TRAINING MANUAL ON CLIMATE SMART POULTRY PRACTICES

Compiled By:
Doctor Fish Agro Consult
And Supported By:

PIND | FOUNDATION FOR PARTNERSHIP INITIATIVES IN THE NIGER DELTA

CONTENTS

"This teaching manual has been painstakingly compiled to address the significant issues involved in poultry production for all categories of trainees/learners who wish to be involved in the poultry value chain. I encourage all who use it to do so with the mindset that agriculture is a goldmine and the way forward for us as a nation. God bless Nigeria."

- Avwerosuoghene Okorodudu (PhD. RAS)

"The manual is a must-read book for those interested in poultry farming and training others seeking information on poultry farming. The radical practical approach to all the topics discussed in this manual is commendable. This manual is undoubtedly a concrete response to the ever-growing demand for all hands-on-desk practical poultry farming. This manual will significantly assist the community of farmers, individuals, students, teachers, NGOs, government agents, retirees, etc., in raising a profitable poultry enterprise."

- Minka N. Salka, DVM; PhD; FCVSN
Professor of Veterinary Physiology,
Ahmadu Bello University, Zaria, Nigeria.

FOREWORD

Climate Smart Agriculture (CSA) for poultry production is an integrated approach to managing poultry production that addresses the interlinked challenges of food security and climate change. Poultry flocks are particularly vulnerable to climate change because birds can only tolerate narrow temperature ranges. Poultry farmers, therefore, need to consider making adaptations to help reduce cost, risk, and concern in the future. The challenges posed by climate change fit broadly into one of the two categories: loss of productivity or increasing costs.

Regarding productivity, housing systems need to be managed to maintain optimal seasonal temperatures and reduce the risk of heat stress. Farmers would need to invest in ventilation and cooling. Reproductive capacity may decrease. Studies conducted on broilers found that a poultry house under a future climate change scenario exceeded critical temperature on 30 percent more occasions despite a 10 percent increase in ventilation. Furthermore, more dramatic events like storms increase stress and may adversely affect productivity.

Costs could increase due to the need to cool buildings more in the hot season and reduce house humidity. Building infrastructure and maintenance will have to cope with extreme weather events and increased rainfall. Building plans must consider more sustainable options, with more significant investment in drainage systems to accommodate frequent floods and rain. Stocking density in the house may need to be reduced in extreme temperatures, and actively controlled ventilation could become essential in transport vehicles.

This manual provides a comprehensive description of how adaptations in poultry production can be built into a climate-smart production system. It presents an excellent scientific basis for rearing poultry birds considering the hazards climate change imposes on the environment. It touches on almost every part of the broiler value chain at the production level, ranging from housing and equipment, breeds, stocking and management techniques, water management, health management, biosecurity, and record keeping. A section of the manual is also devoted to commercial egg production. The manual has useful and appropriate infographics that complement the text. It is highly recommended for training and production purposes.

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Registrar/CEO
Nigerian Institute of Animal Science, ABUJA
January 2023

MODULE 1:

GENERAL OVERVIEW OF POULTRY INDUSTRY & CLIMATE SMART AGRICULTURE

SESSION 1.1 INTRODUCTION TO POULTRY

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand the importance of climate Smart Agriculture
- Define poultry
- Exposed to opportunities in the poultry sector
- Enumerate the economic importance of poultry farming.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce the topic & Session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants. • With real examples, discuss the lesson outlines.
Method	Facilitation.
Material Needed	Visual aid (Flip chart, multimedia).
Time	30 minutes.

REFERENCE NOTES:

1.1.1: CLIMATE-SMART AGRICULTURE (CSA)

CSA is an approach that seeks ways to improve farmers' productivity and income. It is an approach that helps farmers adapt to a changing climate and contributes to mitigating greenhouse gas (GHG) emissions. (FAO, 2018)

CSA is not a set of universally applied practices; instead, it is an approach that involves different elements embedded on-farm and beyond the farm and incorporates technologies, policies, institutions, and investment. Climate-smart poultry farming makes sustainable use of resources by using fewer resources and emitting fewer greenhouse gases than larger livestock such as cattle rearing, pig production, etc.

3 PILLARS OF CLIMATE SMART AGRICULTURE

1. To sustainably increase agricultural productivity and improve the incomes and livelihoods of farmers.
2. To build resilience and adaptation to climate change; and
3. To reduce and/or remove GHG emissions, where possible.

1.1.2: INTRODUCTION TO POULTRY FARMING

The term poultry refers to all species of domesticated birds that are of economic value to man. These include chicken, ostrich, pigeon, turkey, guinea fowl, ducks, goose, pheasants, quails, etc., all belonging to the zoological class, *Aves*.

The poultry industry is one of the most important and viable subsectors in the Nigerian agricultural sector. It contributes 20-25% of the agricultural GDP and engages approximately 20 million people through direct and indirect employment. It also provides means of livelihood for millions of Nigerians and a source of high-value investments for profit-driven entrepreneurs.

The sector has rapidly expanded recently and is one of the agricultural sector's most commercialized (capitalized) subsectors. It is estimated to be worth about N80 billion ($600m), comprising approximately 180 million birds which produced about 650,000 MT of eggs and 300,000 MT of chicken meat. 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. There are still enormous opportunities for the growth and expansion of the sector as Nigeria's chicken meat consumption per capital ranks relatively low (1.41 kg/ capita) compared to Ghana (7.67kg/capita), South Africa (32.98 kg/capita) and US (45.49 kg/capita). Egg consumption is put at 65 eggs per person annually, which is also relatively low compared to South Africa (186), and the US (255).

Demand for chicken meat and eggs in Nigeria is substantial and growing at more than 20% per annum as incomes rise and new marketing outlets appear. The government-imposed ban on poultry imports has raised the price of chicken meat and provides a vital window of opportunity for local production. The live bird market for chickens is dominated, where small farmers in the Niger Delta sell their chickens. A poultry value chain study carried out in 2012 revealed a considerable market opportunity for farmers in both chicken meat and egg production in the Niger Delta. The demand for meat from catering companies, fast food outlets, household consumers, and hotels is estimated at $35.2 million, $43 million, $120.5 million, and $1.78 million, while that of eggs from these market segments is estimated at $5.1 million, $236,000, $163 million, and $378,000 respectively.

International Food and Agribusiness Management Review Volume 18 Special Issue A, 2015
An Assessment of the Nigerian Poultry Industry, Sahel Capital Journal, Volume 11, June 2015
DrAyoolaOduntan, President Poultry Association of Nigeria (PAN), Worldstage News, October 7, 2015, http://worldstagegroup.com/worldstagenew/index.php?active=news&newscid=25085&catid=2

POULTRY SECTOR BACKGROUND IN SUMMARY

- Comprises of about 180 million birds producing 300,000 MT of Meat and 650,000 MtTof eggs/yr.
- Nigeria demand for bird is over 250 million to produce 790,000 Mt of meat and 1.5b Mt of eggs.
- Demand gap: Over 70 Million birds produce 140,000 MT & 1.2MT of eggs.
- Estimated population of poultry birds in the Niger Delta is 45.1m
- Estimated population of poultry farmers in the Niger Delta is 900,000

**PIND Rapid Assessment 2018; PIND Poultry Industry VC Report 2012; Data Food & Agricultural Organization of Nigeria FAO*

1.1.3 ECONOMIC IMPORTANCE OF POULTRY

- Source of food mainly in the form of meat and eggs: Poultry meat is superior to livestock species because of its relatively lower fat and sodium content and higher protein content that is well balanced in essential amino acids. The egg is rich in iron, vitamins B12 and E, and contains richly available vitamin D3.
- Research and medicinal purposes: Some poultry species are suitable for genetic, nutritional, and physiological studies because of their relatively low maintenance cost, highly prolific, and short generation interval.
- Socio-religious roles: Poultry plays a socio/religious role. All world wide chicken and turkey meats are favored at Christmas in western culture. In developing countries, the cock is used as part of the payment of dowries.
- Source of manure: Dried poultry manure is the closest in nutrient profile to N.P.K. fertilizers among the feaces of livestock species. Dried poultry droppings are a non-protein nitrogen source (NPN) in ruminants' diets.
- Ornamental purposes: Feathers from poultry have been used for adornment and ornamental purposes. The downs of geese and ducks are used in making cushions, pillows, and bedding. Chicken feathers are dyed and used to decorate guests at social gatherings in some parts of the world.
- Timekeeping: Poultry species are involved in the daily activities of humans. For example, cocks, because of the accuracy of their crow with the time of the day, are considered timekeepers. Geese have been used as security guides because of their aggressiveness.
- Source of income: Domestic fowl can be a source of good income for the farmers, especially when sold at the end of the production cycle.
- Source of revenue: It also serves as revenue for the government.
- Employment generation: employment opportunities are provided through poultry farming from poultry attendants, casual laborers, and veterinarians.
- Hobby and source of pleasure.

SESSION 1.2 POULTRY VALUE CHAIN

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Define value chain.
- Identify and understand the various levels/functions in the poultry value chain.
- Know where to function better in the value chain.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce the topic & session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants. • With real examples, discuss the lesson outlines.
Method	Facilitation, Exercise
Material Needed	Visual aid (Flip chart, multimedia)
Time	1 hour

REFERENCE NOTE:

Value chain refers to the various business activities and processes involved in creating a product or performing a service. An agricultural value chain is the integrated range of goods and services necessary for an agricultural product to move from the producer to the final consumer.

VALUE CHAIN OF THE POULTRY INDUSTRY

POULTRY BREEDING

These value chain actors specialize in upgrading the genetic makeup of the poultry stock. They are responsible for developing breeds, cross-breeds, strains, and hybrids of chicken and turkey that form the backbone of the poultry industry.

HATCHERY

Hatchery, as a value chain of the poultry industry, specializes in producing day-old chicks. Their products include day-old broilers, pullets, cockerel chicks, turkey poults, noiler, etc. Hatcheries may have their breeder farms supply fertile eggs or contract them with other breeder farms.

BROILER PRODUCTION

These value chain actors specialize in producing table-size birds (2kg and above live weight). They acquire day-old-broiler chicks; feed them intensively for 5-8 weeks, after which the birds are slaughtered for meat.

PULLET GROW-OUT

This value chain actors obtain day-old pullet chicks from the hatchery and raises them to the point of lay (16-20 weeks) before the birds are disposed of. Such farms ensure that the birds receive all their vaccination and medication before they are disposed of. These value chain actors may also raise cockerels for meat.

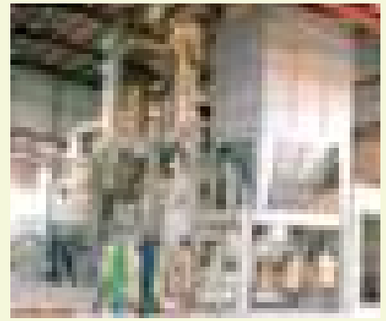
COMMERCIAL EGG PRODUCTION

These value chain actors specialize in the production of table eggs. They may purchase day-old pullets and raise them as replacement stock or purchase point-of-lay birds from reputable grow-out farms. The old birds are slaughtered or sold to the public at the end of the production cycle as spent layers.

PROCESSORS

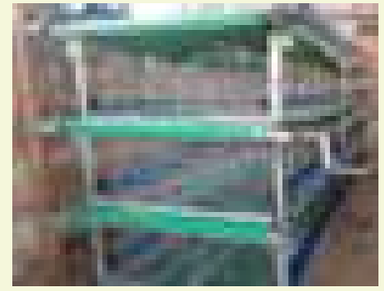
These value chain actors add value to the poultry products through processing. Live broilers, spent layers, cockerels, turkeys, etc, are obtained from different farms, slaughtered, and processed into whole or cut-up parts. Eggs are also processed into frozen or dried products.

POULTRY FEED MANUFACTURING



These value chain actors specialize in producing and supplying feeds to all the value chain actors that rear live birds. The feeds supplied may be closed (commercial) or unique (based on the customer's formula).

EQUIPMENT MANUFACTURERS



They are responsible for supplying all the equipment & farm implements required in poultry production. Examples are feeders, drinkers, cages, and incubators.

DISTRIBUTORS/MARKETER

These value chain actors serve as a bridge between manufacturers and farmers. They promote and sell poultry equipment, inputs, and products to potential buyers.

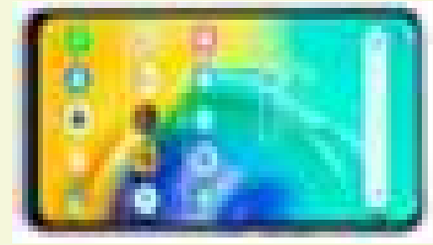
POULTRY SERVICE PROVIDER

This value chain actor provides technical services such as technical and business training, vaccination, debeaking, and linkages to quality inputs, market & finance to farmers.

LOGISTICS

Logistics operators provide mobility to different products in the value chain. They have specialized vehicles for moving chicks, adult birds, processed poultry meat, and eggs.

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)



Those in the value chain provide Apps and Tools. E.g., Basic information gathering, data analysis, e-commerce, etc.

FINANCING

These actors provide financial services to various actors (Farmers, Input Companies, Distributors, Poultry Service Providers, etc) in the value

The poultry industry's different value chain actors can be Integrated horizontally or vertically.

SESSION 1.3 PROBLEMS OF THE POULTRY INDUSTRY IN NIGERIA

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Enumerate the problems of the poultry industry in Nigeria.
- Proffer solutions to the challenges identified.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants. • With real examples, discuss the challenges and possible solutions.
Method	Facilitation, Q and A
Material Needed	Visual aid (Flip chart, multimedia)
Time	30 Minutes

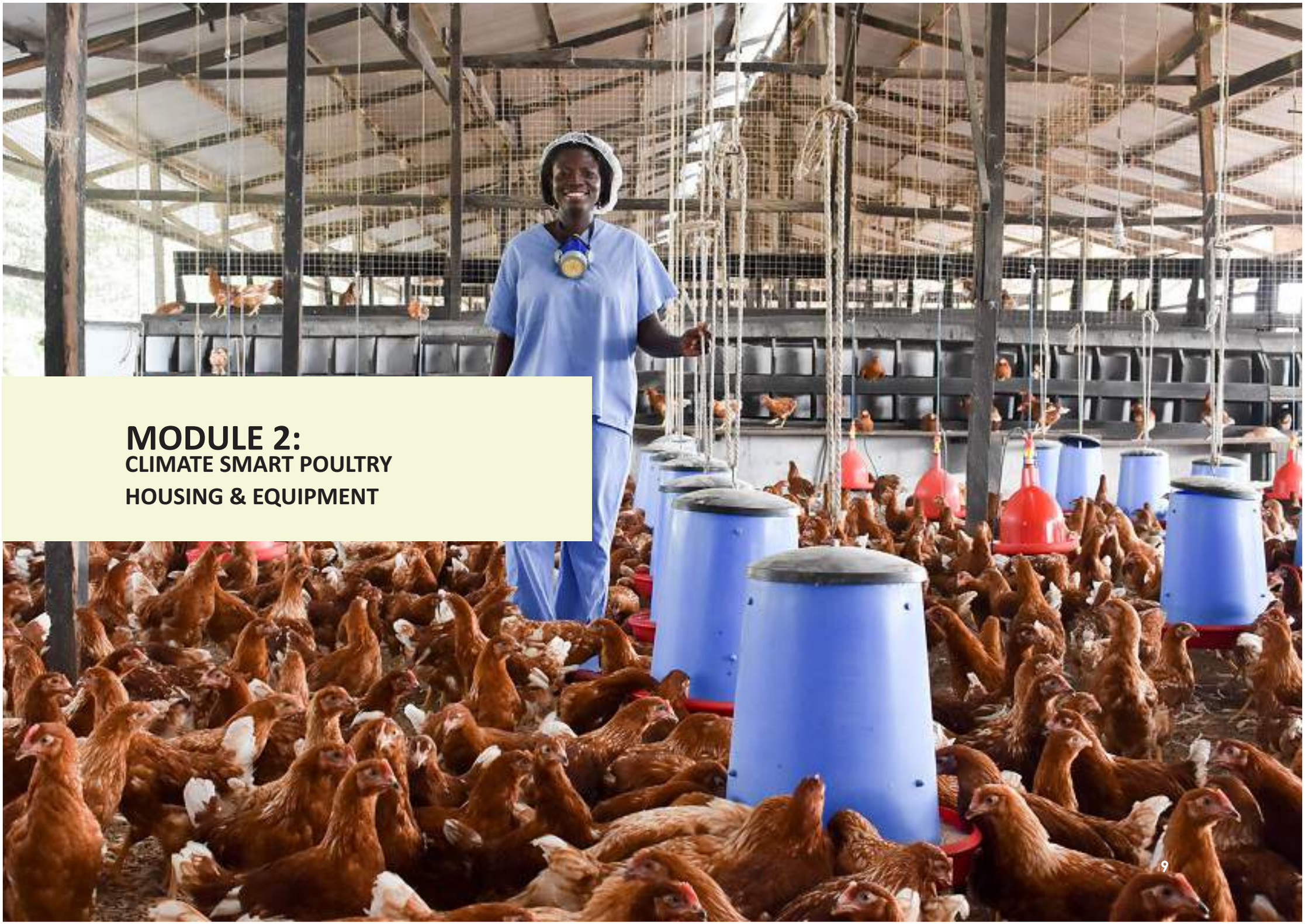
REFERENCE NOTES

Some of the problems facing the poultry industry in Nigeria are:

- Land tenure system.
- Inadequate or irregular supply of feeds.
- High cost of production.
- Breeds with low genetic potential.
- Diseases.
- Inadequate capital.
- Marketing problems.
- Climatic factors.
- Poor management system
- Lack of insurance policy.
- Inadequate extension or advisory services to support developing farms.
- Inconsistent and unfavourable government policies.
- Poor transportation network (roads, vehicles, and cost).
- The poor consumer market is limited by insufficient purchasing power and poverty.
- Climate change.
- Lack of credit facilities and high-interest rates on loans.
- Poor regulation of the poultry Industry.
- Poor production standards for the export-oriented market.
- Lack of harmony among value chain operators.

As stakeholders in the poultry industry, we must all collaborate to overcome these challenges.

- Some of the proposed solutions include but are not limited to the following;
- Advocacy for a review of the existing system.
- Proper planning before stocking.
- Adoption of good management practices.
- Adoption of an effective health management system.
- Development of an effective Agric finance model.
- Strengthening of the processing value chain.
- Adoption of climate-smart practices.
- Training on the excellent management system.
- Cooperation among value chain members.



MODULE 2:
CLIMATE SMART POULTRY HOUSING & EQUIPMENT

SESSION 2.1 GENERAL HOUSING REQUIREMENTS

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand the importance of climate-smart poultry housing.
- Choose the ideal location for poultry housing.
- Enumerate pen construction requirements.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce session objectives • Conduct case study • With real examples, discuss the topics
Method	Facilitation, Q & A, and Case study
Material Needed	Visual aid (Flip chart, multimedia)
Time	45 minutes

REFERENCE NOTES

In poultry farming, housing is essential to protect birds from predators, theft, adverse weather conditions etc. A good poultry house (pen) should

- Provide shelter from the weather.
- Provide adequate ventilation.
- Protect from predators.
- Provide adequate space for movement.
- Provide easy access to feed and water.
- Provide illumination during the day.
- Be easy to clean.
- Be built with strong and durable materials.

Importance of Climate Smart Poultry Housing

- It provides the right environment for maximum comfort.
- It enhances production efficiency.
- It reduces morbidity and mortality.
- It helps maintain optimal conditions for growth, development, and production.
- It provides adequate protection to the birds.
- It enhances biosecurity and is easy to clean.
- It provides good ventilation and illumination to the birds.
- It helps conserve energy and increases profitability.

Location of Poultry House

In planning a poultry pen, the location should be taken into consideration. When choosing a site suitable for a poultry pen, the following factors should be considered.

1. The poultry farm should not be too close to residential buildings.
2. The soil should not be waterlogged.
3. The site should not be prone to flooding,
4. The site should not be swampy.
5. The soil should be water-absorbent.
6. The site should have access to transport, water, electricity, and other infrastructures.
7. It is preferable where there are trees in the surrounding which serve as windbreaks, shade, and sources of oxygen.
8. The site should be good for future expansion.

Pen Construction Requirements

- The orientation of the pen should be east-west direction, as this will prevent direct sunshine over the birds.
- The height of the side walls of the pen should not be more than one meter.
- The roof should be high enough to minimize heat.
- Proper ventilation is essential for bringing clean outdoor air into a poultry house to replace contaminated air, as this improves air quality.

SESSION 2.2 SYSTEM OF PRODUCTION

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Identify various management systems.
- Select the appropriate one (s).

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Conduct a case study. • With real examples, discuss the topics.
Method	Facilitation, Q & A, Case study
Material Needed	Visual aid (Flip chart, multimedia)
Time	1 hour

REFERENCE NOTE

This is an essential factor in poultry production as the rearing conditions can affect growth, egg production, and qualities in hens. Based on management practices, the poultry production system can be classified into three:

1. Intensive system: (Deep-litter and Battery Cage system).
2. Semi-intensive system.
3. Free range or extensive system.

1) Intensive system

Birds are confined to houses on the ground/floor or the wire-netting floor in cages or slats. It is the most efficient, convenient, and economic system for modern poultry production with huge numbers. However, an intensive system can be:

I. Deep-Litter System

Here, birds are kept on the floor, with feeders and available water troughs. The birds are kept on suitable litter material of about 3 to 5 inches in depth, such as wood shavings, groundnut hulls, rice husk, chopped paddy straw, or sawdust. The litter is expected to be changed as the need arises, depending on the poultry breed, stocking rate, and prevailing weather conditions.

ADVANTAGES	DISADVANTAGES
It is cheaper than a battery cage system	Requires more space
It is comfortable for birds	Encourages cannibalism
It provides insulation against cold	Encourages vices (pecking, egg eating)
Generates heat from the decomposition of litter	Feed is burnt in physical activities
Litter material can be sourced easily	More wastage of feeds and water
	Harder to monitor laying performance

II. Cage System

Birds are raised on wire netting floors called cages fitted with stands in the pen house. Though this housing system has huge initial start-up capital, it has been proven very efficient for broiler and layers. Feeders and waterers are placed within or outside the cage, however accessible to the birds. Auto-operated feeding and water system devices and egg collection can also be used in this rearing system. The droppings are either collected in trays underneath cages, on belts, on the floor, or in deep pits under cages, depending on the cage type.

ADVANTAGES	DISADVANTAGES
High feed efficiency	Expensive to set up
Easier to manage birds	Tiny-shelled eggs can easily crack
Birds are less exposed to diseases/contamination	Higher incidences of leg problems, cage fatigue, fatty liver syndrome
A more significant number of birds is reared per unit area	
Helps in the production of clean eggs	

III. Semi-Intensive System

Birds are halfway reared in houses and halfway on the ground or range, i.e., birds are confined to houses at night or as per need, and they are also given access to roam in a fenced area. The house has one or two side open doors for easy movement of the chicken to the fenced area during the day. Feeding and watering facilities are provided in the pen.

ADVANTAGES	DISADVANTAGES
Economical use of land (free range)	High cost of fencing
	Exposure to different diseases

IV. Extensive System

This traditional method of raising birds is adopted in rural areas or where adequate land is available to ensure desired stocking density. A range provides shelter, greens, feed, water, and shade. Foraging is the primary source of feeding for birds. Temporary roofing supported by ordinary poles usually includes shelter.

ADVANTAGES	DISADVANTAGES
Less care required	It can easily be poisoned
Less capital invested	Prone to predators
Less time invested	Diseases spread easily
	Cannot be monitored easily
	Exposure to adverse weather conditions

SESSION 2.3 POULTRY PRODUCTION EQUIPMENT

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Identify equipment used in poultry farming based on the usage.
- Know the required equipment suitable for their production system.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce session objectives • Conduct case study • With real examples, discuss the topics
Method	Facilitation, Q & A, and Case study
Material Needed	• Visual aid (Flip chart, multimedia) • Simple equipment (drinker, feeder, debeaking, packer)
Time	1 hour

REFERENCE NOTE

The equipment required for poultry production is based on the product type, the operation scale, and the standard. It is advisable to use suitable and selected production equipment.

Poultry equipment can be broadly grouped into two based on their usage: General and Specific.

General equipment: feeders, drinkers, shovels, broom, packer, wheelbarrow, etc

Specific equipment: debeaking machine, brooders, de-feathering machine, crate, etc

b) **Feeders:** These are designed to ensure chicks have access to feed as required. They should always be kept clean to prevent the spread of diseases and big enough for all chickens of the same age to feed simultaneously. One meter trough or a 35 cm (diameter) tube feeder is adequate for 20 adult chickens to eat. The feeders must be constructed, so that feed wastage is avoided. Feeders should not be filled to the brim.

Characteristics of Good Feeders:

- Prevent feed wastage.
- Prevent feed contamination.
- Easy to clean and easy to fill.
- Durable & strong.

b) **Drinkers:** These are designed to give chicks access to drinking water conveniently. They should always be kept clean to prevent the spread of diseases and big enough for all birds of the same age to drink simultaneously. One (1) meter trough or a 35 cm (diameter) tube drinker is adequate for 40 chickens. The drinker should always be cleaned, dried at least twice a day, and sun-dried.

Characteristics of good quality drinkers:

- Provide clean and fresh water.
- Easy to clean and fill.
- It should be strong, durable, and stable.
- It should not splash water. It should be made from materials that do not leach into the water.

Feeders **Drinkers**

c) **Laying nests:** These are boxes provided in the pen for laying birds. It makes egg collection more accessible. They are provided before the onset of laying and used to prevent the birds from laying indiscriminately in the pen. They should be kept clean. Ensure eggs are collected at the same time daily (morning and evening). Removing eggs continuously prevents broodiness and egg pecking.

Laying nests:

d) **Thermometer:** This is required to monitor the temperature and relative humidity of the pen.

Thermometer

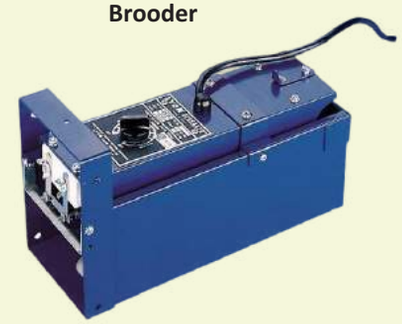
e) **Brooders:** These are used to produce the heat required by chicks during the first 2 to 8 weeks of their lives. For Climate Smart poultry production, a Gas brooder is preferable as it is highly economical, smokeless, and flameless, reduces the emission of greenhouse gases (GHC), and contributes to saving the planet.

Brooder

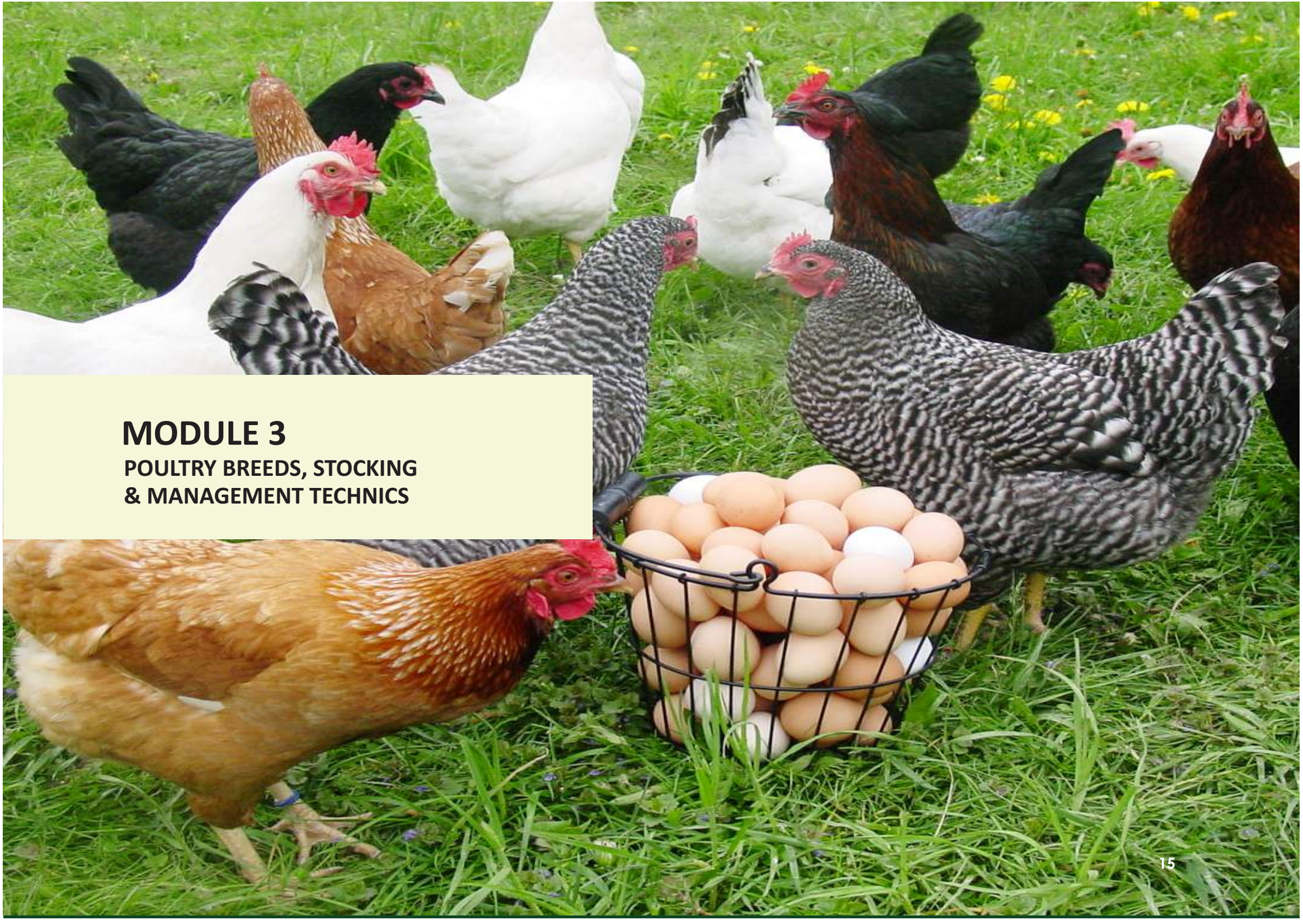
f) **Brooms:** these are required for sweeping and cleaning the pen.

Broom

g) **Debeaking Machine:** This is used to remove the hooked part of the upper beak and is recommended to reduce the risk of cannibalism.



Debeaking Machine



MODULE 3

POULTRY BREEDS, STOCKING & MANAGEMENT TECHNICS

SESSION 3.1 CLASSIFICATION OF BREED

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Classify Commercial breeds of Poultry birds.
- Understand their production characteristics.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce session objectives • With real examples, discuss the topics
Method	Facilitation, Q & A, and Case study
Material Needed	• Visual aid (Flip chart, multimedia)
Time	45 minutes

REFERENCE NOTE

Commercial Poultry birds are classified into three types based on their productivity:

A. Egg Producing Types/ Breeds (Layers)

These are birds raised primarily for egg production. Under good management, the birds start laying eggs within 16 – 20 weeks of age and continue for about 78 weeks. Some highly productive breeds are Hyline, Isa brown, Black Arco (dominant black), Lohmann, Bovan Nera, etc.

Characteristics:

- Egg production capacity
- Egg size
- Reproductive lifespan
- Feed efficiency (Eggs laid/feed intake)

B. Meat Producing Types/ Breeds (Broilers)

These birds are for meat production with very soft and tasty meat, with an expected body weight of 2 to 2.5 kg within 6 to 8 weeks of age, consuming about 4 kg of feed. Examples include Arbor Acre, Ross 308, Marshal, Cobb, etc.

Characteristics:

- Fast growth rate.
- Greater breast meat yield.
- Higher feed conversion.

C. Dual-Purpose Poultry Breeds

Dual-purpose poultry breeds are bird reared for both meat and egg production. Examples include Noiler, FUNAAB Alpha, Hampshire, Australorp, Rhode Island red, Plymouth, etc.

SESSION 3.2: QUALITIES OF GOOD DAY OLD CHICKS

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Enumerate the qualities of good day-old chicks.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce session objectives. • Test participants' level of knowledge through Q and A • Summarize contributions from participants • Discuss the characteristics of good day-old chicks
Method	Facilitation, Q and A
Material Needed	• Visual aid (Flip chart, multimedia)
Time	30 minutes

REFERENCE NOTES

The success of any poultry production operation begins with the quality of the chicks. Therefore chicks must,

- Have fast growth potential
- Have bright and clear eyes
- Be free from disease
- Be dry and clean
- Be alert and active
- Free from deformities (toes, beak, etc.)
- Have healed and closed navel
- Stand firmly and walk well

SESSION 3:3 PEN PREPARATION

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand and prepare a standard operating procedure for pen preparation

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants. • Discuss the procedures for pen preparation.
Method	Facilitation, Q & A, Case study.
Material Needed	• Visual aid (Flip chart, multimedia).
Time	45 minutes

REFERENCE NOTES

Before the chicks arrive

- Ensure there is adequate space and ventilation.
- Spread fresh bedding material (wood shaving, rice husk, etc.), which should be at least 5cm thick.
- Wash all equipment with soapy water two weeks before receiving chicks.
- Disinfect facilities and equipment.
- Protect the facility from predators.
- Ensure protection from extreme weather.
- If there are other birds in the pen to be used, the birds should be removed and the pen adequately cleaned and left free for at least 14 days.
- The floor and walls of the house should be adequately cleaned and disinfected correctly.
- Feeders, drinkers, and other poultry house equipment should be appropriately placed.
- Warm up the pen in good time.
- Fill the drinker with water and ensure it's at room temperature.
- Distribute feed evenly within the pen.
- The pen should be preheated for a minimum of 24 hours before the arrival of the chicks, but consider the geographical region.

After the chicks arrive

- Unload all chick boxes and distribute them in the pen.
- Places chicks near feeders and drinkers.
- Modify temperature as needed to meet the chick's comfort.
- Check to ensure birds are eating/drinking and settling down.

SESSION 3.4 BROODING TECHNIQUES

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand the importance of effective brooding
- Know the types of brooding
- Enumerate the six critical areas of importance for effective brooding
- Know the significant challenges during brooding operation and the mitigation strategy

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants • Discuss the procedures for brooding • Simulate brooding
Method	Facilitation, Q and A, simulation
Material Needed	• Visual aid (Flip chart, multimedia)
Time	2 hours

REFERENCE NOTES

Brooding is the provision of an optimum environment for birds in the early part of their life by the application of external heat and care. This is the period immediately after hatch when special care and attention must be given to chicks to ensure their health and survival. A newly hatched chick does not develop the thermoregulatory mechanism fully, and it takes about two weeks to build this mechanism and homeostasis. Therefore, they cannot maintain their body temperature properly for the first few weeks of life; and may be subjected to chilling, leading to increase mortality if not properly taken care of. This is the most critical period in the bird's life when all the bird's body systems are developing. Optimal brooding is essential to optimize animal health and contributes to good performance and survival in later life.

Natural Brooding

In natural brooding, a broody hen provides all the warmth the chicks require right after hatching up to about 3 or 4 weeks. This is usually used on household farms where only a few chickens are raised yearly.

Artificial brooding

Alternatively, artificial brooding in poultry is done through a temperature-controlled brooder. This type of brooding allows temperature regulation and many chicks to be reared without broody hens.

Equipment used for brooding is called brooders. Brooder comprises three elements: A heating source, Reflectors, Brooder guard. The heating source may be electrical; gas (e.g., natural gas, LPG, and methane), liquid fuel (e.g., kerosene), and solid fuel (e.g., Charcoal) can be used as heating material.

a. Heating Source

- **Charcoal Pot/Kerosene Stove:** Where electricity is unavailable, charcoal pot/ kerosene stoves provide supplemental heat to chicks. These stoves can be covered with plates/pans to dissipate the heat.
- **Gas Brooder:** Natural gas, LPG, or methane is connected to the heating element, which is hung 3 to 5 feet above the chick to provide heat.
- **Electrical Brooder:** A thermostatically controlled heating system spreads the required heat uniformly above a large area. This avoids the crowding of chicks under the brooder directly.
- **Infra-Red Bulbs:** They are self-reflecting bulbs. One 250 watts IR bulb can provide brooding for about 150 to 250 chicks.

b. **Reflectors:** These reflectors are called Hovers.

- **Flat-type hover –** These hovers have a heating element, heating mechanism, and pilot lamp. In some cases, a thermometer is also there to record the temperature.
- **Canopy-type hover –** These reflectors are in concave shape consisting of an ordinary electrical bulb, thermostat mechanism, and in some cases, thermometer.

c. **Brooder guard**

Brooder guards/chick guards prevent chicks from straying too far from the heat supply until they learn the heat source. An ideal brooder guard should have a diameter of 5 feet and a height not exceeding 1.5 feet.

Characteristic of Brooder Guard

- It helps in preventing chilling and piling.
- Guards will ensure chicks stay near the source of heat.
- Made the guards from the material, which can be adequately sterilized, or Plastic, which is cheaper.
- The height of the guard should be approximately 16 inches to 18 inches.

Note: For Climate Smart Farming, a Gas brooder is preferable as it is highly economical, smokeless, and flameless, reduces the emission of greenhouse gases (GHC), and contributes to saving the planet.

Location & Direction of Brooder House:

The brooder house must be away from all other poultry houses. The minimum distance between the brooder house and other poultry structures is 100 meters. The brooder house is constructed in such a direction that the fresh air should first enter the brooder house before other houses. Farmers have to build poultry houses in such a direction that sunlight does not enter their poultry houses. So, the houses should be constructed in the East to the West direction so they may get the advantage of ventilation from north to south.

The 6 Critical Areas of Importance during Brooding

F – Feed
L – Lighting
A – Air
W – Water
S – Sanitation
T–Temperature

Feed

- The feed should be available at all times (ad-lib).
- Place supplemental feeders slightly under the heat source.
- Provide at least 75 grams of feed per chick per day.
- The chick starter should be mashed or crumbled.
- Stir the feed to stimulate feed intake.
- Use the appropriate feed for the correct type of birds (Chick mash for a pullet, Broiler starter for a broiler).
- Adjust feeder height.
- The feed should be distributed uniformly throughout the feeding system.
- Allow birds to clear the feeders daily, but re-fill immediately to prevent feed restriction.
- Chicks should not have to move more than three meters to get feeds.

Note: Poor quality feed during brooding can lead to the following:

- Reduced growth rate.
- Reduced Body Weight.
- Reduced bird uniformity.
- High mortality.

Light

Good illumination is a critical prerequisite in brooding. Chicks grow, gain weight and perform better the faster they gain access to feed and water, and light stimulation further encourages feed and water consumption. Chicks need good illumination to locate feed and water.

- First 7 days – 23 hours.
- After seven days, reduce light intensity and increase the hours of darkness.
- Higher bird activity = fewer nutrients for growth and production.

Large shadows, blown bulbs, and insufficient lighting intensity and uniformity are problems that can be corrected using a digital light meter and solar lights for brooding.

Air

Excess ammonia or carbon dioxide and too high or too low relative humidity can negatively affect birds' growth and performance. This can be prevented/ ameliorated by proper litter management (including using ammonia-suppressing amendments) and increasing the ventilation rate (including control of relative humidity).

- oxygen > 19.6%
- Carbon dioxide < 3,000 ppm of CO_2
- Ammonia < 25 ppm

Water

Chick's body is more than 70% water. Therefore, having high-quality water freely available can make a huge difference in getting chicks off to a good start

- Water is used to transfer nutrients, remove toxic substances, and disperse heat
- Feed consumption is directly correlated to water consumption.
- Control water temperature to less than 25°C
- If the water is warmer, replace it immediately
- Keep nipple height slightly above the chicks' heads
- Chicks should not have to travel more than three meters to find water
- Drinkers should be evenly distributed in the pen
- Drinker height should be adjusted to the height of the chicks' top breast from day 18 onwards

Temperature

Temperature differences as small as 0.5-1.0°C can impact chick health, behavior, and growth. Temperature can be measured with a thermometer placed in the brooder pen. The introduction of electronic controller technology has allowed farmers to monitor and manage temperature precisely and automatically on a real-time, 24-hour basis. This gives farmers a huge management advantage over traditional manual thermostat control.

Recommended conditions:

  - Atmospheric temperature 32°C/90°F
  - Litter temperature: 28-30°C (82-86°F).
  - Relative humidity: 60-70%

- Cold chicks use nutrients from feed for heating instead of protein accretion
- Hot chicks use energy to remove excess heat (panting). This leads to reduced feed intake, increased water intake, and poor litter quality.

  During brooding, it is vital to monitor the birds.
- Bird distribution over the floor area – are specific areas being avoided?
- Bird respiration - are the birds panting?
- Bird behavior – birds should be eating, drinking, and resting
- Temperature- Are the brooders supplying the right amount of heat?
- Water - Is there sufficient water in the pen?
- Litter condition – is the litter wet/ sufficient?

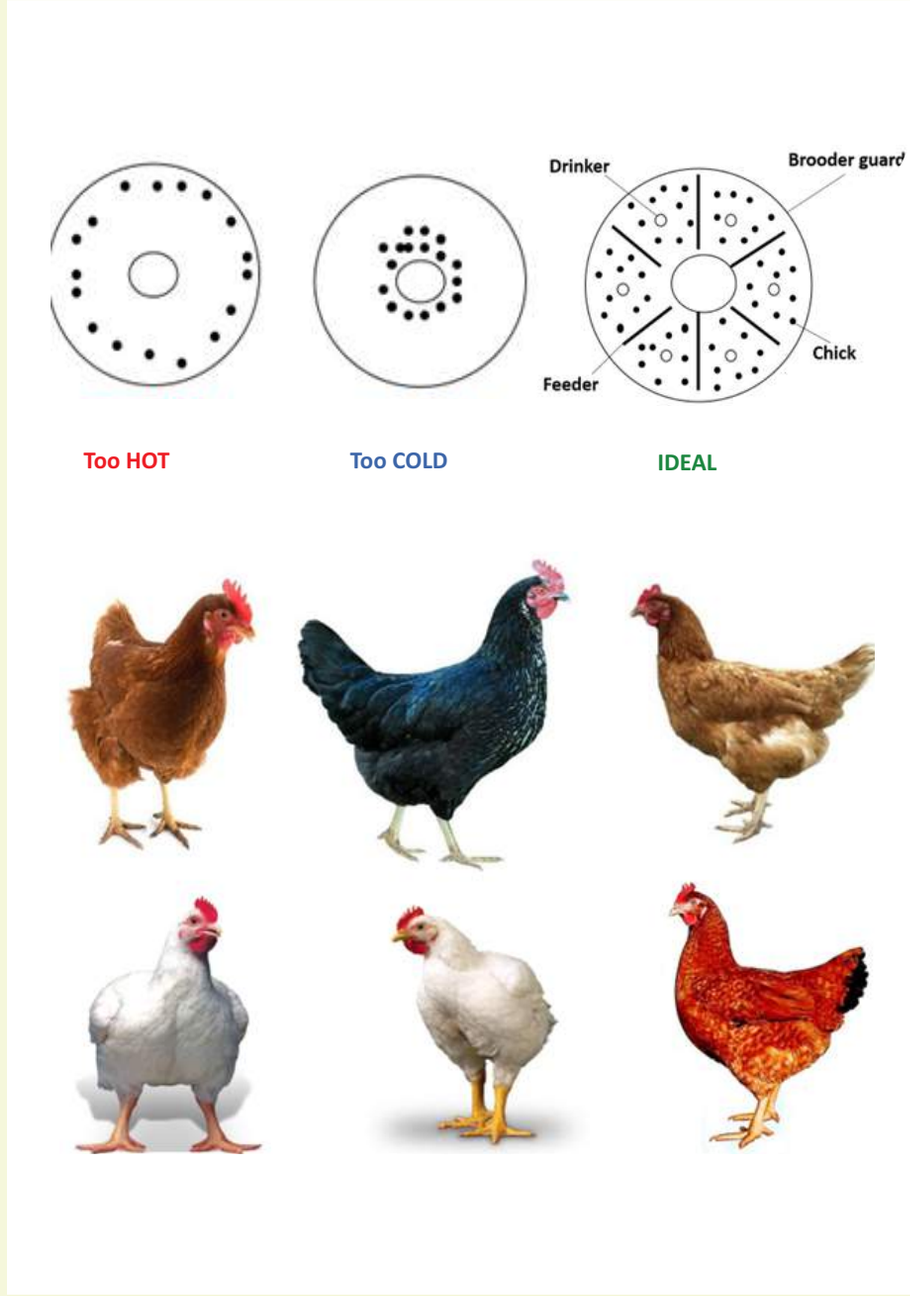
Major Challenges during Brooding Operation:

- Stress – Most stress is caused by poor bird handling during the vaccination (E.g., when birds are huddled together). This can be facilitated by proper handling and medication with an anti-stressor compound in water/feed.
- Inclement Weather – Environmental heat mats create severe stress, although young chicks can tolerate higher temperatures than older birds. When the temperature is high, the birds eat less and drink more water. This can be facilitated by increasing ventilation, increasing the number of drinkers, and reducing the brooding heating system.
- High Mortality – Chick mortality during the first week in the brooder house is higher than any week. Losses during the second week should be slightly less. This can be facilitated by ensuring healthy birds are stocked and adhering to all brooding protocols.
- The brooding area must have good illumination, ventilation, and low levels of ammonia.
- Check birds often to ensure they are comfortable (Walk the house 2 to 3 times per day).
- Maintain a temperature of 32°C to the floor during the first night and then slowly decrease the temp by around 2.5°C (5°F) per week.
- Ensure the brooder guard is adequately placed.

Importance of effective brooding

- Helps in the development of the immune function.
- Reduces mortality.
- Increase body weight.

It is important to note that during the first seven (7) days of brooding, 80% of the energy is used for growth and 20% for maintenance.



MODULE 4

COMMERCIAL BROILER (MEAT PRODUCTION)

SESSION 4.1 COMMERCIAL BROILER PRODUCTION

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Enumerate the various breeds of broiler.
- Understand the conditions required for optimum growth and performance.
- Identify the factors affecting broiler growth and performance.
- Develop a checklist for broiler production.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants. • Discuss the procedures for commercial broiler production.
Method	Facilitation, Case study, Simulation
Material Needed	• Visual aid (Flip chart, multimedia).
Time	2 hours

REFERENCE NOTES

Broiler: A young bird of either sex bred and grown specifically for highly efficient meat production. There are several commercial breeds of broiler in Nigeria, including Arbor Acre, Ross 308, Marshal, Cobb 500, Anak Tital, Anak 2000, etc. Each species has its peculiar characteristics. Therefore, the target market and consumer preference will influence the breed type to rear.

For effective and efficient broiler production, the essential conditions required for optimum growth and performance include:

- Adequate temperature (Heat)
- Good ventilation
- Adequate Lighting
- Quality Feeds
- Floor Space Requirement - 0.06m2 from day old to market age.

FACTORS AFFECTING BROILER PERFORMANCE

- **House temperature**

In a cool environment, broilers will eat more feed, but the many calories they obtain from this feed will sustain normal body temperature. When the calories are used for warmth, they are not converted to meat. Optimum temperatures allow the broilers to convert nutrients into growth rather than using the calories for temperature regulation. The farm attendant will provide the ideal environmental temperatures for promoting feed conversion. At high environmental temperatures, broilers consume less feed and convert this feed less efficiently.

- **Litter quality**

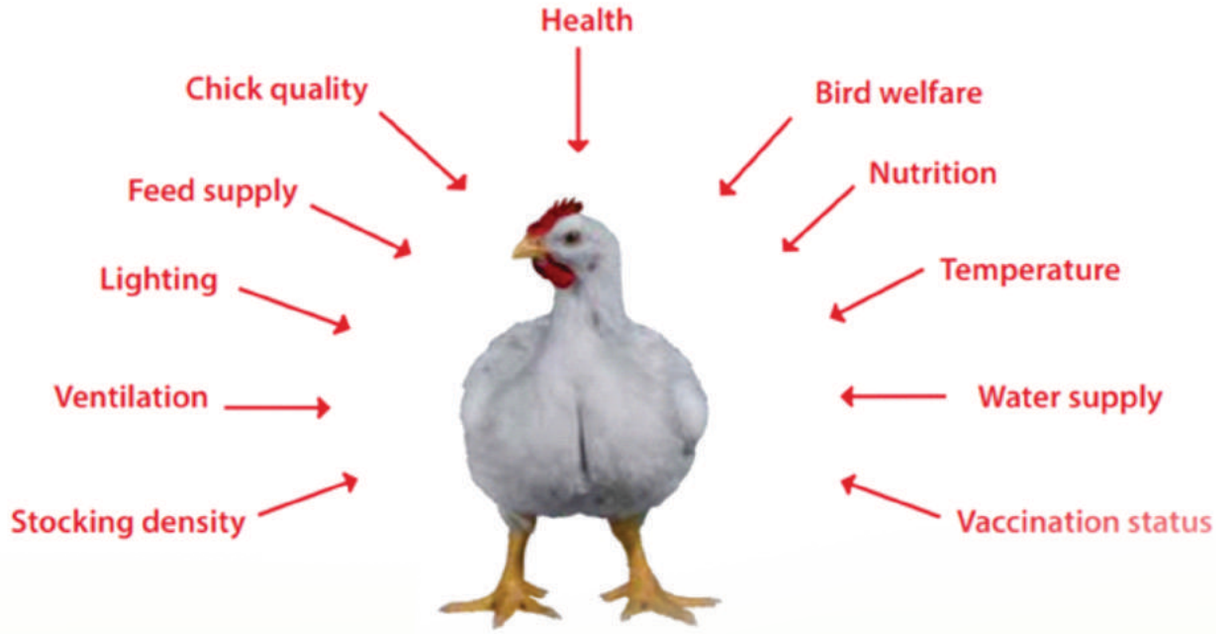
Litter conditions significantly influence broiler performance and, ultimately, profits. Litter is defined as the combination of bedding material, excreta, feathers, wasted feed, and wasted water. Chicks must be placed on a consistent minimum of four inches of dry bedding.

- **Feed wastage and feed deprivation**

Placing too much feed in the feeders results in feed wastage and inferior feed conversion. To prevent excessive feed loss, add sufficient quantities of feed to the feeder and do not fill it to the brim. This will stimulate the chicks to eat more often. Be careful not to raise the feeders too early and/or too high during the production cycle. Early feed deprivation will result in uneven growth, causing poor uniformity.

- **Diseases and culling**

The general health of a flock influences feed conversions. Sick broilers do not perform well. Watch closely for early signs of disease and treat quickly and adequately. Adhere strictly to the vaccination and medication protocol designed by the licensed veterinarian. Improper administration can adversely affect weight gain and feed conversion.



FACTORS AFFECTING BROILER GROWTH AND QUALITY

- **Human factors**

Ensure adherence to good management practices. Kindly note that very young broilers may be susceptible to stressors such as the farm attendant's speed of movement. Therefore, minimize all stressful conditions.

Tips for broiler Health Program

- Strictly adhere to guides on sourcing DOC and brooding management.
- Provide sufficient feeders and drinkers (especially on deep litter).
- Keep feed away from water and rodents.
- Practices good biosecurity practices.
- Administer appropriate drugs and vaccines.
- If there is more than one age group on the farm, the younger batch should be attended to first while performing daily work.
- Good litter management.

Feeding lines

Feed lines need to be adjusted as broilers grow to prevent excess spillage. Feed consumption should be monitored to detect any problems with the operation of the feed lines.

Water lines

The time and labor involved in cleaning open-type drinkers make them impractical for larger broiler farms. An enclosed drinking system that needs little or no cleaning is preferred. Although enclosed drinkers minimize labor, they require as much or more management as open drinkers. Their height is critical and must be adjusted daily. Pressure regulators also need frequent monitoring and adjustment.

THE CRITICAL AGE OBJECTIVES FOR BROILER STOCK ARE SUMMARIZED IN THE TABLE BELOW

<table>
<tr><th>Age (days)</th><th>Action</th></tr>
<tr><td>Before chick delivery</td><td>Clean and disinfect all housing and equipment and verify the efficacy of biosecurity operations.

Preheat the house and establish minimum ventilation. Temperature and relative humidity (RH) should be stabilized for at least 24 hours before chick delivery.
• Air Temp: 30°C (82°F) for whole house brooding and 32°C (86°F) at the edge of the brooder for spot brooding.
• Relative Humidity (RH): 60-70%.
• Floor Temp: 28-30°C (78-82°F).

Complete house set-up:
• Automated or supplementary feeders and drinkers must be in place and filled immediately before chick placement.
• Flush water lines before the chick's arrival. The water supplied to the chicks should be approximately 18-21°C (64-70°F).
• Evenly spread litter on the floor to a depth of 2 to 5 cm</td></tr>
<tr><td>On chick arrival</td><td>Check and monitor environmental conditions (temperature, RH, and ventilation) to ensure they are correct for appetite development and chick activity.

Ensure a minimum ventilation rate is set to maintain temperature and RH, remove waste gases, and supply fresh air. Avoid drafts. Actual air speed at floor level for young chicks should be less than 0.15 m/s (30 ft/min).

Light intensity must be at a level that promotes feed and water intake (30 -40 lux/ 3-4 fc in whole-house, or 80-100 lux /7-9 fc spot brooding). The light must be evenly distributed throughout the brooding area.

Monitor chick behavior 1-2 hours after placement to ensure that environmental conditions are correct and access to feed and water is adequate.

The bulk weighs a sample of chicks (3 boxes per house placed) and calculates average body weight.</td></tr>
<tr><td>0 - 3</td><td>Develop appetite from good brooding practice.

Adjust environmental conditions (temperature, RH, and ventilation) in line with bird behavior and age.

Provide 23 hours of light and 1 hour of dark for the first 7 days after placement.

Monitor chick start
• A vent temperature of 39.4-40.5°C (103-105°F) should be achieved. Vent temperature should be checked in at least 10 chicks from 5 locations in the house.
• Assess crop fill during the first 48 hours to determine if chicks have found feed and water. To check crop fill, samples of approximately 30 -40 chicks should be collected from each population.

<table>
<tr><th>Time of Crop</th><th>Fill Target Crop Fill (% of Chicks with Full Crops)</th></tr>
<tr><td>2 hours</td><td>75</td></tr>
<tr><td>4 hours</td><td>80</td></tr>
<tr><td>8 hours</td><td>>80</td></tr>
<tr><td>12 hours</td><td>>85</td></tr>
<tr><td>24 hours</td><td>>95</td></tr>
<tr><td>48 hours</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>4 - 6</td><td>Adjust environmental conditions (temperature, RH, and ventilation) in line with bird behavior and age.

Manage the transition from supplementary to automated feeders and drinkers smoothly by removing feed on paper and supplementary trays after observing bird behavior and activity in automatic feeders.

If using a brooding circle or half-house brooding, expand the brooding area gradually to allow birds access to the whole house area by 5-7 days of age.</td></tr>
<tr><td>7 - 13</td><td>Adjust environmental conditions (temperature, RH, and ventilation) in line with bird behavior and age.

The bulk weighs a sample of birds at 7 days. Weigh a minimum of 1% or 100 birds (whichever is larger) from each population. Weight at 7 days should be at least 4 times that of day-old weight.

Monitor feed physical quality.
Adjust drinker and feeder heights in line with bird growth.
After 7 days of age, provide a minimum of 4 hours of darkness in one continuous block (or follow local legislation).

Provide a light intensity of 5 to 10 lux (0.5 to 1.0 fc) during the light period.</td></tr>
<tr><td>14 - 20</td><td>Adjust environmental conditions (temperature, RH, and ventilation) in line with bird behavior and age.

The bulk weighs a sample of birds at 14 days. A minimum of 1% or 100 birds (whichever is larger) should be weighed from each population
Adjust drinker and feeder heights in line with bird growth</td></tr>
<tr><td>21 - 27</td><td>Adjust environmental conditions (temperature, RH, and ventilation) in line with bird behavior and age.

Manage the transition to Finisher feed (around 25 days), ensuring a smooth transition between feed rations and without a break in feed supply.

Monitor feed physical quality.

Obtain individual body weights at 21 days. A minimum of 1% or 100 birds (whichever is larger) should be weighed. Calculate flock uniformity.

Adjust drinker and feeder height in line with bird growth.</td></tr>
<tr><td>28 - harvest</td><td>Adjust environmental conditions (temperature, RH, and ventilation) in line with bird behavior and age.

Continue to obtain weekly individual body weights. A minimum of 1% or 100 birds (whichever is larger) should be weighed from each population. Calculate flock uniformity.

Adjust drinker and feeder height in line with bird growth.</td></tr>
<tr><td>Pre-processing management</td><td>Provide 23 hours of light and 1 hour of dark for 3 days before catching.

Reduce intensity during catching.

Calculate the feed withdrawal period. The feed withdrawal period includes the time in the house without feed, catching time, transport time, and holding time, and it must balance food safety and excessive weight loss.

Repositioning feeding equipment.

Maintain access to water.

Ensure catching equipment is clean.

Maintain effective ventilation.</td></tr>
</table>

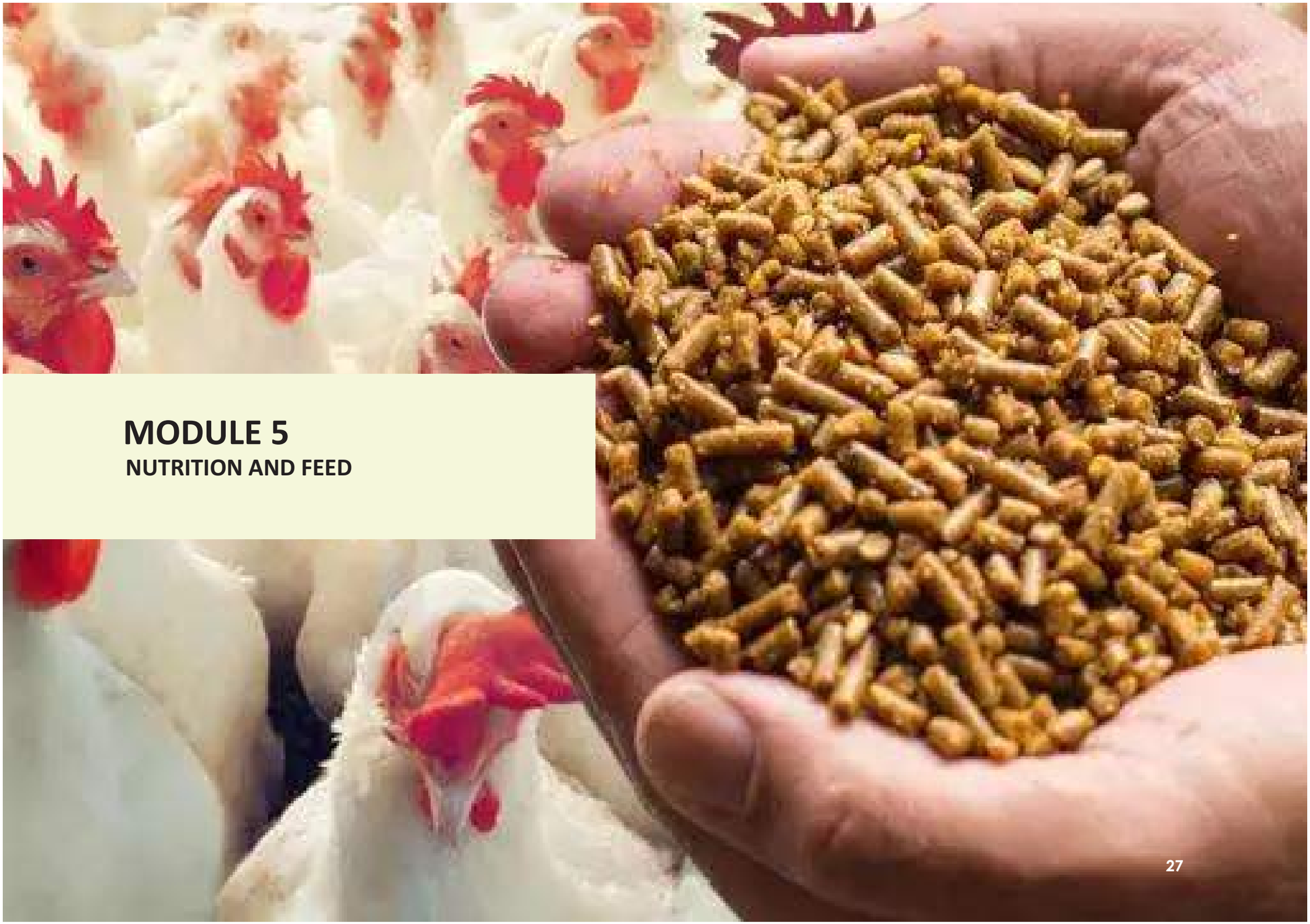
Hubbard

Ross 308

Cobb 700

Cobb 500

BROILER BREEDS



MODULE 5

NUTRITION AND FEED

SESSION 5.1 NUTRITION AND FEED

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Enumerate the various types of feed.
- Understand the nutritional requirement for optimum growth and performance.
- Understand the importance of restricted feeding in pullets.
- Enumerate factors influencing feed consumption.
- Know how to practice phase feeding in laying birds.
- Understand the practice of molting.
- Know how to feed under hot environmental

SESSION GUIDE:

Process	• Prepare visual aid • Introduce Session objectives • Test participants ' level of knowledge through Q and A • Summarize contributions from participants • Discuss the session outlines
Method	Facilitation, Case study,
Material Needed	• Visual aid (Flip chart, multimedia) • Feed samples (Pellet, mash, crumbled)
Time	2 hours

REFERENCE NOTES

Feed is the mixture of agricultural raw materials at a certain percentage to meet the nutritional requirement of different classes of animals. Feed represents the most significant proportion of production costs in poultry production. Feed is essential to maximize the genetic potential and take advantage of the voracious appetite of modern-day chickens.

5.1.1: CLASSES OF NUTRIENT

To support optimum performance, poultry diets are formulated to provide all the nutritional components required by the chicken. The primary dietary components needed by the birds are water, amino acids, energy, vitamins, and minerals. These components must work jointly to ensure proper skeletal growth and muscle deposition.

Crude Protein

The chicken requirement for crude protein describes the requirements for amino acids, the building blocks of protein. Proteins are found as structural components in tissues ranging from feathers and muscle to egg production.

Energy

Energy is not a nutrient, but a means to describe the metabolism of energy-yielding nutrients. Energy is necessary to maintain the bird's essential metabolic functions and growth in weight. Traditionally, the metabolizable energy system has been used to describe the energy content of poultry diets. Metabolizable energy (ME) represents the gross amount of energy of a feed consumed minus the gross amount of energy excreted.

Micronutrients

Vitamins: these are routinely supplemented in most poultry feeds and can be classified into either water-soluble or fat-soluble. Water-soluble vitamins include the B-complex vitamins. Vitamins classified as fat-soluble include A, D, E, and K. Fat-soluble vitamins can be stored in the liver and other body parts.

Minerals: These are inorganic nutrients and are classified as primary or trace elements. The major minerals include calcium, phosphorus, potassium, sodium, chlorine, sulfur, and magnesium. Trace minerals include iron, iodine, copper, manganese, zinc, and selenium.

5.1.2: TYPES OF FEED

Poultry feeds are formulated to meet their nutritional needs at specific ages and production characteristics. The ingredients in these different types of feeds are similar; however, the proportions vary to provide the proper level of nutrition for the particular birds being fed.

BROILER DIETS.

Broiler diets are formulated to provide the energy and nutrients essential for health and efficient broiler production:

- Starter feed: Starter diets are formulated to give proper nutrition to aid the fast growth of broiler chickens. They are higher in protein (22 percent) to maximize growth. Chicks require a ration that can.
- Finisher feed: finisher feed is a high-energy ration formulated as the finishing feed for broiler chickens in the final stage or phase of their growth for meat and weight development.

LAYER DIET.

- **Chick feed:** Chick diets are formulated to provide the nutrients needed for rapid growth and feather development. Chick rations are relatively high in energy, protein (18 - 20 percent), and the vitamins and minerals required for growth and development. They are fed from day old till about 8 weeks old.

- **Grower feed:** grower diets are formulated to sustain good growth to maturity. They are formulated to maintain a growth rate that would lead the pullets to reach sexual maturity at the desired age and weight and to avoid obesity. Grower ration has lower energy and protein levels than chick rations. Sometimes, a pre-lay percentage with an increased calcium level is recommended for feeding 2-3 weeks before the bird begins to lay eggs. Once the chicks are fully feathered, their energy requirements are reduced. They are fed a grower diet from 9 weeks till the beginning of egg production.

- **Layer feed:** Layer diets are formulated for chickens laying table eggs (those used for food) and designed to optimize egg production. This can be in terms of egg numbers, size, or mass. Layer feeds contain about 16 percent protein and extra calcium so that the chickens will lay eggs with strong shells. Start feeding layer feeds at about 20 weeks of age or when the first egg is laid, whichever occurs first.

Note: Feed form varies greatly as diets may be prepared as a mash, crumble, or pelleted.

5.1.3: FEED CONSUMPTION

Feed intake is the primary fact influencing body weight gain, feed efficiency, and production efficiency in both meat-type poultry and egg-laying birds. Several factors influence voluntary feed intake. These factors include

- Lighting.
- Feed distribution.
- Feed management.
- Temperature.
- Health status.
- Noise.
- Ventilation.
- Stocking rate.
- The physical form of feed.
- Feed flavor.
- Water supply.
- Feed wastage.
- Feather cover.

Therefore, maintaining an optimal environment influences feed intake and efficiency.

5.1.4: RESTRICTED FEEDING IN PULLETS

Restricted feeding is sometimes practiced for growers. Restricted feeding means reducing feed intake or nutrient intake, particularly energy and protein, below the regular feed intake or nutrient requirements. This is done during the growing periods of layers (14-20 weeks). The reduction is made either by limiting the total amount of feed to 85-90% of the regular intake or diluting the feed with low nutrient-dense feed ingredients so that there is a reduction in energy and protein content of the feed to 85-90% of the average level. The dilution can be done by adding fibrous materials of low nutrient density, such as rice bran, Maize bran, wheat bran, etc.

The reasons for restricted feeding are:

1. To avoid fattening of birds as obesity leads to poor egg production.
2. Secondly, restricted feeding causes a 5-10 days delay in sexual maturity, reducing the number of small eggs laid at the start of production.
3. Restricted feeding is also being done in broiler breeders to check the breeder's weight gain because the breeder's excess weight affects fertility and egg production.

5.1.5: PHASE FEEDING IN LAYING BIRDS

Phase feeding is feeding layer birds in different phases to adjust their nutrient intake following the egg production rate. Phase feeding refers essentially to a reduction in the protein and amino acid levels of the diet as the bird progresses through a laying cycle. The concept of phase feeding is based on the fact that as birds age, their feed intake increases while their egg production decreases. For this reason, it should be economical to reduce the nutrient concentration of the diet Phase-I continues from 21-45 weeks, and phase II from 46-72 weeks. Layer feed for phase II contains less concentration of nutrients, such as energy, protein, and amino acids, compared to phase II because feed intake increases with age and increases in body weight. Phase feeding controls the feed intake, body weight of layers, and eggs' size. Thus, it minimizes the production cost. Dr. G.F. Combs introduced the concept of phase feeding in 1960.

1. **Phase I** is the most critical period starting from 20 to 45 weeks of age. In this phase, egg production increases from zero to peak (90-96% production). Egg size is increased from 40g to 56g, and the body weight of birds is also increased. Therefore, the birds require an optimum amount of nutrients during this period.
2. **Phase II**: From the age of 46 weeks, when the bird's egg productivity reduces to around 90%, the protein level is changed according to the production level to reduce the production cost. It is also suggested that after the reduction of egg production to 75%, the crude protein level may be reduced to 15%.

If the nutrient density is to be reduced, this should not occur immediately after peak egg numbers but after peak egg mass has been achieved. The main reason for reducing the level of dietary protein and amino acids during the latter stages of egg production is to reduce production costs.

As a guide, it is recommended that protein intake be reduced from 17g/day to 16g/day after the birds have dropped to 80% and 15g/day after they have dropped to 70%

5.1.6: CALCIUM FOR LAYER

Calcium is the primary mineral required for eggshell quality. Thin eggshells are observed when calcium, phosphorus, zinc, and vitamin D3 are not provided in diets at adequate levels. Laying birds need 3 – 3.5 grams of calcium per day. The recommended strategy is to feed a constant, modest level of calcium in the feed and to use calcium grit (e.g., limestone or oyster shell) to provide the additional requirement. After peak production, the feed intake is gradually reduced, and by increasing the amount of calcium grit, the total amount of calcium per day from feed and grit can be secured. The metabolic requirement for calcium occurs mainly at night when the eggshell is formed. Feeding the additional grit in the afternoon can provide the bird with calcium during the night when it is needed most. Laying hens should have some available calcium-free-choice while calcium is added to feed.

5.1.7 MOLTING HEN

After 8 to 12 months of egg production, some laying birds are molted to extend the production period. Molting is the physiological process of the bird shedding and re-growing feathers to rejuvenate its body to start laying. Molting occurs naturally in the wild as seasonal daylight shortens and females stop laying eggs.

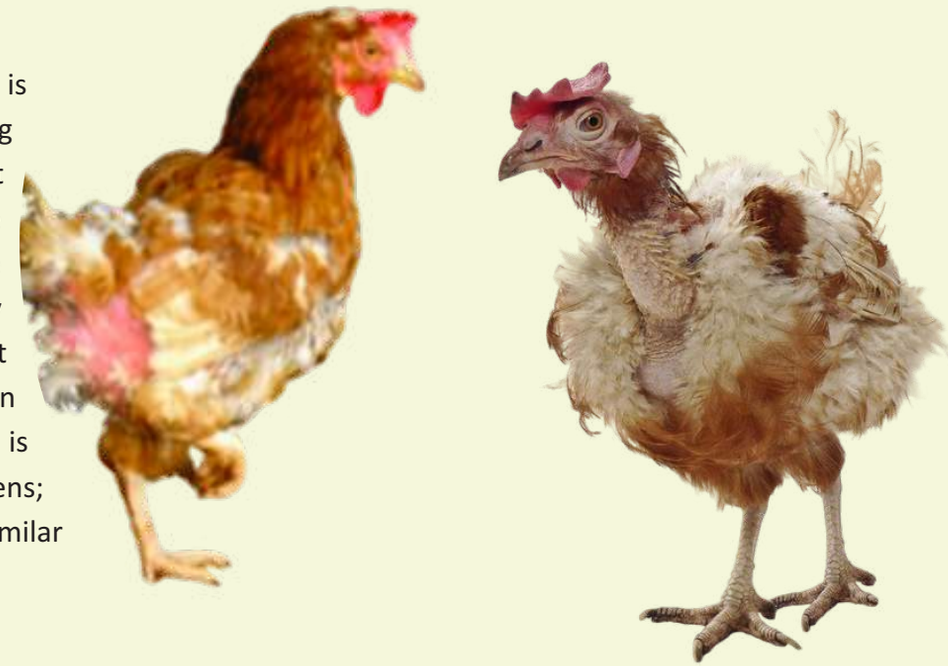
Laying hens are generally molted once or twice during their productive lives. When laying birds are starved of feed along with a reduced amount of daylight and low amount of water, the birds lose a portion of their body weight, called forced molting. Molting usually does not affect egg size but allows for an improved egg-laying rate, improved shell quality, and increased albumin height. When daylight length increases, hens begin laying eggs again as normal productivity resumes.

Forced molting increases the laying periods of birds and is practiced when the birds' egg production is low, and egg price is also low. A combination of feed, water, and light restriction is usually used to stop egg production and cause a rest, which may last from 3 to 6 weeks. Rest can also be induced by feeding with a diet containing a deficiency (sodium chloride deficiency) or excess of a specific nutrient such as excess iodine or zinc. After the rest, egg production can be initiated by stimulatory lighting. Little research is available on the nutrient requirements of molted hens; therefore, NRC (1994) recommends that conditions are similar to those of hens during the first production cycle.

5.1.8: FEEDING UNDER HOT ENVIRONMENTAL TEMPERATURE

Feed and nutrition significantly influence how birds, especially broilers, respond to hot environmental temperatures. To aid the health, welfare, and performance of birds during hot environmental temperatures, the following should be applied

- Ensure the pen is well-ventilated.
- Roofs should be kept free of dust and rust.
- Provide clean, fresh, and cool water regularly.
- Give good feed with physical quality (pellet, crumbled, or mash). This will minimize the energy expended to eat and physically reduce feed generated during feeding activity.
- The feed should be provided during the cooler part of the day.
- Provide extra light for feeding at night.
- Vitamins and Electrolytes can be added to the drinking water to replace lost ones.



MODULE 6

POULTRY AND HEALTH MANAGEMENT

SESSION 6.1: VACCINATION

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Enumerate the various types of vaccines.
- Understand general vaccine handling & management procedures.
- Monitor their birds for effective vaccination.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Test the participant's level of knowledge through Q and A. • Summarize contributions from participants. • Discuss the procedures for effective vaccination.
Method	Facilitation, Case study, Q and A
Material Needed	• Visual aid (Flip chart, multimedia). • Empty vaccine bottle.
Time	2 hours

6.1.1: IMPORTANCE OF POULTRY HEALTH

Poultry health plays a vital role in determining the success and profitability of the poultry business. Poor bird health hurts all flock management and production aspects, growth rate, feed conversion efficiency, and livability.

Therefore, prevention is the most economical and best method of disease control. Disease prevention is best achieved by the implementation of an on-farm disease control program which involves;

- An effective biosecurity program in conjunction with appropriate vaccination and medication regime.
- Early detection of ill health
- Prompt treatment of identified disease condition

However, there is a possibility that poultry diseases can overcome these precautions. When they do, it is crucial to prevent the spread of the disease-causing pathogen to other flocks/farms.

Chicks, upon hatching, have maternal antibodies, which are effectively passed on to them from the parent stock. These antibodies serve to protect the chicks during the early part of the brooding period. However, these antibodies do not protect the birds throughout the entire grow-out period. Therefore, it is necessary to vaccinate the birds to prevent certain diseases.

Biosecurity and vaccination are integral to successful health management (Biosecurity to prevent disease introduction and vaccination programs to address endemic diseases). The timing of vaccinations should be based on veterinary guidance, the level of expected maternal antibody, the disease in question, and current field challenges.

Vaccines are biological preparation that improves immunity to a particular disease. An appropriate vaccine program should be developed in consultation with a veterinarian considering the local disease challenges.

6.1.2: GENERAL VACCINE HANDLING & MANAGEMENT PROCEDURES

- Ensure that vaccines are stored at the manufacturer's recommended temperature of 2-8°C (36-46°F).
- Record vaccine product type, serial number, and expiration date on pen charts or record books.
- Ensure vaccines are maintained and stored appropriately (e.g., temperature requirements, time frames, etc.) as identified by respective manufacturers.
- Do not store food and beverages inside a refrigerator or freezer with vaccine
- Prepare the vaccine in clean containers free of chemicals, disinfectants, cleaners, or organic materials.
- The amount of water for vaccination should be calculated based on 90-120 min vaccination time.
- Vaccinate early in the morning to reduce stress, especially in warm weather.
- Avoid using water rich in metallic ions (e.g., iron and copper).
- The water pH should be 5.5-6.5. High-pH water can taste bitter to the birds, which may reduce water and vaccine intake.

- Ensure rapid vaccine uptake by depriving the birds of water a maximum of 1 hour before vaccine administration begins and increasing the number of drinkers.
- Mix 2.5 g (2 teaspoons) of powdered skimmed milk per liter of water
- Prepare skimmed milk solution for 20 min. before administering the vaccine to ensure the skimmed milk powder has neutralized any chlorine present in the water
- Avoid using metal, aluminium, or brass containers for mixing vaccines, as the metal ions react with the vaccines to inactivate the live vaccines. Use PVC or plastic containers
- Clean each drinker, emptying any water and litter. Do not use a disinfectant to clean the drinkers.
- Carefully fill each drinker in a predetermined fashion, ensuring not to overfill the drinker or spill the mixed vaccine solution.
- During vaccination, walk the house to encourage birds along the walls to get closer to the drinkers.
- Use vaccines as soon as they are reconstituted (within 1 hour). Therefore, increase no of drinkers if need be
- Do not vaccinate birds during periods of stress – deworming, debeaking, extreme weather, etc
- Remove all medications, especially Antibiotics, at least 48hrs before and after vaccination.

6.1.3: MONITORING WATER VACCINATION INTAKE

It is crucial to monitor the birds after receiving a vaccine. The use of a vaccine manufacturer's approved dye or colored stabilizer may help in determining how many birds have consumed the vaccine.

- Select 5% of birds per house and check how many have dyed tongues, beaks, or crops.
- Divide the house into four parts and check for staining from 5% of birds per division.
- Calculate the number of birds on a percentage basis with staining.
- Vaccination is successful when 95% of birds show staining after 2 hours.

6.1.4: SAMPLE VACCINATION & MEDICATION PROTOCOL

SAMPLE VACCINATION & MEDICATION PROTOCOL FOR BROILER

Age	Vaccine /Medication	Route
Day 1	HB1 (Newcastle)	Intraocular
Day 1 - 5	Anti-stress	In water
Day 8 - 10	Gumboro (IBD)	In water
Day 14	Lasota (Newcastle)	In water
Day 21	Gumboro (IBD)	In water
Day 22-26	Coccidiostat	In water
Day 28	Lasota (Newcastle)	In water
Day 35	Dewormer	In water

SAMPLE VACCINATION & MEDICATION PROTOCOL FOR LAYERS

Age	Vaccine /Medication	Route
Day 1	Marek, HB1 (Newcastle)	Sc, Intraocular
Day 1 - 5	Anti-stress	In water
Day 8 - 10	Gumboro (IBD)	In water
Day 14	Lasota (Newcastle)	In water
Day 21	Gumboro (IBD)	In water
Day 22-26	Coccidiostat	In water
Day 28	Lasota (Newcastle)	In water
Day 35	Dewormer	In water
Week 6	Komarov	Intramuscular
Week 7	Fowl pox	Wing web
Week 13	IB+ND+EDS	intramuscular
Week 16	Komarov	intramuscular

Note: Please consult your veterinarian before adopting any vaccination and medication protocol.

SESSION 6.2: POULTRY DISEASE

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Enumerate the cause of poultry disease.
- Identify signs of illness.
- Evaluate their birds for signs of illness.
- Know the proper measures to take in addressing the disease.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants. • Discuss with examples of poultry disease.
Method	Facilitation, Case study, Q and A, practical.
Material Needed	• Visual aid (Flip chart, multimedia). • Live bird.
Time	2 hours

REFERENCE NOTES

A disease is any harmful deviation from an organism's normal structural or functional state. It can also be defined as a disorder of the structure or function of an organism that is not a direct result of physical injury. The manifestation of the disease is a direct consequence of a disruption of the function of a biological system at a molecular and cellular level.

Poultry diseases are classified into eight categories, namely

1. Viral diseases.
2. Bacterial diseases.
3. Mycoplasmal diseases.
4. Fungal diseases.
5. Parasitic diseases.
6. Nutritional diseases.
7. Metabolic diseases.
8. Miscellaneous diseases/conditions.

Diseases cause a noticeable loss in poultry farming, such as poor feed conversion, an increase in the cost of production, poor growth and productivity, and death. The key to disease control is prompt on-the-spot diagnosis. Therefore, it is essential to recognize sick birds before the onset of mortality. As a farmer, check your flock regularly for abnormal signs/symptoms. It takes special skills to identify sick birds, which can be learned. When walking through a flock, take time to scan the birds and spot individuals that may be showing signs of illness.

Some of those signs might be:

- Lethargy, lack of energy, drooping wings.
- Loss of appetite.
- Swelling of the head, eyes, comb, wattles, and hocks.
- Purple discoloration of the wattles, combs, and legs.
- Nasal discharge.
- Coughing, wheezing or sneezing.
- Lack of coordination or complete paralysis.
- Muscle tremors or twisted necks.
- Diarrhea.
- Sudden or excessive mortality without clinical signs.
- For broiler breeders.
- It decreased egg production.
- Soft-shelled or misshapen eggs.

SOME IMPORTANT POULTRY DISEASES

Disease	Cause	Ages affected	Species	Mortality	Signs & Symptoms	Control
Velogenic Viscerotropic Newcastle disease (VVND)	Virus	Any	Most domestic birds	Mortality may reach 100% but is often lower in ducks	Sudden mortality, often with few or minimal signs **Nervous:** Balance & walking problems, twisted neck **Respiratory:** gasping, difficulty breathing, swelling of the head **Digestive:** diarrhea **Reproductive:** decreased egg numbers	Biosecurity, Vaccination
Highly Pathogenic Avian Influenza (HPAI)	Virus	Any	Most domestic birds	Mortality may reach 100% but is often lower in ducks & pigeons	Sudden mortality, often with few or no signs **Respiratory:** gasping, swelling of wattles & combs **Nervous:** tremors of the head and neck **Digestive:** diarrhea, thirst **Reproductive:** soft-shelled or shell-less eggs, decreased egg numbers	Biosecurity, Depopulation, Vaccination
Newcastle disease (lentogenic or mesogenic)	Virus	Any	Most domestic birds	Low, except in young birds where mortality may reach 20%	Signs may vary by species. There may be no signs of waterfowl. **Respiratory:** sneezing, coughing, difficulty breathing **Nervous:** twisted neck **Reproductive:** decreased egg numbers	Vaccination, Biosecurity
Infectious bronchitis	Virus	Any but most severe in chicks	Chickens	0 – 25%	Birds may be depressed with ruffled feathers. **Respiratory:** gasping, sneezing, coughing, wet eyes **Reproductive:** thin-shelled, rough, and misshapen eggs, decreased egg numbers	Vaccination, Medication for secondary bacteria
Infectious bursal disease	Virus	Mostly 3 to 6 weeks	Chickens	Usually, 0-25% but in some cases, maybe up to 100%	Prostration and death **Digestive:** vent picking, soiled vent feathers, whitish or watery diarrhea	Vaccination, Biosecurity
Fowl pox	Virus	Any, except newly-hatched	Chickens, Turkeys	<5%, in skin form; 10-50% in the respiratory form	Poor weight gain. Skin: scabby, raised pocks on the face **Digestive:** loss of appetite **Respiratory:** nasal discharge, difficulty breathing	

Coccidiosis	Protozoa	Any but Young birds more	Most, but coccidia of one species do not infest other birds	Variable depending on the severity of the case and the type of coccidia	Depression, weakness, decreased weight gain, dehydration **Digestive:** may have mucoid or bloody diarrhea	Medication, Vaccination
Fowl Cholera	Bacteria	Birds > 4 weeks are more susceptible	Chickens, ducks, geese, and most birds	10-90% mortality. Mortality is highest in turkeys, ducks	Death may be the first sign of disease. Respiratory: gasping, difficulty breathing **Digestive:** diarrhea, especially in ducks	Medication, Remove reservoirs, Vaccination
External parasites	Insects, arachnids	Any	Any	Usually low unless infestations are severe	Birds can become weak and unthrifty if heavily infested. **Skin:** mites, ticks, fleas, and lice can cause itching and loss of feathers. **Reproductive:** decreased egg numbers	Biosecurity, Application of pesticides,
Internal parasites	Various worms	Any	Any	Mortality is variable depending on the age of the birds, type, and severity of the infestation	Depression, failure to gain weight, anemia. **Digestive:** diarrhea,	Medication, Biosecurity (Especially sanitation)
Aflatoxicosis	Toxin from fungus	Any	Any	Variable	**Nervous:** difficulty walking, convulsions, feather picking **Reproductive:** reduced fertility and hatch rate, decreased egg numbers	Remove contaminated feed
Vitamin deficiency	Lack of complete nutrition	Any	Any	Variable	**Vitamin E:** Death before 4 days of age **Nervous:** difficulty walking and standing **Reproductive:** Decreased hatchability **Vitamin A:** slow growth, drowsiness, and mortality **Respiratory:** discharge from nose & eyes **Reproductive:** decreased egg numbers & hatching, increased blood spots in eggs	Supplement vitamins in water or feed, feed with balanced nutrition

EVALUATING YOUR FLOCK

Standing or sitting quietly, watching and listening to the birds, can sometimes be beneficial. Once the flock has settled down, only mildly ill birds l may be seen. When things have quieted down, abnormal respiratory sounds can be heard. These sounds may have a variety of characteristics, such as a high-pitched 'squeak,' a sudden 'chuck' sound, a cough, or a gurgling or rattling sound. The flock should be inspected at least once daily.

How to Evaluate Bird Condition

- Walk through the flock slowly, looking for sick or dead birds. Walk in a pattern that covers the entire poultry pen from one end of the pen to the other.
- Pick up any birds that do not move. Are birds sick? - How many birds are affected?
- Periodically stop and assess individual birds for the following:
  - Eyes - clear, no signs of irritation.
  - Skin - unblemished with no scratches
  - Breast - not blisters
  - Feet and hocks - clean with no irritation markings
  - Vent - clean with no signs of loose droppings
  - Crop - Are they feeding? Does the crop contain litter?
  - Are birds alert?
- Gather all dead or culled birds for removal.
- Record the number of dead and culled birds found.
- Follow the appropriate response protocol described in the farm SOP if there is a rise in mortality.
- If a rise in mortality cannot be explained, then a sample of birds must be submitted for diagnostic services.

Prevention of disease is a vital key to maximizing productivity, and this depends on a comprehensive program incorporating a sequence of planning, implementation, and control in a repetitive cycle. These include stocking quality chicks, vaccination, medication, biosecurity, and efficient management system.

NOTE: it is vital to enlist the services of a poultry service provider or veterinarian on your farm to ensure prompt response during emergencies.

MODULE 7

BIOSECURITY

BIOSECURITY

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand the meaning and importance of biosecurity.
- Enumerate how disease spreads.
- Develop a biosecurity plan.
- Develop good litter management habits.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants.
Method	Facilitation, Case study, Q and A, practical.
Material Needed	• Visual aid (Flip chart, multimedia) • Disinfectant • Litter material • Boot • Broom and packer • Foam • Compass • Coverall • Water
Time	3 hours

REFERENCE NOTES

7.1: INTRODUCTION

Biosecurity is the term used to describe the overall strategy or measures employed to prevent infectious diseases from a farm. It refers to procedures to prevent the introduction and spread of disease-causing organisms in poultry flocks.

Poultry producers operate within a complex global food system and are the first line of defense in our food security system. Maintaining an effective biosecurity program, employing good hygiene practices, and following a comprehensive vaccination program are all essential to disease prevention. A comprehensive biosecurity program involves planning, implementation, and control. The key to biosecurity success is to reduce the potential for pathogen introduction and to prevent pathogen spread within a farm or to other farm premises.

The benefits of biosecurity include the following:

- Helps keep out diseases.
- Reduces the risks.
- Limits the spread of disease.
- Improves the overall health of the flock.
- Reduces mortality losses.
- Improves profitability.

7.2 HOW DISEASE SPREADS

The primary method of spreading disease-causing microorganisms between poultry flocks are

- Using contaminated equipment such as egg crates, drinkers, and feeders.
- Contaminated clothing, footwear, hair, and skin of humans.
- Infected animals, such as wild birds and rodents.
- Animals such as dogs, cats, mice, rats, and free-flying birds
- Insects such as flies, beetles, and mosquitoes
- Transmission through the air.

14. Wear dedicated boots and coveralls when working with flocks.
15. Wash and disinfect boots at the entrance to the poultry area.
16. Use footbaths and change disinfectant in footbaths regularly.
17. If possible, provide shower facilities for visitors.
18. Remove poultry mortality daily. Dispose of them in an approved method.
19. Minimize entry of equipment, supplies, etc., and take appropriate precautions such as disinfecting, removing shipping boxes, etc.
20. Maintain a strong vector control program for insect, mammalian, and avian vectors. Maintain bait stations, clean up feed spills, and prevent entry by wild animals (rats, birds, insects) or pets (dogs, cats). Use screens in windows, air inlets, etc.
21. Ensure that feed, water, and bedding sources are free from infectious agents.
22. Review the biosecurity plan and flock health program, including vaccination protocols, with the veterinarian regularly.

7:5 FARM SANITATION

The most critical factor in keeping poultry healthy is maintaining good hygiene. Farm sanitation is critical to maintaining a healthy flock throughout production. The key to farm sanitation is effective cleaning. Disinfectants will be inactivated by organic material.

Essential Steps for Effective Farm Sanitation

- Remove all the birds from the pen at the end of each production cycle.
- Maintain the rodent control program.
- Remove all unused feed from the feed system, including all bins.
- Clean out all the litter from each pen and dispose of it appropriately.
- Clean all the dust and dirt from the building, and pay exceptional attention to less obvious places such as nets, the tops of walls and beams, etc.
- Dry clean any, equipment (e.g., electrical) that cannot be washed directly and cover it completely to protect it from the washing process.
- Open up any drainage holes and water runoff pathways, wash down all interior surfaces of the house, and fix equipment with a general detergent. If using a foam or gel, allow the reopenable product to enable the product to have adequate time to work.
- Washing from the top to the bottom of the house (ceiling to the floor). The house should be washed from one end to the other.
- Open and scrub water storage or overhead tank clean with a detergent.
- Drain the drinking system and overhead tank entirely before adding the cleaning solution.
- Remove any washed-out litter or organic matter from the farm compound. Unused and unneeded equipment should be removed from the farm.
- Removable equipment should be cleaned first with a detergent (or, if needed, a scale remover) and then thoroughly disinfected.
- Apply an effective broad-spectrum disinfectant through a pressure washer or sprayer. Thoroughly soak all the interior surfaces and equipment working from top to bottom.
- When choosing which disinfectant product to use, check the label to verify the environmental temperature(s) recommended for optimal product effectiveness. Also, verify the efficacy of the product against bacteria and viruses of concern
- After disinfection, biosecurity controls at house entrances should be reinstated

7.6 LITTER MANAGEMENT

Poultry litter is bedding material, such as wood shavings, sawdust, or straw, spread on broiler house floors.

A suitable litter should provide the following:

- Good moisture absorption.
- Bird comfort.
- Low dust level.
- Biodegradability.
- Freedom from contaminants.
- Consistent availability from a bio-secure source.

Poor quality litter, with high moisture content, may result in a high level of ammonia in the pen, which can result in increased respiratory stress and disease.

Ammonia (NH_3) is the most prevalent toxic gas in poultry housing. Exposure to high ammonia concentrations for extended periods seriously affects human and poultry respiratory health. Airborne ammonia is generated from decomposed uric acid vaporizing in poultry manure. Microbial decomposition of uric acid to ammonia and carbon dioxide is a function of the litter's moisture content, temperature, and pH, all of which influence the number and type of microorganisms (bacteria and fungi) present in the litter. High ammonia concentrations affect the birds in several ways, such as

Keratojunctivitis, an infection of the eyes observed at concentrations of ammonia as low as 50 ppm. Ammonia blindness is seen five to seven days after the damage has been done. Long-term exposure to ammonia concentrations breaks down the bird's first defense against infection in the respiratory system. Ammonia-laden air destroys cilia in the trachea, impairs mucus flow, and thickens tissue around the alveoli. This damage makes the bird more susceptible to respiratory infections like Newcastle disease and air sacculitis. Ammonia concentrations ranging from 25 to 50 ppm over a 4-8 week period have been proven to reduce weight gains and feed efficiency.

After being used, litter consists mainly of poultry manure and the original bedding, feathers, and spilled feed. The manure contains nutrients, including nitrogen (N), phosphorus (P), potassium (K), and calcium (Ca), that can be used to fertilize farmland for crop production. Excessive applications of nutrients can create environmental risks to water and air resources. Litter management, therefore, becomes an important issue.

7.7: METHODS FOR DEAD BIRD DISPOSAL

Method	Advantage	Disadvantage
Disposal pits	Inexpensive to dig and tends to produce a low odor	• It can be a reservoir for diseases and requires adequate drainage. • Has the ability to contaminate groundwater
Incineration	• Does not contaminate groundwater or produce cross contamination with other birds when the facilities are properly maintained • Little by-product to remove from the farm	It is more expensive and may -produce air pollution
Composting	Economical and, if designed and managed correctly, does not pollute groundwater or air	• Can attract rodent • If not done correctly, it can harbor disease-causing agents
Rendering	Materials can be processed into feed	• Requires freezer or oven • Requires intense biosecurity measures to prevent the transfer of diseases

MODULE 8

WATER MANAGEMENT

WATER MANAGEMENT

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand the importance of water in poultry farming.
- Factors affecting water intake.
- Water management.

SESSION GUIDE:

Process	• Prepare visual aid. • Introduce Session objectives. • Test participants' level of knowledge through Q and A. • Summarize contributions from participants.
Method	Facilitation, Q and A, practical.
Material Needed	• Visual aid (Flip chart, multimedia).
Time	1 hour

REFERENCE NOTES

8.1: IMPORTANCE OF WATER IN POULTRY FARMING

Water is the most critical nutrient for poultry's overall health and performance. Water plays a vital role in metabolism, regulating body temperature, food digestion, and waste elimination. Chickens will drink between two and three times as much water by weight as they eat in feed. Their consumption of water increases in warm weather. Therefore, it is necessary to provide adequate amounts of clean, fresh water daily, especially during growth and egg production.

Well, or borehole water is preferred, and where it is not available, rain or tap water could be used. Clean, fresh water should be presented so birds can drink with minimum effort. Water and the source should be checked for quality regularly and treated as required. The bird should be provided water with at least thrice their feed. Adequate water storage should be provided on the farm. A farm water supply should equal a maximum of 48-hour demand in an emergency.

8.2: FACTORS AFFECTING WATER INTAKE

Many factors affect water intake and result in less profitable farming. Hence, monitoring the factors affecting water intake will help in a more profitable business through efficient water management. Some of the factors include:

1) Diet Composition

- Crumble and pelleted diet results in more feed and water intake compared to mash feed.
- More salt in feed: Daily water intake is increased by 13.5 ml/g of sodium (Na) added to the diet
- More crude protein in feeds: A higher level of potassium (K) and soluble oligosaccharides from soybean (vegetable diet) results in a 13% higher water intake when compared to a non-vegetable diet as the protein source.

2) Management Conditions

- Higher stocking density increases water consumption.
- When lights are turned on in the pen early (5 am) and switched off late (8 pm), birds tend to consume more water.

- Types of drinkers and the number of drinkers: Total water intake was 7.55 times higher in bell drinkers (28.11 ml) compared to nipple (3.72 ml).
- Birds on restricted feeding programs consume more water to feel complete than usual.
- Less number of drinkers and less feeding space result in a lower intake of water.
- Blocked nipple line results in a lower intake of water.
- Weak, lame, and emaciated birds often consume less water.

3) Environmental Factors & Stress

- High Temperature (Heat Stress) – Chickens drink around 30-50% more water when the environmental temperature exceeds 32°C than at 21°C.
- A shallow temperature of the pen results in less water intake as the birds huddle together.

4) Infectious Conditions

- Birds consume more water during infections such as new castle disease (NCD), necrotic enteritis, infectious bursal (IB) disease, reo viral infection, and avian influenza (AI).
- Coccidial infection reduces water intake during acute disease.

5) Antimicrobials Use

- Sulpha drug treatment and poisoning increase water consumption.
- Some ionophorous anticoccidials, such as diclazuril, will stimulate water consumption.

6) Water-related factors

- Excess hot or cold-water results in less water intake.
- Excess minerals in water reduce water intake.
- Reduced water consumption is seen when water pH is less than 4.
- Freshwater attract birds to consume more water, while dirty water (from litter, feather, and vomiting) limits water intake.

It is important to note that excessive water intake can be indicative of gut health issues. Routine on-farm recording of water intake is a key management practice that can help identify potential health or management issues.

8.3: WATER MANAGEMENT

BELL DRINKER

For the first week, 6 bell drinkers are required for 1000 chicks. While for the third week, 8 bell drinkers are necessary for 1000 chicks. The drinkers should be evenly distributed around the house. The height of the drinkers should be adjusted to the same height of the chicks' top breast from the 18th day onwards. The height of the drinkers should be adjusted as birds get older. If the drinker is too high, it can restrict bird water consumption, while a lower drinker can result in wet litter.

NIPPLE DRINKER

The number of birds per nipple depends on age, weather, and water flow rates. It is recommended that 10 birds per nipple are sufficient after brooding. The height of the drinkers should be adjusted as birds get older. If the nipple is too high, it can restrict bird water consumption, while a lower nipple can result in wet litter.

For any breed of chicken, a drop-in feed or water consumption can be a sign of an infectious disease. Feed and water consumption should be monitored closely. A significant drop in consumption must be considered a trigger event, and specific diagnostic actions should be taken. These actions include investigations of the drinking or feeding system to ensure that a failure in the supply has not resulted in the observed consumption drop. If no physical reason is apparent, then diagnostic procedures should be followed in the same manner as if sick birds were observed. This includes seeking veterinary advice.

MODULE 9

FARM RECORD

FARM RECORD

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

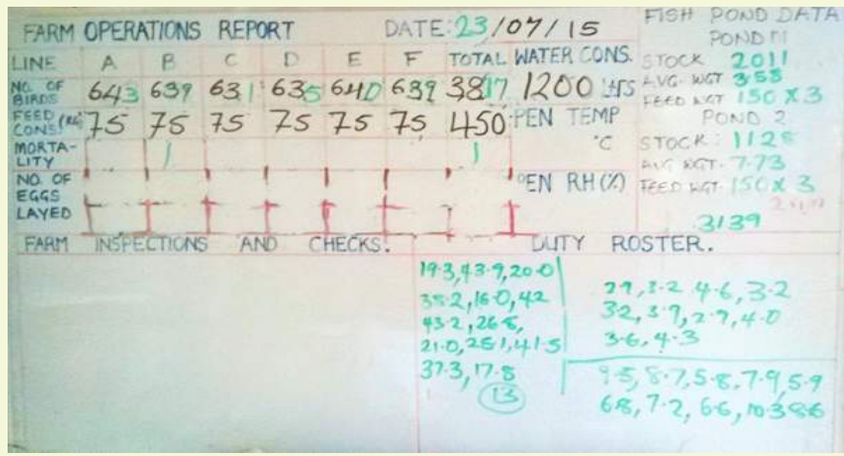
- Understand the importance of record keeping.
- Develop an excellent record-keeping habit.

SESSION GUIDE:

Process	• Prepare visual aid • Introduce Session objectives • Test participants' level of knowledge through Q and A • Summarize contributions from participants
Method	Facilitation, Case study, Q and A, practical
Material Needed	• Visual aid (Flip chart, multimedia)
Time	3 hours

REFERENCE NOTES

Record keeping is the art of logically organizing and storing information, documents, files, or invoices for future reference. It is a major prerequisite to successful poultry farming and can be done manually or electronically.



Accurate record-keeping is essential to monitoring the performance of your birds. It is a valuable tool in planning, forecasting, and determining the business's profitability. It also serves to provide an early warning of potential problems. Record keeping is also essential for loan applications. The daily records should be maintained for each pen.

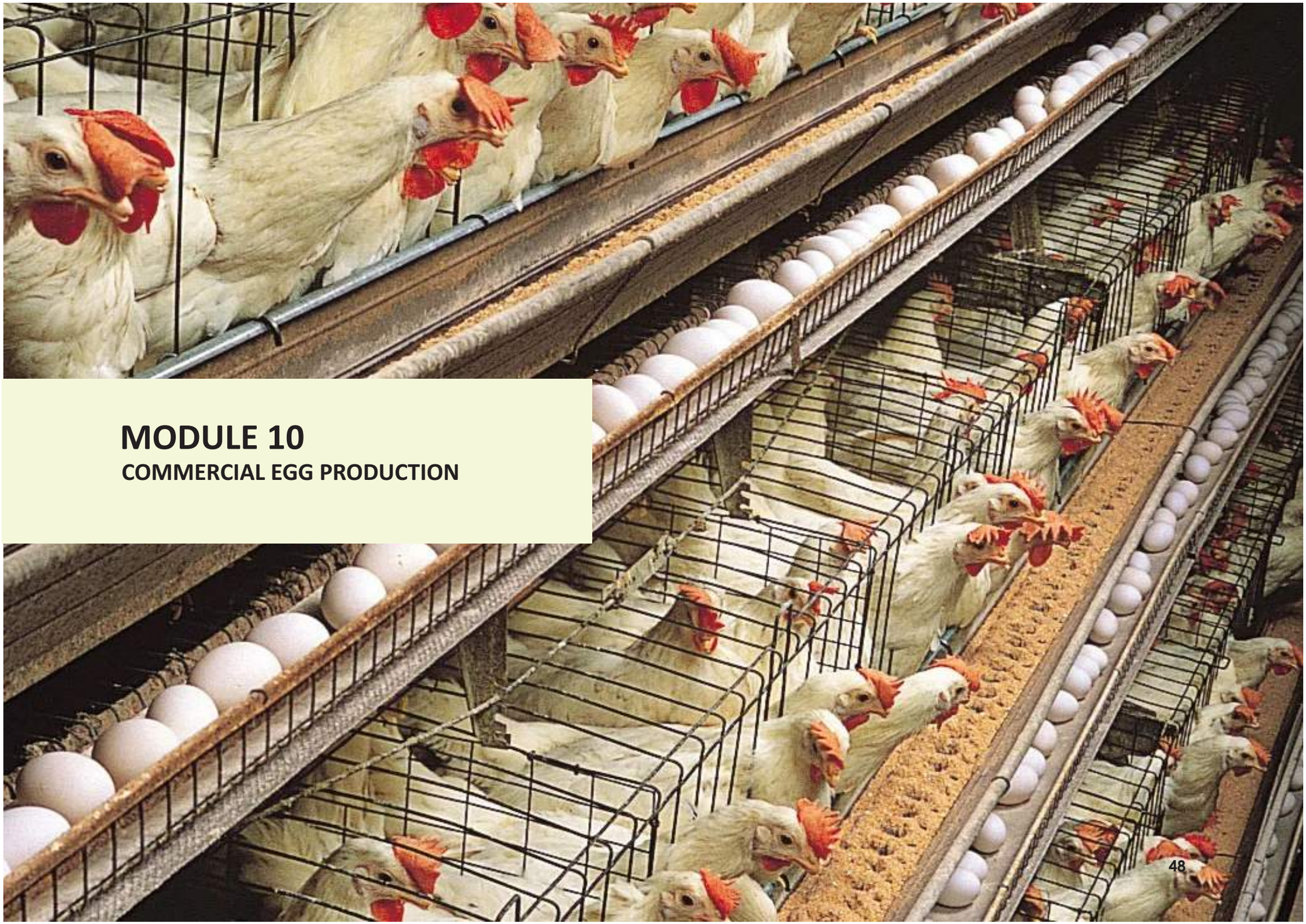
TYPES OF RECORDS

Daily Records include

- Mortality and culls by house and sex
- Daily feed consumption per bird per day
- Daily water consumption per bird per day
- Water-to-feed ratio
- Water treatments
- Minimum and maximum daily temperatures
- Minimum and maximum daily humidity
- Type and number of culls (e.g., small birds, defects, legs, etc.)

Flock Records

- Feed deliveries (supplier/amount/type/date of consumption)
- Feed sample from each delivery
- Live weight and % uniformity
- Medication (type/batch/amount/veterinary approval/date of administration/date of withdrawal)
- Vaccination (type/batch/amount/date of administration)
- Lighting program
- Pen floor and litter temperatures during brooding
- Crop fill percentage at 24 hours post placement during brooding
- Litter (type/date of delivery/amount delivered/visual inspection)
- Chick delivery
  - number/date/time/count in boxes
  - truck temperature and humidity
  - internal chick temperature
- Stocking density
- Chick source (hatchery/breed/donor breeder code/chick weight)
- Date and time feed withdrawn
- Post mortem results
- Visitor Book



MODULE 10

COMMERCIAL EGG PRODUCTION

COMMERCIAL EGG PRODUCTION

SESSION OBJECTIVES:

At the end of the session, participants should be able to:

- Understand the importance of record keeping.
- Develop an excellent record-keeping habit.

SESSION GUIDE:

Process	• Prepare visual aid • Introduce Session objectives • Test participants' level of knowledge through Q and A • Summarize contributions from participants
Method	Facilitation, Case study, Q and A, practical
Material Needed	• Visual aid (Flip chart, multimedia)
Time	3 hours

REFERENCE NOTES

10.1: INTRODUCTION

Layer refers to chickens that are raised for commercial egg production. The birds have three phases of life

- The brooding phase (day 1 to 8 weeks)
- The growing phase (weeks 9 to 20) note this is based onthe breed of the bird
- and the laying phase (20 till the end of lay)

It is strongly recommended that the same type of housing system should be used for rearing and production. This enables the birds to become familiar with the production house and its equipment after a transfer, overcoming this stressful period smoothly.

10.1.2: TRANSFER TO LAYING HOUSE

- Transfer to a cage or laying facility at 15 – 16 weeks of age.
- Ensure you administer the last live vaccine before transferring.
- Weigh before transfer and monitor weight loss during transfer.
- Ensure rearing and production cages use similar feeders and drinkers.
- Administer multivitamins 3 days before and after the transfer.
- The transfer should be done with utmost care.
- Transfer all birds on the same day.
- Transfer only during the cool part of the day (mornings or evenings).
- Early morning transfer is better so birds can maintain a regular daily routine.
- Monitor water consumption frequently after the transfer.

It is essential to follow the breeder's body weight recommendations during the whole life of the bird. Layers are bred to grow slowly, and organ development occurs at various ages. A lack of growth during a stage could negatively impact pullet quality. Two birds with the same body weight haven't necessarily developed the same body composition. Good growth curves lead to good pullet development

10.1.3: GENERAL RULES FOR NESTS AND EGG COLLECTING

- Provide an adequate nest box at a rate of one nest for four hens.
- The entrance of the nest box should be visible to birds.
- The nest box should be easily accessible.
- Diminish the number of dark spots in the house.
- Place obstacles in places where birds continue to lay floor eggs.
- Collect floor eggs frequently and several times per day.
- Regularly renew the litter in litter-type nests and keep them clean.
- Do not disturb the birds during laying.

10.1.4: CULLING

This is the act of removing sick, injured birds, broody birds, and non-performing birds from a flock.

GUIDES FOR CULLING LAYERS

S/N	CHARACTER/BODY PART	GOOD LAYER (keep)	POOR LAYER (Cull)
1	Vitality	Vigorous and active	Weak, sluggish
2	Comb and wattles	Full, smooth, glossy brighted	Shrunken, dry, dull, pale, and scaly
3	Eyes	Prominent, sparkling	Sunken, listless
4	Vent	Large, moist	Small, dry
5	Pubic bones	Thin, can allow 3-4 fingers	Thick, can only allow 1-2 fingers
6	Pigmentation	Bleached vent, eye-ring, ear lobe, beak, and shank	The yellow pigment in the vent, eye-ring, ear lobe, beak, and shank
7	Molt	Late, rapid	Early, slow
8	Weight	Medium, Well developed	Overweight

10.1.5: PROLAPSE IN LAYING BIRDS

Prolapse refers to a condition in laying hens characterized by part of the oviduct remaining outside the vent after the hen has laid an egg. Prolapse is often combined with pecking of the vent and cloacal area or at the everted oviduct, leading to rapid death.

The leading causes of prolapse are the following:

- Improper body weight and frame development: underweight pullets at the point of lay, before the reproductive tract is completely mature and oviduct muscles have developed elasticity and strength. Pullets with excess fat are also more prone to prolapse since fat excess contributes to lower elasticity and tone of the tissues involved in egg laying.
- Lighting program: too early light stimulation, before complete development, or giving substantial light increments, leading to an increased incidence of double yolks.
- Any condition encouraging pecking behavior: high light intensity, unbalanced feed, poor quality beak trimming, enteritis increasing the chances of physical damage to oviduct tissues.

To control prolapse, we advise:

- Making sure the flock is uniform during rearing
- Ensuring body weight is on target by getting steady growth from an early age
- Avoiding excess weight (i.e., fattening) during rearing
- Avoiding any sudden increase in the light period
- Applying a proper lighting program to compensate for natural light and avoiding unwanted early light simulation

10.1.6: BEAK TRIMMING

This is the removal of the hooked part of the upper beak and is usually carried out to prevent feather pecking and cannibalism. It is best carried out at 12–14 weeks of age.

Some Basic guides for beak trimming

- Do not de-beak sick birds.
- Perform it during the cooler part of the day.
- Clean the blade or knife as often as possible.
- Cut the beaks of older birds separately.
- Do not vaccinate just before de-beaking.
- Work as swiftly as possible, but maintain quality.
- Ensure the tongue of the bird is not burnt.
- Ensure the trimming blade has the correct voltage and temperature.
- Increase the level of feed and water and feed adlibitum.
- Avoid conditions that lead to stress as much as possible.
- Change your litter one within two weeks after de-beaking.
- Administer vitamin K and anti-stress 48 hours before de-beaking.

MODULE 11

NIGERIA AGRICULTURAL ENTERPRISE CURRICULUM (NAEC)

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NIGERIA AGRICULTURAL ENTERPRISE CURRICULUM (NAEC)

Introduction

- **Farm business cycle**
- **Keeping records**
- **Planning**

Simulation 1

- **Purchasing decision**
- **Cost and benefit of investment**
- **Cash flow**
- **Accessing and managing credit**

Simulation 2

- **Poultry value chain**
- **Market Analysis**
- **Bio Security in Poultry Business**
- **Sheering with peers**
- **Putting into action and continual learning**

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ABOUT PIND

PIND is a non-profit organization that promotes peace and equitable economic growth in the Niger Delta region through strategic partnerships and collaborations.

Since 2010, with our partners, we have been contributing to strengthening and stabilizing the region by

- Reducing conflict and fostering peace & stability,
- Reducing poverty,
- Facilitating alternative clean energy solutions for remote coastal communities that are off the national grid,
- Enabling youth employment,
- Supporting gender equality and social inclusion for women, youth, and people with disabilities,
- Empowering local civil society organizations, and
- Influencing governments policies, programs & practices that significantly benefit the poor and marginalized.

We implement collaborative market-based, community-owned programs to mitigate conflicts and boost economic opportunities for local businesses, ensuring that economic progress occurs in a systemic, inclusive, and sustainable manner.

Our projects span all nine Niger Delta states: **Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers**, focusing on the underserved and hard-to-reach coastal communities of the region.

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