MINISTRY OF AGRICULTURE
ANIMAL INDUSTRY AND FISHERIES

POULTRY TRAINING MANUAL
For Extension Workers In Uganda



Theme: Transforming Livelihoods through sustainable poultry production

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PARTNERS

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FORWARD AND ACKNOWLEDGMENT

Objective three of the National Agricultural Extension Policy (NAEP) provides for the development of a sustainable mechanism for packaging and disseminating appropriate technologies to all categories of farmers and other beneficiaries of the agriculture sector.

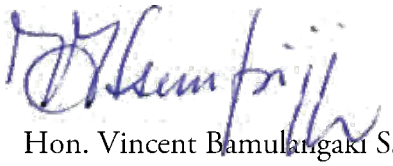
Poultry has the potential of transforming lives of key stakeholders (majority of whom are women smallholder farmers) by increasing household incomes. It also has the potential to generate national revenues. Poultry provides its value chain actors an opportunity to leverage the big market for its products and byproducts, created by the growing population. In addition, poultry are a source of affordable proteins, essential for health and nutrition. Poultry waste provides manure for other agribusiness enterprises.

The Ministry of Agriculture Animal Industry and Fisheries (MAAIF) with support from USAID Feed the Future Uganda Enabling Environment for Agriculture Activity (EEA) developed the Poultry Training manual and a corresponding user's Guide to facilitate the growth of the poultry sub-sector by improving the quality of agricultural advisory information delivered to farmers and other value chain actors. This is expected to improve the production and productivity of poultry and transform livelihoods.

This training manual has been designed for use by extension workers. It provides recommendations for improving the production of different types of poultry through various modules which include poultry production systems; planning; production management; poultry health; marketing; value addition; standards; and investment guide. I urge all extension service providers to widely use this manual to equip farmers and other value chain actors with the relevant knowledge and techniques to improve the contribution of the poultry enterprise to their lives.

I wish to thank the stakeholders that provided input into the drafting and validation of this manual, members of the development team for their involvement in the entire process and USAID Feed the Future Uganda Enabling Environment for Agriculture Activity for funding the development of the manual and user's guide.

It is my hope that this manual will be resourceful and adequately used by extension workers and other value chain actors to strengthen the Poultry sub-sector in Uganda.



Hon. Vincent Bamulangaki Ssempijja (MP)
Minister of Agriculture Animal Industry and Fisheries

ACRONYMS AND ABBREVIATIONS

2Cs	Two "Cs" of marketing (customer and competition)
4Ps	Four "P's of marketing (product, price, place, promotion)
AE/POX	Avian Encephalomalytis and Fowl Pox
Av. Weight	Average weight
BUKALASA	Bukalasa Agricultural College
Ca	Calcium
CBA	Cost Benefit Analysis
COVAB-MaK	College of Veterinary Medicine Animal Resource and Biosecurity.
CP	Crude Protein
D.O.A	Death on Arrival
D.O.WT.	Day Old Weight
DOC	Day Old Chick
DRC	Democratic Republic of Congo
EEA	Enabling Environment for Agriculture
FAO	Food and Agriculture Organization
FCR	Feed Conversion Ratio
FtF	Feed the Future
GDP	Gross Domestic Product
GUMB.	Gumboro
HDEP	Hen Day Production
IB/IBD/NCD/REO	Infectious Bronchitis, Infectious Bursal Disease, Newcastle Disease and Reovirus
IB2	Infectious Bronchitis 2
Inf. Coryza	Infectious Coryza
IR	Inclusion Ratio
Kcal/kg	Kilo calories /kilogram
Lab. Immunity	Laboratory Immunity check up
LYS	Lysine
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
ME	Metabolizable Energy
Met.	Methionine
Mj/kg	Mega Joules/kilogram
MTIC	Ministry of Trade Industry and Cooperatives
Muchomo	Roosted meat

MUK	Makerere University Kampala
NAGRC&D	National Animal Genetic Resources Centre and Data Bank
NALIRI	National Livestock Research Institute
NARO	National Agricultural Research Organization
NCD	Newcastle Disease
NM	Nitrogen Matter
PAU	Poultry Association of Uganda
POL	Point of Lay
Rollex	Omelet in chapati fast food
SACCO	Savings and Credit Cooperative
Sq. m	Square meter
STD	Standard
UBOS	Uganda Bureau of Statistics
UNBS	Uganda National Bureau of Standards
URA	Uganda Revenue Authority

MODULE 1: INTRODUCTION AND BACKGROUND

Poultry is an emerging (figures: 1-4) industry in Uganda's livestock subsector. Livestock contributes 5% to the national GDP and 17% to the agricultural GDP.

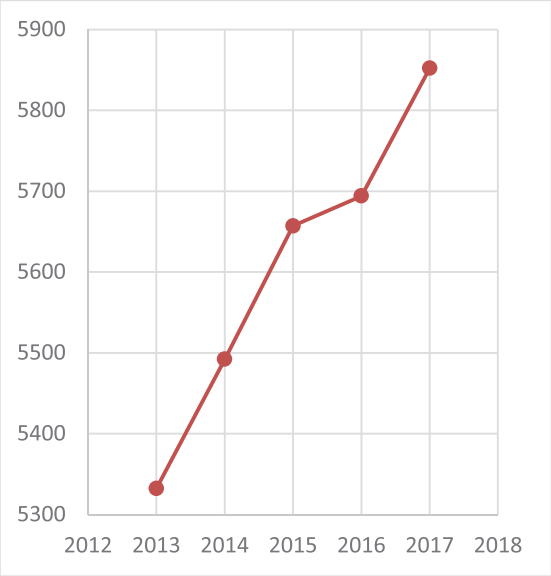


Figure 1: Exotic Poultry Production ('000))

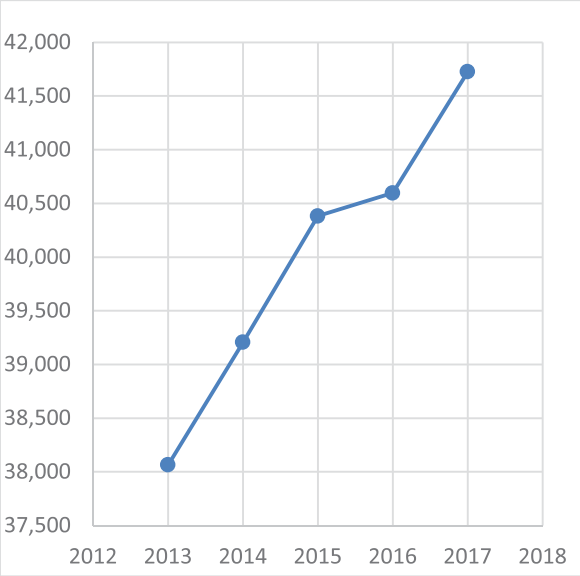


Figure 2: Indigenous Poultry Production ('000)

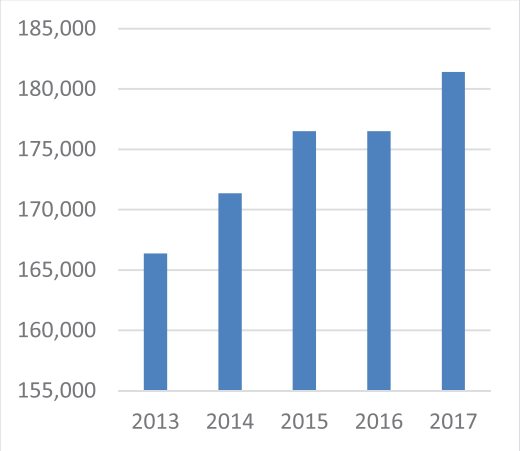


Figure 3: Egg Production (Millions) for Exotic Chicken

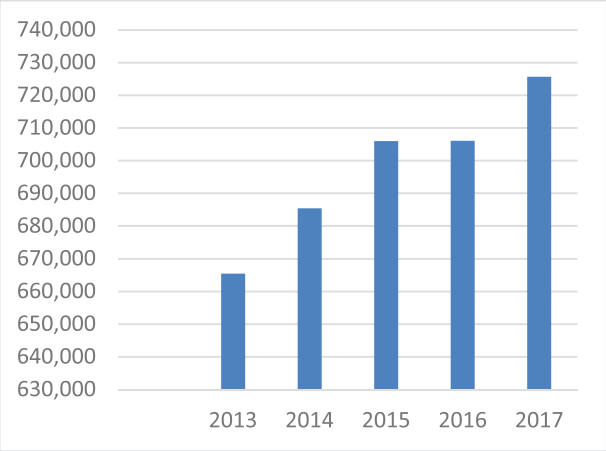


Figure 4: Egg Production (Millions) for Indigenous Chicken

Source: UBOS: Statistical Abstract, 2018

Poultry is the most popular type of livestock kept in East Africa. Between 2013 and 2017, the poultry population in Uganda grew by 9.6% and egg production grew by 9% with chicken being predominant. Uganda has about 47.6 million birds (Indigenous-41.7 m, Exotic-5.85 m) (UBOS, 2018).

1.1 Key Stakeholders

The poultry subsector in Uganda has the following key stakeholders:

1. Commercial poultry farmers - keeping flocks ranging from 200 birds to several thousand for egg and poultry meat production.
2. Breeders- keeping parent stock flocks for production of day-old chicks
3. Poultry feed processors.
4. Traders of animal feed and raw material ingredients.
5. Poultry drugs dealers (Pharmacies, Drug shops)
6. Poultry product traders and transporters.
7. Ministries, Departments and Agencies (MAAIF, MTIC, UNBS, NAGRC&DB, etc.)
8. Development Partners (USAID, FAO)
9. Training Institutions (COVAB-MaK, BUKALASA)
10. Research institutions (NARO, NALIRI)
11. NGOs, Private Sector and Civil Society Organizations (PAU, UVA, UVB, Mercy Corps)

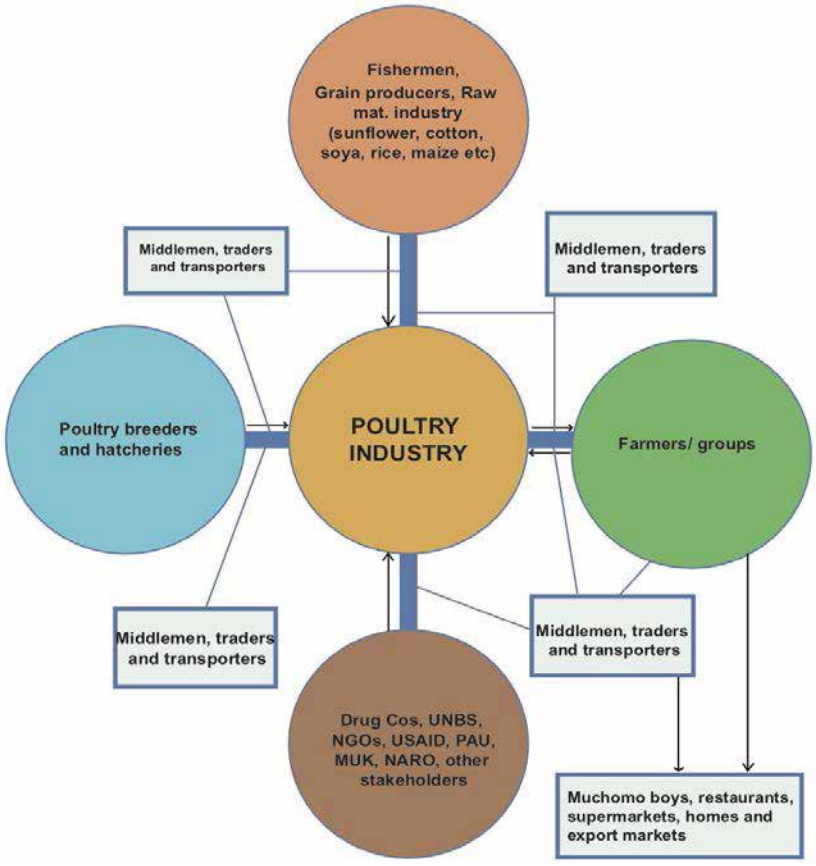


Figure 5: Stakeholders Linkages

1.2 Importance of Poultry

I) **–Direct employment**

Many people are directly engaged in poultry production, majority of whom are small holder and women.

Indirect employment

A substantial number of people are engaged in poultry related businesses e.g. chicken roasting, "rollex" making, restaurants and hotels and transportation.

II) **Foreign exchange earnings.**

Uganda earns foreign exchange revenue from the export of eggs, poultry meat and day-old chicks.

III) **Nutrition**

Consumption of highly nutritious poultry products improves health status of communities.

IV) **Manure**

Poultry manure is used to improve soil fertility and increase crop yields.

V) **Culture and Sports**

Poultry are used for social-cultural activities such as traditional engagements and weddings and making ornaments from poultry feathers e.g. earrings. In the sports arena they are used for entertainment for instance, in cock fighting.

1.3 Opportunities

Managing poultry in Uganda is highly competitive in terms of feeds, market and infrastructure as explained in the favorable factors below:

a) Production of feeds – Availability of fertile soils, good weather and climate provides an opportunity to produce cheap raw materials for making feeds.
b) Processing of feeds - There is potential for exploiting the existing unutilized installed capacity for feed production and processing for most feed manufacturers.
c) Access to feeds - Many mushrooming small-scale feed producers, increase access to feeds by small scale poultry farmers.
d) Domestic market –Existence of potential effective demand caused by high rate of urbanization and population growth in Uganda.
e) Export market - Uganda is strategically located in the Great Lakes region which is ideal for supplying the growing regional markets in Kenya, Tanzania, Southern Sudan, Congo and Rwanda.
f) Affordable inputs- Livestock feed and labor for poultry feed production.
g) Improved transport infrastructure: in form of upgraded road network and air transport.
h) Availability of freshwater bodies provides adequate fish raw material resources for production of feeds.

1.4 Challenges

i. Cost of poultry feeds has escalated yet it is not matched by increase in the price of poultry products.
ii. High taxes on imported inputs such as parent stock chicks, veterinary drugs, equipment and feed additives.
iii. Existence of many unregulated and unqualified feed manufacturers due to limited enforcement of standards in the subsector.
iv. The emergence of many unregistered, unregulated breeding farms.
v. Lack of feed reserves for feed production during off-season.
vi. The emergence of many unprofessional veterinarians, paraprofessionals and drug sellers.
vii. Inadequate enforcement of quality standards leading to substandard veterinary inputs and equipment on the market.
viii. Increased antibiotic resistance of poultry caused by drug abuse.
ix. High levels of aflatoxins caused by poor quality feeds.
x. Over dependence on imports of poultry parent stock from other countries.
xi. Inadequate extension services in the poultry sector.

1.5 Ten suggested steps to a sustainable poultry enterprise

To succeed in poultry farming as a business, do the following:

i. Choose the enterprise type and size, type of bird and breed based on a cost benefit analysis (CBA) and your capability.
ii. Register your business entity.
iii. Organize adequate finances for operations and fixed assets.
iv. Construct and properly equip a well-designed poultry structure on a good location.
v. Organize and manage a professionally competent team (manager, accounts assistant, security, poultry attendants and a veterinarian).
vi. Cater for the right quality, quantity and distribution of feeds.
vii. Cater for good farm biosecurity, good poultry health and welfare.
viii. Market your products well – add value, ensure hygienic and good quality and categorize your customers according to their credit worthiness.
ix. Plough back at least 80% of your sales revenue to grow the business.
x. Have a good succession plan.

MODULE 2: POULTRY MANAGEMENT SYSTEMS IN UGANDA

Classification of poultry management systems in Uganda is based on the level of capital investment, method of housing and management practices. There are three main systems spread across the geographical regions of Uganda. These are extensive, semi-intensive and intensive. The most predominant is the extensive system in which free range poultry farming of local chicken is practiced. The management system dictates the type of poultry and breed that the farmer will use.

2.1 Types of Poultry

Below are the major types of poultry in Uganda:

i. Chicken
ii. Turkeys
iii. Ducks
iv. Geese
v. Pigeons
vi. Ostriches
vii. Guinea Fowls

Of the above, the most predominant are chicken.

2.2 Poultry Breeds

Below are the common poultry breeds in Uganda.

Table 1: Common Poultry Breeds in Uganda

No.	Type	Breed	Local synonyms
1	Chicken - Local	Uganda black and red breeds	Nganda, Nsoga, Nkore
		Ugandan short legged	Nyoro
		Uganda brown	Nganda, Nsoga, Nkore
		Nsesere	
		Teso chicken	
		Ugandan red	Nkooki, Nganda, Nsoga, Nkore
		Ugandan white	
2	Chicken – Duo Purpose (Improved breeds)	Kroilers	
		Rainbow	
		Sasso	
3	Chicken - Exotic - Broiler	Cobb 500	
		Hubbard	
		Ross	
	Chicken - Exotic - Layer	Issa brown,	
		Issex	
		Bovan Brown	
		Shaver	
		Hubbard	

4	Turkeys - Local	Ugandan black turkey (Broad breasted bronze)	Teso
	Turkeys - Exotic	White meat turkey	
5		White Holland, Bourbon Red, Belts- ville small white, Broad breasted white	
6	Ducks – Local	Ugandan duck (Muscovey)	Teso, Nganda, Nsoga, Nyoro, Nkore

Source: Fact sheet on animal genetic resources of Uganda, NAGRC&DB, 2002

2.3 Poultry Management Systems

There are three systems of poultry management in Uganda.

2.3.1 Extensive Systems

The birds are exposed to an unlimited amount of land. Under this system capital investment and productivity are low with no disease control measures. There are two types of extensive management systems.

a) The traditional free-range scavenging system: birds are left to roam free around the village.
b) The free-range commercial system: birds are fed and wander within fenced land and are housed during the night.

Table 2: Advantages and disadvantages of a free-range system

Advantages	Disadvantages
• It is cheap. • Birds exercise and are fit. • Birds have access to fresh green vegetation for vitamins and minerals. • Birds are immune to some diseases and parasites.	• Birds are exposed to harsh weather, thieves, diseases and predators. • Eggs laid in bushes can be damaged, stolen and are hard to collect, birds are not secure, few small-sized eggs, and little meat. • Poor production.

Note: The advantage of free-range commercial system over the traditional free-range is that: the number of birds is known; diseases are controlled; and egg production is better.

2.3.2 Semi-intensive system

Under this system, birds are provided with proper housing but are allowed to wander in the grassland. There are two types under this system.

a) Run system: a piece of grassland is enclosed in a fence; egg nests, feed and water are provided in the house.
b) Fold unit system: birds are kept in a small portable house all made out of wire mesh with a space where they can run and is moved on a daily basis to a fresh spot in the lawn.

2.3.3 Intensive system

Under this system birds are confined within a house and are fed. There are three types.

a) **Deep litter system** – where chicken is reared on floors made of concrete but covered with litters like saw dust or wood shavings to make birds feel comfortable.

Figure 6: Deep litter system

Table 3: Advantages and disadvantages of a deep litter system

Advantages	Disadvantages
• Good management of flocks • Increased production • Reduced labor costs • Relatively hygienic.	• High initial costs • All nutritious feeds must be provided • High risk of diseases e.g. coccidiosis and worms • Birds develop bad habits like pecking,

b) **Slatted floor system** – Similar to deep litter but no litter used. It has a raised floor fitted with slats of wood, strong mesh or plastic. The poultry manure passes through the slates to the ground.

Table 4: Advantages and disadvantages of a slatted floor system

Advantages	Disadvantages
• Good management of flocks • Increased production • Reduced labor costs • Cleaner and more hygienic • Less chance of infections because the birds are not in contact with fecal matter.	• High initial costs • All nutritious feeds must be provided • Birds develop bad habits like pecking,

c) **Battery cage system** - The birds are confined in cages arranged in tiers provided with feed and water.

Figure 7: Battery Cage System

Table 5: Advantages and disadvantages of a battery cage system

Advantages	Disadvantages
• Good management of flocks • Reduced labor costs • Cleaner and more hygienic • Less chance of infections because the birds are not in contact with fecal matter. • Can have a large number of birds in a small area • Less feed wastage • Easy to monitor • Controls broodiness in chicken.	• All nutritious feeds must be provided • High equipment and maintenance costs • No exercise for birds that means poor health • Equipment is specific and not flexible in use • More damaged eggs • High risk of breakdown of the automated equipment.

MODULE 3: POULTRY PRODUCTION PLANNING

Successful poultry production requires proper planning which involves constructing suitable infrastructure and having enough land for expansion. It also enables you to avoid biosecurity threats. Planning starts with selecting an appropriate site, followed by designing a farm lay out plan (Figure 8) followed by designing and constructing poultry houses (Figures 9-14) and other infrastructure, installing biosecurity measures and procuring the right production equipment.

3.1 Site Selection

What to consider when selecting a site?

i. The land should be flat, well drained and not swampy.
ii. Location should have a good flow of fresh air.
iii. Land should be accessible but not on the highway.
iv. The site should be far from other poultry farms, piggery or dairy to avoid noise and diseases.
v. There should be a reliable source of water.
vi. Where possible, the land should have some trees and grass cover for shade to cool the poultry houses during hot periods.

3.2 Farm Lay Out

A good poultry farm should have the following components (Figure 8):

i. Perimeter chain link
ii. An entry-gate
iii. Poultry houses
iv. Offices and toilets
v. Changing room and shower facility
vi. Disinfection barriers (at main gate and entrances to poultry houses)
vii. Feed and equipment store
viii. Clean water source
ix. Access roads
x. Toilets
xi. Incinerator or sanitary pit

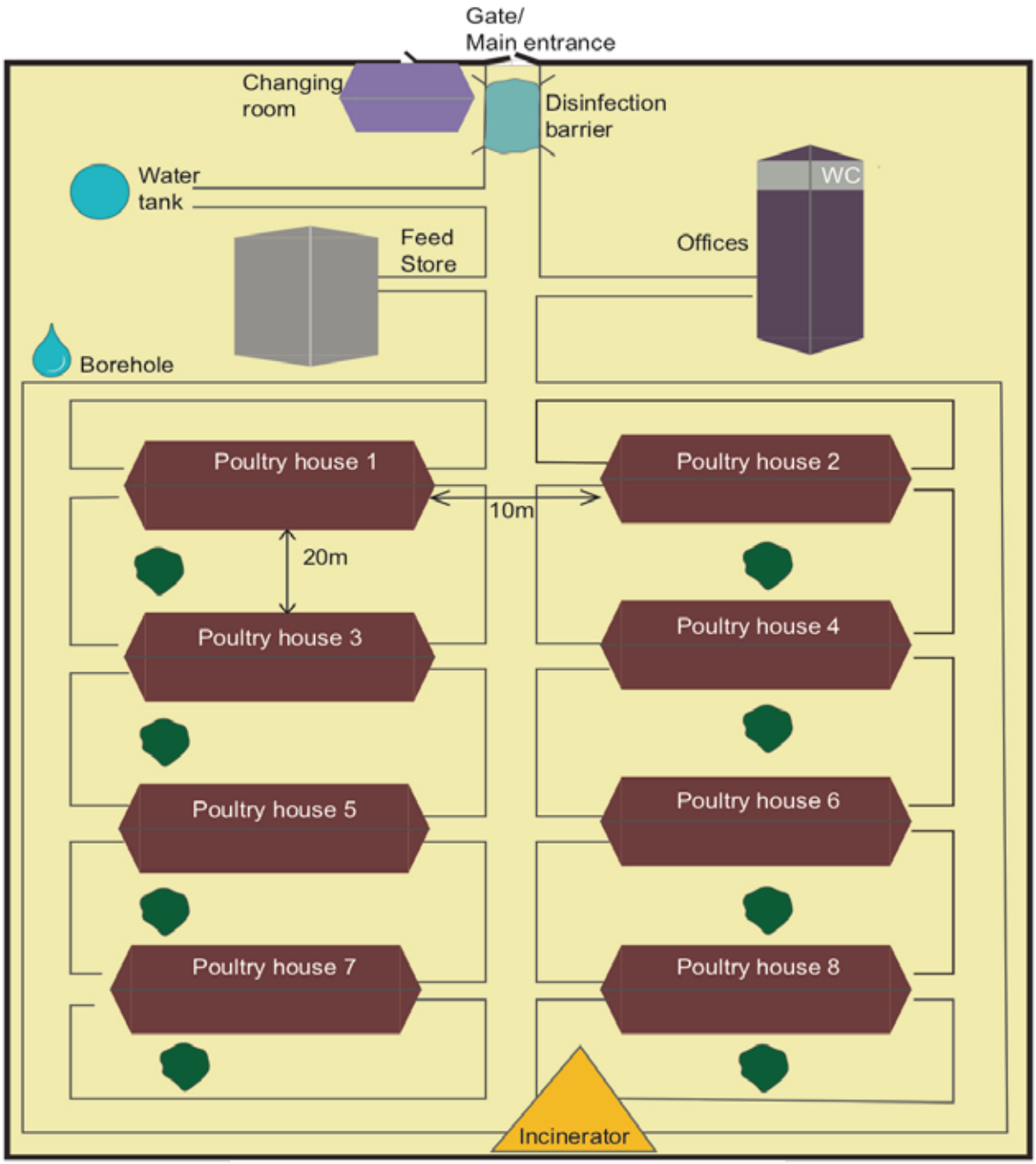


Figure 8: Layout of a commercial broiler farm

3.3 Construction of a Poultry House

3.3.1 Poultry house at the household level

A simple poultry backyard, open sided house for 500 layers should be 7m x 12m (84sq m.). The walls should be short 1m high made of timber, bricks, iron sheets or mad and wattle. The roof should be v-shaped (for easy flow of rainwater) made of iron sheets, plastic sheets with papyrus or grass thatched. The floor can either be marram rammed and cement screened, or marram mixed with limestone and then rammed. The door should be double leafed either wooden or metallic (Figure 10).

Figure 9: Simple Local Chicken House

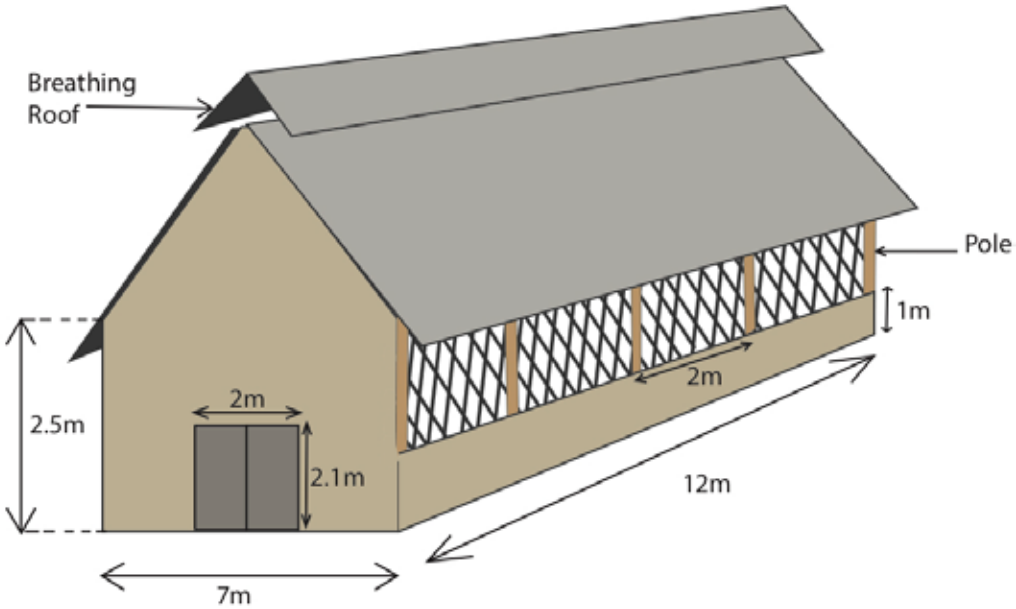


Figure 10: A sketch of poultry house for 500 layers

3.3 Poultry house at commercial level

A good commercial poultry house should have the following components (Figure 11):

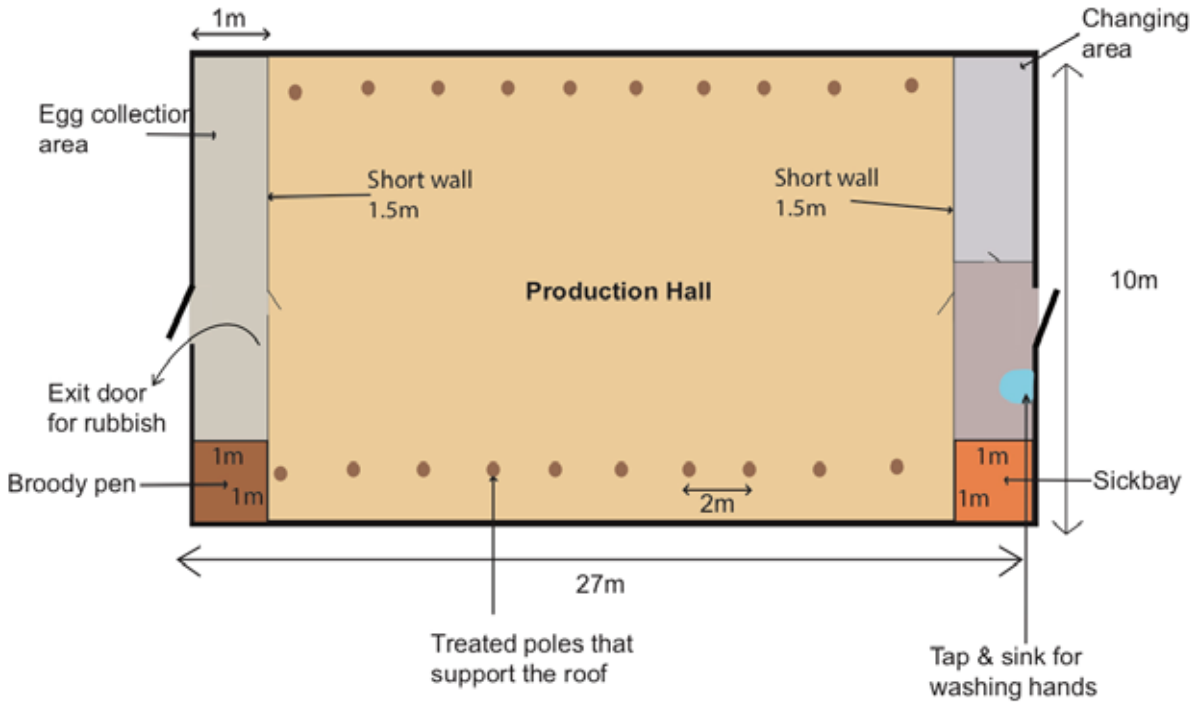


Figure 11: Ground plan for a commercial poultry house

a) Production hall
b) Changing area
c) Egg collection/feed holding unit
d) Entry (clean) and exit (dirty) doors
e) Sink and water taps with detergents
f) An isolation unit

An open sided commercial poultry house for 1,500 layers should be 10m x 25m (27m)[1] 250sq. m – 6 birds per sq. m) and for 2,500 broilers should be 10m x25m (250sq m – 10 birds per sq. m). See fig 12-14. The open sided design is meant to take care of the following:

a. Maximum comfort for the birds.
b. Convenience for poultry attendants.

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[1]The length of the entire house is 27m, however the effective length is 25m because of the space deducted for the work area in front (1m) and behind (1m).

c. Ease of disinfection.
d. Simple and cheap to construct.

The construction of workers' quarters must be outside the perimeter fence in order to avoid biosecurity threats of diseases coming from the quarters and people who visit them.

Figure 12: Design of a commercial poultry house

The following should be considered during construction:

Roof: Construct using timber/poles/metal bars and iron sheets. The roof should provide sufficient over-hang (1.5m) to prevent rainwater from entering into the building during the windy weather. On top of the roof, one side should over-hang the other to form a ventilation duct. The duct should be covered with welded and chicken wire mesh to prevent wild birds from entering the poultry house.

Walls: The long side walls should be 1m high (brick or plain sheet). The space between the wall and the roof should be covered with welded/chicken wire mesh on a frame of treated wooden poles and timber. The gables made of either bricks or plain sheet from the floor to the roof and a double leaf door on both sides.

The difference in design between a broiler and layer house is determined by ventilation and light needs of the two. While the short wall of the layers' house is 1 meter high, the one for the broiler is half a meter, but with a second overhang or tarpaulin to avoid harsh weather like storms. See figs 13 and 14.

Floor: The floor should be of rammed marram and cement screened to prevent rodents from digging through.

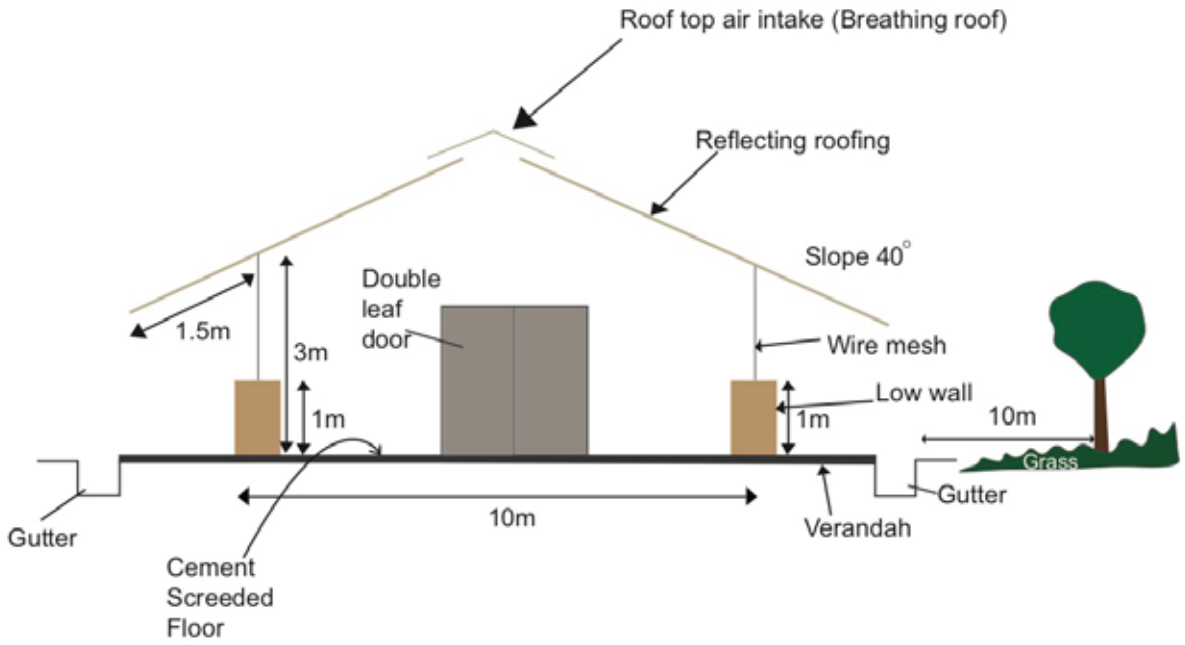


Figure 13: A cross-section of a layer commercial open-sided house

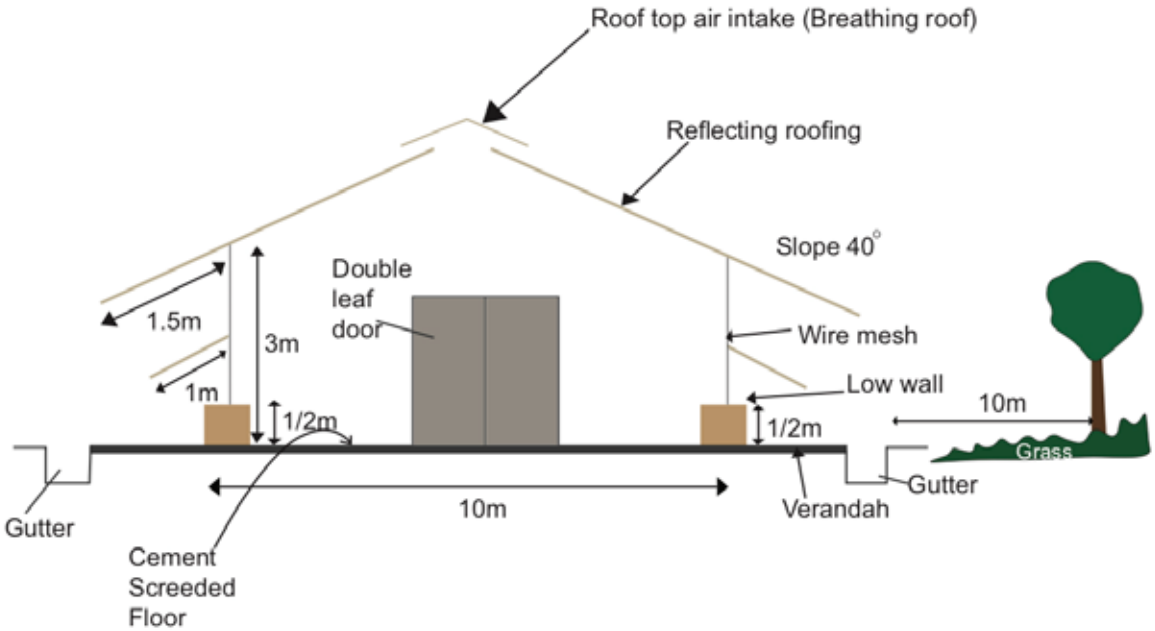


Figure 14: A cross-section of a commercial broiler open-sided house

3.4 Poultry Tools, Equipment and other Farm Necessities

The basic equipment used on poultry farms include drinkers, feeders, trays, nests, pots and charcoal stoves. The level of investment in the farm determines the quality of equipment used.

Figure 15: Bell drinker

Figure 16: Wooden trough feeders (small, medium, large)

Figure 17: Plastic crates for dressed chicken

Figure 18: Trays for feeds in the brooder

Figure 19: Font drinkers for young birds

Figure 20: Plastic bucket feeder for mature birds

Figure 21: Incinerator for disposing dead birds

Figure 22: Pots for brooding

Figure 23: Charcoal stove for brooding

Figure 24: Nipple drinker

Figure 25: Knapsack sprayer for disinfection

Figure 26: Debeaker macine

Table 6: Advantages and disadvantages of water drinkers

No.	Drinker	Advantages	Disadvantages
1	Round Drinker	• Water readily available • Water level and suspension height easy to regulate	• Open system, not always fresh, high chances of contamination • Water spills resulting in wet litter
2	Drinking Nipples	• Closed system, water always fresh • Very little spillage Doesn't occupy much space, giving more room for the birds and attendants	• Expensive • Water dispensing harder to control
3	Drinking Cups	• Water is readily available • Easy to check for blockages	• Expensive • High chances of contamination • Less room to walk around

MODULE 4: POULTRY PRODUCTION MANAGEMENT

Performance in poultry depends on the effectiveness of production methods and techniques that are used. This module presents recommended practices of housing, feeding, watering, vaccination and general husbandry that can be applied to boost production and productivity of the poultry enterprise. The module concentrates on the management of chicken, turkeys, and ducks and is divided into 9 parts: brooder, layer breeder, broiler breeder, commercial layer, commercial broiler, improved breeds, local chicken, turkeys and ducks.

4.1 Brooder Management

A Brooder is a special room designed to provide optimal conditions for the growth and development of the day-old chicks in the first three weeks of their lives.

Figure 27: Simple brooder

Figure 28: A Commercial broiler brooder (Source: Cobb Seminar Zimbabwe)

The first two weeks of a chick's life are the most important in the development process as mistakes made at this time cannot be corrected later. It is during this period that **maximum** growth is attained, and the development of all internal organs and the skeleton takes place. The brooder is therefore the foundation of the poultry enterprise and should be properly managed for high performance.

4.1.1 Qualities of a good brooder

A good brooder should have the following:

1) Optimum Temperature (start 34°C at the end 28°C)
2) Good Ventilation (oxygen)
3) Optimum light
4) Adequate space (30 to 40 birds per sq. m)

4.1.2 Construction of a brooder

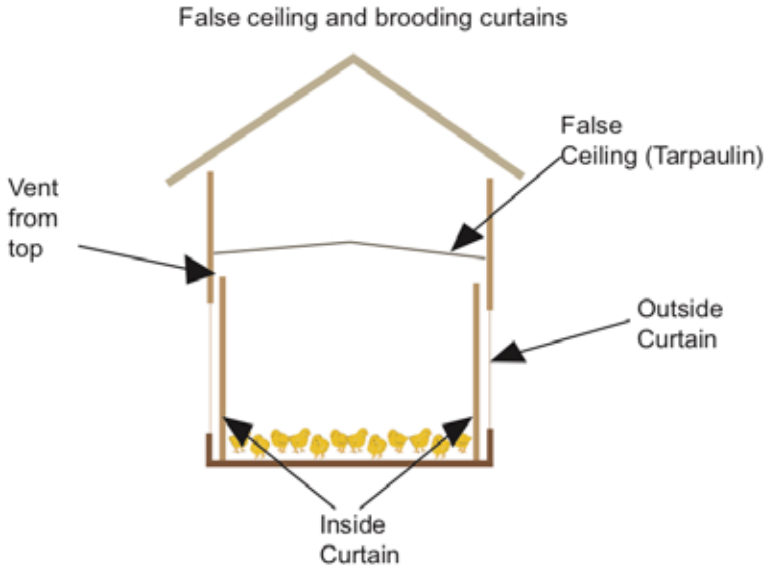


Figure 29: Cross-section of brooder (Source: Cobb 500 Broiler Breeder Manual)

In order to construct a brooder, the following steps should be undertaken:

a) Know the number of birds to be brooded;
b) Compute the appropriate area of the brooder basing on the rate of 30 birds per sq. m;
c) Determine the materials needed for constructing and operating the brooder (tarpaulin, charcoal stove, pots, feeders, drinkers, trays, thermometers, paper, feeds, water and personnel);
d) Fix five tarpaulins accordingly- 2 along the length of the house, both inside and outside and one covering the entire ceiling area (false ceiling), this helps to reduce on heat loss.
e) Use a charcoal stove and pots with charcoal or a gas brooder to generate heat. Use a thermometer to measure temperature. Use properly spaced fonts of 3 liters to distribute water.
f) Use small wooden feeders, hand filled troughs (linear feeders) and hand filled hanging hoppers to distribute feeds.

4.1.3 Key points to consider in brooder managment

1) Get good quality chicks from a reliable source (see attributes in table 7 below).

Table 7: Attributes of a good day-old chick

Check	Attributes for good chicks	Attributes for bad chicks
Reflex	Lay chick on its back. It should stand up within 3 seconds	Chick takes more than 3 seconds to stand up: chick is listless.
Eyes	Clean, open and shiny	Closed, dull
Navel	Closed and clean	Bumpy: remnants of yolk, open navel; feathers smeared with albumen
Feet	Normal color and not swollen	Red hocks, swollen hocks, malformation, deformed toes
Beak	Clean with closed nostrils	Red beak, dirty nostrils; malformations
Yolk sac	Stomach soft and malleable	Stomach hard and skin taut
Down	Dry and shiny	Wet and tacky
Uniformity	All chicks the same size	Chicks of uneven sizes (small, medium and big)
Temperature	Between 40 and 40.8°C	Above 41.1°C: too high below 38°C: too low. Should be 40° 2-3 hours after arrival

2) Carry out a complete farm clean out and disinfection program before introducing chicks (see module 7 for details).
3) Determine the brooding space by the number and type of birds. Normally it should range between 30 -40 birds per square meter.
4) Use litter for cushioning the birds and absorbing moisture in the brooder. The following types of litter can be used: wood shavings, sawdust, rice husk, straw, corncobs, groundnut hulls and rice husks. Spread it evenly to ensure an even floor temperature and chick mobility. For broilers use 5-7cm deep whereas for layers use a depth of 10–15 cm. On top of the litter spread clean papers in 3 rows where the drinkers and the initial feeds and feeders are placed to enable the chicks easily get water and feeds in the first three days of their life.
5) Provide optimum and evenly distribute light by using kerosene lamps or electric bulbs, raised at about 40 cm above the ground. Use the following lighting program: 1st day - 24 hrs.; 2nd day - 23hrs; after 7days -18 hrs.
6) Pre-heat the house for at least 24-48 hours prior to placement.
7) Minimum ventilation should be started as soon as preheating begins to remove waste gases and condensation. Seal leaks in the house to prevent drafts and maximize airflow.

Figure 30: Minimum ventilation in an industrial brooder using tarpaulins outside (Source: Cobb Zimbabwe training)

8) High quality thermometers (use thermometers that are calibrated by UNBS either digital or ordinary mechanical type) should be suspended just above the litter at key points to effectively record the room temperature.
9) Maintain a temperature of 32°C for litter (40.5°C directly under brooders) and the floor temperature 28°C.
10) Arrange the drinkers and feeders in an orderly manner, alternating the lines of drinkers with the feeders. Provide the following feeder space for the birds when they are growing:
    - Day old to 14 days – 2 linear inches (5.0 cm) per bird
    - 15 to 35 days – 3 linear inches (7.5 cm) per bird
    - 36 days onwards (broiler) – 4 linear inches (10.0 cm) per bird. For improved birds and parent stock 15 cm per bird.
    - When determining the amount of space per feeder, measure both sides of the feeder. Maintain height of all trough and pan feeders so that the lip of feeders is at level with the backs of the birds.
11) Set the appropriate drinker system height to allow chicks' easy access (usually chick eye height).

12) Ensure there are no airlocks in the pipes and that each nipple has a droplet of water present. Bell drinkers should be suspended with the base just above the litter.
13) Provide Quality water – Water from a clean water source, optimum in quantity and well distributed using the appropriate drinkers for the age of the birds.

14) Supplementary drinkers (mini drinkers, fonts) should be filled with lukewarm water mixed with chick formula and glucose (according to the manufacturer's recommendations). Add 3-4 drops of liquid paraffin or cooking oil on every font drinker after every 2 hours for the first days to prevent constipation.
15) In case you don't have nipples, maintain font drinkers in the first two weeks.
16 Fill the feeders with a dust free crumbled ration or mash of the right particle size from a reliable source and place them on the floor to make access easier. Additional feeding space should be provided for the first week in the form of paper, polythene or feed trays for maximum consumption. 20% of the brooding area should be covered with paper or polythene. Trays should be provided at a rate of one per 100 chicks.65 grams of feed per chick should be provided on/in the additional feeders.
17) After 2 hours after placement, check the chicks to ensure that they are comfortable with the temperature. Chicks that are too warm will be panting and trying to move away from heat, appear quiet and their wings may drop. Chicks too cold will crowd towards the heat, huddle in groups and be noisy. Chicks at the correct temperature will be evenly spread, show varied behavior (eating, drinking, resting, and interacting).
18) The crops of chicks should be checked the morning after placement to ensure that the birds have found food and water. Crops should feel soft and pliable and a minimum of 95% of them should be filled. If the crops are hard then the chicks have not found adequate water and the availability of water should be checked. If the crops are swollen and distended, then the chicks have found water, but not enough feed and the availability and consistency of the feed should be critically evaluated.

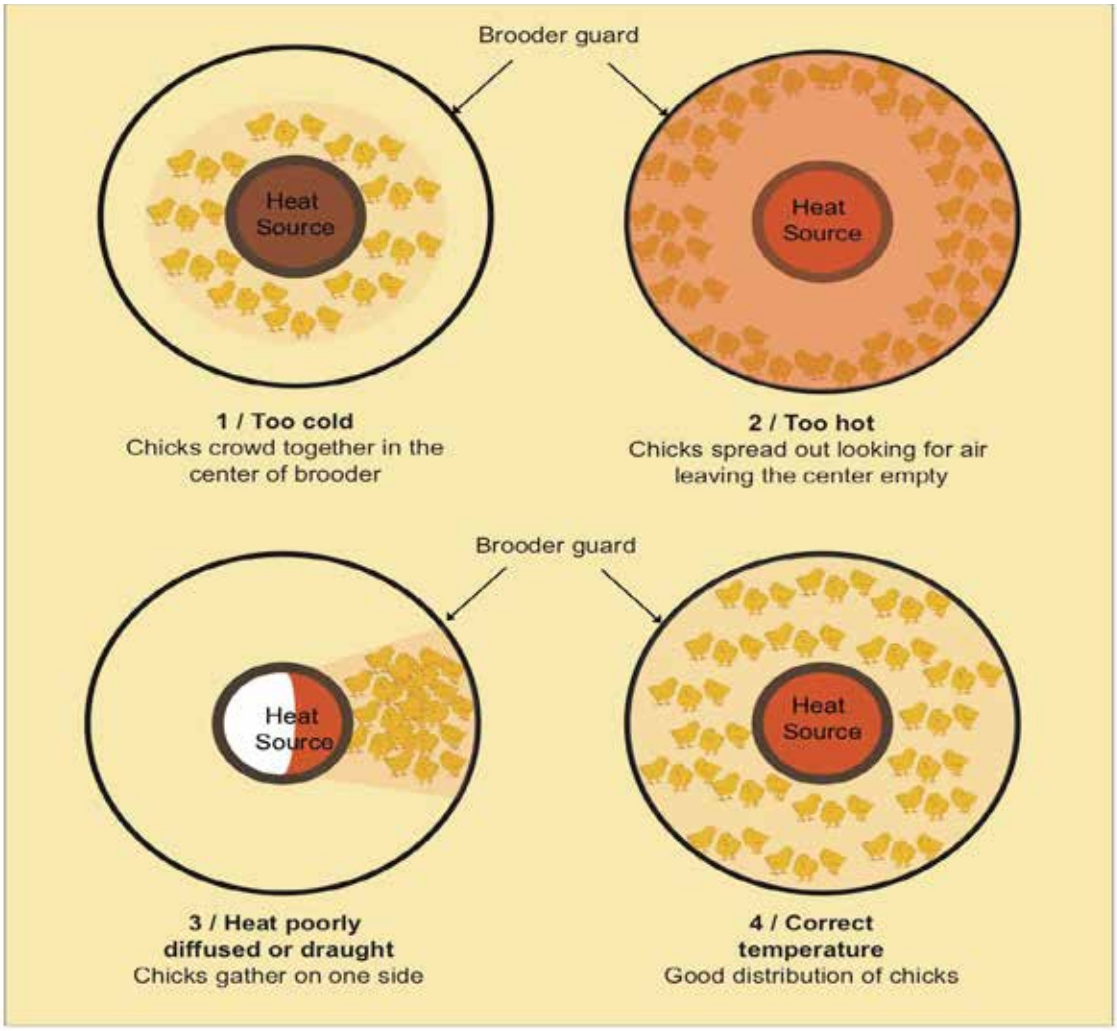


Figure 31: Chicks distribution in the brooder

4.1.4 Ventilation

Provide a good ventilation system in the house to ensure good air quality. Ventilate the brooder at every 4-hour interval, by opening up the upper curtains for 10 minutes and dropping them again while monitoring the temperature and air flow. This exercise should continue day and night to allow exchange of air.

A proper ventilation system serves the following purposes:

- Provides continuous adequate supply of fresh air and oxygen to the birds
- Removes foul air, harmful gases like ammonia, carbon-mono-oxide and carbon-dioxide.
- Maintains the correct temperature and humidity as per the age of birds
- Dilutes disease-causing agents like bacteria and maintains healthy environment in poultry house
- Maintains good litter conditions
- Increases stocking capacity of the house to achieve optimum performance.

4.1.5 Temperature

It is important to maintain the proper temperature in the brooder. Temperature is controlled with the help of curtains. When it is too cold, either cover the open sides of the house with curtains or use the source of heat to increase the temperature. When it is too hot, open the side curtains from the top for about 10 minutes to regulate the heat. Perform this exercise at intervals of 4 hours while monitoring the temperature.

Guidelines for maintaining the temperature are given in the table below.

Table 8: Temperature in the brooder

Age (Weeks)	Temperature (°C) at chick level	Temperature (°C) in the house
1	33-35	30-32
2	30-32	27-29
3	27-29	21-23
4	24-26	21-23

Check the temperature of the chicks' feet against the neck or check. If the feet are cold, reevaluate the preheating temperature.

Effects of variations in temperature

Low temperature result in cold litter which manifests in:

1. Poor early feed intake

2. Slow growth

3. Lack of uniformity

Excessive chick noise during brooding is an indication that the chicks are uncomfortable. This is commonly due to improper temperature and symptoms include:

Chilled chicks

- Chicks chirp and huddle together especially under the brooder.
- Watery intestinal contents leading to watery/ wet droppings leading to
- Wet pasted vents.

Overheated chicks

- Chicks lie prostrate with their heads and necks stretched out on the floor.
- Chicks pant.
- Increased water consumption by chicks, leading to distention of the crop and intestines by the extra water.
- Chicks move away from the heat source and seek cooler parts of the house. Sometimes crowd around the drinkers.

4.1.6 Water

Provide clean, lukewarm water in font drinkers at a rate of 50 chicks per font during the first week. Then gradually replace them with the regular drinkers (trough -2cm per bird, bell shaped -35 cm diameter for 75 birds and nipples- 8 to10 birds per nipple). The rate at which layers and broilers consume water in the brooder is illustrated in the table below.

Table 9: Water consumption for layers and broilers in the brooder

Age (Weeks)	Broiler Consumption Water mls/Bird	Layer Consumption Water mls/Bird
1	40-50	20 -30
2	60-80	40 -50
3	100-120	50-60

4.2 Management of Layer Breeders

Production of layer breeders involves the production of fertilized layer eggs from layer parent stock birds. When these eggs are incubated, they produce layer commercial birds. The breeders are mainly imported as day old chicks, males and females, and then reared up to point of lay to get fertilized eggs. This section provides information on what is required to successfully manage layer breeders. This include farm location and housing; key activities; feeding program; lighting; equipment; pecking; prolapse; smothering; broodiness; vaccination and routine management.

4.2.1 Farm location and housing

The farm should be located as far from other poultry enterprises as possible. Preferably use the principle of "all in all out", implying that one stock at a time, grow and lay and then dispose them off at ago before bringing a replacement stock. The houses should be built in such a way that they are easy to clean and disinfect between flocks. Partition the house to get smaller pens which are manageable and enhance production. The partition should be up to 60 cm high to avoid smothering along the panels. Use equipment designed for easy access and removal of waste, easy maintenance and biosecurity. See module 3 for housing, module 4 for brooder and brooder management and module 6 for biosecurity and disinfection.

4.2.2 Key objectives and activities in the grower period

The following should be achieved during this period:

- Recommended weight at 5% production.
- Good feeding behavior pattern.
- Development of the digestive tract (crop and gizzard).
- Good uniformity of 80% minimum.

To achieve the above do the following:

- Correct stocking density and housing condition.
- Provide a lighting program adapted to rearing condition.
- Do a good quality beak trimming.
- Manage a good feeding program.

4.2.3 Feeding program

Implement the following feeding program.

Table 10: Feeding program

No.	Age (Weeks)	Diet
1	0 to 4	Starter
2	5 to 10	Grower
3	10 to 16	Pullet
4	17 to 18 (just before 2% production)	Pre-lay
5	2% production to 25 weeks	Layer 1
6	26 to end of lay	Layer 2

- A system of flat chain floor feeder is the most suitable for feeding the parent stock. Tube and pan feeders are tedious to use as they are difficult to empty, and the feed depth must be regulated correctly.
- Empty the feeders' everyday around midday for 2 -3 hours to avoid the buildup of fine particle residues. Encourage crop development by having rapid feed consumption.
- Supply insoluble grit for gizzard development. From 3 to 10 weeks- 3gms/bird/per week after 10 weeks - 4 to 5 gm/bird /week.

Monitor the development of the parent stock by weighing the birds every week and benchmarking with the standard weight of the breed. If the weight range is outside the standard, check the following**:**

a) feeder space and position
b) speed of the feed distribution
c) vaccination status
d) diseases and parasitism

Figure 32: Layer parent stock rearing (Source: Asiima ACL)

Males and females are reared together because it reduces stress, provides for better production and livability.

Table 11: Feed specification for layer parent stock (0-18 weeks) in Uganda (temp. above 24 °C)

Content	Diet units	Starter 0 -4 wks. (chick & duck mash)	Grower 4-10 wks. Grower mash)	Pullet 10-16 wks. (Grower mash)	Pre-lay 112 days to 2% lay
Metabolizable Energy	Kcal/kg	2,950-2,975	2,850-2,875	2,750	2,750
Crude protein	%	20.5	20	16.8	17.5
Methionine	%	0.52	0.47	0.35	0.42
Lysine	%	1.16	1.03	0.78	0.84
Threonine	%	0.78	0.69	0.53	0.59
Calcium	%	1.05-1.10	0.95-1.10	0.95-1.05	2.1-2.2
Phosphorus	%	0.48	0.44	0.38	0.44
Fiber	%	4.45	5.56	5.56	4.16

Table 12: Diet standard for breeder layer (19 to 72 weeks) in Uganda (temp. above 24 °C)

Content	Diet units	Layer breeder	
		Minimum	Maximum
Met. Energy	Kcal/kg	2,650	2,800
Crude protein	%	14.2	15.1
Methionine	%	0.33	0.35
Lysine	%	0.72	0.80
Threonine	%	0.47	0.49
Calcium	%	2.8	3.9
Phosphorus	%	0.73	0.9
Fiber	%	3.6	7.5

4.2.4 Lighting program

Implement the following lighting program.

Table 13: Lighting program for open-sided houses

Age (days) or % of lay	Daily Light Duration
	Natural light < or = 12hr
1 -3	22 hr.
4 -7	20 hr.
8 -14	19 hr.
15 -21	18 hr.
29 -35	17 hr.
36 -42	16 hr30
43 -49	16 hr.
50 -56	15 hr30
57 -63	15 hr.
64 -70	14 hr. 30min
71 -77	14 hr.
78 -84	13 hr.
85 -91	12 hr. 30 min
92 to 5% of lay	12 hr. 30 min
5 to 20% lay	13hr 30 min
20% to 35% lay	14 hr. 30 min
35% t0 50% lay	15hr 30 min
50% to 65% lay	16hr
After 65% lay	16hr

- Avoid any light stimulation before 5% lay.
- Use incandescent bulbs with lamp shades and warm color lights (yellow or orange light spectrum).
- Conduct midnight feeding to encourage the birds to eat during the cooler part of the day this reduces the negative effect of high temperatures during the day.

The Lighting program achieves the different objectives

During rearing:

a) Promotes early development and encourage feed intake and growth
b) Controls the birds' sexual maturity.

During production:

a) Encourages growth at start of lay.
b) Encounters the harmful effects of decreases in natural day length.
c) Controls livability through the light intensity management.
d) Increases egg size rapidly to more than 52 grams, which gives chicks of good quality and livability
e) Enables the formation of quality eggshell for a long period which guarantees maximum rate of hatching eggs.

4.2.5 Age at transfer

Vaccinate the pullets a week before transferring them to the laying house at the age of 16 weeks (112 days). Ensure all water devices are working properly before transfer.

Effects of late transfer:

- Delayed start of lay and higher mortality
- Increased risk of floor eggs

4.2.6 Stocking

Table below shows the stocking density of the birds in different production systems with the corresponding equipment.

Table 14: Stocking density and equipment

Item	Specification	Floor	Cages
Stocking density	Birds/sq. m.	6 – 8	12
	Birds/sq. m. (hot climate)	6	
	Sq.cm/bird		830
Water supply	Birds /drinker	100	
	Birds /drinker (hot climate)	70	
	Birds /nipple	9	9(2)
Feed supply	Trough feeders(cm)	10	12
	Birds /round feeder	20	
Nest space	Hens/nest(individual)	5	
	Hens/sq. m. nest(collective)	120	

- If males are reared separately, increase floor space by 25%.
- Ensure that all the birds have at least an access to 2 nipples.
- The stocking density can go up to 8 birds /sq. m if the house has slates.
- Layer breeders must have fresh clean water all the time, the drinkers should be placed evenly over the whole area, the bottom of the bell drinkers should be hanging to the height of the birds' back.

Perches

Perches are poles suspended at about 40cm from the floor for birds to rest on especially at night.

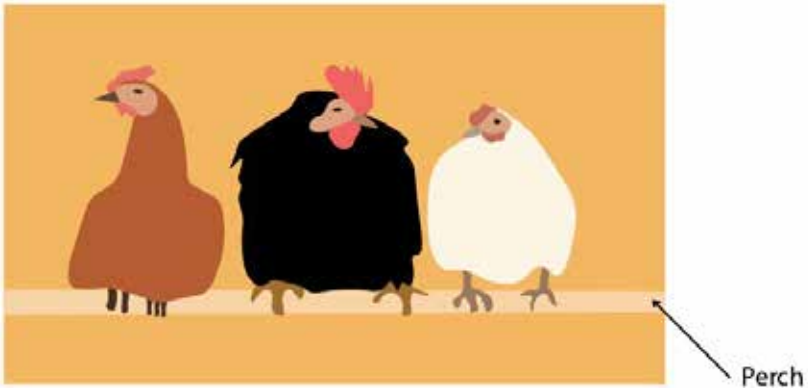


Figure 33: Perch

They are useful in reducing aggression. The distance between perches should be 40cm and the perch space should be 5 – 10 cm for each bird.

Mating ratios

Keep between 9% to 10% males for mating. In the cage system, 13% of cocks are in colony cages and 6% in artificial insemination. Have a pen for separating aggressive cocks.

Beak trimming

Beak trimming (section 4.4) is carried out to reduce feather pecking, cannibalism and feed wastage. Trim the beaks at the hatcheries but if not then de-beak at 15 days then follow it again at 8 - 10 weeks.

4.2.7 Pecking

When an egg is laid, there is extraversion of the oviduct with high light intensity and poor nest quality; the protruded oviduct can be pecked by other birds causing death.

How do you prevent pecking?

- Use artificial lights with warm colors.
- Control light intensity.
- Shade open-sided houses.
- Provide comfortable nests in the right location and numbers.
- Install perches in the production house.
- Avoid feed deficiency and under consumption.
- Provide enough feeder space.
- Ensure a rapid feed distribution system.
- Avoid crumble and pellet feeds (takes a short time to consume).
- Avoid stress, parasites (internal and external) and enteritis.
- Provide good quality litter to keep birds occupied,
- De-beak properly.

4.2.8 Prolapse

It is the extraversion of the cloaca and oviduct, which sometimes gets wounded and leads to rapid death. It occurs with birds that are too lean at point of lay and with fatty pullets.

What is the cause of prolapse?

- Giving light stimulation to underweight birds before their body frame is developed.
- Giving excessively large light increments.
- Fat pullets are prone to prolapse because excess fat contributes to lower elasticity and tone of the tissues involved in egg laying.

How do you avoid prolapse?

- Make sure the flock is uniform at rearing.
- Ensure target body weight by age.
- Avoid excess weight during rearing.
- Avoid any sudden increase in light period.

4.2.9 Smothering

It is the crowding together of floor-reared (deep litter) pullets, which may lead to piling, suffocation and death.

Causes of smothering-

- Reaction of panic- when birds are frightened.
- Attraction – to feed and to discover the environment.
- Sleeping behavior- to lose heat.
- Social behavior -to protect against danger.
- Following a change in feeding times due to lack of feeding or drinking equipment.
- Sunlight getting in the poultry house.

How do you avoid smothering?

- Bring forward the times of “light on” and” light out” by half an hour.
- Use perches to reduce number of birds on the floor.
- Use an electric fence along the partitions.
- Round off the four corners of the house with either plywood or concrete.
- Distribute grit or cereals on the litter after lay.
- Use opaque partitions up to 60cm to separate pens.

4.2.10 Broodiness

This is the habit of birds sitting on eggs in the nests. It appears in flocks in case of stress or when they are underweight.

Figure 34: Broodiness

How do you avoid broodiness?

- Prevent floor lying.
- Close nest in the evening (4hours to lights out).
- Collect eggs 4-6 times a day.
- Avoid leaving broody hens to brood on the floor to stop the spread of the behavior.
- Avoid high stocking densities which compromises feeder and drinker space per bird.
- Make a broody pen. For a 300sq. m. house the dimension of the pen should be 1sq m.This is enough to accommodate up to 5 birds.

Procedure to break up broodiness:

- Identify 5 broody hens.
- Dip them in cold water for 20-30 seconds at least 3 times a day.
- Transfer them in a broody pen 1 sq. m., well ventilated, on a concrete or slatted floor, without a nest but with feed and water available at all times.
- After 5 days of separation the birds that will respond by widening of the pelvic bones will be returned to the flock.

4.2.11 Vaccinations

Implement the management and vaccination program in the table below.

Table 15: Routine management program including vaccinations

Age (Days/Weeks)	Vaccine /Activity	Date	Method of Admin.	Remarks
1Wk	NCD Lasota		Eye Drop/ In Water	
2Wks	Gumboro		Water/Eye Drop	
16Days	De-Beaking			
3 Wks.	Gumboro		Water/Eye Drop	
4 Wks.	IB/ND		Water/Eye Drop	
5Wks	REO Virus		Injection	
8 Wks.	Deworming/Vit.		In Water	
8 Wks.	Typhoid		Injection	
10 Wks.	NCD		In water/Eye drop	
12 Wks.	Inf. Coryza		Inject.	
13 Wks.	AE/Pox Vaccine		Inject/Wing Web	
14 Wks.	IB 2		Water/Eye Drop	
16 Wks.	Deworming/Vitamin		In Water	
17 Wks.	IB/IBD/NCD/REO		Inject.	
18 Wks.	Vit/ Census		In Water	
19 Wks.	Lab. Immunity Checking			
26-28 Wks.	Deworm After Peak/Vit.		In Water	
34 Wks.	Deworm/Vit.		In Water	
38 Wks.	Vit/Census		In Water	
41 Wks.	IB2		In Water	
42 Wks.	NCD Lasota		In Water	
43 Wks.	Deworm/Vit.		In Water	
49 Wks.	IB 2		In Water	
50Wks	NCD Lasota		In Water	
51 Wks.	Vit/Census		In Water	
52 Wks.	Deworm/Vit.		In Water	
57 Wks.	IB2		In Water	
58 Wks.	NCD Lasota		In Water	
59 Wks.	Deworm/Vit.		In Water	
63 Wks.	Vit/Census		In Water	
65 Wks.	IB2		In Water	
66 Wks.	NCD Lasota		In Water	
67 Wks.	Deworm/Vit.		In Water	
71 Wks.	Vit/ Census		In Water	
72 Wks.	Off Laying			

NCD Lasota – Newcastle Disease Lasota, Vit. – Vitamin, IB2 – Infectious Bronchitis 2, AE/Pox – Avian Encephalomylitis/fowl pox, IB/IBD/ND/REO – Infectious Bronchitis/Infectious Bursal Disease/Newcastle Disease/Reovirus.

Reovirus disease (viral arthritis) is clinically manifested by lameness and swellings affecting primarily tarsometatarsal joints and the feet. Reovirus vaccine is used to control this disease in breeding stock to avoid lameness. Marek vaccine is normally given to day-old chicks at day one in the hatcheries but when the parent stocks are imported from abroad there is no need to vaccinate because they come already vaccinated.

Use the table above to record:

a) Date when you received the flock and program the interventions above according to the schedule, from the beginning up to when you off lay.
b) Dates when each intervention will be undertaken.
c) Remarks when you undertake the intervention.

Egg production should begin at week 18 and gradually increase to reach a peak of about 96% in 6 to 8 weeks, depending on the uniformity of the chicks. Nest material (rice husks or wood shavings must be clean and without mold and be changed regularly to avoid contaminating the eggs. The nest must have a closing system. Collect eggs regularly (4-6) times a day. Before egg collection, wash hands and sanitize with a disinfectant. Hatching eggs must be disinfected quickly, after collection. You can use hydrogen peroxide, quaternary ammonium compounds, chlorine, Ozone, UV rays or dipping in a disinfectant solution.

4.2.12 Egg storage

Eggs should be stored at between 15°C to 18° C depending on the duration of storage. Keep the eggs with the narrow end of the shell down for short term storage and for long term (more than 7 days), with the broader end down. Pack eggs on wooden pallets.

4.3 Management of Broiler Breeders

Broiler breeder production involves the production of fertilized broiler eggs from broiler parent stock birds which when incubated produce broiler commercial birds. The breeders are mainly imported as day old chicks' males and females, and then reared up to point of lay to get the fertilized eggs. This is a highly professional undertaking requiring frequent weighing of the birds, separate feeding, challenge feeding, artificial insemination for better egg production and longevity of the flock.

This section provides information on what is required to successfully manage broiler breeders. This include rearing; vaccination and routine management; bird weighing; feeding and watering;

4.3.1 Rearing

Farm preparation

For any information concerning the brooder refer to section 1 of module 4. There are only a few exceptions for the breed. The brooding farm should be as far as possible from older birds. Brood chicks on "an all-in, all-out program".

- Avoid multi-age flocks.
- Ensure a good brooder house security program.
- The same person should not look after young chicks and older birds.
- Keep all visitors out.
- The house and equipment should be thoroughly cleaned and disinfected.

Before the chicks arrive, pre-heat the house for at least 48 hours. cockerels should be brooded and fed separately from the pullets, stocking males at 4.2 birds/m^2 (2.5ft^2/bird) and females at 7 birds/m^2 (1.54 ft^2/bird). This will help to maintain good litter conditions and allow the cockerels to express fully their potential frame size. Keep accurate records of feed consumption, mortality and all other relevant factors such as diseases, vaccination and unusual circumstances. Carryout a weekly random 5% check, weighing of the flock starting at 7 days of age to determine feed amounts. (Additional weighing can be carried out at 10, 17 and 24 days to assess bird weigh gain.) Initially bulk weigh a sample of chicks, then from 28 days of age carry out individual bird weighing. A minimum of 10% of birds should be weighed for each group which is fed together.

Figure 35: Broiler parent stock rearing (Source: Asiima ACL)

Isolate small-framed birds into separate pens to reduce competition for feed and encourage growth. These smaller-frame birds should be retained in their own pen or house until transfer and may need to be given the light stimulus when they are older than their sisters. Selection of small framed birds may begin when chicks are 14 days of age to be completed by 28 days of age. Make three groups (bigger birds, medium birds- main flock, and small framed birds).

For the first 48 hours continuous lighting should be provided in all types of houses to help the chicks return to feed, water and heat.

Follow the lighting recommendation set out in table 19 below.

At 56 days of age – and not before – the males can be selected to reduce their numbers to 11% of the total number of females prior to mating. A second selection of males should be completed, prior to mating, removing retarded males. Males should be housed with the females by 140 days of age at a mating ratio of 10 males per 100 females. By 154 days the ratio should be 9.5 males/100 females. Use of more males than these recommended numbers can lead to over-mating of females and fighting between males. Sexual maturity between males and female must always be in balance.

Inactive males should be removed throughout the life of the flock. As part of the daily management routine males which are overweight or with any indication of leg problems should be removed.

As a guide, 6.5 to 7 males per 100 females are adequate from 50 to 60 weeks.

To improve uniformity and reduce stress within a flock, it is important that feed is distributed throughout the house within a maximum time of three minutes. Clearly identifiable sexing errors should be removed as they appear during the latter part of the rearing period. De-worm at 119 and 140 days with a good de-wormer.

Record and plot daily, weekly production, body weight and egg weight in order to monitor performance trends. Litter should be 8-9 inches, remove wet or caked litter. Individual nests should measure 30.5×30.5×30.5cm with a 12.5cm front litter board per 4 hens. The nest must be 15cm above the litter. See module 4 section 4.4.4

Table 16: Performance data (COBB 500 Broilers)

Age at depletion	Weeks (Days)	60 (420)	65 (455)
Age at 5% production	Weeks (Days)	24 (168)	24 (168)
Total eggs/hen housed		159	175
Hatching eggs/hen housed	50g - minimum	153	169
Peak hatchability		91%	91%
Average hatchability		85.8%	85.1%
Broiler chicks/hen housed		131.3	143.8
Feeds from day-old to depletion (100 chicks hatched)		38.4 kg	38.9 kg
Livability from day-old to depletion		88-90%	88-90%

Table 17: Performance data (COBB 500 Broilers) - body weights

	In Season (kgs)	Out of Season (kgs)
Female bodyweight (24 weeks)	2.93	3.03
Female bodyweight (65 weeks)	3.95	4.05

Source: Cobb 500 Breeder Management Guide

4.3.2 Vaccination

Table 18: Routine management program including vaccinations

Age/Wks.	Vaccine /Activity	Date	Method of Admin.	Remarks
1 Wk	NCD Lasota		Eye Drop/ In Water	
14 Days	Gumboro		Water/Eye Drop	
16 Days	Debeaking			
3 Wks	Gumboro 2		Water/Eye Drop	
4 Wks	IB/ND		Water/Eye Drop	
5 Wks	Reovirus		Inject	
8 Wks	Deworming/Vit.		In Water	
8 Wks	Typhoid		Inject.	
10 Wks	NCD		Water/Eye Drop	
12 Wks	Inf. Coryza		Inject.	
13 Wks	Ae/Pox Vaccine		Inject/Wing Web	
14 Wks	IB 2		Water/Eye Drop	
16 Wks	Deworming/Vitamin		In Water	
18 Wks	IB/IBD/NCD/REO		Inject.	

19 Wks	Lab. Immunity Checking			
30 Wks	Deworm After Peak/Vit.		In Water	
34 Wks	Deworm/Vit.		In Water	
38 Wks	Vit/Census		In Water	
41Wks	IB2		In Water	
42 Wks	NCD Lasota		In Water	
43 Wks	Deworm/Vit.		In Water	
49 Wks	IB 2		In Water	
50 Wks	NCD Lasota		In Water	
51 Wks	Vit/Census		In Water	
52 Wks	Deworm/Vit.		In Water	
57 Wks	IB2		In Water	
58 Wks	NCD Lasota		In Water	
59 Wks	Deworm/Vit.		In Water	
63 Wks	Vit/Census		In Water	
65 Wks	Off Laying			

NCD Lasota – Newcastle Lasota, Vit. – Vitamin, IB2 – Infectious Bronchitis, AE/Pox – Avian Encephalomylitis/fowl pox, IB/IBD/ND/REO – Infectious Bronchitis/Infectious Bursal Disease/Newcastle Disease/Reovirus

Use the table above to record:

a) Date when you received the flock and program the interventions above according to the schedule, from the beginning up to when you off lay.
b) Dates when each intervention will be undertaken.
c) Remarks when you undertake the intervention.

4.3.3 Bird Weighing

i. Weigh weekly on the same day at the same time.
ii. Weigh birds before feeding.
iii. Weigh 3% of all females in the poultry house from two different ends of each pen/house and always in the same area.
iv. Weigh a minimum 10% of all males in the poultry house from two different ends of each pen/house and always in the same area.
v. When hanging birds individually on the 5 kg scale, care must be taken not to injure the birds. All birds (Males & Females) must be hung by either both legs or, both wings (never one leg or one wing) or by the use of a cone or wing clip.

Preparation for weighing

a). The day before weighing:

- Prepare weighing sheets
- Check availability and operation of scales
- Determine how many birds (approximately) to weigh per pen to achieve 3% females and 10% males in total.

b). The day of weighing:

- Do not feed birds till after weighing
- Make an early start to minimize feeding delay.
- Adjust the light intensity to allow accurate reading of scales.

Weighing Procedure

i. Push birds into a weighing frame.
ii. Avoid crowding by weighing fewer birds per frame, but more often.
iii. Do not remove individual birds to reduce overcrowding but release them all.
iv. Do not hold many birds at a time, three are enough.
v. Do not add birds to the one's you are already holding but empty your hands before accepting more.
vi. Hold & weigh birds either by both-wings or both legs.
vii. Weighing frames must be sturdy to prevent smaller birds escaping.
viii. Scale operators must check "zero" of scale after approximately every ten birds weighed.
ix. Read the scale when it is reasonably stable and call out the weight loud and clear.

All birds in the weighing frame must be weighed and recorded without exception. Never weigh more than one frame in one specific location.

4.3.4 Natural daylight rearing

In open- sided and windowed houses, local day length conditions require a specific lighting program. The lighting program in the production period is determined by the natural day length at 140 days (20 weeks). Increase the light gradually from day light at week 20 to week 24 by adding one hour per week to reach 16 hours of light by week 24. Light stimulation at 141 days should only be done when the birds are of the appropriate weight (males 3.1kgs and females 2.68kgs) with the right fleshing. See table below.

Table 19*:* Light program for open sided houses with day length of 12 hours.

Days	141	148	155	162	169
Hours of light	13	14	15	16	16

4.3.5 Allocation of feeds

1. On arrival of the day-old chicks at the farm, supply sufficient feed on the chick paper and in the feed trays. A maximum of one day's supply should be provided.
2. Small amounts of feed should be given frequently (4 or 5 times/day) to encourage feed intake.
3. Restrict feeding daily as early as 7-10 days of age.
4. Determine daily feed allocation by weigh-back method.
5. Rear the parent birds to achieve strong, healthy and viable Point of Lay (P.O.L.) birds.
6. Feed the birds early morning every day and at the same time especially in hot climates. Peak environmental heat load occurs in the afternoon, so there is a distinct disadvantage to have extra heat in the birds' body currently. Heat will peak 4-6 hours after feeding.
7. Feed birds according to body weight and condition.
8. Be flexible in feed allocation taking into consideration stress factors such as the health status of the flock, vaccinations and handling etc.
9. Pay attention to bird weight because it will guide you in determining the feed allocations required.
10. Grade the birds at 4 weeks of age into three categories of body weights, (medium weight, light weight and heavy weight) and feed them as per the following schedule.

a. Light weight birds having a body weight less than 10% of the average will get a 5-10% feed increment more than the medium weight-group. This can be practically implemented by allotting 5-10% extra feeder space.
b. Heavy weight birds having a body weight more than 10% over the average will get 5-10% less feed than the medium birds, by giving them 5-10% less feeder space. Never reduce the daily feed allocation.
c. The medium weight birds will get the appropriate feed increments based on deviation from the standard body weight.
d. The aim is for each category to achieve the target body weight by allocating the above-mentioned feed within the period in which skeletal development and growth is taking place.

11. Provide adequate feeder space/bird (15cm/bird will be the optimum).
12. Feed only when farm staff is present and feed distribution can be completed within 3 minutes.
13. Provide feed for different categories of birds by adjusting feed space per bird and not by feeder pan levels.

4.3.6 Feeding program

Do separate sex feeding of males and females; this keeps males in a fit and active condition for long, improves fertility, hatchability and lowers feed consumption. Use the female and male feed tables (23 – 25) for guidance.

Figure 36: A feed trough with grids for separate sex feeding (females)

You can use any of the following feeding programs:

- Daily feeding
- One day on, one day off (skip a day).
- Five days on, two days off.
- Two days on, one day off, two days on, one day off, one day on.

Details are explained in the next section.

4.3.7 Feeding procedure

Skip-a-day Feeding

When using this program, it is recommended to use an effective separate sex feeding method. Fast and even feed distribution is of paramount importance in improving and maintaining uniformity. Skip a day feeding requires a mash feed. Do not skip a day on pellets. Use a grill height of 55mm and width of 45mm to enable separate sex feeding. From day old until day 28, feed daily. (Crumble starter for 14 days then mash starter until day 28). Skip a day program starts at day 29 (growers mash feed). Day 29 double feed, day 30 no feed, day 31 double feed etc. Do not feed more than the peak daily feed allocation in the production phase on any one feed day.

Total feed per week as indicated in the tables is divided amongst the feeding days and it changes by week depending on the average weight of the males and females as matched with the standard. Never decrease the feed portions but instead maintain the same quantity if the birds are overweight. And increase accordingly as the birds grow according to the standards provided.

For example, female daily allowance -53g

- Female weekly allowance, 53g/bird/day × 7 days = 371g.
- Divide by 5 days (371/5) =74g/bird.
- Begin the program for the start of week 4-5 to the end of week 19-20.
- Put anti-coccidiostat from day old up to week 14-15.
- Up to 5% HD (Hen-day) production, feed according to bodyweight.
- From 5% production, use a feeding for production program below.

Table 20: Feeding for production (females)

Production %	Standard feed (g/bird/day)	Alternative feed (g/bird/day)
5%	130	130
15%	136	133
25%	142	136
35%	148	142
45%	154	150
55%	160	160
65%	166	166

4.3.8 Feeding for production

When the flock reaches 5% daily production, make a program to lead production with feed. The flock should be on peak feed at 60-70 % daily production. The program can be built by deducting actual feed at 5% from peak feed. Calculate an amount to increase for each 10% increase in egg production as illustrated below.

Table 21: Calculating production feeding

Feeds	g/ bird/day
Feed at 5% daily Production	130
Peak feed amount:	166
Amount to increase	36
Number of increases	6
Amount of feed to increase per 10%	6

4.3.9 Water

At temperature up to 25˚C (77 ˚F) normal water consumption is 1.6 to 1.8 times the food intake; thus, birds eating 100 g/day would require 160-180 liters of water per 1,000 birds. This factor should be used only as a guide (it is not a fixed), so that deviations in consumption due to feed quality, temperature or bird health can be noted and appropriate management actions taken.

When feed intake is controlled, and when 'skip-a-day' feeding is practiced, over consumption of water results in wet droppings and poor litter condition. To overcome this problem in moderate and cold weather, control access to water at about 4.30 pm.

Water must always be available when the temperature is higher than 30˚C (58˚F) and when there is disease or stress condition. Never restrict intake of water during egg production.

4.3.10 Male selection

Male selection is an important step towards ensuring high fertility and maximum hatchability throughout the entire production phase. Select males (12%) at 8 weeks and culled as required thereafter. A final selection is done at 18 – 21 weeks before transfer to the production house and before mating (10%). During rearing the males must be fed following the recommended male body-weight standard and condition (table 24). Ensure a proper synchronization of male and female maturity.

Steps to take in male selection

- Remove any sex errors that may still be in the group to avoid in-breeding. Sex errors are birds that are found to be females in the male line or males in the female line caused by errors during sorting of the respective parent stocks at the hatchery.
- Do a uniformity test of the males by weighing a minimum of 10 % of the total number.
- Only males within plus or minus 10 % (no more than 15 %) of the average weight will be used for transfer. Large males may be suitable for spiking.
- From this group cull all males who look haggard or show signs of feather wear or feather removal as these are inferior males that cannot compete.

Cull all males who have:

- Swollen and/or abnormal legs.
- Crooked and/or deformed toes.
- Short uneven or deformed beaks.

- Crooked breast bones.
- Crooked and/or narrow backs.
- Cloudy and/or dull eyes.
- Feather color other than what is typical for the strain.
- Immature heads (comb and wattle development).
- Poor stance and/or gait.

Therefore the 10 % males that you select for transfer will all have the following features:

- Be of plus or minus 10 %, (15 % maximum) of the average weight of the males.
- Be well feathered.
- Have strong and normal well-placed legs and toes.
- Have a normal stance and active gait.
- Have a beak of a normal length and structure.
- Have straight breast bones.
- Have wide and straight backs.
- Have clear and fiery eyes.
- Have mature heads (combs and wattles)
- Have feather coloring normal for the strain.

Remember

To do a proper final male selection; it is of major importance that each individual male be handled and assessed according to the above criteria. A male not possessing the above important criteria will not perform well as a breeder and will also pass poor genes on to the next generation (Broiler).

Ensure they have ample water, feeding and floor space; natural selection will begin to occur during the time post transfer. As a pecking order amongst them is established the overly dominant and the inferior males will show up. This is a form of natural selection which will help you in your male selection.

4.3.11 Egg weight

Weigh a sample of eggs each day, the result of this will give early indications of stress brought on by disease, nutritional deficiencies, water shortage, temperature extremes etc.

Weigh at least 90 eggs daily, immediately following the mid-morning collection, excluding only double-yoked and cracked eggs. This gives an indication of the potential danger which must be investigated immediately.

Table 22: Weighing of eggs

Common causes of incorrect egg weight	
Overweight	**Underweight**
• overfeeding • above normal levels of energy or protein	• underfeeding • below normal levels of energy or protein • shortage of water • disease • presence of parasites extreme house temperatures

Table 23: Body weight target (females)

Age		Body weight	Feed /day	Key points
Days	**Weeks**	**g**	**g/bird**	
	0-1		20	Chick Starter
7	1-2	150	38	19% Protein
14	2-3	290	44	(2860 Kcal/Kg)
21	3-4	420	47	(11.97 MJ/Kg/)
28	4-5	540	49	(chick breeder)
35	5-6	650	51	
42	6-7	750	53	
49	7-8	850	55	
56	8-9	950	56	
63	9-10	1050	58	Developer
70	10-11	1150	59	15% Protein
77	11-12	1230	60	(2770 Kcal/kg)
84	12-13	1310	61	(11.60 MJ/kg)
91	13-14	1390	64	(Grower breeder)
98	14-15	1475	68	
105	15-16	1560	74	
112	16-17	1660	81	
11	17-18	1770	89	
126	18-19	1900	97	Pre- Breeder
133	19-20	2060	105	16% Protein
140	20-21	2260	111	(2860 Kcal/kg)
147	21-22	2520	116	(11.97 MJ/kg)
154	22-23	2685	121	
161	23-24	2850	126	
168	24-25	3030	131	
175	25-26	3200	Feeding for Production	Breeder
182	26-27	3300	Feeding for Production	16% Protein
189	27-28	3400	Feeding for Production	(2860 Kcal/kg)
196	28-29	3475	Feeding for Production	(11.97 MJ/kg)
203	29-30	3525	Feeding for Production	

Source: Cobb 500 Breeder Management Guide

Table 24: Male feeding body weight targets

Age		Body weight	Feed /day	Key points
Days	weeks	g	g/bird	
	0-1		FULL	Chick Starter
7	1-2	150	FULL	19% Protein
14	2-3	350	FULL	(2860 Kcal/Kg)
21	3-4	500	60	(11.97 MJ/Kg/)
28	4-5	640	62	(Chick Breeder)
35	5-6	800	65	
42	6-7	960	68	
49	7-8	1115	70	
56	8-9	1270	72	
63	9-10	1420	74	Developer
70	10-11	1550	76	15% Protein
77	11-12	1660	78	(2770 Kcal/kg)
84	12-13	1770	80	(11.60 MJ/kg)
91	13-14	1880	82	(Grower Breeder)
98	14-15	1990	85	
105	15-16	2100	87	
112	16-17	2210	89	
119	17-18	2330	91	
126	18-19	2470	93	Pre- Breeder
133	19-20	2620	99	15% Protein
140	20-21	2800	106	(2770 Kcal/kg)
147	21-22	3060	113	(11.97 MJ/kg)
154	22-23	3210	120	
161	23-24	3360	125	
168	24-25	3495	129	
175	25-26	3630	132	
182	26-27	3760		
189	27-28	3880		Breeder
196	28-29	3950		16% Protein
203	29-30	3995		(2860 Kcal/kg)
210	30-31			(11.97 MJ/kg)

Source: Cobb 500 Breeder Management Guide

From week 4-20 the weights are off-feed weights. From week 21 onwards birds are weighed in the afternoon on a feed day. When using mash feeds the feeds amounts could be higher during the rearing days. It is recommended to give small feed increases for the male (3-5g per bird per week) from transfer to adult weight (30 weeks). Monitor weight weekly and adjust feeds accordingly. After 30 weeks, small amount of feed increases (1-2g per week per week) should be used throughout the production period. Observe that the male feed continually progresses gradually as they perform to ensure quality sperms all through the production whereas, the females feeds after the peak production will gradually be reduced from about week 34-36 to week 56 to 150g per bird per day. This is important to maintain the right body weight for the females to guarantee good egg production throughout the cycle.

4.4 Management of Commercial Layers

Commercial layer production involves the rearing of commercial layer birds for eggs. This process starts from the brooder through egg production and finally to off laying. This section covers post brooder management, beak trimming, nutrition, laying nests, lighting program, disease control, routine management and vaccinations.

4.4.1 Post brooding phase

(Information on brooder is in section 4.1).

After the brooding phase (from one month onwards), layers develop various vices or abnormal behaviors such as:

i. Cannibalism,
ii. Egg eating
iii. Toe and vent pecking
iv. Feather pecking

The above vices cause trauma and damage to the birds which reduces their production potentials. These abnormal behaviors in chicken are influenced by stress resulting from poor management. Factors causing the above vices

- over crowding
- too much space
- poor nutrition as result of poor-quality feeds
- under feeding chicken
- inadequate nesting materials
- open nests or laying nests that are not dark enough during oviposition
- broken eggs due to pilling up
- infestation with external parasites
- too much bright light

4.4.2 Debeaking (beak trimming)

Debeaking is a process of partial removal of the beak of poultry. It is a good management practice to prevent and control abnormal behaviors in layer birds. The first debeaking is at 15 days (precision debeaking) and the second debeaking is done at 8- 10 weeks of age.

Precaution-

- Ensure the birds are healthy and have not been vaccinated recently.
- Add vitamin K to the drinking water to avoid over bleeding.
- Ensure the temperature of the trimming blade is high enough to prevent over bleeding and burning the birds

Procedure of debeaking

- Hold the chick in one hand with the thumb behind the head.
- Hold the head firmly in position resting on the thumb.
- Cut the beak tip and the lateral edges at least 2 mm from the nostrils.
- After debeaking increase the level of feed in the feeders and the level of water in the drinkers to ease drinking and eating.

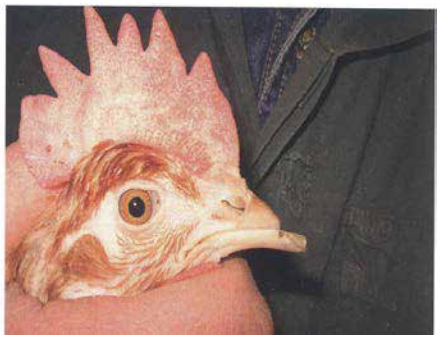


Figure 37: Incorrect Beak trimming (only the top beak has been shortened)

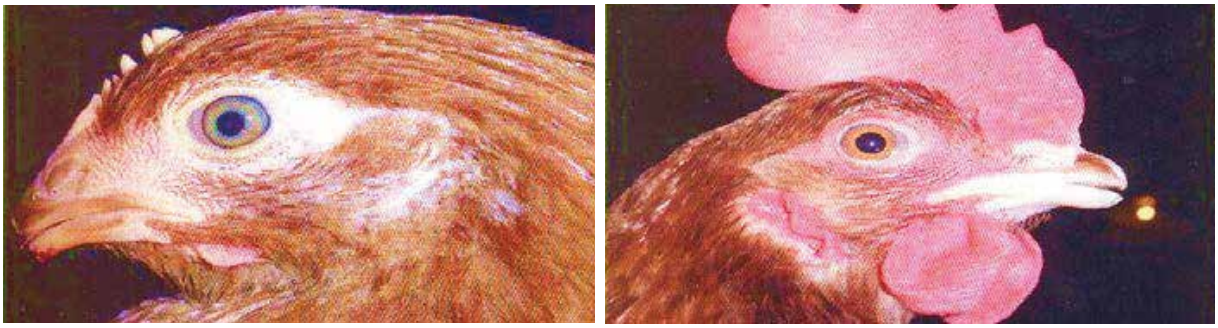


Figure 38: Good beak trimming

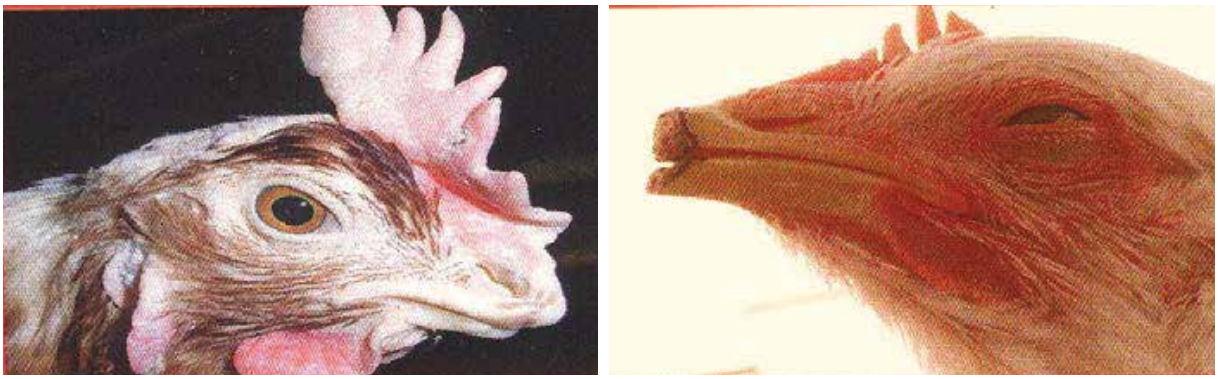


Figure 39: Bad beak trimming

Source: Layer Signals-Hendricks Genetics

4.4.3 Nutrition

Provide feeds of good quality - Right particle size, the correct feed for the age and production needs, feeds made from best quality raw materials and well distributed in the poultry unit. Use the standards in the tables (26-27) below to guide you in making the right choice of feeds for the birds and approximate consumption for the respective feeds during the production cycle.

Always when feeding the birds weigh 10% of them every week and benchmark with the standard weights for age provided in the table 27 below. If the body weights are below target introduce midnight feeding (between 10 pm and midnight) to encourage the birds to eat more feeds to catch up with the standard body weights. By end of week 18 the flock should have attained an average weight of 1450 to 1500g, only then good production with an excellent peak will be guaranteed.

Mature layers consume an average of 125 to 135 gm of feeds per day and drink up to 300 – 350 mls of water per day depending on the quality of feeds and water as well as the environmental conditions prevailing at that material time.

Table 25: Standard feeds for layers and pullets

Age element	**Starter pullet (0 -10 wks.) (Chick & duck mash)**	**Pullet End Growth (10-20 wks.) (Grower mash)**	**Start of production (20 -40 wks.) (Layer mash)**	**Middle of Production (40-55 wks.) (Layer mash)**	**End of production (starting at 55 wks.) (Layer mash)**
M.E. Kcal/kg of feed	2,700	2,600	2,800	2,800	2,800
Crude Protein %	18 -19	15	17	16.5	16
Methionine%	0.4 - 0.5	0.3 - 0.35	0.37	0.36	0.35
Lysine %	1	0.7	0.78	0.75	0.73
Calcium%	1	1.1	3.8	4	4.2
Phosphorous available %	0.48	0.4	0.4	0.38	0.36
Sodium %	0.16 - 0.17	idem	idem	idem	idem

Table 26: Feed consumption in pullets and layers

Age (Weeks)	Type of Feed	Feed (Mash)/Bird/Day Grams	Cumulative Feed Intake (Kg)	Water (Ml)	Average Weight (Grams)
1	Chick & Duck	11	0.1	20-30	60
2		17	0.2	40-50	120
3		25	0.4	50-60	190
4		32	0.6	60-70	275
5		37	0.9	70-80	360
6		42	1.1	80-100	450
7		46	1.5	100-120	540
8		50	1.8	120-130	630
9		54	2.2	130-140	720
10		58	2.6	150-160	810
11	Grower Mash	61	3	160-165	900
12		64	3.5	165-170	1000
13		67	3.9	170-175	1095
14		70	4.4	175-180	1180
15		73	4.9	180-190	1265
16		76	5.5	190-195	1350
17		80	6	195-200	1425
18		87	6.6	205-210	1475
19	Layer Mash	90	6.9	210-220	1500
20-80		95	7.7	220-230	1565

Note: From week 17 to19 weeks a special grower feed (pre -layer which has more calcium than grower mash) is given to the birds to prepare them for laying and when they achieve up to 2% production change to layer mash.

4.4.4 Nests

Nests are specially designed pigeonholes made of wood or galvanized steel, where the laying bird comfortably lays its' eggs. They should be evenly distributed in the laying house and easily accessible at one or two levels, locate the nests in the darker side of the house. Each individual nest is for 5 hens or 1 square meter for 120 hens. See a simple design of a laying nest below.

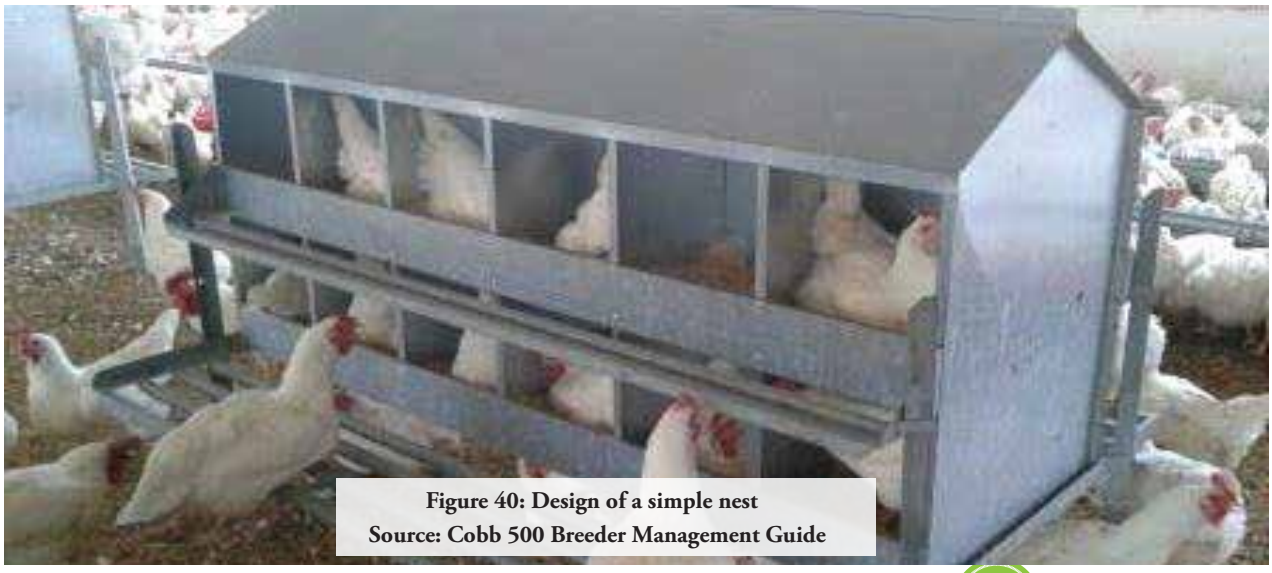


Figure 40: Design of a simple nest
Source: Cobb 500 Breeder Management Guide

Design of a simple nest

30cm wide, 32 cm high, 30cm deep, 20cm high entrance, 12cm (min) scratch plate height. Perch rails 19mm² Steel tubing or timber, spaced 7.5cm apart, 2 rails for the top tier, 4 rails for the bottom tier, ±45degree angle between top and bottom tier

4.4.5 Broody pen and perches

Provide for a broody pen of 1m×1m for 2000 layers. This helps to treat broody hens.

Refer to section 4.2 on how to treat broody hens and the use of perches.

4.4.6 Lighting program

- Provide a lighting program for growth and production of the layers. In the absence of electricity, kerosene lamps can be used. Light influences the age of sexual maturity and feed consumption.
- Long day-length throughout the rearing period allows the birds to increase their feed intake and hence growth.
- Use a slowly decreasing light program for the first 7 weeks before leaving the birds on natural day length.

Three rules to observe

- **Never** increase the day-length during the growing stage (8-14 weeks)
- **Never** increase the day –length when the flock's body weight is below 1250 grams
- **Never** decrease day-length after the start of lay.

Use the table below for the lighting program.

Table 27: Lighting program

Age (weeks)	
1-2	23 hours for 2-3 days, then 22 hours
3	19 hours
4	18
5	17
6	16
7	14
8-16	Natural day length (12 hours)
17	14 hours (increase by 2 hours)
18	14.5 hours (increase by half hour weekly to 16 hours – week 21)

4.4.7 Water

Distribute drinkers evenly throughout the whole house, alternating them with feeders so that they are easily accessible to all birds. The birds should not walk more than 1.5m to get feed or drink. Provide one font for 50 chicks during the first week and gradually replace them with regular drinkers. See brooder management in section 4.1.

Table 28: Recommended space for drinkers

Type of Drinker	Recommended Water Space
Trough	2.0 cm per bird
Bell Shaped (35cm Diameter)	10 to 13 per 100 birds
Nipples	8-10 birds per nipple

Wash and disinfect the chick drinkers daily. Fill the drinkers with clean fresh water every day. **Never** allow drinkers to go dry. During vaccinations do not disinfect the drinkers after washing. Use non chlorinated water when using the drinking water method of vaccination. Always adjust the drinkers and feeders' levels as the birds grow to ensure that the equipment is always slightly above the level of the chicks' back. This minimizes spillage.

4.4.8 Disease control and prevention

General information about diseases and their control is found in module 6

The flock attendant should judge the daily status of the birds by their behavior, droppings, feed intake, and mortality rates.

Note: when you use killed vaccine (k) at week 16-18, repeat NCD + IB after 6 months. If you use the live (L) vaccine of NCD+IB, repeat vaccination every after 6 weeks. See vaccination and routine management in table 30 below.

Organize the equipment in the poultry house in a manner that is easy to manipulate around the feeders, drinkers and nests when collecting eggs, treating the birds and making it easy for chicken to find feed, water and the nests. Below is a simple equipment lay out for a 500-layer house.

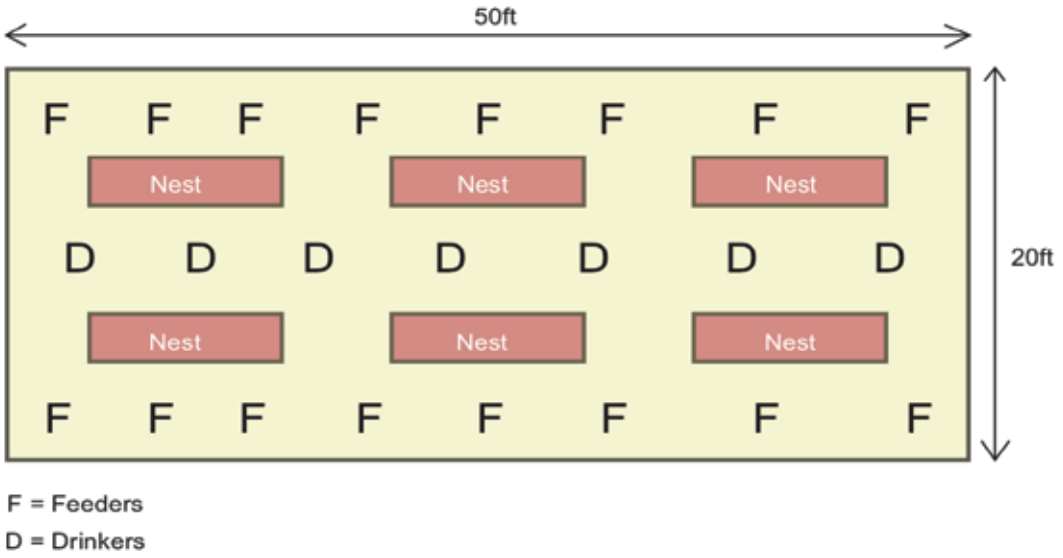


Figure 41: Equipment outlay for a house of 500 layers

6 nest boxes each with 20 slots on 2 levels@ slots for 5 birds

F = Feeders {16 feeders @ 30birds / feeder} D= Drinkers {7 drinkers @13drinkers / 1000 birds

Table 29: Routine management and vaccination program for commercial layers

Age/Wks.	Vaccine /Activity	Date	Method of Admin.
1	NCD Lasota		Water/Eye Drop
2	Gumboro		Water/Eye Drop
2.2	Debeaking		
3	Gumboro		Water/Eye Drop
4	IB/ND		Water/Eye Drop
6	Pox Vaccine		Wing Stab
8	Deworming/Vit.		In Water
8	Typhoid		Intramuscular
9	NCD Lasota		Inject.
10	Fowl Pox		Injection/Wing Web
11	2nd De-beaking Fowl Cholera		Subcutaneous
14	IB 2		Water/Eye Drop
16	Deworming/Vitamin		In Water
17	NCD Lasota		In Water
18	Vit/ Census /Fowl Cholera		In Water /Subcutaneous
19	Lab. Immunity Checking		
26-28	Deworm After Peak		In Water
34	Deworm/Vit.		In Water
38	Deworm/Vit.		In Water
41	IB2		In Water
42	NCD Lasota		In Water
43	Deworm/Vit.		In Water
47	IB 2		In Water
48	NCD Lasota		In Water

51	Vit/Census		In Water
52	Deworm/Vit.		In Water
53	IB2		In Water
54	NCD Lasota		In Water
59	Deworm/Vit.		In Water
63	Vit/Census		In Water
58	IB2		In Water
59	NCD Lasota		In Water
67	Deworm/Vit.		In Water
71	Vit/ Census		In Water
79	Census		
80	Off Laying		

IB2- infectious bronchitis2, NCD – Newcastle Lasota, Gumb. – Gumboro Vaccine IB/ND-infectious bronchitis and Newcastle

Laying flock card

Is used to monitor the performance of the birds on the farm and it registers the age of the birds, eggs laid per day, average eggs per week, mortality, feeds consumed and culled chicken. See module 9layer commercial production table no 55. Use this table to take records and monitor layer production indicating the period of execution of the activities for the entire month.

4.5 Management of Commercial Broilers

Commercial broiler production involves the rearing of broilers to produce meat in the shortest time possible; normally between 5-6 weeks. The process starts from the brooder in the first two weeks then up to 5 – 6 weeks when they are ready for the market. For brooder refer to module4 section 4.1.

After brooding (2 weeks) increase the space to 25 chicks per square meter and at 5 – 6 weeks give 10 birds per square meter.

4.5.1 Feeds and water

1. Give broiler starter (23% crude protein, 3100 kcal/kg of feed) to chicks during the first four weeks of their life, or give broiler starter crumble pellets, for two weeks followed by broiler grower pellets for two weeks.

2. Give broiler finisher (20% crude protein and 3100 kcal/kg of feed) from four weeks to marketing or finish with broiler finisher pellets from four weeks to marketing.

3. Provide fresh water all the time and clean the drinkers every day. Use bell drinkers, improvised drinkers and nipples.

4. The litter should be 15cm thick and must be turned every day to avoid caking and molding. Avoid water spillage on the litter.

Figure 42: Commercial broiler production using bell drinkers and plastics bucket feeders (Source: Asiima ACL)

4.5.2 Broiler health

Vaccination for Newcastle (NCD), Gumboro (IBD) and Infectious bronchitis must be done to safeguard the birds.

- Weighing the birds must be done on a weekly basis taking 10% of the total birds from the four corners of the house, getting the average weight of the birds, which is bench marked with the standard for the breed.
- It is important to note that the broilers grow so fast that you can even market them as early as 5weeks if you use pellet feeds. For vaccinations and routine management use table 30 below to guide you.
- Broilers grow so fast. They can be sold as early as 5 weeks if fed on pellet feeds. For vaccinations and routine management use table 30 below to guide you.

Table 30: Broiler production card

Farm ----------Date…… Flock…… Number Brooded ----------

Death on Arrival …… Day Old Weight. ……. Attendant------ House Number ……

Date in Days	Age In Weeks	Mortality		Culls	Temp. ℃	Feeds Kg	Vaccines	Av. Weight g	Std. Weight g	Std. Weight Using Pellets g
		Day	Night							
2					34					
3					34					
4					33					
5					33					
6					33					
7					32		NCD		150g	160
Sub Total										
8					32					
9					32					
10					31					
11					31					
12					31					
13					30					
14					30				375g	435
Sub Total							GUMB.			
15					30					
16					29					
17					29					
18					29					
19					28					
20										
21							GUMB.		705g	760
22										
23										
24										
25										
26										
27										
28							IB/ND		1140g	1290
Sub Total										
29										
30										
31										
32										
33										
34										
35									1600g	1750
Sub Total										

36												
37												
38												
39												
40												
41												
42											2000g	
Overall Total												

FCR (Feed Conversion Ratio) …… Mortality ……Total Feeds…….

Total Birds Sold ……Av. Weight ……Average Weight At 6 Weeks ……FCR

Table 31: Daily water consumption for broilers

Age in Weeks	Water consumed mls
1	40-50
2	60-80
3	100-120
4	140-160
5	180-200
6	210-230

Table 32: Broiler feeding with pellet feeds (100 birds)

100 Birds	Broilers			
Age (Week)	Feed Type Pellet Feeds	Total Feed Per Day (Kg)	Total Feed Per Week (Kg)	Av. Bird Weight (g) End of Week)
1	Starter Crumble	2.3	16	160
2	Starter Crumble	5.4	38	435
3	Grower	8.0	55.6	760
4	Grower	12.7	88.8	1290
5	Finisher	13.5	94.6	1750
Total			**293**	

Table 33: Broiler feeding with broiler mash (100 birds)

Age in Weeks	Feed Type Broiler mash	Total Feed Per Day (Kg)	Total Feed Per Week (Kg)	Av. Bird Weight (g)
1	Starter	2	14	150
2	Starter	4.29	30	375
3	Starter	8.14	57	705
4	Starter	12.57	88	1140
5	Finisher	16	112	1600
6	Finisher	17.42	122	2000
Total			**423**	

4.6 Management of improved breeds: (dual purpose birds)

Dual purpose birds have all the attributes of native birds but grow faster, have less fat, tastier and lay more eggs compared to local birds. They are very good scavengers and utilize vegetables efficiently. Their fast growth potential is during the first 6 weeks. This implies in less brooding and contributes to the low fat, good taste and higher meat yield compared to local birds. In Uganda there are four main breeds (Kroiler, Rainbow Rooster, Sasso and Crosses).

Rainbow Rooster Kuroiler Sasso

Figure 43: Improved Chicken Breeds (Duo Purpose)

The management begins with the brooder which is like that of commercial layers see section 4.1.

4.6.1 Vaccination

The same for commercial layers but dependent on production of meat or eggs. For the meat strain, the vaccinations stop at 4 weeks. See module. 4. Section 4.4

4.6.2 Routine Management

Use less investment on housing and feeding. Housing is similar to that of commercial broilers and layers in dip litter system depending on whether they are for meat or eggs.

- Brooder management is just like for commercial layers see Section 4.
- Adjust side curtains of the chicken house to give proper ventilation. Curtains should be rolled up during daytime to provide cross ventilation.
- Space - one sq. ft. /bird (or 9 birds/sq. m) if growing for meat.
- 0.5 sq. ft. /bird (or 18 birds/sq. m) in "mother units" while, growing for distribution at 4-5 weeks.
- 3 sq. ft. /bird (or 3 birds/sq. m) if kept for laying.
- Ensure the litter is not wet. Manage the drinker's height at the level of the tail of the bird.
- If the litter gets wet or caked, take out the dirty litter and add fresh litter.
    - Poor litter, overcrowding, poor ventilation and insufficient feeding space initiate Pecking.
    - Beak trimming can be done at any time when pecking is noticed, and it is the best solution to solve the problem but can start at 15 days.
    - Can rear chicks in regular broiler houses and low-cost thatched houses.

4.6.3 Feeds and feeding

Improved birds are fed for different markets. They may be reared on standard Broiler diet, if the farmer decides to sell them early for meat. Standard Broiler Starter diet up to 25-28 days (1Kg/bird), (20% protein &2800 Kcal ME) followed by finisher diet (18% protein & 2900 Kcal ME) gives birds of 1.3Kg in 42-45days.

Give layer chick diet for 28-30days (1Kg/bird), (19% protein & 2700Kcal ME) followed by layer grower. The birds grown on layer feed, take more time to get the same weight but the meat is harder and tasty like that of local birds. Use grower concentrate, which can be mixed with maize, broken rice, maize bran etc. to grow the birds. The cost of this feed is lower and easy to prepare.

Feeders and watering equipment like for commercial layers and broilers (font drinkers, wooden small feeders in the brooders, improvised drinkers, bell drinkers and bucket feeders for more mature birds. Give 23% Crude Protein (C.P) and 3100 Kcal/kg for broiler starter and 20% C.P., 3100 kcal/kg for broiler finisher that is why the weight at 10 weeks are an average of 2.5kg.

These birds will also have the same vices like commercial layers – toe, vent and feather pecking, cannibalism and egg eating at the same time will exhibit smothering, broodiness and prolapse when their terms and conditions of management are violated. For more details refer to section 4.2 and 4.4.

Table 34: Feed consumption for improved breeds for meat (Using broiler starter- 4 weeks and broiler finisher- 6 weeks)

Age (Weeks)	Feed/Bird/Day (g)	Av. Weight (g)	Feed Type
1	15	134	
2	29	238	
3	47	393	
4	78	540	Broiler Starter
5	104	1,200	
6	122	1,300	
7	144	1,850	
8	150	2,000	
9	162	2,400	Broiler Finisher
10	178	2,500	

4.7 Management of local chicken

Local chicken production involves the rearing of local chicken to produce eggs and meat, mainly practiced at homestead level using the extensive system of management –either free range or scavenging around. There are 7 local breeds commonly reared in Uganda.

Ugandan Black &Red (Nganda, Nsoga, Nkore)

Nsesere

Ugandan Brown (Nganda, Nsoga, Nkore)

Teso Chicken

Ugandan Short Legged (Nyoro)

Uganda Red (Nkooki, Nganda, Nsoga, Nkore)

Ugandan White

Figure 44: Local Chicken Breeds

Rearing local chicken can so start with a brooder but most cases the mother hen provides the warmth and the farmer simply provides medication and supplementary feeds. For brooding see module 4. Section 4.1.

4.7.1 Housing

Structures are constructed using local raw materials – mud and wattle and roofed with iron sheets or thatched. See module 3. The floor is covered with litter – wood shaving, rice husks, coffee husks. These structures are used for night shelter and during daytime the birds scavenge in the compound.

4.7.2 Space

Put 5 birds per square meter, for growers 10 birds per square meter. Partition the shelter to provide separate housing for young and mature chicken. The floor should be concrete, and the walls plastered but you can also have a floor with marram compacted with mixture of lime. When the space is not enough the chicken develop vices like pecking.

Table 35: Common diseases and parasites

Diseases	Parasites
1.Newcastle	1.Intestinal worms
2.Infectious bronchitis	2.Lice
3.Fowl pox	3.Fleas
4.Fowl typhoid	4.mites
5.Mareks' disease	
6.Coccidiosis	
7.Nutrient deficiencies	

For symptoms and interventions see module 6.

4.7.3 Vaccination and farm hygiene

Do Newcastle within the first week after hatching, at six weeks old, at three months of age and adult birds twice a year. Vaccinate against fowl pox, mareks' disease and infectious bronchitis. Deworm every month using a good de-wormer after 2 months of age. Spray the walls, the floor and nests with an acaricide for mite infestation and with an insecticide for lice infestation. See Module 7.

4.7.4 Feeds and water

Use wooden feeders or improvised containers for feeds and water distribution. The chicken fonts can also be used for watering. Spacing for feeders – 4cm for chicks, 6cm front for growers and 10 cm front for mature birds.

Feed them on chick mash up to 2 months, each chick consumes up to 2 kg. Cockerels consume about 10 kg of feed per bird between 2 to 5 months of age. Pullets eat about 7 kg in the same period. Breeding chicken require 100 g of layers mash per bird per day. The chicken scavenges around the compound and supplements on food leftovers. Maggots and termites are given to them as extra feeds. In order to supplement the feeding in the extensive system the farmer may also use the simple technology of growing maggots and termites as illustrated below.

Technique for growing maggots

- Blood, offal, and cow manure are mixed in a large open pot.
- The pot is filled with 1/3 water. Flies will lay their eggs in the mixture.
- Leave the pot open during daytime and closed during night.
- After 5-10 days (depending on temperature), when the maggots are ready to pupate, you collect the maggots by gently pouring the water into the pot.
- The maggots will float allowing you to collect and then feed them directly to the birds.
- Remember to place the pot away from public places, as the smell at times may be offensive.

Technique for growing termites

- Take a pot with a short neck and a capacity of at least 10ltrs. Fill up with cow dung and straw, then sprinkle on it little water. Set the pot upside down with the opening on sandy soil.
- After one day and one night, the pot will be full of termites.
- Empty the living contents in front of the hen house or in the hen house in the morning.

Improve local chicken production through synchronized natural hatching or purchase the day-old chicks from local hatcheries.

4.7.5 Synchronized hatching of local chicken eggs

Synchronized hatching is a means of regulating a flock of hens to lay eggs, wait for other laying hens and sit on the fertilized eggs together on the same day, so that hatching also happens on the same day.

The system of synchronized hatching has been developed basing on the following principles:

- Chicken can provide enough heat (by sitting on eggs) that is required for a fertilized egg to grow and hatch.
- Chicken have not studied mathematics of counting to know when 21 days reach!
- Chicken do not count how many eggs they have at one time.
- Chicken do not know whether the eggs they have are fertilized or not.

Procedure

As the hens lay eggs (preferably in individual nests), the farmer boils eggs to 'death' and labels them with a marker. Place one boiled egg on each nest to motivate the chickens that are laying. Other proceeding eggs are taken off the nest daily, marked on the date with a pencil and stored in a cool and humid place: for example, in a box. Normally some hens start sitting on the eggs earlier than others. This does not have any problem because the egg they are provided with initially is boiled dead. When the hen has sat on the boiled egg, it will not withdraw even if it went past 21 days.

If 10 hens are prepared for organized hatching; they will produce 150 chicks on the same day.

Avoid the following types of eggs when selecting eggs for hatching:

- Eggs that are too small
- Eggs that are too round/spherical
- Eggs that are too big
- Eggs that are too pointed/sharpened

4.7.6 Chick rearing

Chicks are kept with the broody hens for two weeks; the hens are removed, and chicks are brooded artificially.

Hens and chicks are fed on chick mash, vitamin provided in water after two weeks the hens are removed leaving the chicks alone. When growers are 8 -12 weeks old, separate the cockerels to allow them grow fast, to attain market weight at 18 -20 weeks of age. Pullets start laying eggs at 5 months of age.

4.7.7 Selecting hens for laying eggs

A healthy and good egg-layer should have the following features;

- Should appear healthy and lively.
- Have a red comb (comb is more colored when in lay.
- Clean and dry beak and nostrils.
- Clean feathers around vent.
- Straight legs and toes with no sign of scaly legs.
- The breastbone should not be too sharp.
- A big broad bottom.

In small flocks, it is easy to check whether the hens are laying or not. Check with your hand. The distance between the pubic bones (top) will be equivalent to two fingers, when the hen is in lay. Only one finger may pass between the pubic bones, when the hen is outside lay.

4.7.8 Selecting cocks

A healthy and good cock should have the following features:

- Alert and protective nature.
- Smooth and shiny feathers.
- Clear and shiny eyes.
- Clean feathers around vent.
- Straight legs and toes with no sign of scaly legs.
- Large size relative to hens.

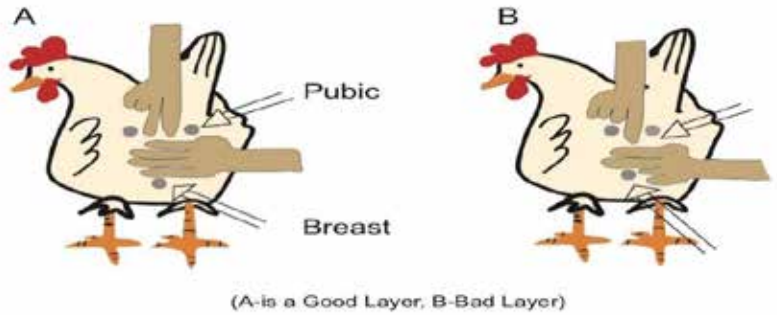


Figure 45: How to identify a laying hen (Source: Small Holder Poultry farmers-mercy Corps)

Figure 46: Local Chicken on free range (Source: Trainees manual-poultry-course-kenya)

4.8 Management of Turkeys

Turkeys are reared mainly for their meat using the natural means of breeding and sometimes exploiting the mother hens as natural brooders. However, there are some farmers who collect their eggs and incubate them in hatcheries and use the artificial brooders.

4.8.1 Rearing

Below are the commonly reared breeds of Turkeys.

White Holland

Bourbon Red

Belts-ville White

Broad Breasted White

Broad Breasted Bronze

Ugandan Black Turkey

Ugandan Teso

White Meat Turkey (Introduced)

Figure 47: Turkey Breeds

Turkeys are reared under three systems.

i. Free range
ii. Backyard
iii. Deep litter.

Free range

In the free-range rearing system turkeys are left to roam freely throughout the whole day and kept inside the house at night. However, with this method, they are exposed to a lot of diseases, stray animal attacks especially dogs.

Backyard Farming

In this farming system make a fence in the yard for the turkeys to stay together. In this system the birds have the freedom of movement inside the fence. However, it is the role of the owner to avail water, feeds and all the required care.

Deep-litter farming system

This is involves building a poultry unit for the turkeys, based on the repeated spreading of straw or sawdust material in indoor stalls. An initial layer of litter is spread for the animals to use for bedding material and to defecate in, and as the litter is soiled, new layers of litter are continuously added by the farmer.

Brooding

Brooding turkeys takes 0-4 weeks. The young turkey (poult) need double the space as compared to chicken. Brooding day old poults can be done using infra-red bulbs or gas brooder and traditional brooding systems**.**

Points to be noted during brooding:

- The floor space requirement for 0-4 weeks is 1.5 sq. ft. per bird (6 birds per sq. m).
- The brooder house should be made ready at least two days before the arrival of poults.
- The litter material should be spread in a circular manner with a diameter of 2 meters.
- Poult guard of at least 1 feet height must be provided to prevent the poults from wandering away from source of heat.
- Starting temperature is 95°F followed by weekly reduction of 5°F per week up to 4 weeks of age.
- Shallow water should be used**.** Dip the beak of the poults one by one if they do not see the drinking water. The brooding should last about 6-8 weeks because they have a poor feather cover.
- If natural brooding is to be done it is better to use broody chicken to raise poults. The incubation period for turkey chicks is 28 days.

Turkeys are not the best starters in their life and will really need some tender loving care to get them safely through the first four weeks of life. The average mortality rate is 6-10% during this period. Young poults by nature are reluctant to eat and drink in the first few days of life, primarily because of bad eyesight and nervousness. Hence, they must be forced to feed.

Force Feeding

Starve out problem is one of the major factors for early mortality in poults. Special care has to be taken for supplying feed and water. In force feeding, milk should be fed at the rate of 100ml per liter of water and one boiled egg have to be given at the rate of one per 10 poults up to fifteen days and that will compensate the protein and energy requirements of the poults.

Poults can be attracted to the feed by gentle tapping of the container with the fingers. Colored marbles or pebbles placed in feeders and water will also attract poults towards them. Provide chopped green leaves and add to the feed to improve the feed intake. Also, colored egg fillers can be used for the first 2 days as feeders.

Litter materials

The common litter materials used for brooding are wood shavings saw dust, paddy husk, chopped saw etc. The thickness of the litter material should be 2 inches at the beginning and may be increased to 3-4 inch in course of time by gradual addition. The litter should be raked at frequent intervals to prevent caking.

4.8.2 Growth and nutrition

Growing turkeys from eight weeks of age can be done in the run or free-range systems or in turkey burns. A fold unit measuring 1.2m wide by 1.2m high by 3.6m long can accommodate 12 turkeys. Good quality feed and water must be provided in the fold unit. During this period feed them on turkey grower until 20 weeks, also supplement with pasture.

Table 36: Space requirements for intensively reared turkeys

Age in Weeks	Space (Sq. m /100 Birds)
0-5	8
6-10	12
11-15	25
15 weeks to slaughter	40
Breeding turkeys on pasture	200

Just like chicken, turkeys consume a well formulated ration containing energy feed sources, proteins, fiber, vitamins and minerals.

- Among the energy feed sources, we have brand, broken maize, brewers waste, millet, sorghum, rice pollard, wheat pollard.
- Proteins fish meal, cotton seed, soya meal, bone meal, blood meal.
- Vitamins are locally harnessed from greens mainly leaves and fruits if accessible.
- Synthetic vitamin supplements are available on the market.
- Minerals are added to a ration to make it balanced
- These rations are designed in relation to the growth stage as the newly hatched start on chick and duck or chick mash, after two months the feed is changed to grower mash and later after 4-5 months they can continue on grower however the particle size of broken maize has to be increased.
- The quantities of feed to be given are to be judged by the animal owner in a manner almost like the improved birds' formula.
- Poults find difficulty in feeding because they have poor sight.
- Sprinkle some cooked carrots or egg York chopped into small pieces over the feeds so that they sense the bright yellow color.

Table 37: Diets and nutrient requirement of turkeys

	ME (kcal/kg)	C.P. %	Ca. %	Methionine %	Lysine %
Turkey starter (0-8 wks.)	2,900	28-30	1.2	0.5	1.6
Turkey grower 1(8-16 wks.)	3,100	21	0.8	0.4	1.0.83
Turkey Grower 2 (16-20 wks.)	2,900	17	0.7	0.3	0.7
Turkey Finisher (20-24 wks.)	3,300	14	0.6	0.3	0.6
Breeding turkeys >24wks	2,900	14	2.3	0.2	

4.8.3 Health

Common health problems (see module 6)

a) Gape worms
b) Intestinal worms
c) External parasites (mites and lice)

Common diseases include:

Blackhead, Newcastle disease, coccidiosis, mycoplasma, fowl cholera (vaccinate breeders) Aspergillosis, Nutrient deficiencies. Vaccination against the common diseases plus good bio-security practices is a must.

4.8.4 Turkey breeding

Wild turkeys

In the wild, male turkeys seek the attention of females in the mating season by wooing them with a special courtship dance. During this dance, male turkeys fan out their tail feathers, puff up their body feathers and display their brightly colored waddles to win a female.

The courtship dance

Every morning during the mating season, just before sunrise, the male turkeys start loudly gobbling to attract the females. Once the females come around, the males fan out their tail feathers and raise their body feathers while they dance around. Their dancing display is meant to entice the females to mate with them. Turkeys are polygamous, so they will mate with multiple partners. If the female turkey is receptive to his advances, she will lower herself in front of the male.

Laying eggs

After mating, the females seek out a good nesting spot. Turkeys lay their eggs in ground nests. They choose nest areas that are covered by brush to help prevent detection by predators. The female turkey lays an egg each day in her nest for up to 11 days. The eggs take about 28 days to hatch.

Poults spend their nights in the ground nest under their mother's watchful and attentive care for the first two weeks of their lives. At two weeks of age, they fly up to tree branches at night with their mother, she offers them protection from predators.

Sex determination and methods used for the same:

- Vent sexing at the time of hatching.
- By weight - males are heavier than females.
- Matured male of all species has conspicuous black bearing attached to the skin of the upper region.
- Dewbill or snood, a fleshy protuberance near base of the beak- It is relatively large, plump and elastic in males and small, thin and elastic in females.
- Male sturt (mating behavior of males) even at day-old age and continue to do so throughout their life- sturting is not seen in females.

Natural mating

The mating behavior of tom (male turkey) is known as Strut, where it spreads the wings and makes a peculiar sound frequently. In natural mating the male; female ratio is 1:5 for medium type turkeys and 1:3 for large types. On an average 40-50 poults are expected form each breeder hen. Toms are rarely used for mating after the first year due to reduced fertility. There is a tendency in toms to develop affinity towards a female, so change the toms every 15 days. Breeding turkeys must be provided with laying nests, communal nest or individual nests (45cm wide by 45cm long by 60cm high).

Table 38 Reproductive parameters

Age of laying	24 - 28 weeks
No. of eggs produced per year	70 - 100
Egg weight	85 gm app.
Incubation Period	28 days
Male female Ratio	1: 5
No of chicks per female	43 - 63

Incubation

The incubation period is 28 days. There are two methods of incubation.

(a) Natural incubation with broody hens

Naturally turkeys are good brooders and the broody hen can hatch 10-15 numbers of eggs. Only clean eggs with good eggshell and shape should be placed for brooding to get 60-80% hatchability and healthy poults.

(b) Artificial incubation

In artificial incubation, eggs are hatched with the help of incubators.

4.8.5 Challenges of rearing turkeys

- The domestic turkey's way of life is difficult as they retain much instincts of the wild like laying in bushes and aggressive behavior.
- Turkeys have poor hatchability and do not have the mothering ability to protect their young ones. After hatching the poults are left to fend for themselves and this affects them, sometimes leading to death.

4.9 Management of Ducks

Ducks can be reared from varied climatic conditions. Brooding is like for turkeys (refer to section 4.1 on brooding). They are very tolerant to common poultry diseases; therefore, they shouldn't be mixed with chickens and with turkeys. Below are the commonly reared breeds of ducks.

Muscovey Duck Ugandan (Teso, Nganda, Nsoga, Nyoro, Nkore)

Muscovy (for meat) A

White Pekin (for meat) B

Aylesbury (for meat) C

Khaki Campbell (for eggs)

Indian Runner (for eggs)

Figure 48: Duck Breeds

Commercial ducks weigh up to 3kgs. These include the following meat breeds: Muscovy, Aylesbury, white pekin and egg breeds: Khaki Campbell and indian Runner.

Table 39: Advantages and limitations of duck rearing

Advantages	Limitations
Can utilize marshy and wetlands better than any livestock/poultry species	Ducks are dirtier birds due to their production of watery droppings that attract flies
Ducks lay 40 to 50 eggs more than chicken	They are very destructive to crops because they forage (esp. matoke, maize etc.)
Need less attention than chicken	They need more feeds
Have a more profitable life than chicken since they can lay economically in the second year	Duck eggs do not keep fresh like chicken eggs under the same conditions (can keep for 10 days compared to chicken eggs 3 weeks)
Ducks are quite hardy and resistant to diseases	
Cannibalism is not frequent in ducks like in chicken	
Ducks are easier to brood than chicken	
Can get some of their food by foraging hence are economical to rear as compared to chickens	
Require simple housing	

4.9.1 Brooding

Rear the ducks in the brooder for 2-3 weeks using the same procedure like for chicken (refer to section 4.1). The brooding of ducklings is best done on raised wire-floor cages (1.0m by 2.1m) can hold 100 ducklings. They need adequate water throughout to avoid "staggers" which causes death. Ducklings should be brooded in sheltered enclosure, which should be dry and warm. They do not want damp chilled conditions.

In the brooder the initial temperature should be 29°C to 35°C depending on the weather condition and the locality. Temperature should be reduced by 3°C every 4-7days until ducks require no further heat usually by the end of the fourth week of age. Provide adequate feed, water and ventilation during brooding.

4.9.2 Rearing

Meat type ducks are reared intensively in houses. However, layer ducks and the local strains may be reared by free range, semi intensive or intensive. Water and feed should be available all the time. Feeders and water troughs should be placed near one another. Put water in narrow containers, deep enough for the ducks to immerse in their heads else their eyes become scaly and later become blind. They do not need perches but should be provided with laying nests one foot high of dimensions (30cm×30cm×35-37cm) for every 3 ducks one laying nest is provided.

4.9.3 Feeding

In addition to greens, feeds suitable for domestic fowls are also recommended to ducks. Ducks have a preference to wet mash because they have difficulty in swallowing dry mash. Feed consumption is 50-60 kg per duck (3 kg of feeds is required to produce a dozen eggs and 3.22 kg of feeds to produce a kg of duck meat). Duck feeds is better presented in pellet form instead of mash for better and economical consumption.

Table 40: Diet of ducks

	ME Kcal/kg	CP %
Duck Starter (2wks)	2,850	22
Duck Grower (3wks to market)	3,125	16
Duck layer (breeding ducks)	2,770	17

The layer diet must have 3% calcium.

4.9.4 Common diseases

Salmonella Infection, Coccidiosis, Aspergillosis, Botulism, Collibacillosis, Fowl cholera, Duck pox, Duck influenza, Duck Virus Hepatitis, Duck plague. Worms and parasites are like the ones of chicken. Vaccination against the common diseases applies to ducks also. See section 4.1 4.6 and module 6.

4.9.5 Breeding

- Ducks start laying at 6 months of age. The recommended ratio of drakes to ducks (1:4-6).
- Drakes should be mixed with ducks at least one month before fertile eggs are required.
- The incubation period of ducks is 28 days except for Moscovery ducks in which it is 35 days.
- All domestic ducks will interbreed with one another and produce fertile off springs except in the case of Moscovery which when crossed with other domestic ducks the off springs produced are sterile.

4.9.6 Natural incubation

- Some ducks can incubate their eggs but most of the egg laying type do not go broody.
- Hens can be used for incubating duck eggs. Each hen can incubate 8-12 eggs depending on their body size. When hens are used to incubate duck eggs, the eggs are sprinkled with lukewarm water once a day.
- In artificial incubation the temperature of duck eggs is 0.6°C lower than chicken eggs.

4.10. Management of Guinea Fowls

Guinea fowl birds act as guards, alerting you with lots of noise whenever a human stranger, wild animal or snake approach. They eat veggies, so bird netting or other protection over your crops is advisable. On farms and homesteads, they are valuable because they eat ticks and fleas. They also provide delicious eggs and tasty and nutritious meat. Maintaining adult guinea fowls is not expensive however raising keets (baby guineas) is much more challenging.

Figure 49: Guinea Fowl on Pasture

4.10.1 Housing and husbandry

Guinea fowls are reared in an enclosed coop because they can fly.

- The coop should provide at least three to four squares feet of space per bird. you should provide more space if you do not plan on allowing them to roam freely after the training period.
- Provide food and water in the coop, as well as clean bedding on the floor and perches for them to roost on.
- Provide a night-time shelter that protects them against predators like foxes and owls. If you don't provide a shelter, your Guineas will roost in the trees at night. The shelter can be as simple as a three-sided shed with a wire front. Put a perch near the back of the shelter that is long enough so that each bird has about a foot of space to roost.
- Make sure the space is dry and has clean beddings on the floor.
- Provide a light in the shelter, as Guineas don't like entering dark building.
- The shelter should have two entries to prevent more dominant guineas from blocking the entrance.
- Clip their wings to prevent them from flying away.
- Purchase guinea fowls from local breeders. There are also imported breeds.
- Buy adult guineas if you want, but they will be easier to tame if you raise them from keets (young guinea fowls)
- Guinea fowls are available in a variety of "pure-bred" colors, but many of the birds are cross- breeds, resulting in multicolored feathers. the feather color is the only difference between the different varieties
- Guineas are monogamous creatures, so it's best to buy them in male-female pairs. Males differ from the females in the following ways. They:
    i. Have larger wattles than females
    ii. Make a single-syllable sound, while females make a two-syllable sound.
    iii. Have a narrower opening between their pelvic bones than females. If you hold the guinea under one arm and use your free hand to feel the bones frequently and about two fingers on males and three fingers on females.

4.10.2 Feeds and water

Guinea fowl will eat ticks, grasshoppers, spiders, and small snakes. Provide them with some mixed grains in their shelters at night if you want to encourage them to spend the night there.

- If you keep your guineas penned, feed them on chicken feed (one kg per day for every six guineas). To increase egg production, switch them to a higher protein feed formulated for turkeys and wild fowl areas. They lay six months of the year.

- Provide a constant source of fresh water. You can buy drinkers for poultry, which hold a large amount dispenses it little by little into a small dish.

4.10.3 Management of adult guinea fowls.

- Keep the guinea in the cage for at least a couple of weeks. Give them scratch or millet shortly before sundown. They will return to their home if you make it a practice to throw scratch to them as you reward their returning.
- They are very easy to feed, although their dietary needs will depend upon whether you keep penned or allow them to roam and forage.
- They make their nests on the ground, but they like to conceal them by choosing areas with tall grasses. They also share nests with other guinea hens and sometimes.
- Collect eggs every afternoon because guineas roam freely. To find them, follow them at a distance during the mid- morning to early afternoon hours, when they are most likely to lay eggs. Once you have identified the nest, wait for the hen and her husband standing to leave and gather some eggs with a large spoon or a kitchen tool. Leave at least half the gees in the nest so that the guinea hen will continue to lay there.

4.10.4 Raising keets

Guinea fowls are not very good at taking care of their delicate little keets. They are fierce protectors, but they will walk through grass with morning dew on it and expect the keets to follow, the keets are very sensitive to dew and rain so keep them warm and don't allow the mother to walk the keets in the morning dew. Guineas sometimes will abandon a nest even after the hens has gotten broody and spent several nights sitting on right away. The incubation period is for eggs is up to 28 days.

- Once the keets hatch, care for them until they have fully developed feathers and are strong enough to hold their own with the rest of the flock.
- Broody hen can be used to hatch the eggs and raise the keets.
- Turkeys can also make suitable replacement mothers.

Brooder

Create a safe home for the keets. Keep the keets contained in a box for the first six to eight weeks. A 16" X 28" box will provide enough space for about 15 keets.

- Keets are very delicate, so be sure to provide adequate space for them to prevent trampling. If they appear to be overcrowded, move them to a larger box.
- Keets can escape through very fine wire mesh, so keep them in a container with solid sides, like a sturdy cardboard box.

- Cover the box with a screen to avoid them from jumping out.
- Keep the box lined with clean paper towels for the first week or more, and then switch to wood shavings. They need a textured surface to prevent them from slipping and injuring their legs, so don't line the box with newspaper. Keep the box warm. Keets need to be kept nice and toasty, so use a heating lamp to maintain a constant temperature in their container or use a pot with charcoal. Maintain a temperature of 95° then lower the temperature by 5 degrees each week until the temperature in their box is the same as the temperature outside.

Light

Keep the light at one end of the brooder box. That way, the keets can move to a cooler part of the box if they get too hot. If you see them clumped in a pile under the light, it means they are still cold; try to move the light closer. If they stay at the cooler end of the brooder box. Their behavior will let you know when they are comfortable.

Feeding

Feed your keets with chick starter crumble rather than pellets, for the first couple of months. Use a starter mix for chick birds with 24% to 28% protein for the first five weeks, and then switch to a mixture containing 18% to 20% protein for the next three weeks. If you don't have feeds boil some eggs and feed the keets on the yolks. Hand feed the keets to get them used to you.

Water

Provide the keets with a steady source of fresh, warm water. Use plastic water fronts like for chicken. Keets are susceptible to drowning, so provide water in a shallow bowl filled with marbles at first. The keets will climb on the marbles and drink the water between them, very young keets will require some help at first, so tip each keet's beak briefly in the water to let them know how and where to drink. After the initial period, provide a jar of water with a watering base. Keets may get dried feces to their feet or bottoms, so be sure to clean and wipe the area with a moist cotton ball or soak the area in warm soapy water.
Scraping or picking the feces off of the the keets may cause injury. Frequently change the lining in the box to prevent this.

Challenges

- It is possible to keep guinea fowl penned, but they much prefer to roam freely.
- They are not as tame as chickens, and they are hard to catch if you let them roam.

5.1 Feeds

Poultry feeds are food for poultry which has been blended from several raw-material feedstuffs using a special formula to meet the physiological needs of the birds. Feed is very important in the poultry production as it constitutes 60 – 70% of the total production costs. Compounded (mixed) feed is expensive and for this reason many farmers have resorted to home-made feeds.

5.1.1 Feedstuffs

Feedstuffs are materials with different nutrients. Poultry have different nutrient requirements for different breeds, age groups and production systems.

5.1.2 What are nutrients?

Nutrients are chemicals in feedstuffs required by organisms to live, grow, reproduce and produce.

Different poultry require different amounts of nutrients grouped in 6 categories:

i. Energy (from carbohydrates, fats, oils and proteins)
ii. Proteins
iii. Fatty acids
iv. Minerals
v. Vitamins
vi. Water

Energy and protein nutrients contribute over 70% of poultry practical rations.

Common feedstuffs used in poultry diets are classified in 6 groups:

i. Energy sources (cereals grains, and their by-products, root crops and lipids (fats and oils))
ii. Protein supplements
iii. Mineral supplements
iv. Vitamin supplements
v. Synthetic amino acids
vi. Non-nutritive feed additives

A balanced ration / diet is a feed formulation that contains all nutrients in adequate amounts required for the different poultry breeds, production systems and age.

5.1.3 Composition of feeds

Table 41: Main source of minerals

Raw materials	Observation
Lake shells,	Dried and ground shells content of calcium 35%
Fish	Phosphorus 1-5% calcium 1-6%
Bone meal	Phosphorus 17% calcium 30%
Calcium carbonate	Calcium 38% sodium 0.02%
Di-calcium phosphate	Calcium 23 % phosphorus 18%
Limestone	Calcium 45% sodium 0.2% phosphorus 0%
Sodium chloride	Sodium 39.3% chloride 60.6%

Table 42:Main sources of energy

Maize	Good source of energy. inclusion rate (IR) 60-70%
Coconut and peanut	Avoid use for layer hens- promotes fattening IR 5-10%. High in fiber and low in digestibility
Wheat by product	Rich in cellulose limits its' use IR 20% for ground product, 10% for the bran.
Rice by product	Rich in fat therefore more energy, silica limits its' use IR max.15-20%
Brewery by product	After drying, rich in cellulose and protein. Max IR 5-10% for layer hens and 20% for broilers
Cane molasses	Max: IR: 20%. Increases diuresis
Tapioca (cassava)	IR 25%. High in energy but very low in protein, must be dry, add methionine to feed
Sorghum grain	High in energy and higher in protein than maize but has high tannin content.
Sweet potato tubers	Should be used dry and milled, High in energy but low in protein.

Table 43: Main sources of proteins

Raw materials	Observation
Groundnut cake	High in protein (45-55%) low in lysine, methionine, tryptophan and contaminated with aflatoxins
Cotton cake	Protein 40-45% poor in lysine and sulfur amino acids. Gossypol must be treated before use. IR 40% if detoxified and husked.IR 10% for decorticated cotton seed cake
Coconut cake	Poor in NM 20% and in lysine. Rich in cellulose10-25%, IR 20%
Leguminous grains (peas)	Protein 20%, good energetic value, need cooking before use, IR 25-30%
Fish meal	Protein:30-60%, High in protein and amino acids, good source of minerals, essential fatty acids and balanced in amino acids, but highly adulterated, poorly processed, contaminated with heavy metals, IR 10-20%
Meat meal	Irregular quality depending on its' degree of drying: Protein 30-70%, Fat content 2-10%, IR 10%
Blood meal	Rich in digestible protein (60-70%) and energy, with balanced amino acids but subject to quality of processing. IR max 5%
Soya bean cake/roasted soya beans	High in energy, protein, lysine, methionine and histidine Protein 42-43%. IR 25%
Palm cake	High protein and energy but with very low digestibility. Contains high tannin content and less suited for poultry nutrition .IR15% often used like bran
Sunflower cake	High in protein, high in lysine, methionine, and histidine but also high in fiber and low in energy.

NM- Nitrogen matter IR- Inclusion rate in feed

Vitamin supplements- These are the multivitamin premixes (layer, broiler, grower, breeder, chick premixes).

Synthetic amino acids- Lysine (Lys) is supplied as L- Lysine HCI = 76% Lysine, Methionine (Met) is supplied as DL-methionine = 98% Methionine. These premixes are either in liquid or powder form.

Non-nutritive feed additives – can be included in the ratio to serve the following functions:

1. Aids in digestion –Enzymes (phytase & β-gluconase).
2. Controls diseases (coccidiostats, antibiotics, organic acids, antifungals).
3. Alter metabolism of birds towards more productivity –growth promoters.
4. Improving feed texture (form) - pellet binders.
5. Prevent rancidity of the fat in the feeds – use antioxidants (Buylhydroxyanisole (BHA), BHT and Ethoxyquin.
6. Impart yellow pigment in egg/meat- carotenoids and xanthophylls. Natural ones are in yellow maize, green vegetables (Amaranthus and Russian comfrey).
7. Improve palatability of feeds – flavors like spices.
8. Detoxify feeds – Bentonite against aflatoxins.

5.1.4 Feed manufacturing process

The quality and cost of feed ingredients are a major determinant of the cost of feeds. It is better to use more expensive feed ingredients of high quality than cheaper ones that are heavily contaminated and of low nutritive value. Quality feed ingredients will provide the targeted nutrient levels more accurately and birds will grow faster, produce more and attain market weight early using less feeds.

When formulating feeds, consider the following:

i. Available feed ingredients to use in the rations
ii. Nutrient composition of the feed ingredients
iii. Cost of the feed ingredients
iv. Nutrient requirements of the target birds
v. Minimum and maximum rate of inclusion of the selected feed ingredients in the poultry ratio

5.1.5 Feed formulation

Making a good formulation that meets all the nutrient requirements of the target bird is one major step towards good feeding but does not guarantee good results. Proper mixing of the ration to ensure that the feeds meet the target nutrient level is very important. Secondly, the feeds should be ground to the recommended particle size for the different ages of birds. For example, day old chicks can't consume big particle feeds.

To ensure that the feeds mixed matches with the formulation made, samples of the feeds should be collected and taken to a nutrition laboratory for testing the nutrient content. The results will guide on how well the feeds match with the formulated ration and the necessary adjustments required.

The mixed feeds may be presented in either mash, crumb, or pellet form to the target birds. All these forms are suitable under specific conditions of the birds. Day old birds (up to 1wk old) will benefit more from crumbs. Older birds will benefit more from pellets. The formulated feeds should be packed in water-proof sacks to avoid development of molds. Avoid compacting the feeds in sacks as this will create anaerobic conditions that encourage mold formation.

The shelf life of mixed feeds is two weeks beyond which it turns moldy and becomes unfit for consumption. Always mix feeds that will last for not more than two weeks and store them in a dry damp-free and rodent-free place. Mark the date when the feeds were mixed to ensure proper utilization before they get spoilt.

5.1.6 What the farmer needs to know?

There is a physiological relationship between all the nutrients, especially energy and proteins. This should be used when mixing feeds in order to minimize costs and maximize output. Feed consumption is regulated in most cases by the energy content. For instance, birds eat less of high energy feed rations. Therefore, high energy feed should also have high concentration of all other nutrients. Birds also eat less of imbalanced rations especially when amino acids are disproportionate.

Fiber content regulates feed intake for example if feed has high fiber, it stays partially digested in the digestive system for a long time. This lowers feed intake and reduces nutrient supply to the bird. Anti-nutritional factors in some feed stuffs (like soya) affect the digestibility and bioavailability of nutrients in the feeds, therefore such feedstuffs should be well processed (for example heat treatment of soya to remove trypsin inhibitor).

Figure 50: Soya roasting using a fabricated roaster (Source: Asiima ACL)

Table 44: Dietary nutrient requirements of poultry

Ration	ME (Kcal/Kg)	C.P (%)	Ca. (%)	Available P (%)	Met. (%)	Lys (%)	Linoleic acid
Broiler Starter	3050	23	1	0.42	0.55	1.3	1
Broiler Finisher	3150	21	0.92	0.4	0.49	1.1	1
Chick Mash (Crumb)	2940	20.5	1.1	0.48	0.52	1.16	1.2
Grower's Mash (Pellet)	2840	20	1.2	0.44	0.47	1.03	1.1
Pullet Mash (Pellet)	2740	16.8	1.2	0.40	0.36	0.78	1.1
Pre-lay Mash (Pellet)	2740	17.50	2.1	0.47	0.38	0.87	1.1
Layers' mash (Pellet)	2870	17.70	3.7	0.40	0.41	0.87	1.6
Turkey starter (0-4 wks.)	2801	28	1.2	0.65	0.55	1.7	1.0
Turkey grower I (5-8wks.)	2900	25	1.0	0.42	0.45	1.3	1.0
Turkey grower II (9-12 wks.)	3000	22	0.85	0.38	0.40	1.15	0.8
Turkey Pullet I (12-16wks.)	3100	19	0.75	0.32	0.35	0.95	0.8
Turkey Pellet II (16-20wks.)	3200	16.5	0.65	0.28	0.25	0.85	0.8

Turkey Pre-lay (20 – 24wks.)	3300	14.0	0.55	0.25	0.25	0.65	0.8
Turkey layer	2900	12.0	2.25	0.35	0.35	0.6	1.1
Turkey Breeder	2900	14.0	2.25	0.35	0.35	0.6	1.1
Duck starter (0 – 2wks.)	2900	22	0.65	0.4	0.40	0.9	1
Duck grower (2 – 7wks.)	3000	16	0.60	0.35	0.30	0.65	0.8
Duck layer	2900	15	2.75	0.4	0.34	0.60	1.2

5.1.7 Quality control in grains and their by-products

A simple method for testing moisture in grains for proper storage is using an empty dry soda bottle and salt following the procedure below.

- Put a handful of maize grains after drying and half a handful of table salt in an empty dry soda bottle.
- Shake the bottle vigorously for 2-3 minutes. Allow the grains to settle at the bottom of the bottle. Observe whether salt sticks onto the walls of the bottle. If salt sticks to walls of the bottle, this is an indication that the maize has not dried properly for storage.
- Dry the maize and repeat the test until no salt sticks to the sides of the bottle. The maize can then be stored without danger of developing moulds/aflatoxins. For cereal by-products, ensure that they are thoroughly dried after processing and make sure the bran is dusty to avoid caking during storage.

5.1.8 Mixing feeds by the backyard farmer.

Formulation of compounded poultry feed is both an art and science. Hands on field demonstration is essential. Ensure that the raw materials are of high quality, wholesome and safe for consumption. Pay attention to adequate mixing of minerals/vitamins in the animal feeds using a formula from a feed nutritionist. Correctly weigh and measure feed ingredients, premix with a portion of the major ingredients in a good mixing facility. Use a spade or a fabricated mixer and information in tables (41-44) above.

To mix good quality feeds, the farmer should follow the following steps:

1) Get a feed formula for the target animal species and age from a qualified animal nutritionist.
2) The formula should be based on the feed ingredients that are locally available within the farmer's environment.
3) Collect and weigh all the target feed ingredients to be used and ensure that they are available in the required quantities for the amount of the feed ration you are preparing to mix.
4) Get a clean cement screened floor of about 10ft ×10ft surface area.
5) Get a shovel or a fabricated mixer, a simple motorized hummer mill, 10 new bags, a role of string, and a marker.
6) Premix the raw materials with a shovel to get a homogenous mixer.
7) Using a simple hummer mill, mill the ingredients to the right particle size for the different age groups of birds (Chicks, growers, layers, broilers etc.).

8) Weigh the smallest quantities first and mix them together to make a homogeneous mixture.
9) Mix the ingredients of close weights together to get a homogeneous mixture.
10) Make the final mixture by mixing the mixture with the bulkiest ingredient.
11) Spread one ingredient thinly on the ground and spread the other ingredient on top, then mix them together using your hands or spade to make a heap. Transfer the mixture from one heap to another while pouring the ingredients on top of the heap.
12) Mix the raw materials and the premix – mineral mixture thoroughly for between 15 to 20 times to achieve a uniform mixture.

Figure 51: Mixing feeds for a small-scale farmer in the backyard
(Source: Ssewagudde Samuel 2017)

13) Bag the feeds in new 50kg bags and tie the bags with a string.
14) Label the feeds with a maker to show the type of feed and date of mixing.
15) Store the feeds on wooden pallets not more than 5 bags one on top of the other in a well-ventilated feed store.

Caution:

- Avoid compacting feeds in bags.
- Use complete compounded feeds within two weeks from the time of mixing. Beyond this period, the feeds will go bad and become dangerous to the birds.
- For any issues concerning feeds and formulation consult a qualified feed nutritionist.
- Make use of the feed laboratories to confirm the quality of the feeds.

When mixing large amounts of feeds, use motorized mixers. Two types of motorized mixers exist – vertical mixers and horizontal mixers.

Vertical mixers are easily available in the country; easy to fabricate, take a longtime to thoroughly mix and produce a less fine mix of the feed.

Figure 52: Vertical mixer

Horizontal mixers are faster, more accurate in mixing and produce a more homogeneous mix of the feed in a short time.

Figure 53: Horizontal mixer

There are two main types of feeds namely, mash and pellet.

Table 45: Advantages and disadvantages of pellets

Advantages of pelleting	Disadvantage of pelleting
Decreases waste	High cost of purchasing and maintaining the equipment
Reduces the risk of separation	Risk of denaturing of protein and vitamins by heat
Partial sterilization of feeds	Promotes pecking by reducing feeding time
Less risk of feed sticking to the beak	Can result in high consumption and fattening of layer hens and hence low productivity.
Facilitates the use of fats and molasses	
Easy to feed to the birds	

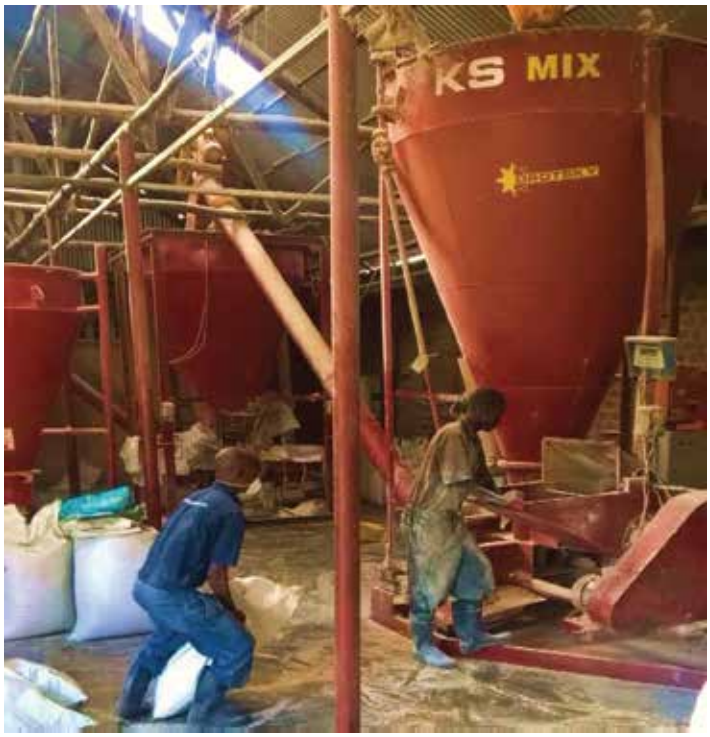


Figure 54: A commercial feed mill (Source: Asiima ACL)

5.1.9 Feed storage

Store feeds and raw materials in regular layers on pallets. Avoid leaning the sacks directly against the walls of the store. Use the products according to 'first in first out' principle. Control insects using a spray or rodenticide, repeat every ten days and remove dead rats. Can also employ biological means like the cats to fight the rodents.

5.2 Water

Water is one of the most important nutritional requirements of poultry. Feed consumption is conditioned by consumption of water. An interruption in water distribution lowers feed consumption, retards growth and reduces production. Water provided to poultry should be cool (12 -15°C), clean (see standards in the table 46 below) and plentiful. Sources of water can vary from underground water source (protected springs, bore holes, wells) to tap water (from National Water and Sewerage Cooperation) to harvested rainwater.

Figure 55: Water harvesting

Figure 56: Shallow well (source of water)

Water intake depends on feed composition, feed consumption, house temperature and age of the birds. Under or over consumption of water is not good for the growth of birds. The water consumption levels should therefore be regularly monitored.

Troubleshooting the possible causes of overconsumption of water

Check whether:

- It is real or due to broken pipes.
- It is due to increase in temperature.
- It is caused by too much salt in the water or feed resulting into diarrhea.

Troubleshooting the possible causes of under consumption of water

Check whether:

- The decrease in consumption is not due to the breakdown and obstruction in the water supply system.
- It is due to appetite problems (water containing medicines or too hot).
- It is caused by stress (vaccinations, transfers, diseases).
- It is due to insufficient number of drinkers or drinking space.

Distribution

Distribute drinkers evenly throughout the whole poultry house, alternating them with feeders so that they are easily accessible to all birds. No bird should walk more than 1.5m to get to either feed or water. Use the standards for measuring water-front (space provided for every bird to drink water depending on its age). Table below gives the parameters that determine the right quality of water to be provided to poultry.

Table 46: Water Standards

Parameter	Very Pure Water	Drinkable Water	Suspect Water	Foul Water
Number of germs/liters	0-10	10 to 100	1,000 to 10,000	100,000
Number of fecal germs	0	0	+	+
Hydrometric level	5-15°	15 - 30°	30°	30°
Organic Matter (mg/1)	0	1	3	6-Apr
Nitrates (mg/1)	0	0 – 15	15 - 30	30
Ammonium hydr. (mg/1)	0	0	2	10
Iron (mg/1)		0.3		1
Manganese (mg/1)		0.1		0.5
Copper (mg/1)		1		1.5
Zinc (mg/1)		5		15
Calcium (mg/1)		75		200
Magnesium (mg/1)		50		150
Sulfate (mg/1)		200		400
Chlorides (mg/1)		200		600
pH		7 to 8.5		<6.5 or >9.2

Caution!!! Water analysis should be regularly done in the laboratory to monitor the quality of water.

Always adjust the drinkers and feeders' levels as the birds grow to ensure that the equipment is slightly above the level of the birds' backs. This minimizes spillage. Use water sanitizers (like chlorine, virukill, norocleanse, water guard) to control disease – producing organisms in water.

During hot weather add vitamin C (1gm per/liter of water) or of vinegar (one liter for 100 -200 liters of water) to acidify the water and make it more appetizing to poultry. Vitamin C has anti stress activity.

MODULE 6: POULTRY HEALTH

Poultry health is very important because it determines the ability of the farmer to provide good quality poultry products, byproducts and hence income. It has also been greatly affected in this era of high incidences of anti-microbial resistance coupled with high aflatoxin contamination of feeds, which affects man.

6.1 Classification of poultry diseases

Classification of diseases in poultry is done according to:

1. The causes (Viral, Bacterial, Fungal, Parasitic, Nutritional).
2. The organs affected (Renal, Genital, Respiratory, Nervous, Digestive, and General).

6.1.1 Signs of good health

A healthy bird will

- Be active
- Feed normally
- Have normal droppings
- Make normal sounds and movements
- Drink optimum water
- Have clear open nostrils with no discharge
- Have clear and shiny eyes without discharge, no swellings around the eyes and eyelids
- Carry wings close to the body
- Have clean vent area without sores
- Have normal feathers without large missing patches
- Breath with a closed mouth except in very hot conditions,

6.1.2 Signs of poor health

There may be one or a combination of the following

- The birds appear dull with sleepy eyes
- Drooping wings
- Ruffled feathers
- Loss of appetite
- Diarrhea (white, yellow, green, red, colorless)
- Strange sounds and actions
- Loss of weight.
- Coughing.
- Swellings on the head and or feet.
- Drop in egg production.
- Abnormal shell quality.
- Sudden deaths

6.2 Diagnosing Diseases

This section explains diagnosis, prevention, control and treatment of common poultry diseases.

6.2.1 Steps in diagnosing diseases

The extension worker should follow the four steps below in diagnosis of diseases:

i. History of the disease from the farmer:
   a) Species, breed, age of birds
   b) Management factors (ventilation, feeding, watering system, feed, brooding, rearing procedure)
   c) Performance: growth or laying curve
   d) Previous treatment/vaccinations- type, dosage, route of administration, duration.
   e) Previous disease challenges- type, duration, date when started, clinical signs, mortality, morbidity

ii. Clinical signs of the diseases:
   a) Respiratory b) enteric c) nervous d) locomotor system

iii. Post-mortem examination report by a veterinarian/extension worker highlighting lesions of certain diseases (e.g. Gumboro, Coccidiosis etc.).

iv. Laboratory examination/investigation report of specimen from the ante-mortem and postmortem. Samples of organs, blood, fecal, tissues swab and smears are taken for further examination in the laboratories. The tests to conduct include viral, bacterial, parasite isolation and serological depending on the sample request provided.

6.2.2 Common Poultry diseases

Table below illustrates the common poultry diseases, causes, symptoms, treatment and prevention.

Table 47: Common poultry diseases

Disease	Causes / in Species	Symptoms	Prevention and treatment
Infectious Coryza	Bacterial in chicken, Pheasants, Guinea fowl	Foul smell and discharge from the eyes and nostrils, swollen, facial tissue and wattles, sneezing, coughing, difficult breathing no appetite, drop in egg production, high mortality	• Vaccinate the healthy birds. • Stock coryza free birds • Seek advise from your local vet for treatment.
Avian Influenza (AI)	Virus All poultry	High mortality, swelling of head, purple discoloration of the head, comb and wattles, subcutaneous hemorrhages, shortness of breath, diarrhea, lameness, huddling and ruffled feathers	• Vaccinate the healthy birds Stock AI free birds • No treatment • Notify the authorities
E. Coli	Bacterial All poultry esp. chicken	Loss of birds, production usually maintained, huddling together and ruffled feathers for chicks, breathing is labored, they snort and cough, lame birds, PM shows inflamed air sacs, liver capsule and heart sac	• Good hygiene and good house climate. • Organic acids in feeds • Seek advise from your local vet for treatment.
Omphalitis (Navel ill)	Bacterial Chicken	Affected chicks may have external navel infection, large unabsorbed yolk sacs, peritonitis with fetid odor, exudates adhering to the navel, edema of the skin of ventral body area and septicemia	• Effective hatchery sanitation • Seek advise from your local vet for treatment.
Fowl cholera	Bacterial esp. turkeys & chicken	Blue combs, swelling of wattles and face, convulsions, sudden death, drooping wings and diarrhea	• Vaccinate the healthy birds. • Seek advise from your local vet for treatment.
Aspergillosis	Fungal All poultry	Common in young birds, gasping for breath, stunted growth.	• Keep litter dry • Avoid moldy feeds • Use toxin binders in feeds • No treatment
Mycoplasma	Bacterial in most poultry	Affects the lungs in chickens, chronic Life-long condition.	• Kill the birds, stock mycoplasma free birds • Ensure biosecurity • Vaccinate the healthy birds. • Use tiamulin feed additive

			for prevention. • Seek advise from your local vet.
Lice	All poultry External parasites	Seen on feathers, around vent, breast, under wings and on the back, drop in egg production, droopy birds, ruffled feathers, low immunity	• Spray or dust with Dudu dust • Mix the poultry powder with dust bath.
Tropical chicken flea	All Poultry Ecto Parasite	Cluster on comb, wattles and around eyes. Eye irritation, weight loss, low egg production, death.	• Spray or dust with Dudu dust • Rub vaseline lotion onto the affected birds' combs • Mix the poultry powder with dust bath.
Mite Grey mite and Feather mite Parasite	All poultry	Mites attack feathers, suck blood, weight loss, pale comb and wattle	• Spray the poultry houses with an acaricide • Spray the affected birds with an appropriate acaricide. • Seek advice from your local vet.
Red mite	All poultry Ecto parasites	Underside of perches, in cracks in woodwork. They suck blood from birds	
Worms	All poultry Internal parasites (Caeca worms, Cape worm, Tape worms)	Weight loss, diarrhea, poor growth in chicks, drooping wings, death, pneumonia, gasping for air and suffocation	• De-worm every two months • Seek advice from your local vet.
Ascites (water belly)	Broilers	Broilers are highly susceptible – heavy and fast growing. Accumulation of fluid in the abdominal cavity, the birds move and breathe with difficulty, death.	• Proper ventilation • Proper vaccination • Control the daily consumption of pellet feeds as per tables (Module 5 Feeds). Don't give add-lib. • Seek advice from your local vet.

Nutritional deficiencies	All poultry	Stunted growth, bone deformities, the skin becomes rougharound the eyes, beak and claws), or paralysis and deaths. In layers a deficiency of calcium, phosphorous or vitamin D causes a drop-in egg production.	• Give multivitamins in water, add Dicalcium Phosphate in feeds. • Seek advice from your local vet.
Coccidiosis	Internal parasites especially in chicken and turkeys	Mortality, bloody diarrhea, loss of performance, reduction in weight and poor feed conversion ratio (FCR).	• Use coccidiostats in feeds • Vaccinate the young birds in the first 3 days • Improve on litter management • Seek advice from your local vet.
Salmonellosis Pullorum disease (PD) and Fowl typhoid	Bacterial Chicken, Guinea fowls and ducks	In the incubating egg- embryonic death, in the chicks- very acute whitish diarrhea, arthritis and neck twisting. In adult's prostration, cyanosis, yellowish green diarrhea, high mortality (30-50%). Septicemiclesions, hypertrophy and discoloration of the liver, translucid punctuation in the shape of millet grains on the lungs, renal congestion, enlarged and congested heart, spleen and kidneys. A drop-in egg production.	• Vaccinate the healthy birds • Test and eliminate carriers • Seek advice from your local vet.
Newcastle disease (NCD)	Viral All poultry	High mortality, twisting of neck, paralysis, walking backwards, coughing, hemorrhagic and necrotic gastro- intestinal lesions, drop in egg production. Hemorrhage in the proventiculus.	• Vaccinate the healthy birds • Notify the authorities • No treatment • Seek advice from your local vet.
Infectious Bronchitis (IB)	Viral Layers and broilers	Cough, sneezing, labored breathing, mortality 5-20%. For layers affects the genital tract-sterility, respiratory distress, drop in egg production, deformed eggs (rough egg shell). Lesions- catarrhal inflammation of the respiratory tract, atrophy of the oviduct, deformation of the eggshell.	• Improve disinfection and biosecurity. • Vaccinate the health birds. • No treatment. • Seek advice from your local vet.

Gumboro disease - Infectious Bursal Disease (IBD)	Viral Broilers, layers and turkeys	Prostration, trembling, greenish diarrhea, growth retardation, high mortality in 3 days, lesions –Hemorrhage/petechiae of the pectoral muscles, the thigh, at the junction between the proventriculus and the gizzard. Edema, hemorrhage, necrosis of the cloacal bursa.	• Disinfect (formaldehyde gas). • Vaccinate the health birds. • Improve biosecurity. • No treatment • Seek advice from your local vet.
Fowl pox	Viral Chicken, Turkeys, Guinea fowl	Papule-vesicular-pustular eruptive nodular lesions on the head, feet, the cloaca or the mucous membranes of the digestive and respiratory passages, weakness, lack of appetite, sudden death	• Disinfect • Vaccinate the healthy birds. • Control secondary bacterial infection. • Treat open wounds. • Seek advice from your local vet.
Avian Encephaloma litis (AE)	Viral Chicken	Chicks – no movement, trembling, tremors of the head, paralysis then death 50-80%, Adults- paralysis, drop in egg production, cataracts	• Stock AE free birds • Vaccinate the parent stock • No treatment • Seek advice from your local vet.
Marek disease (MD)	Viral Chicken, pheasants, quail and turkeys	Paresis, paralysis, enlargement of the sciatic and vagus nerves, depression, weight loss, lack of appetite, tumors in the liver, spleen, kidney, gonads and skin.	• Vaccinate at day old in the hatchery • Stock MD free birds • No treatment • Seek advice from your local vet.

Histomoniasis(Black head)	Protozoal Chicken, turkey, quail	Listlessness, drooping wings, unkempt feathers, sulfur –colored droppings, the head may be black –cyanotic, necrotic hepatic lesions in craters with depressed centers.	• Improve biosecurity • Seek advice from your local vet.
Infectious larygotracheitis (LRT)	Viral Chicken, pheasants.	Nasal discharge, coughing, gasping for air, tracheal rales, conjunctivitis, swelling of infraorbital sinuses and nasal discharge, drop in egg production up to 60%, hemorrhagic –diptheric exudates which extend to the entire trachea. Expectoration of bloody mucus.	• Vaccinate health birds • Improve biosecurity • No treatment • Seek advice from your local vet.
Egg drop syndrome 76 (ED 76)	Viral Chicken, ducks-and geese	Loss of color in pigmented eggs, soft shelled eggs, shell less eggs as the birds reach peak production.	• Stock ED free birds. • Vaccinate the healthy birds • No treatment • Seek advice from your local vet.
Reovirus	Viral Chicken, turkeys	Lameness with swelling, edema and inflammation of tibia-tarsal-metatarsal Tendon sheaths, rupture of the gastrocnemius tendon, reduced growth rate and infertility. Malabsorption- reduction in growth and other disorders.	• Vaccinate the healthy birds • Improve biosecurity • Stock reovirus free birds. • No treatment • Seek advice from your local vet.

Table 48: Common diseases in poultry in pictures

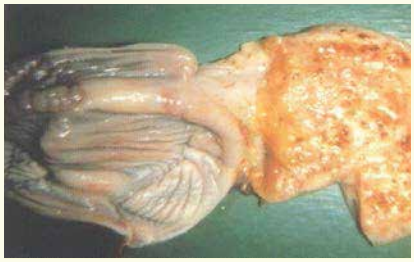
	Disease
	**Figure 57 : Avian influenza (AI, bird flu or fowl pest)**
	**Figure 58: Spleen and liver tumor, breeder with tumoral lesions due to MD**
	**Figure 59: MD infection – a) muscles & b) spleen**
	**Figure 60: Lymphoid proliferation and enlargement of the peripheral nerves in MD** **a) normal b) affected**
	**Figure 61: Infectious bursal disease (IBD)/Gumboro. Hemorrhagic (H) Lesions on proventriculus**

	**Figure 62: IBD hemorrhagic lesions of the thigh**
	**Figure 63: Colibacillosis Lesions due to E. coli: Liver and spleen enlargement and necrotic and fibrinous exudates on liver and pericardium** (liver capsule and heart sac)
	**Figure 64: Roundworms (acaricida gallinarum)**
	**Figure 65: Abnormal ovary with follicle stalks commonly seen with an salmonela gallinarum infection (Fowl typhoid)**
	**Figure 66: Blood on the shell comes from a damaged vent caused by big eggs or vent pecking**

Figure 67: Ridged shell. A possible cause is stress during laying.

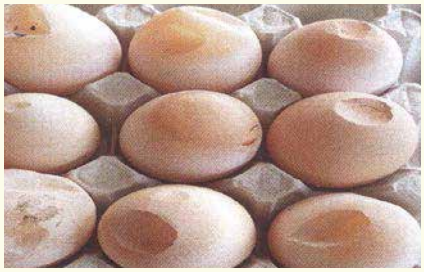


Figure 68: Larger eggs production at the end of the laying period can have weaker shells.

Adjust calcium content of the feed in good time and provide extra calcium. Make sure the hens feed well before the dark period starts, as shells are mainly deposited at night. There may be a problem with the hen's feed intake (disease, high temperature)

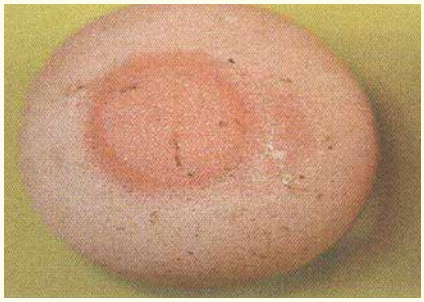


Figure 69: Eggs with extra calcification in the appearance of the ring are laid 6-8 hours too late

You find these eggs everywhere on the floor or on the slats. Wherever the hen happened to be that moment.

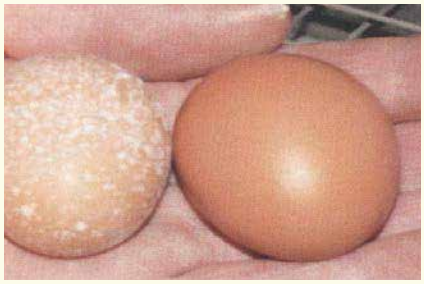


Figure 70: The egg on the left has calcium speckles, which can have different causes

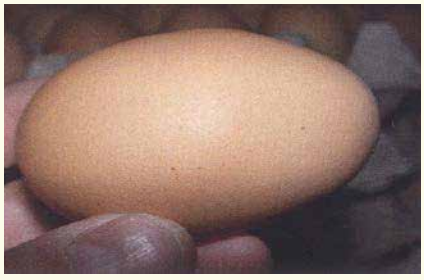


Figure 71: Ridged shell: usually caused by infectious bronchitis

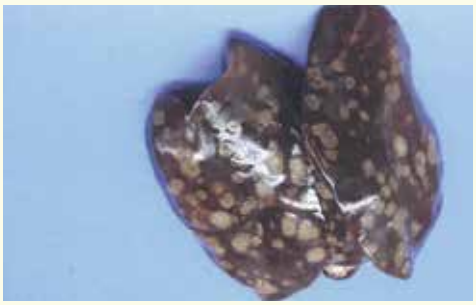
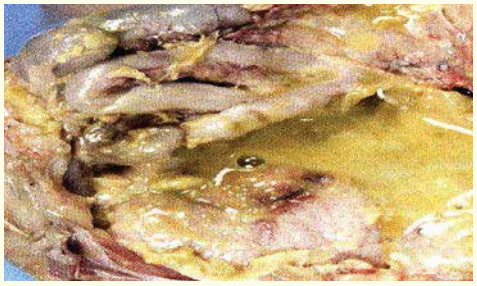
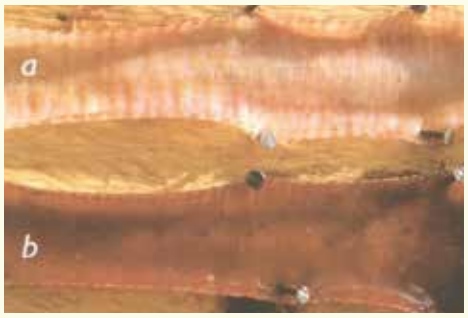
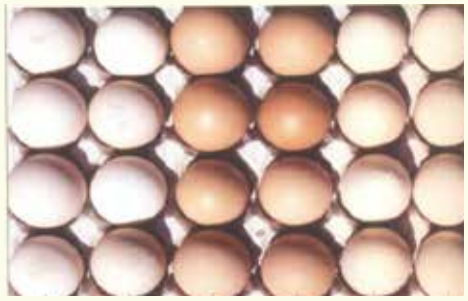
	**Figure 72: Pimples can have various causes e.g. infectious bronchitis. It can also be due to the breed of the bird.**
	**Figure 73: Histomoniansis: Causes typical lesions in the liver, especially with turkeys.**
	**Figure 74: Marek's disease: Neurological: often asymmetrical lameness in the feet.**
	**Figure 75: Coccidiosis: pale bird suffering from caecal coccidiosis**
	**Figure 76: E. Coli or Peritonitis: Peritonitis in a layer**

	**Figure 77: Large roundworm infection**
	**Figure 78: Respiratory diseases: Signals of fever: Short of breath, but no unusual noises. These chickens have a fungal infection of the lungs.**
	**Figure 79: Mycoplasmosis: swollen head caused by mycoplasmosis**
	**Figure 80: Fowl Cholera (Pasteurella multocida): swollen comb and wattle caused by Pasteurella**

	**Figure 81: Avian Encephalomyelitis (AE): Typical lateral position caused by AE**
	**Figure 82: Fowl pox lesions on the eye lids of a layer**
	**Figure 83: Pox lesions on the leg of the chicken**
	**Figure 84: Infectious Coryza (sinusitis, conjunctivitis, swollen head, rhinitis)**

	**Figure 85: Infectious Bronchitis (IB) - a) Normal Trachea b) IB Affected trachea**
	**Figure 86: Characteristics of IB Affected eggs**
	**Figure 87: Reovirus affected tibio-tarsal joints**
	**Figure 88: Reovirus- Lesions in the synovial sheath**
	**Figure 89: Infectious larygotracheitis (ILT)– Breathing in breeders**

Source: all the above-Layer Signals Hendrix Genetics

6.3 Effects of Climate Change

Climate change causes shifts in temperatures, rainfall patterns and brings in climate extremes. This not only affects animals and plants, but also the distribution and pressure of pathogens and diseases affecting these hosts. Cold weather is more conducive to certain infectious diseases, such as Newcastle Disease (NCD), Avian Influenza (AI), Infectious Bronchitis (IB) and Infectious Bursal Disease (IBD/Gumboro).

Cooler temperatures allow these viruses to survive longer and in effect increases the disease risk making it harder to manage them. They also cause birds to huddle together more and this closer proximity of birds increases the risk of disease transmission. Warmer temperatures help to destroy some of these viruses, but higher humidity levels on the other hand worsens the respiratory problems and enteric diseases. Temperatures that are too high or low and unfavorable relative humidity causes stress that can render birds more vulnerable to diseases and strain their productive performance.

6.4 Biosecurity

Biosecurity is a practice designed to prevent the spread of diseases onto and within the farm. It is the most cost-effective means of disease control available and no disease prevention program will work without it.

Minimum biosecurity procedure.

Biosecurity involves establishing mechanical barriers, for example suitable farm location, orientation of farm structures, gate, fence and changing rooms. It also involves disease control protocols, for example records of people entering the farm, where they come from, one man one house and disinfection of equipment and vehicles. In addition, it involves boosting the immune system of the poultry using vaccines and antigens. Control of rodents, insects and wild birds is also part of biosecurity.

Access to farms

- All doors and gates must always be closed and locked.
- Where transit facilities are provided, visitors must pass through this facility and change into transit clothing.
- Everyone entering the farm must shower and change into farm uniforms and gumboots.

Shower facilities

- There must always be additional towels, uniforms, slippers and gumboots available at the farm for visitors, maintenance crew, veterinarians etc.
- Socks must be kept for outside visitors and managers.
- No private clothes or personal items can be allowed inside the transit and/or farm area.
- All available showers must be fully functional with hot & cold water. Shower roses, curtains, soap and shampoo must be available and heaters where required must always be functional.
- Enough hooks must be provided for towels and uniforms.
- Keep the shower facilities clean and tidy.
- Regularly check & repair perimeter fencing.
- Gates & doors must always be kept closed.
- No unauthorized visitors should be allowed on the farms.

- Farm uniforms & gumboots must not be taken outside the farm, to other farms during transfers, vaccinations, catching of birds etc.
- Everyone must use foot dips before and after entering facilities where they are provided.
- No farm towels or protective clothing may be taken to staff accommodation.
- Shower and ablution facilities must always be kept in good working order.

Canteen facilities

- The canteen must be on the clean side of the ablution facility to minimize traffic from clean to dirty side.
- Keep the canteen area clean and tidy and do not leave food and scraps lying around.
- Take lunch inside the farm area, in farm canteen or in clean area.

Vehicles

- No vehicles should be allowed inside the farm other than those essential for farm duties and must be disinfected prior to entering the farm.
- Feed delivery drivers may not leave the truck cabin without showering and changing into farm clothes.
- Keep tyre dips clean and correctly dosed with disinfectant or use a disinfection spray. It is recommended that spray races should be used in conjunction with the tyre dips.
- Farm staff must unload feed while the driver remains inside the truck.

Rats & wild birds

- No holes in walls & under the doors.
- No feed spillage around feed store or in and around poultry houses.
- Water tanks must always be kept covered with an appropriate lid.
- Silo covers and feed store doors must always be closed.
- Keep service room doors closed.
- Maintain rat poison in panel boards, cooling rooms and service rooms.
- Wood shavings must be kept indoors.
- Keep grass cut short for 20 meters around poultry houses.

Equipment

- Avoid bringing equipment from other farms.
- Clean and disinfect, fumigate where possible, all equipment brought onto the farms.

Feeds & water

- Keep silo covers and feed store doors closed.
- Keep water tank covers closed.
- Clean water tanks, cooling tanks & flush nipple lines on every other day.
- Ensure water sanitation in all farms.
- Repair and prevent any leakage from the tanks.

Important

- Anything used outside the farm should not be used inside the farm without proper disinfection.
- Anything used inside the farm should preferably not be taken outside the farm.
- Clean all foot dips and refresh them at least every 48 hours.
- Keep tyre dips clean where applicable and replace water & disinfectant as required.
- Clean service rooms, farm accommodation & bathrooms daily.
- Dispose of dead birds daily preferably by incineration or use a pit.
- Old litter must be disposed of properly and immediately.

Although vaccination remains an important part of disease control, **without strict biosecurity, vaccination cannot provide full protection but with strict biosecurity a farmer can prevent up to 90% of the diseases on the farm!!!!**

Cleaning

Steps under cleaning

Step 1: Clean out all the old organic matter

- Sweep the poultry house after dusting down the walls and roof.
- Remove all the litter from the entrance to the poultry house.
- Remove all litter as far away from the houses as possible.
- If the litter is used in the fields, make sure it is worked into the soil to avoid recontamination of the houses.

Step 2: Water line sanitation

- After dry cleaning the house, at the point of washing the house, add a dilution off Hydrogen Peroxide to the header-tanks,
- Leave this for 12 hours and then flush through the lines to clean tank, pipes and drinkers. Ensure that the drinkers are properly cleaned and disinfected.

Step 3: Wash with a detergent

- Wash the house with a detergent to ensure that all surfaces - are clean.
- Ensure that the water drains away from and out of the poultry house and entrance.

Step 4: Disinfect

- Spray down the house working from the roof down to the floor using a suitable sprayer.
- Apply disinfectant to the surfaces at low pressure.
- Use only registered disinfectants with proven ability to kill poultry pathogens.
- Allow the house to dry and stand closed for as long as possible (two weeks or more).
- After one day lime the floor and short wall of the house with construction lime.
- After preparing the house to receive the next batch of day-old chicks, ensure that everyone who enters the building has showered onto the farm, and that they are wearing the appropriate clean protective clothing.
- Ensure boot dips are placed at the entrance of the house.

Step 5: Pest control and management

- Of major importance is the control of rodents (rats and mice)
- They cause damage to buildings, consume feed and defecate and urinate on the feed bags.
- They carry diseases such as Gumboro Disease and Salmonella into the poultry house.
- Rats consume 10% of their body weight in feed, therefore each rat could be consuming between 20-40 grams of feed per day, use baited traps outside and non-baited traps in the poultry houses.
- Wild birds, dogs and cats can also be involved in the passive transmission of diseases.

Step 6: Control of people and equipment

- The movement of people into the poultry house should be restricted as far as possible.
- Ensure that those who enter your farms have not come from another poultry farm and that they have changed into clean protective clothing (preferably after a shower!!). Have a log in and log out system of control of human traffic.
- Spray all vehicles and equipment with a disinfectant. Spray before they enter your farm (feed trucks)
- The susceptible host (chicks//chicken) must be protected at all times against exposure to pathogen.

Figure 90: Simple disinfection of a car at the gate (Source: Asiima ACL)

MODULE 7: SAFE HANDLING AND USE OF VACCINES, DRUGS DISINFECTANTS AND OTHER CHEMICALS.

Vaccines, drugs, disinfectants and other chemicals are used in the poultry industry to help mitigate disease challenges on the farms. Their professional use is important because they have a direct impact on human welfare, safety of poultry and provide a guarantee for biosecurity on the farms.

7.1 Vaccines

Vaccines are weakened live disease-causing microorganisms which when introduced in the birds, makes the body to produce antibodies against them.

Vaccines are divided into two groups:

a) Live agent vaccines
b) Killed agent vaccines

There are different types of vaccines namely a) bacterial b) mycoplasma and c) viral

Table 49: Comparison of live agent and killed agent-vaccine

Characteristics	Live agent vaccine	Killed agent vaccine
Mass vaccination	Yes	More difficult
Active acquired immunity	Rapid	Slower
Quality of immunity	Short duration	Long duration and high level
Reaction to vaccine	Sometimes	No
Vaccination during egg production	No	Yes
Cost	Cheap	Expensive

7.1.1 Conditions for safe use of vaccines

- Do not vaccinate poultry during stress (debeaking, transfer, high heat or when sick).
- Use clean equipment
- Do not use metallic water containers

- Use a sterile solvent (saline solution or sterile distilled water) for injectable vaccine as recommended by the manufacturer.
- Do not use water containing disinfectant or organic matter (chlorine, acid water etc.)
- Use the vaccine as soon as it is reconstituted (does not last for more than 2 hours after reconstitution).
- After reconstituting the vaccine, water in the drinkers should be consumed within a maximum of one hour (when using water method).
- Follow manufacturer's instruction for storage of vaccines.

7.1.2 Procurement, transportation and storage

- Purchase your vaccines from a National Drug Authority (NDA) registered pharmacy or drug shop which employs competent and qualified veterinarians with a valid trading license in vaccines.
- Get a receipt which shows the vaccine purchased, active ingredients, expiry date, batch number and date of purchase.
- Ensure that the supplier has a reliable power-backup for electricity fluctuations.
- Transport vaccines in a food flask, ice box with enough ice in it, or in liquid nitrogen cylinders (for mareks vaccine).
- Respect the cold chain from the supplier to the farm.
- Store vaccines within a temperature range of 2-8 ^{0}C in a cool dark place in (a fridge, ice box) or in liquid nitrogen cylinders (mareks vaccine).

7.1.3 Administration of vaccines

Strictly follow the manufacturer's instructions and use vaccination schedules recommended by the breeders, in collaboration with the local veterinary staff.

Figure 91: Spray vaccination in a hatchery

Vaccination methods

- **Nasal drop**: by instillation or Deeping the beak (normally water for injection, an application syringe, and ice are provided to facilitate this process).
- **Eye drop**: by instillation (Same as above)
- **Injection** in the breast or thigh muscle, wing web, neck area depending on the vaccine and the manufactures instructions in consultation with your local veterinarian.
- **Spray**: method especially with respiratory infection (can use special sprayers or a clean knap suck sprayer purposed for vaccination only) Mix the vaccine – 1000 doses in 300mls of distilled water or mineral water and spray after repartitioning the poultry house to bring the birds closer to gather.
- **Oral**: this corresponds to oral and intranasal administration. When using drinking water method get as many drinkers as possible, improvise with small basins. Prepare un-chlorinated clean water (borehole water, good rainwater, good spring water) or if you are using tap water add skimmed powdered milk at the rate of 25gm in 20-liter jerry can and let it stand for 30 minutes before mixing the vaccine. Starve the birds for one and a half hours (give them feeds but deny them water) before mixing the vaccine according to the program below:

Table 50: Program for mixing vaccines in water for 1,000 birds by oral method

Weeks	Water (Liters)/1,000 doses
1	8
2	15
3	20
2 months and above	40

Note: Administer the water in as many drinkers as possible to maximize access within two hours. Always vaccinate during morning hours when it is cool.

Make sure the equipment (filters, O-rings) is clean on the inside and outside

For hygiene reasons, but also for your own safety, always wear gloves. Open the vaccine ampoule under water

Use a filter to prevent any sediment and other impurities from getting into the spray and blocking the nozzle.

If possible, use a vaccine containing a dye so you can see whether all the birds have taken it.

Figure 92: Good vaccination procedures (Source: layer signals (Hendrix genetics)

7.1.4 Disposal and protection

- When the vaccine remains unused, add hot water to it and discard the mixture in the toilet or add any disinfectant to it before disposing it. Properly dispose off the used vaccine containers in a pit latrine or in an incinerator.
- Whenever you are using vaccines protect yourself using gloves to reconstitute in water and use nose and eye masks for spray vaccines.
- NEVER discard the unused vaccine in the poultry house after vaccination because you are contaminating the house with the microorganisms.
- Wash your hands with soap and water and take a shower after the exercise.

Vaccine failure – This is when a disease caused by a specific wild virus appears during the protection period (2 weeks and above after vaccination, when effective immunity is working). Possible causes are:

i) poor storage
ii) stress
iii) presence of maternal antibodies
iv) excessive rapidity of the vaccinator

v) health status of the birds

vi) immune suppression induced by mycotoxins-aflatoxins.

7.2 Drugs

Drugs are medicines or substances which have a physiological effect when ingested or otherwise introduced into the body. They are used for stimulating growth, treatment and prevention of diseases in poultry.

7.2.1 What to consider before treatment

- Etiological (causative agent): aims at eliminating the cause of the disease.
- Symptomatic: aims at limiting the harmful effect of an infection. E.g. complication with fowl pox disease use antibiotics to control secondary bacterial infection.
- Preventive: prevents or limits an eminent risk or that threatens the farm.

7.2.2 Treatment methods

- **Oral (in drinking water):** used a lot in poultry farming, it allows rapid intervention and optimal efficiency. Sick birds continue to drink even when they no longer eat. Depends on the age of the birds, the environmental conditions, temperature of drinking water, water quality- poultry prefer slightly acid water, the condition of the birds- stressed, weakened etc.
- **In feed**: This must be used only when the technology is good enough to mix the micro-element thoroughly with the feed.
- **Through air (aerosol):** nebulization, pulverization, fumigation – mainly used in treating external parasitic diseases (lice, mites, ticks).
- **By injection**: It allows the administration of a precise dose of medicine, but it is costly and stressful to carry out.

Gumboots

Overall

Nose Masks

Gloves

Googles

Figure 93: Protective gear for handling vaccines, drugs, disinfectants and other chemicals

7.2.3 Procurement, storage and transportation

- Purchase your drugs from a National Drug Authority (NDA) registered pharmacy or drug shop which employs competent and qualified veterinarians.
- Get a receipt which shows the drug purchased, active ingredients, expiry date, batch number and date of purchase.
- Transport drugs in boxes that are clearly labeled the type of drug, expiry date, the name of manufacturer. The drugs must be intact and not leaking anywhere.
- Store the drugs on shelves away from light in a cool dry place in a properly ventilated store or cupboard specially meant for this purpose. Or if you are using a bigger store, place the drug boxes on a wooden pallet in a dry well-ventilated room away from children and family members.

7.2.4 Safe use and disposal

All drugs have a label or pamphlet which gives guidance on the use, dosage, consequences of misuse, species specifics, antidots and instruction of disposal of used containers.

The disposal of expired drugs should follow the guidelines of NDA. Used drug containers must be incinerated or disposed of in a special pit after cutting it to pieces.

7.2.5 Self protection

Always use protective gear (goggles, nose masks and gloves) during the administration of drugs. The choice of gear to use depends on the type of drug and manufacturer's instructions. Seek advice from your local veterinarian for guidance.

7.3 Disinfectants and other chemicals

A disinfectant is a chemical used to fight germs on the farm. Use only disinfectants that are registered to kill poultry pathogens and select disinfectants according to time to work, temperature, concentration and method of disinfection. If a disinfectant is applied to a soiled or poorly cleaned surface, the soiling reduces the killing effect by stopping the disinfectant from reaching and killing the pathogens.

7.3.1 Classification of disinfectants

i. Acids- acetic acid, boric acid
ii. Halogens- iodine, chlorine
iii. Alcohols- ethanol, isopropanol
iv. Oxidizing agent- hydrogen peroxide
v. Phenol derivatives- phenol, cresol, dettol
vi. Aldehyde- formaldehyde
vii. Quaternary Ammonium compounds (QAC)- centrimide, virukill, norocleanse
viii. Dyes- gentian violet

7.3.2 Other chemicals used in the poultry industry

Table 51 Other chemicals used in the poultry industry

No	Chemical	Targeted pests & vectors
1	Caumarin, Organophosphorus, Organochloride.	Rodents
2	Carbamate, arsenical compounds	Insects
3	Organophosphates, pyrethroids, Ivermectin, carbamate	Ticks, louse, mites

7.3.3 Factors that affects cleaning and disinfection

a. Time: products need time to work properly – maximum contact time with the surface.
b. Temperature: the higher the temperature of the solution (detergent) the quicker the cleaning.
c. Concentration: products should be used at the correct concentration for best results (according to manufacturer's recommendations).
d. Energy: this can be mechanical pressure pumps and hoses used for disinfection.

7.3.4 Procurement, transportation, storage and safe use

- Purchase your disinfectants and chemicals from an NDA registered pharmacy or drug shop which employs competent and qualified veterinarians.
- Get a receipt with the chemical name, expiry date, batch number and date and name of the purchaser clearly spelt out.
- Transport in its' container using a well-ventilated means of transport.
- Store in a well-ventilated cupboard, on shelves or wooden pallets.
- Use all chemicals according to the manufacturers' instructions written on the labels provided on the containers. Pay attention to issues like toxicity, precautions and mixing concentration.

7.3.5 Self protection

When applying chemicals, you need to have the correct gear (over- rolls, gumboots, goggles and masks). Remove this gear after the exercise, take a shower and change to your clothes.

8.1 Marketing

Marketing is critical to improving the visibility and hence revenues of the poultry enterprise.

8.1.1 What is marketing

Marketing is the science and art of exploring, creating, and delivering value to satisfy the needs of a target market at a profit[2]. In poultry it involves producing a high-quality product (e.g. eggs, chicken, chicken meat), processing it (e.g. simple slaughter, cleaning, freezing, storing) and selling it to targeted customers (supermarkets, processing plants, restaurants) at a profit.

8.1.2 How do I improve the market of my products?

All poultry farmers want to see financial gains from their efforts. However, most of them spend a lot of resources and energy on the production and overlook the core aspect of marketing. Do the following to improve your market:

i. **Product**. Produce a high-quality product in quantities required by the market and brand them if possible. For example, clean, sorted, graded and packed eggs for sale. Consider adding value to your products (e.g. yellow york eggs, frozen meat, meat parts) for a niche market and improved income.
ii. **Price**. Most customers are price sensitive. Set an attractive and competitive price for your product in respect to the market and your competitors. For example, if the current market price is UGX 7,000 per tray of eggs, don't sell yours at UGX 10,000.
iii. **Location**. Locate your business (farm or outlet) in a convenient place- easily accessible to customers, suppliers and transporters.
iv. **Promotion**. Make your products known by talking to individuals, companies, announcing at village gatherings, participating in exhibitions, advertising on placards, radio, television, newspapers and social media.
v. **Customer**. Know your customers, treat them with respect and dignity, take time to talk to them and swiftly respond to their queries. Consider giving credit and discounts to loyal and consistent customers.
vi. **Competitors**- Know your competitors, their share of the market, what they do and how they do it so that you can adjust accordingly.

[2] https://heidicohen.com/marketing-definition/

Other tips on improving the market of your products

- The demand for poultry meat and eggs is expected to continue increasing due to population growth and rising individual consumptions
- Sell off non-performing cocks, if they are too many for mating (ratio of 1:10 is enough), old off-layers and culled hens.
- Collect and sell eggs while fresh, clean dirty ones with a green pad.
- Pack, sort and grade eggs in trays, then in boxes for the market.
- Sell more frequently in the market to establish a good name for selling fresh eggs.
- Utilize the high demand and prices during festive seasons like Christmas, Easter and Idd.
- The dynamics of world poultry markets are driven by animal disease outbreaks and trade policies e.g. Avian Influenza and Newcastle diseases in the recent decade, so take adequate precautions to avoid and control them.
- Maintain a clean and tidy environment at the farm or outlet to give confidence to your customers about the safety and hygiene of your products.
- **Do Not Wash Eggs with Water!!**

8.1.3 Group Marketing

Farmers can form groups in order to pool resources and improve their operations and competitiveness through horizontal and vertical linkages. Group marketing involves either farmers taking their products to a bulking center owned by their group (horizontal linkage) for joint processing and marketing or collectively selling to an entrepreneur like supermarkets, restaurants and abattoirs (vertical linkage) through legal contracts. This arrangement requires farmers to produce items of the same standard, quality and synchronizing their production operations (stocking, treatment regimes, withdraw period of drugs, good sanitary conditions) and postharvest operations (sorting, grading, packing, freezing and transporting of the products) to produce the required volumes cost effectively.

Advantages of collective marketing

- Attracts large-scale buyers such as poultry meat processing plants and export markets using mutual legal contracts.
- Provides entrepreneurs with more bargaining power (in terms of prices, sales volume and time of delivery of the poultry products).
- Makes small scale farming competitive - small farmers can access technology, credit, marketing channels and information at low costs.
- Reduces costs as some activities are carried out as a group (transporting, grading and packaging and procuring feeds and other inputs that can be shared).

- Promotes access to better marketing information and market advisory services.
- Improves quality of products due to timely and sequenced production.
- Enables groups to purchase high quality inputs and transport in bulk.
- Provides a link to get training from the off- takers, NGOs, implementing partners and government extension.

Challenges of collective marketing

- It may be difficult for the group to agree on crucial issues (slow decision making).
- Dishonesty/non-transparency among members especially in management.
- Poor record keeping may lead to losses.
- It requires safe collection and holding centers in accessible areas, thefts or losses can occur if the facility is in a location that is poorly secured.
- Good road infrastructure is required to attract large scale buyers to remote/rural areas.

Key success factors in group marketing

For group marketing to be successful, the following factors are critical:

i. Members should be knowledgeable in business management.
ii. Members should attend group meetings regularly and participate actively in decision making.
iii. There should be mutual trust among members with emphasis on ethics and integrity.
iv. The group should have dedicated and committed leaders who are democratically elected.
v. The group should have clear and enforceable by-laws on corrupt and unaccountable leadership.
vi. There should be clearly defined roles and responsibilities especially in relation to promotion and marketing of group products.
vii. Existence of financial institutions offering appropriate products which poultry farmers can access through their groups to improve their operations.
viii. Conducting regular pre-production planning.
ix. Having access to marketing information through market research. Consistency and quality of group's product (size, quality, packaging, grading etc.)
x. Having access to a reliable cold storage and ordinary storage facilities with good road infrastructure.
xi. The group should have accurate record keeping.
xii. There should be transparent and equitable distribution of benefits.

8.2 Value Addition

Poultry farmers have an opportunity of improving their markets, income and mitigating losses by adding value to their products. Value addition involves processing products, to increase their life span and convenience to the consumers.

Examples of value addition poultry enterprises in Uganda are large scale meat and egg production units that are vertically integrated with breeding farms for parent stock, hatcheries, feed mills and egg and meat processing facilities.

8.2.1 Value addition opportunities in poultry

Poultry farmers can make the following products

Meat products

a) **Fresh broiler meat** -this meat is popular. It is kept at 4°C but for less than 24 hours.
b) **Frozen meat –** this is popular in developed countries and has a lifespan of eight months. Farmers can undertake this with minimum costs through pooling resources in cooperative societies (e.g. SACCOs and investment clubs to buy freezers where they can store products during low demand seasons and selling during peak seasons.
c) **Boneless products** -these are easy to cook and popular with middle-class citizens.
d) **Semi-cooked meat parts** can be sold in supermarkets, hospitals, schools and hotels.
e) **Fully cooked meat –** farmers can sell to restaurant and chicken roasting points (grills).
f) **Seasoned or marinated products-** marinating takes about 72 hours and is popular in most restaurants; the meat is juicy and has an aromatic taste.
g) **Chicken parts or portions.** These are quite popular and include drumsticks, thigh, wings, breasts, breast halves, poultry halves, winglets, drumettes, breast quarters, leg quarters, legs (drumstick+ thigh), gizzards and necks. They can be packed and sold to supermarkets as fresh or frozen cutups.
h) **Blood –** it can be dried and sold as fish meal, while feet and heads are packed and sold as pet food.

Egg products.

Eggs may be sold either as table eggs or processed into egg products that go into a wide range of food products, including soups, sauces, cakes, biscuits and desserts. To prepare the value-added products, the eggs are broken, the liquid is then filtered, mixed and stabilized. Blend and pasteurize the mixture to kill pathogens before cooling it into liquid form. Then freeze or dry into powder. The mixture is then packed as liquid, frozen or dried powder. The egg powder has a lifespan of four years. Preparing a meal involves mixing two tablespoons of egg powder with one tablespoon of water and are then cook.

Other products

i) Feathers - can be dried and used as fire source, making furniture cushions and pillows.
ii) Poultry manure- used for improving soil fertility. It is a rich source of nitrogen and phosphorus. It can be sieved, packed and sold in kilograms.
iii) Minced meat, sausages, chicken soup, bones for calcium, buttons and animal feeds among others.

8.2.2 Simple slaughter

This is an example of value addition enterprise in poultry. It is carried out using simple tools and follows the following process.

Arrival at the processing plant

Once they've reached the proper size and weight (broiler chicken take up to six weeks to reach market weight), workers trained in humane care catch each them by hand after starving them for at least 8 hours but not limiting the water. During this process, chicken is transferred into holding crates specifically designed for transport to the processing plant, aimed at ensuring that birds don't hurt themselves and that air is able to circulate. The distance should be less than 60 miles away. Weigh every bird and record the weight.

Stunning

The chicken is suspended by their feet on a moving line. They become calm after stunning by an electric shock or by knocking the head with a rod.

Slaughtering and bleeding

A single cut is made to the throat of an unconscious bird without removing the head. The carcass bleeds for 3-6 minutes to ensure the meat remains white.

Figure 94: Simple slaughter using cones

Scalding

After slaughter, the birds are scalded by dipping the carcass in hot water (60-64°C) for one minute or (54 to 55°C) for three minutes. Then their feathers are plucked and filleted, mostly by hand. This is necessary in order to prepare the bird for processing. The bath of hot water is designed to help loosen feathers.

Figure 95: Scalding chicken locally using a saucepan (Source: Asiima ACL)

Feathers can also be removed using a machine called a "picker," which has hundreds of little rubber "fingers" that rotate around to remove the feathers or in the traditional way manually with the fingers. After feathers are removed, the birds are sent to an "eviscerating" line which removes internal organs and feet.

Figure 96: Defeathering machine

Evisceration

This is done on a clean, smooth surface bench; remove the oil gland and feet. Make a vertical cut running from the tip of the sternum to the vent. Or make two horizontal cuts across the abdomen and remove the internal organs through the lower cut. Remove the gizzard and liver, slice open the gizzard and remove the inner lining and contents. Here inspection of the carcass takes place.

Cleaning

Remove the lungs, kidneys, head, neck, esophagus and crop. Cut the skin at the dorsal part of the neck and cut the neck at the shoulders. Pull the esophagus and crop out from the neck region. Wash the carcass with cold water. Inspection of the carcass takes place here.

Chilling

Dip the carcass in cold water (15-10°C) mixed with chlorine.

Dressing, packing and grading

Pack and seal in plastic bags with a label indicating the weights, date of packing and what is packed.

Freezing and storage

The packed products are frozen (-35°C) immediately. They can then be transferred into a freezer (-18 to -24°C) in supermarkets and hotels.

8.3 Markets

There are two types of poultry markets as described below.

8.3.1 Internal Markets

Internal markets are categorized as local and organized. Local markets are unstructured and include farm gate, neighborhood, friends, relatives, roadside "rollex" and "muchomo" markets. Organized markets are well-structured and pay taxes to local governments. They include town council, municipal council, private local markets, supermarkets, hotels and restaurants. The internal markets are easy to access. Other internal markets include large scale processors who operate their own abattoirs where poultry are slaughtered, processed, graded, packed, stored and distributed either to direct sale or under contract to other large organizations such as supermarkets.

8.3.2 External Markets

These are markets outside Uganda but mainly in the East African region. They include countries like Kenya, South Sudan, Rwanda, DRC, and Tanzania. This market is well-structured and has several requirements including conforming to international standards by Uganda National Bureau of Standards (UNBS) and regional standards agencies (see module 11). In order to satisfy this market, you need to contact the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Uganda Revenue Authority (URA) and Ministry of Trade Industry and Cooperatives (MTIC) to process movement permits, clear and facilitate the movement of exports. In addition, you need to invest in various equipment and machinery like refrigerated trucks and cold room facilities.

Poultry meat is usually exported frozen whereas, eggs are exported in the following three categories:

(i) In-shell table;
(ii) In-shell eggs for hatching; and
(iii) Egg products in liquid, frozen or powder foam (not yet developed in Uganda).

Conclusion

The market of poultry and poultry products exists and highly unexploited. Farmers and other value chain actors are advised to apply the techniques described above to benefit from this market.

9.1 What are profits?

Poultry farming should be done as a business in order to increase productivity, production, profitability and sustainability of the enterprise. Profits = Revenue – Expenditure, so lowering expenditure (costs) and maximizing revenue (sales) results into high profits. Success of a business requires the proprietor to accurately know and record the sales, cost of production, margins and how to maximize profits. Farmers should therefore acquire entrepreneurship skills that will enable them to do proper business planning; enterprise selection; bookkeeping, farm budgeting and cost benefit analysis with good interpretation of the data collected.

9.2 Benefits of farming as a business.

i. Able to track, control costs and improve sales (revenue).
ii. Improved access to funding.
iii. Growth in income as a result of increased profit margins.
iv. Improved standards of living due to increased income.
v. Improved nutrition and household food security.
vi. Increased productivity and efficiency of the enterprise.

9.3 Good business principles

i. Invest resources with a profit motive.
ii. Provide products or services of good quality to satisfy the market in exchange for a high price.
iii. Apply good ethics and conform to the laws and standards of the society in which you operate. For example, pay taxes and your workers on time. This will enable you to win many stakeholders and avoid incurring high costs in terms of penalties, fines and legal fees.
iv. Assess and mitigate the risks affecting your business, both internally and externally. For example, plan for alternative poultry feeds when there is scarcity of the traditional feeds.
v. Record all the expenses and income immediately they take place. You will need them for calculating profits, planning and decision making.
vi. Identify your key stakeholders, meet their needs and develop long-term relations for the sustainability of your business. For example, financing institutions, suppliers and customers.

9.4 Records

There are two major records used in poultry namely financial and production.

9.4.1 Financial

a) Budgets (provides a financial working plan for the farm).
b) Annual inventory (record of all assets - buildings, birds, equipment, feeds, supplies and value of real estate at the end of a financial year).
c) Invoices, vouchers, receipts and expenses.
d) Bank records like statements

9.4.2 Production

a) Vaccinations and treatment records.
b) Death and health records.
c) Records on production and weight gain.

Tables below show templates for the various records used in poultry

Table 52: Annual cash expense budget
A template for annual cash expense budget of a poultry farm

Item	Total Required	Unit Cost	Jan	Feb	Mar	April	…..	Dec
Chicks								
Labor								
Feed								
Fuel								
Vaccine								
Drugs								
Disinfectant								
Detergent								
Equipment								
Taxes								
Water bills								
Electricity								
Interest on loans								
Total								

Table 53: Annual cash income budget
A template for annual cash income budget of a poultry farm

Item	Total Expected	Unit Price	Jan	Feb	Mar	April	….	Dec
Live birds								
Eggs								
Used litter, etc.								
Total								

Table 54: Annual cash-flow
A template for annual cash flow of a poultry farm

Item	Total Expected	Unit price	Jan	Feb	Mar	April	….	Dec
Gross Income Gross Expense								
Difference								
Surplus (+)/Deficit (-)								

Table 55: Layer production record

Month……. Flock……. Date transferred…….

Number transferred……Attendant…… House Number……

Month Date	Age In Wks	Eggs Laid 1 2 3 4	Total Layed	Mortality		Daily Prod %	Weekly Prod %	M	F	Feeds (kg)	Remarks
				Culls	Death						
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
“											
“											
“											
“											
“											
26											
27											
28											
30											
31											
Total											

Total number of eggs collected x100 = Hen-day egg production (HDEP)
Numbers of hens in the pen

Broiler Production Card- Refer to module 4 section 4.5 (table 30) and use it to take records for production, weight gain, temperature reading during brooding, feeds consumed, mortality and culls.

Table 56: Template for growing immature pullets

Batch No--------- Date---------- No of Day-Old Chicks Received ……

Age (Wks.)	Mean Body Wt. (g)	Cumulative Feed Intake (g/Bird)	No. Dead/Culled & Reason
0	36		
4	300		
8	800		
12	1,000		
16	1,300		
20	1,500		
	FCR = Total feed consumed(g)/mean body weight gain(g)		
	Mortality: %		

Table 57: Template for egg production layers (deep litter) budget

Item	Rate	Cost
Day -old chicks	@ Ugx…… chicks)	……
Feeds		……
(i) Chick Starter (0-8 weeks)	2.0 kg / Chick at Ugx……. (…….kg)	
(ii) Grower mash (9-18 weeks)	5.0 kg /pullet at Ugx …… (……kg)	……
(iii) Layer mash (19-80)	50.0 kg/hen at Ugx…(……kg)	……
Coffee husks (litter)		……
Kerosene lamps/ Electric bulbs/ Charcoal stoves		……
Fuel (electricity/Kerosene/Charcoal)		……
Feeders, drinkers and nests		……
Vaccines		……
Drugs such as de-wormer		……
Labor (about 85 weeks)		……
Miscellaneous costs and depreciation of facilities (transport, water, disinfectant and so on)		……
5% loss of birds and damage eggs		……
Total costs		**……**
Sales		
300 eggs/hen	(……..eggs @ at Ugx……)	……
Sale of aged hens	(…….hens@ at Ugx…….)	……
Sale of manure (if possible)		……
Profit/Loss: (Total sales- total costs)		**……**

Table 58: Template for broiler enterprise (deep litter) budget using mash feeds

Item	Rate	Cost
Day -old	@ at Ugx……(….chicks)	……..
Feeds		
(i) Broiler Starter (0-4 weeks)	1.5 -2.0 kg /chick at Ugx…….(…….kg)	…… ……
(ii) Broiler Finisher (4-8 weeks)	4.0 -5.0 kg/ broiler at Ugx……. (……..kg)	…… ……
Drinking water (about 20 liters per bird)		……
Coffee husks (litter)		……
Kerosene lamps /Electric bulbs/charcoal stoves		……
Fuel (electricity/kerosene/charcoal)		……
Feeders and drinkers		……
Vaccines		……
Drugs, e.g. de-wormer, coccidiostat		……
Labor (0-8 weeks)		
Miscellaneous cost (depreciation of facilities, transport, water, disinfectants, etc.)		……
Total		……
Sales		
Sale of broilers (……. Broilers)	@ at Ugx……	……
Sale of Manure (if possible)		……
Total Income		……
Profit/Loss: (Total Sales - Total Costs)		**……**

9.5 Business Plan

A business requires extra resources to grow. The resources may come from own savings or funding from individuals or institutions. A business plan is essential to explain the prospects of your business to stakeholders who may provide the resources required. It is a written description of the business' future. It serves as a road map that describes what you plan to do and how you plan to do it. It is an important step for any size of business. As a strategic planning tool it enables you organize your business well and provide information required by stakeholders especially funders before they take a decision whether to support the business or not.

A good poultry business plan should include:

- The goal –direction of the business.
- Plans to make the farm more efficient or profitable.
- An outline of the business activities. For a commercial layer enterprise, the plan shows the stages from brooding to off laying and what activities need to be done at each of these stages.
- Production and prices used to estimate income.
- Plans to market poultry and its products.
- Business expenses.
- Additional resource needed and source (e.g. saving, loans etc.)
- Measures of business success.

9.6 Cost-Benefit Analysis

During enterprise selection, profitability of the enterprise should be taken as key. One of the ways of determining the profitability is by carrying out a Cost Benefit Analysis (CBA) of the enterprise. Profit = Sales – Cost of production.

Tables 59-61 illustrate the CBA for various poultry enterprise options

Table 59: CBA for the option of rearing 1,000 brooded improved breeds (4 weeks)

(Brooded 4 Weeks)		Quantity	Rate (UGX)	Amount (UGX)
	D.O.C	1,000	2,500	2,500,000
Feed expenses	Chick Mash Kg	1,000	1,500	1,500,000
Consumables	Charcoal Bags	4	60,000	240,000
	Wood Shaving Bags	10	2,000	20,000
	Disinfectant Liters	1	20,000	20,000
	Egg Trays Pc	10	600	6,000
	Protective Wear Set	1	50,000	50,000
	Lime Bags	1	27,000	27,000
Vaccines and drugs	IB/ND 1000ds	1	7500	7,500
	GUMBORO 1000ds	1	12,000	12,000
	NCD 1000ds	1	7,500	5,500
	Glucose Pkts	10	600	6,000
	Chick Formula Sach.	4	7,500	30,000
	Assorted Drugs	1	50,000	50,000

Labour		1	400,000	400,000
Miscellaneous & Depreciation				500,000
Mortality 5%			125,000	125,000
Total Expenses (B)				**5,499,000**
Total Income (A)		**950**	**7,500**	**7,125,000**
Profit(A-B)				**1,626,000**
Profit rate (100xProfit/Total Expenses)				**30%**

Total birds sold 950 @7,500 = UGX.7,125,000

Total Profit = UGX.1,626,000

For 5 times a year = 5×1,626,000 = UGX. 8,130,000

Assumptions

1) A day-old chick is at UGX. 2,500
2) Mortality in the brooder is 5%
3) The farmer can stock after every 2 months using the same house, implying 5 times in a year.
4) Duration of brooding is 4 weeks
5) The market for the brooded birds is UGX.7,500
6) All prices are subject to change depending on location and seasons.

Advantages of this enterprise option

- It takes a short time
- It has quick returns - you brood for only 3 weeks and there is minimum deaths because they are more resistant.
- It can be practiced by low income earners using the tradition backyard system of management.
- They are good scavengers-can utilize fodder, suitable for rural areas.

Challenge

You need more space than for broilers.

Table 60: CBA for the option of rearing 500 broiler production (5 weeks) using pellet feeds

Expenses	Qty	Cost (UGX)	Amount (UGX)
Day old chicks' broilers (DOC)	510	2,300.00	1,173,000.00
Broiler pellet crumble Kg	46	2,180.00	100,280.00
Broiler grower pellet Kg	145	2,000.00	290,000.00
Broiler finisher pellet Kg	120	1,880.00	225,600.00
Water Jerri cans	150	200.00	30,000.00
Wood shaving Bags	10	2,000.00	20,000.00
Charcoal Bags	4	60,000.00	240,000.00
Power	1	100,000.00	100,000.00
Feeders and drinkers	10%	502,500.00	50,250.00
Vaccines	1	32,500.00	32,500.00
Drugs & disinfectants	1	70,000.00	70,000.00
Labor	1	300,000.00	300,000.00
Depreciation of building& Misc. Exp.	5%	7,000,000.00	350,000.00
5% loss of birds	5%	1,173,000.00	58,650.00
Total expenses (B)			**3,040,280.00**
Income			
Sale of broilers birds	484	12,000.00	5,808,000.00
Sale of manure bags	12	5,000.00	60,000.00
Total income (A)			**5,868,000.00**
Profit (A-B)			**2,827,720.00**
Profit rate (100xProfit/Total Expenses)			**93%**

Assumptions

1) Feeding of birds is for 5 weeks only with pellets
2) Price of a day-old chick is at UGX 2,300
3) Chick mortality is 5%
4) Feeding to attain 1.75-1.8 kg in 5 weeks
5) Price per bird is at UGX12,000

Note. All costing and prices are subject to change in subsequent years depending on the location, access, season and availability of the products.

This is a good option for farmers because of the following **advantages**:

- Has quick returns
- Requires small capital
- Requires smaller rearing space
- You can use the space up to 7 times in a year revolving the same money.

Challenge

You need to be close to the market to lower transport costs.

Table 61: CBA for the option of rearing 500 layers commercial birds on deep litter (80 weeks)

Expense	**Quantity**	**Cost (UGX)**	**Amount** (UGX)
Layer Commercial	500	3,400	1,700,000
Chick Mash (0-8wks)2kg/Chick	1,000	1,500	1,500,000
Growers Mash (9-18Wks)5kg/Pullet	2,500	1,435	3,587,500
Layers Mash (19-80 Weeks)50kg/Hen	25,000	1,460	36,500,000
Wood Shavings Bags	20	2,000	40,000
Charcoal Bags	4	60,000	240,000
Disinfectant Liters	1	20,000	20,000
Egg Trays Pcs	30	700	21,000
Protective Wear Sets	1	50,000	50,000
Lime Bags	1	30,000	30,000
IB/ND 1vials (1,000ds)	1	7,500	7,500
GUMB.2 vials(1,000ds)	2	12,000	24,000
NCD 7 Vials (500ds)	7	5,500	38,500
IB2 5 Vials (1000ds)	5	20,000	100,000
POX 1 Vials (1000ds)	1	20,000	20,000
Typhoid 5vials (100ds)	5	20,000	100,000
Vitamins Kg	1	60,000	60,000
Dewormers 1.5 Liters	1.5	17,000	25,500
Glucose Kg	0.5	14,000	7,000
Chick Formula Sachets	1	7,500	7,500
Assorted Drugs	500	700	350,000
Labor (85 weeks)	85	40,000	3,400,000
Miscellaneous costs and depreciation of facilities			1,500,000
5% loss of birds and damaged eggs			85,000
Total expenses (B)			**49,413,500**
Income			
300 eggs per hen (10 trays)	5,000	9,000	45,000,000
Sale of aged hens (@12,000)	500	12,000	6,000,000
Sale of manure bags	45	5,000	225,000
Total income (A)			**51,225,000**
Profit (A - B)			**1,811,500**
Profit rate (100xProfit/Total Expenses)			**4%**

Assumptions

1) Feeding and rearing of birds is for 80 weeks
2) Price of a day-old chick is UGX 3,400
3) Mortality is 5%
4) Price of a tray of eggs is UGX 9,000
5) Price of manure a bag is UGX 5,000
6) Price of old birds is UGX 12,000

Note. All costing and prices are subject to change in subsequent years depending on the location, access, season and availability of the products.

Characteristics of this enterprise option

- Not economical for 500 birds or less.
- You need at least 5,000 birds in 5 batches because you need more space.
- You can rear them far from the market and only bring the products to the market once a week.
- They should be in a phase manner. Spread the batches in a systematic manner throughout the year to make use of the same equipment for brooding purposes and to ensure constant supply of eggs throughout the year.

9.7 Labor

Many farms use semi-skilled labor. Labor requirements in poultry depend on the size of the farm as shown in table below.

Table 62: Labor requirements in poultry

Farm size	Number of birds	Equipment	Labor recommended
1. Big farm for broilers	80,000- 100,000 plus	Automatic chain feeders, bucket feeders, nipple drinkers	2 Attendants per 10,000 birds-house 1 Veterinary Doctor 2 Veterinary paraprofessionals
2. Big farm for layers	100,000 plus	Automatic feeding and watering systems nipple drinkers	2 Attendants per 10,000 birds-house 1 Veterinary Doctor 2 Veterinary paraprofessionals
i. Medium farm for broilers	24,000- 28,000	Houses accommodating 4,000 birds, automatic bell drinkers or nipples, manually filled bucket feeders	2 Attendants during brooding, 1 during rearing 2 Veterinary paraprofessionals 1 visiting Veterinary Doctor
ii. Small farm for layers	5,000- 20,000	Houses with a capacity of 2,000 birds, with bell drinkers or nipples and manual bucket feeders/wooden trough feeders	1 Attendant per house and one veterinary Paraprofessional to handle the farm.
iii.Much smaller farms for broilers and layers	Below 5,000	Houses with a capacity of 1,000 birds, with bell drinkers or nipples and manual bucket feeders/wooden trough feeders	Paraprofessional hired according to need.
iv.The small back yard farm	100 and below	Improvised feeders, drinkers	Family labor to run the business Paraprofessionals and veterinarians according to their needs.

Conclusion

Poultry is a profitable enterprise that can improve household livelihoods if:

1. The right enterprise option is selected based on resources available.
2. Effective marketing techniques are used.
3. Expenses are minimized and revenues maximized.

MODULE 10: QUALITY PRODUCTS STANDARDS

10.1 Introduction

A standard is a document that provides requirements, specifications, guidelines, or characteristics that can be used consistently to ensure that products, materials, processes and services are fit for their purpose. Standards are developed by national, regional and international standards institutions often to enforce legislation. These bodies issue specifications for commodities as well as methods of testing. In Uganda the standards for poultry products are developed by the Uganda National Bureau of Standards (UNBS).

10.2 Importance of standards

- Complying with standards reduces losses and ensures that the final product is of high quality.
- Farmers get better prices, traders and processors get reliable supply of poultry products that they can sell to their clients.
- Consumers get food that is safe and nutritious to eat.
- Facilitates both national and regional trade.

10.3 List of Uganda meat and egg standards in enforcements.

1. US ISO 13720:2010, Meat and meat products — Enumeration of presumptive Pseudomonas spp.
2. US ISO 936:1998, Meat and meat products — Determination of total ash
3. US ISO 1442:1997, Meat and meat products — Determination of moisture content (Reference method
4. US ISO 1443:1973, Meat and meat products — Determination of total fat content
5. US ISO 1444:1996, Meat and meat products — Determination of free fat content
6. US ISO 2917:1999, Meat and meat products — Determination of pH — Reference method
7. US ISO 6887-2:2009, Microbiology of food and animal feeding stuffs — Preparation of test samples, initial suspension and decimal dilutions for microbiological examination — Part 2: Specific rules for the preparation of meat and meat products
8. US ISO 6887-4:2009, Microbiology of food and animal feeding stuffs — Preparation of test samples, initial suspension and decimal dilutions for microbiological examination — Part 4: Specific rules for the preparation of products other than milk and milk products, meat and meat products, and fish and fishery products
9. US CAC/RCP 58-2005, Code of hygienic practice for meat
10. US 917:2012, Dressed poultry — Specification
11. US 739:2012, Sausages — Specification
12. US CAC/RCP 15:1976, Code of hygienic practice for eggs and egg products
13. US 733:2017, Handling and transportation of slaughter animals —Requirements (Second edition)
14. US 734:2017, Design and operation of abattoirs and slaughterhouses — Requirements (Second edition)
15. US 736:2017, Hygienic requirements for butchery (Second edition)

16. US 779:2017 Transportation of meat and meat products —Requirements (Second edition)
17. US 778: 2017, Animal stock routes, check points and holding grounds — Requirements (Second edition)
18. US 737:2017, Production of packaged meat products (processed) — Hygienic requirements (Second edition)
19. US 1683:2017, Egg powder — Specification
20. US 1682:2017, Edible eggs in shell — Specification

10.4 East African standards in the development process

1) DEAS 955:2019, Hygienic requirements for the production of packaged meat products
2) DEAS 954:2019, Sausages — Specification
3) DEAS 953:2019, Dressed poultry — Specification

For details on specific standard codes, requirements, specifications and guidelines refer to UNBS.

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APPENDICES

Appendix I: Factors to consider in using an ingredient

Price • Supply • Supplier • Contract terms • Shipping	**Nutrition** • Nutrient levels • Variation • Bioavailability • Anti-nutritional factors
Processing • Pelletability • Grinding • Storage • Handling	**Animals** • Performance • Disease • Palatability • Profit!

APPENDIX II: Drinking Height & Water Control (Nipple Lines & Bell Drinkers

Nipple Lines

1. Ensure even the smaller birds can reach the nipples without standing on their toes or having to jump.
2. Birds can drink reaching straight up.
3. Adjust the line height weekly according to the birds' growth and litter depth.
4. Increase pressure to a maximum of 25 coils.
5. Check that the nipples provide a water flow rate equivalent to the manufacturer's specification.

Bell Drinkers

Height

1. The proper height of a bell drinker is determined by observing the smallest birds.
2. The bell drinker height must be such that smallest female must stretch slightly to drink. It must not be necessary for her to stand on her toes.
3. It must also be at a height that the birds can walk under the bell drinker by merely pulling their head down slightly.
4. A rule of thumb is that the bell drinker lip must be ±6-8cms above the back of your smallest bird. This height works well in allowing easy enough access for the birds to drink as well as helping to control litter condition.

Water access:

Reasons for poor litter conditions often are:

1. No ballasts (weights) on the bell drinkers.
2. Poor height adjustment on bell drinkers.
3. Too much water in the bell drinkers. Half a finger nail is sufficient under normal conditions.
4. Do not walk fast or run in the house which will cause the birds to bump and push the bell drinkers resulting in spillage of water.
5. Regular turning of litter not done.
6. Not removing wet litter soon enough.
7. Another major reason for poor litter can be due to too little air exchange in the sheds to remove moisture and keep the air fresh.

APPENDIX III: Key Brooding Factors

Key Factors	Targets
Chick feathers at placement	closed
Chick Vitality	When turned on their backs should stand up in 2-3 seconds
Crop-fill- at twenty-four hours after placement	95%
Feed area	50% of floor area minimum
Feed on paper	50-65g / chick at placement
Light intensity	25 lux at floor level
Litter moisture level	<35%
Floor Temperature	28 ^{0}C
Pre-heating before placement	24-48 hours
Seven-day weight	4-5 times day old weight
Radiant litter temperature under heater	40.5 ^{0}C (104.9 ^{0}F)
Seven-day mortality	<1%
Water temperature at placement	10-14 ^{0}C (50-57.2 ^{0}F)
Water consumption for the first twenty-four hours	1ml /chick/hour

APPENDIX IV: Chick Quality

Undesired Chick Quality

	**Figure 97:Poor naval quality**
	**Figure 98:Red hocks**
	**Figure 99: Beak, red dots, nostrils contaminated with albumen, malformed beaks**
	**Figure 100: Big yolk residue**
 	**Figure 101: Injuries**

MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES

P.O. Box 102, Entebbe Plot 16 - 18, Lugard Avenue, Entebbe - Uganda

Email: www.agriculture.go.ug

Website: info@agriculture.go.ug