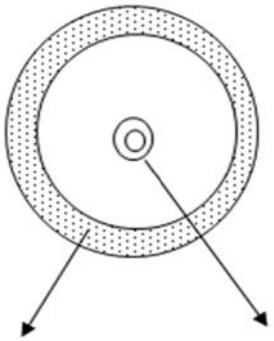
Temperature in the brooder house is vital for the chicks' survival. Temperature in the first day of brooding should be about 35 °C. This is slowly decreased to about 30 °C towards the end of the first week. From then on, the temperature should be decreased by about 3 °C for each successive two weeks because chicks require lower temperature to grow feathers. They should neither crowd together nor disperse from the source of heat. Removal of source of heat depends on the climate and season as well as rate of feathering. Proper aeration will also eradicate strong ammonia odour. Stocking density in the brooder is in most cases at the discretion of the farmer but a space of 7-8$m^2$ for about 1000 chicks is recommended.

**Fig.23: Brooding under Intensive Management**

**Fig. 24: Even Distribution of Chicks during Brooding**

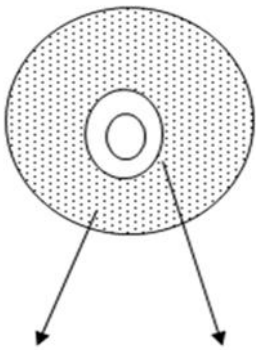


Bird Brooder **TOO COLD**



**TOO HOT**

Bird brooder



Bird Brooder **JUST RIGHT**

**Fig. 25: Reactions of Birds to Heat during Brooding**

## 3.2 Management of Growers

Growers are birds between 8 and 18 weeks of age. The growing or rearing period is that period between brooding and the point of lay in layers and between brooding and marketing for broilers and turkeys. Management of growers in confinement is common and popular with large scale farmers. In general, the temperature requirement for growers is less than that for chicks while the former require more ventilation.

Growers are reared on deep litter. As from the 8th week, the chick's mash is gradually replaced with growers mash.

## 3.3 Management of Layers

It is very important that hens start laying eggs at about 18 weeks. At this stage, the birds must be acute, lean and relatively small. If the birds are too heavy, their feed intake should be restricted. Routine management of laying birds in cages consists mainly of provision of feed and water without restriction and egg collection. In the tropics, birds lay mainly between 0800 and 1700h while egg collection is carried out twice at 1100h and 1500h.

When layers are kept in deep litter, routine operations carried out include removal of dead birds, provision of fresh feed; after litter and droppings have been removed from the feeder; cleaning of water fountain and replenishment with clean cool water; collection of eggs and turning of the litter. Deworming, delousing and occasional offer of anti-stress are also carried out in the layer unit.

A bag of feed 25kg is sufficient for 200 layers for one day. The laying birds are maintained for about 12 months. To cover cost of feed, the laying rate should not be less than 45 to 50%. This means that 100 layers should produce not less than 45 to 50 eggs per day. A 1000 layer unit should produce 450 to 500 eggs or 15 to 17 trays of eggs per day. Nevertheless, about 65% hen day production is required in order to cover the cost of production and still obtain a margin of profit. Eggs weighing less than 50 g may not attract good market. Management should be efficient so as to keep the mortality below 10%.

**Fig. 26: Battery Cage System of Layer Production**

**Fig. 27: Laying Birds on Deep Litter System**

### 3.3.1 Debeaking

This is a process of removing at least ½ of the upper beak from the nostrils and 1/3 of the lower beak. There is cold debeaking, this is carried out by the use of a scissors or any sharp cutter. With cold debeaking, the beaks will grow back after sometimes. The more effective method is by an electric debeaker. Debeaking is best carried out at between 6 and 8 weeks of age and early in the morning between 6-7 am. Be sure that the flock is in good health before debeaking. Debeaking prevents cannibalism and egg eating habits in the flock.

### 3.3.2 Lighting Programme

In the laying phase, it will be advantageous to increase the day length by 3 hours by giving supplementary lights from 6-9 pm in the evenings. Once a supplementary lighting schedule has been started, it must not be interrupted by power failures. Hence standby generators may be required for a successful lighting programme for layers.

### 3.3.3 Forced Moulting

Forced moulting is the practice of forcing the flock to rest from egg production for the purpose of the flock to be re-cycled for the second year. Forced-moulting may be achieved in cages simply by withdrawing the feeds from the flock for 10 days. Production will drop to zero level

by the 5th day. Normal feeding should start by the 11th day while the flock should be back in production within 28 days. Forced-moulting must be done by the end of 10 months in lay to be effective. It is also a useful practice if the glut of eggs coincides with this age for a flock and there is no good market for the old layers.

## 3.4 Feeding of Starters, Growers and Layers

Feed is a major component of the total cost of poultry production. To support optimum performance, formulate rations to give the correct balance of energy, protein and amino acids, minerals, vitamins and essential fatty acids. The choice of feeding program will depend on the target of the business; for instance whether the focus is on maximizing profitability of live birds or optimizing yield of carcass components.

### 3.4.1 Feeding Pullets

Two types of feeds are used in raising pullets to point of lay. The first is the chick mash or chick starter. This type is fed from day old to 7 or 8 weeks of age. It is then followed by a growers' mash which is fed from 7 or 8 weeks to about 18 weeks of age or point of lay. The switch from chick to grower ration should be gradual (3/4 + 1/4), (1/2 + 1/2) and (1/4 + 3/4). It is worth noting that growers show great capacity to perform well on different diets even on those diets that do not meet the specific nutrient requirements. This is because the growth rate is much slower than for fast growing boilers which require precise formulations.

### 3.4.2 Feeding Layers

Feed constitutes between 50 and 60 percent of the cost egg production. Feed cost is therefore an important factor to consider for the improvement of production efficiency. It is recommended that pullets be changed from grower to layer feeds when they attain at least 5% production which should be between 18 weeks and 22 weeks of age.

### 3.4.3 Feeding Commercial Layers

Hens laying table egg production and layer breeder hens should be fed a*d libitum* (i.e. at all times) from point of lay for the entire laying period of 12 months. Balanced feed must be provided. Feed dilution with maize, wheat offal or other grains will reduce productivity.

### 3.4.4 Layers Mash

This feed contains 16.5 to 17% crude protein and is meant for table egg production flocks. It must contain sufficient energy of 2600-2700 kcal/kg. The protein ingredients must be such that provide the required levels of the essentials amino acids such as lysine, methionine (Methionine + Cysteine) and tryptophan.

## 3.5 Performance Standards

Under good feeding and management practice a high level of performance can be maintained. It is necessary for the poultry farmers to monitor regularly the performance of their flocks by comparing them with the standards achievable by the top ranking farmers in the locality. The following standards may be taken as a guide:

| | |
|---|---|
| **For rearing of chicks** (0-8 weeks) | (egg- type chicks) |
| Mortality up to 8 weeks | below 3% |
| Feed intake to 8 weeks | 1.6kg/birds |
| Weight at 8 weeks | 650g/birds |
| | |
| **For Growers** 9-20 weeks | |
| Mortality rate 9-20 weeks | Less than 2% |
| Feed intake | 6.5kg/bird |
| Body weight at 20 weeks | 1550g/bird |
| | |
| **Laying birds** | |
| Laying house mortality | less than 10%/year |
| Age at 5% production | 147 days |
| Age at 50% production | 168 days |
| % HD production at peak | 87 |
| Feed/dozen eggs (kg) | 2.35 |
| Egg weight (g) | 59g/egg |
| Average feed intake g/hen/day | 135 (depends on energy content of feed and environment temperatures) |
| Broiler 0-8 Weeks | |
| Mortality | less than 5% |
| Feed intake | |

| | |
|---|---|
| (Starter, 0-5 weeks) kg/bird | 1.4 |
| (Finisher 6-8 weeks) kg/bird | 3.5 |
| Feed efficiency (kg feed/kg gain) | 2.20 |

## 3.6 Important Considerations in Feed Formulation

Among such factors to be considered in making good feed formulation are:

1 **Acceptability to the birds:** The ration being formulated has to be palatable enough to stimulate intake by the birds. Any feed refuse by the bird is worthless, since the feed has to be consumed by birds to serve its purpose.

2 **Digestibility:** The nutrients in the feed have to be digested and released into the gastrointestinal tract to be utilized by the animals. For instance, rations with high fiber content cannot be tolerated by poultry.

3 **Cost:** The requirement of the birds can be met through several combinations of feed ingredients. However, when the costs of these ingredients are considered, there can only be one least-cost formulation. The least cost ration should ensure that the requirements of the animal are met and the desired objectives are achieved.

4 **Presence of Anti-nutritional Factors and Toxins:** This affects the digestion of some nutrients by making them unavailable to the birds. e.g. antitrypsin factor in soybean, meal. Some feed ingredients may also contain toxic substances which may be detrimental to the animal when given in excessive amounts,

## 3.7 Methods of Formulating Feed:

There are several methods of formulating rations; all of them have the same objectives of providing the required balanced nutrients at the least possible cost. Some of these methods are:

### 3.7.1 Trial and Error Method:

This is the most popular method of formulating rations for poultry. As the name implies, the formulation is manipulated until the nutrient requirements of the birds arrived at. Trial-and error method can be done manually on paper or with the aid of a computer using programme like spreadsheet e.g. Excel, Lotus123, and Quattro pro. This method makes possible the formulation of a ration that meets all the

nutrient requirements of the birds. The limitation of this method is that; it is laborious and takes more time before one will arrive at a *fairly* satisfactory result.

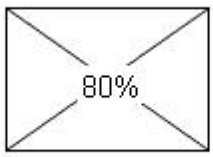
**3.7.2 Pearson Method:** The Pearson square or box method of balancing rations is a simple procedure that has been used for many years. It is of greatest value when only two ingredients are to be mixed. In taking a close look at the square, several numbers are in and around the square. Probably one of the more important numbers is the number that appears in the middle of the square. This number represents the nutritional requirement of an animal for a specific nutrient. It may be crude protein or TDN, amino acids, minerals or vitamins.

**3.7.3 Substitution Method:** A second method of ration balancing may simply be termed **substitution method**. In this method, a ration is estimated, and the nutrient content calculated. These results are then compared to the nutrient needs of the animal for which the ration is being balanced. Deficiencies are corrected by changing proportions of feeds in the rations or by substituting or adding ingredients. Knowledge of animal nutrient requirements, feeds available and their nutrient composition are still necessary.

**3.7.4 Linear Programming (LP):** This is the common method of Least Cost Feed Formulation. This method was first developed in 1947 by G.B. Dantzig to solve some U.S. Air Force planning problems but now it is widely used in all types of fields. This is a method of determining the least-cost combination of ingredients using a series of mathematical equations

**Example 1**: Formulate a finishing diet containing 80% TDN on a DM basis. The feeds to be used are roughage (60% TDN on a DM basis) and a concentrate mix containing 83% TDN on a DM basis.
Place the percent TDN desired in the combination of the two feeds in the center of a square and the percent TDN content of each feed at the left corners as shown in the figure below.

Roughage 60%




3 parts roughage

Concentrate 83%

20 parts concentrate
23 parts total

Subtract diagonally across the square, the smaller number from the larger without regard for the sign and record the difference at the right corners.
The parts of each feed can be expressed as a % of the total.

3 part roughage x 100 = 13% Roughage
23 parts Total

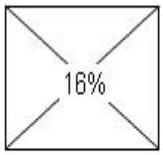
20 part concentrate x 100 = 87% Roughage
23 parts Total

**Double Pearson's Square Example**

**Example 2**: Suppose we want a final mix with 16% CP and 72% TDN. We have corn silage with 9% and 68%, concentrate with 24% and 79%, and alfalfa hay with 20% and 68% CP and TDN, respectively.

Mix 1, 16% CP and >72% TDN

Corn Silage 9%




8 parts roughage = 53.3% x 68% TDN = 36.3

Concentrate 24%

7 parts concentrate = 46.7 % x 79% TDN = 36.9
15 parts total 73.1 % TDN

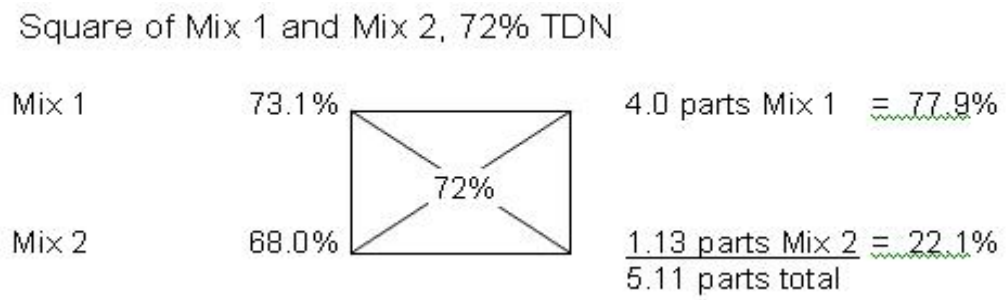
Mix 2, 16% CP and <72% TDN

Corn Silage 9%


4 parts roughage = 36.4% x 68% TDN = 24.7

Alfalfa Hay 20%

7 parts concentrate = 63.6% x 68% TDN = 43.3
11 parts total 68.0% TDN




The ration would contain 77.9% Mix 1 and 22.1% Mix 2. Corn Silage was in both squares or mixes, so there are two calculations needed to determine the total amount of corn silage and only one calculation each to determine the amounts of Concentrate and Alfalfa Hay. Calculations for individual ingredients are shown in the table below.

**Example 3**. Grain mix A is 40% corn and 60% soybean hulls (SBH), whereas grain mix B is 50% dried distillers grains (DDG) and 50% cottonseed hulls (CSH). The energy requirement being balanced for is 1.44 Mcal/d. The energy contents of the feeds are listed in the table below.

| **Feed** | **Energy (Mcal/kg)** |
|---|---|
| Corn | 2.01 |
| Soyabean hull | 1.37 |
| Dried distiller grains | 1.97 |
| Cottonseed hulls | 0.48 |

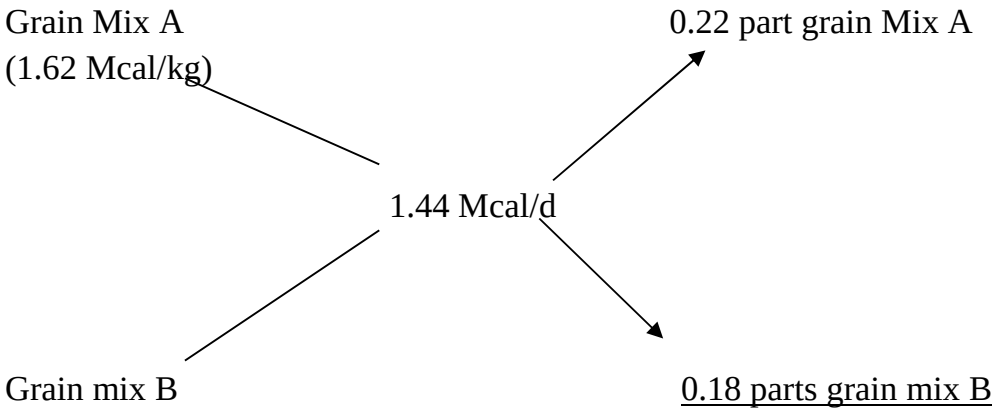
"

First, treat grain mixes A and B as the two feeds to use in the Pearson's Square. This means you must calculate the amount of energy (Mcal/kg) available in each mix. These are the steps:

1. Grain mix A
   a. 40% corn at 2.01 Mcal/kg, so 2.01 x (40 ÷ 100) = 0.80 Mcal/kg
   b. 60% SBH at 1.37 Mcal/kg, so 1.37 x (60 ÷ 100) = 0.82 Mcal/kg
   c. 0.80 + 0.82 = 1.62 Mcal/kg

2. Grain mix B
   a. 50% DDG at 1.97 Mcal/kg, so 1.97 x (50 ÷ 100) = 0.98
   b. 50% CSH at 0.48 Mcal/kg, so 0.48 x (50 ÷ 100) = 0.24
   c. 0.98 + 0.24 = 1.22 Mcal/kg

Second, make sure the energy requirement (1.44 Mcal/d) falls within the range of the energy content of each grain mix (1.22 to 1.62 Mcal/kg);
Third, set up the Pearson's Square as in Figure below.




Using Pearson's Square to formulate rations with more than two ingredients.

Pearson's Square calculations:

1. Subtract across the diagonal:
   a. 1.44 – 1.22 = 0.22 parts grain mix A
   b. 1.44 - 1.62 = 0.18 parts grain mix B

2. Sum the parts:
   a. 0.22 parts grain mix A + 0.18 parts grain mix B = 0.40 total parts

3. Divide each part by the total to calculate the percent of each feed to include. This step varies from the first example, because more than two ingredients are being used. Before dividing, multiply the parts of each grain mix by the proportions of each ingredient in the mix (this should sum to the total parts). The total ration will be 55% grain mix A (40% corn and 60% SBH) and 45% grain mix B (50% DDG and 50% CSH).:

   a. 0.22 x (40 ÷ 100) = 0.09 parts corn
   b. 0.22 x (60 ÷ 100) = 0.13 parts SBH
   c. 0.18 x (50 ÷ 100) = 0.09 parts DDG
   d. 0.18 x (50 ÷ 100) = 0.09 parts CSH

4. For grain mix A:0.09 parts corn ÷ 0.4 total parts = 0.225
   0.13 parts SBH ÷ 0.4 total parts = 0.325

5. For grain mix B: 0.09 parts DDG ÷ 0.4 total parts = 0.225
   0.09 parts CSH ÷ 0.4 total parts = 0.225

Finally, go back and check the math as follows:
0.225% corn x 2.01 Mcal/kg = 0.45 Mcal/d
0.325% SBH x 1.37 Mcal/kg = 0.44 Mcal/d

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.225% | DDG | x | 1.97 | Mcal/kg | = | 0.44 | Mcal/d |
| 0.225% | CSH | x | 0.48 | Mcal/kg | = | 0.11 | Mcal/d |

0.45 + 0.44 + 0.44 + 0.11 = 1.44 Mcal/d

## 3.8 Merits of Formulated Rations - Using Computer

1. Least cost minimizes the cost of ration, given a certain set of ingredients and their nutritional content which is done in real time using a computer.
2. It is convenient and saves manpower.
3. It allows 'least cost' diet formulation using the specific information fed into them.
4. It eliminates human error both in calculation and in speed.

**SELF-ASSESSMENT EXERCISE**

i. Write short notes on the different methods of feed formulation
ii. Highlight 3 factors to be considered in formulating a good ration

## 5.0 SUMMARY

The management of chicks called brooding and the response of birds to brooding temperature were highlighted in the lecture. The management and feeding of growers and layers were also discussed. The difference between ration (the total amount of feed given to the animals on daily basis) and Feed formulation (the process of quantifying the amounts of feed ingredients that need to be put together, to form a single uniform mixture (diet) for animal that supplies all of their nutrient requirements) was explained in this unit. Before any farmer can make a good feed, some factors like, acceptability of the feed, cost, digestibility of the feed and presence of antinutritional factors and toxins needs to be considered. Trial and error, Pearson square, Substitution method and Linear-programming are some of the methods of feed formulation.

## 4.0 CONCLUSION

Proper management and care of chicks during their first week of arrival (brooding period) will determine their survivability. Techniques such as forced molting, debeaking and adequate lighting programme are used in every layer production. Ration formulation is one of the central operations of the animal industry, in view of its role in ensuring good

nutrition. Therefore, efficient ration formulation should be done by farmers so as to meet the nutrient requirement of the type of animal to be fed with such ration to ensure optimal production at a reasonable cost.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. To reduce birds mortality, how will you manage chicks at the brooding stage.
2. Provide short notes for debeaking and forced-moulting in management of layers.
3. You have been requested by a stall feeder to help formulate a 15% CP and 75% TDN ration for steers. The farmer would like to include 5% wheat, 5%GNC and 1 % slack space for minerals. How much of each available feed ingredient is required in the ration

## 7.0 REFERENCES/FURTHER RAEDING

Sonaiya, E.B. (2007). Family Poultry, Food security and the impact of HPAI. World Poultry,science Journal 63:132-138

CTA. 1990. Small-Holder Rural Poultry Production - Requirements of Research and Development. Thessaloniki, Greece, 9–13 October 1990

Valerie Brewer (2007). An Introduction to Chicken Production; A brief insight into the modern chicken and egg industries.National Chicken Council.Pg 1-14

# UNIT 3 POULTRY BUILDING AND EQUIPMENT

## CONTENTS



## 1.0 INTRODUCTION

The housing systems collectively known as the intensive system are the deep litter, the wire or slatted floor, the straw yard and the cage systems.

## 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the types of intensive system of poultry production and their advantages
- identify the various poultry equipment and appliances.

## 3.0 MAIN CONTENT

### 3.1 The Deep Litter or Built-up Litter System

The deep litter system consists of a fixed building having suitable litter material spread on the floor (Fig 28).

A windowless house, with provision for environmental control is used in temperate regions but an open-sided house is used in the tropics.

The deep litter house is variable in size depending on the ages of the birds; larger sizes may be used with skilled management.

Poultry houses are usually rectangular in plan. Square and round designs are rare.
Large deep litter units can function efficiently only if the width of the house does not exceed 7.2-10m and internal fixtures are at a minimum to permit straight-through ventilation of the house. The length of the house is determined by the gradient of the ground.

The roof of a poultry house may be full-span (gable) or lean-to. The height of the ridge is related to the width of the house, the difference between the ridge and eave heights is about one quarter of the width of the house for houses of 7.2 m or less in width. Wider houses have a lower ratio of ridge height to width, so that the house will not be too high. Lean-to roofs may create the problem of rain drifting into the house. -With all types of roofs, the eaves should be long enough to check rain.

The floor of the deep litter house should be cemented and strong to prevent entry of rats and mice. A cemented floor also improves the efficiency of washing the floor clean of old litter material. A floor that is poorly cemented is worse than one not cemented.

Suitable litter materials in the tropics are wood shavings, crushed cobs of maize (after removing the grains), crushed dry kenaf stems, and peanut shells. Dry sawdust is not a suitable material as it may easily block the nostrils of the birds when they peck the litter, or irritate the nasal passages and the throat-a stress factor contributing to respiratory infection. Litter material must be water absorbent. In temperate regions, materials that are used include peat moss and chopped straw.

### 3.1.1 Advantages of the Deep Litter System

The advantages unique to the deep litter system, and associated with litter materials, are as follows:

(1) The litter converts the poultry droppings into a drier material which is easier to remove, and the frequency of removing the droppings is reduced.
(2) The litter is useful in controlling disease infections, largely because the system reduces the concentration of pathogens. The presence of litter material and droppings with their moisture provides a suitable environment for the pro-liferation and action of pathogens;
(3) This action generates heat and ammonia, both of which are lethal to and thereby control the population of pathogenic organisms themselves, thus providing a sort of natural population control. Under good management, whereby the litter material is constantly mixed with the droppings, the pathogens are thinly spread out. In effect, the birds on litter arc exposed to a subclinical level of infection which not only fails to produce clinical symptoms but also produces natural immunity in the birds.
(4) Also related to disease prevention, the litter appears to alleviate temperature effects by acting as an insulator.
(5) The action of micro-organisms on litter and on droppings produces "animal protein factors' (A.P.F.) which notably include vitamin $B_{12}$. This is essential for the development of chick embryos and hence for the hatchability of chicken eggs.
(6) There may be an economic advantage in that litter materials arc sometimes obtained more cheaply than any other materials that may be used to prevent direct contact between the birds and their droppings on the floor.

### 3.1.2 Management of the Deep Litter System

Well-managed litter is friable, has a crumbly consistency, a low concentration of pathogens, and is practically free from ammonia. It is difficult to form a ball of it with the hand, as it constantly breaks down. It is thoroughly mixed with the droppings. Poorly managed litter manifests opposite characteristics, and in extreme cases, it may be wet or mucky producing a pungent odour of ammonia that may affect the eyes of the birds. It increases disease risk partly by acting as a favourable medium for the development of pathogens that can resist the destructive effect of ammonia. The accumulation of ammonia in litter

due to poor management is injurious to the birds and is incompatible with a high level of performance.

Satisfactory management of litter should start with the initial provision of enough quantities of the materials. Otherwise it is practically impossible to obtain the right ratio of litter to droppings, or litter of the right consistency. As soon as there is an excess of droppings, more litter should be added.

The litter should be turned with the rake daily, or at least three times a week, to ensure that the droppings are thoroughly mixed with litter.

Wet litter is undesirable, as discussed above, and it should be minimized by placing drinkers on droppings-pits or wired sections of the floor, and on low platforms. The wet litter under the platform and droppings in the pits are outside the reach of the birds. However, the wet litter should be removed frequently or mixed with dry litter. Water drinkers should not be overfilled, and should be stable, well-constructed and of the right size and number for the birds.

**Fig. 28: Deep Litter Housing System for Layers**

## 3.2 The Cage or Battery (or battery cage) System

This system appears structurally closer to the wire floor than any other of the intensive systems. In the cage system, the birds are housed in individual compartments, each accommodating a limited number of birds, mostly one or two (Fig 29). This individual cage compartment is the basic component unit of the cage system and it is essentially a laying nest with a sloping floor, and feed and water troughs.
It is constructed to permit ventilation from all sides. Usually the sides,

top and floor are constructed of heavily galvanised iron. While the sloping floor extends forward and folds gently to form the cradle from which the eggs are collected. The hardness of the material and the slope of the floor are disadvantages, often causing breakage of eggs.

### 3.2.1 Advantages of the Cage System

1. The birds are free from the various problems associated with mutual contact or social friction resulting in vice habits and stress. Significantly, pecking which may predispose birds to fowl pox are avoided. Birds suffering from infectious diseases are automatically confined and the spread of disease is controlled.

2. The birds are less exposed to disease organisms since practically no contact exists between them and their droppings. They are also less predisposed to infection because the exposure of the birds to litter, ammonia and their mutual contacts is minimal.

3. The birds are easier to manage. Feed or water condition is checked in the more comfortable position of standing or bending slightly. Keeping the birds in separate compartments simplifies the identification of the birds. It is less easy for birds to feed on eggs and thereby develop egg eating habits.

The only disadvantages that used to be associated with this system is the assumed high initial capital outlay, largely on account of the cage, but it may cost about the same to house a bird in the cage or on deep litter.

**Fig. 29: Cage System of Housing for Layer**

## 3.3 Poultry Equipment and Appliances

Poultry houses cannot function satisfactorily unless they are properly equipped and supplied with appliances. These are the basic requirements for the successful management of fowls.

Poultry equipment and appliances vary from the simple to the complex, from the most elementary makes to the most advanced electronic devices. The temptation is usually to go in for the complicated item, but it is worth realising that if an aluminium cup can be used satisfactorily for a purpose, it is wasteful to buy the gold cup.

### 3.3.1 Feeders

Feeders and drinkers are the appliances used to supply feed and water respectively to the birds. Feeders and drinkers are components of the cage system. The construction of feeders should be such as to avoid waste, to prevent fouling of feed with droppings and litter, easy to clean or wash, and constructed of durable material. If timber is used for the construction, preservatives like solignum should be used to prevent fungal or insect damage. Automatic feeders may become important with the increasing cost of labour in many tropical areas. One form distributes feed from the feed-hopper through a chain electrically driven and operated by a time switch. It activates feed and reduces crowding but it is expensive.

#### 3.3.1.1Trough Feeders

Apart from flat feeders like the Keyes-type trays for feeding chicks, feeders are mostly troughs or hoppers. The main part of the trough feeder is the feed container, with either the top and base widths equal or the top wider than the base so that the sides slope or may even gave a V-shape in cross-section. The latter shape brings every particle of feed within reach of the birds and makes it easy to clean.

The top of each of the long sides is curved in to form a ‘lip’ as a means of limiting feed waste. A spinner mounted on top of the feeder gives sufficient access to feed and prevents fouling and wastage of feed by the bird.

The trough feeder comes in a variety of sizes; the length can be about 0.6m to 1.6m. The base width of a sloping sided trough is about 8cm when the trough is for 8-week-old birds and 20-25cm for adults. The feeders have legs which lift them above the litter. Some feeders are placed on stands which have perches.

### 3.3.1.2 Tube Feeders or Hanging Feeders

These are metal feeders which are cylindrical in shape, and with a pan into which feed flows from the main body in which reserve feed is contained. Another type of tube feeder has sloping sides, wider at the base than at the top. They vary from about 6kg to 14kg in the quantities of feed that they can hold. The lower pan may be detached and used as a chick feeder. Some of them have covers at the top end.

### 3.3.2 Drinkers

The commonest form of drinker in Nigeria is the water fountain, which may be made of galvanised iron, alummium or plastic. The latter is not durable, while iron becomes rusty, in contrast to alummium which is rust-resistant, durable but expensive. They are usually conical or partly cylindrical. They vary in capacity from, say, 2 to 6 or 8 litres. The shape should facilitate quick and thorough washing.

Some drinkers are trough-shaped, like feeders and made of galvanized angle iron. Bars spaced at 7.5cm prevent fouling of the water. The trough is placed on a slatted or wired platform over a drain, running along one side of the house. The trough may be filled manually or by an automatic device based on a spring-loaded ball-valve attached to the supply pipe. This permits storage of water in a reserve tank from which water is supplied to the drinker.

**Fig. 30: Flat Tray Feeder**

**Fig. 31: Fountain Drinker**

## 5.0 SUMMARY

In this unit, we have learnt the type of intensive system of poultry housing and their advantages. The various equipment used in poultry house was also highlighted.

## 4.0 CONCLUSION

The poultry house must be constructed in such a manner that it takes into account the ease of operations, the prevailing winds and rain to enhance drying of manure or litter, also various diseases and infections that can cause damage to the health of the birds. The poultry equipment should be such that it avoids waste, prevent fouling of feed with droppings and litter, easy to clean or wash, and constructed of durable material.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Explain 3 advantages of deep litter system and cage system?
2. List the various equipment used in poultry house?

## 7.0 REFERENCE/FURTHER READING

Oluyemi, J.A and Robert, F.A (2000). Poultry Production in Warm West Climate. Revised Ed, Macmillan Press Ltd, London 88: 54-69

https://pubs.ext.vt.edu/2902/2902-1092/2902-1092_pdf.

http://articles.extension.org/pages/66243/small-scale-poultry-housing