

# CLIMATE ACTION MODEL VILLAGE PROJECT (CAM PROJECT)

Local Poultry Paravet Training Manual

## A TECHNICAL GUIDE FOR USING PROGRAMMED HATCHING MANAGEMENT METHOD



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# **A TECHNICAL MANUAL FOR LOCAL POULTRY IMPROVEMENT USING PROGRAMMED HATCHING MANAGEMENT METHOD**

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# Foreword

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To secure technical support in developing small animal sub sector in West Nile region, in 2012, the Agency For Accelerated Regional Development (AFARD) signed a Memorandum of Understanding with Africa Institute for Strategic Animal Resource Services and Development (AFRISA) a not-For-Profit and autonomous government institution furthering Academic-Community-Private-Public Partnership (ACP3) engagement platform for the College of Veterinary Medicine, Animal Resources and Bio-security (COVAB), Makerere University. Since then, AFARD and AFRISA have undertaken various successful partnerships to propel local poultry production by equipping national and refugee smallholder farmers with basic knowledge and skills in poultry husbandry and especially the new programmed hatching technology. It is in this spirit that this manual was written by Dr. Eneku Wilfred of AFRISA.

Local chicken production has been identified as one of the livestock enterprises with great potential for reducing poverty, malnutrition and gender inequality among rural communities of West Nile regions of Uganda. Although the main aim of rearing the chicken is not for income generation, with the increasing demand for local chicken there is an enormous opportunity that can be tapped to both improve household nutritional needs as well as increased income. This is possible when the key hinderances to increased production and productivity such as diseases, predators, poor husbandry practices, and lack of appropriate skills are addressed. Programmed hatching technology provides a faster means by which smallholder farmers can increase the number of their poultry production cycle in a year while ensuring reduction in mortality of chicks.

By building the capacity of community-based support structures – poultry paravets –in the project villages with relevant knowledge and skills, basic equipment, and linkages to both the market and local government department, committed farmer, as is in other projects, will succeed. “Success is deciding from the start what end result you desire and creating circumstances to achieve it”- (Marker Victor Hansen).



Dr. Alfred Lakwo

Executive Director, AFARD

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# Preface

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This manual gathers existing knowledge on how to improve village poultry production systems with relatively low inputs. It deals with improved free-range systems consisting of small flocks of 5 to 50 local or cross-bred chickens. It also introduces programmed hatching, which makes it possible to quickly increase the number of chicks per flock.

The main target group of the manual is para-veterinarians (= facilitators) involved in the development of small poultry farms at the village level. The intention is that the paravets will extract from the manual the materials they need for training. To this end, each topic is organized into chapters. These chapters can be covered in short training sessions spanning about 6 weeks. This should be possible as the farmers are organized into groups and have regular VSLA+ meetings every week. This manual will help the facilitator prepare the training session in the most practical and participatory way possible.

It is important that the training is conducted in a participatory manner because involvement and learning are enhanced when participants contribute to the discussion. It is therefore essential that participants are encouraged to share their own experiences before the theoretical material is brought to them. Similarly, practical exercises, where participants prepare equipment from local materials, mix local foods, etc., are also important. The participatory method and learning by doing will create a direct link between the training and the challenges farmers face when implementing new methods at home. It is recommended to start each training session with the practical part, before the facilitator gives technical advice at the end of the training sessions.

## Acknowledgement

The following five manuals have been important sources for the development of this manual and for the illustrations presented in it:

Eneku, Wilfred. 2019. "Strengthening Resilient Livelihoods Project (RELIP) Report on Local Poultry Market Assessment in Yumbe District."

Eneku, Wilfred, and Pascale Waelti. 2020. *Action for Livelihood Enhancement in Northern Uganda: Local Poultry Programmed Hatching Management Trainer's Guide*. First Edit. AFARD.

MAAIF. 2019. *Poultry Training Manual For Extension Workers in Uganda Theme : Transforming Livelihoods through Sustainable Poultry Production August 2019*.

Riise, J. C., & Vesterlund McAinsh, C. (2004). *Farmer Field Schools Facilitators Manual On Small-scale village poultry production*. Copenhagen: Network for Smallholder Poultry Development.

Risse, J. C., Permin, A., Vesterlund McAinsh, C., & Frederiksen, L. (2004). *Keeping Village Poultry: A technical manual on small-scale poultry production*. Copenhagen, Denmark: Network for Smallholder Poultry Development.

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# Glossary

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<b>Antibiotics</b>	Substances capable of killing bacteria (germs) or stopping their growth
<b>Bacteria</b>	Very small organisms only seen by a microscope and are known to cause disease
<b>Breeding</b>	The interaction of the females and males purposely to produce young
<b>Broiler</b>	Chicken kept for meat. They grow fast and can be ready from 5 weeks of age
<b>Brooder</b>	A house or room where young birds are reared until they become pullets or cockerels
<b>Brooding</b>	Is the method of raising these birds in the brooder
<b>Coccidiostat</b>	A drug which prevents coccidiosis in animals
<b>Cockerel</b>	Male chicken at the stage beyond a chick but before being able to produce young ones
<b>Contagious</b>	The ability of a disease-causing agent to move from the sick to healthy bird by contact or being near each other
<b>Culling</b>	Removal of one or more birds as a result of poor performance ( poor growth rate, poor egg production, poor hatchability, low chick survival, chronic disease)
<b>Dam</b>	Mother of a young one
<b>Diarrhoea</b>	Passing out watery faeces very often
<b>Digestion</b>	The process of breaking down feed from large particles to very small ones that can be taken into the body
<b>Embryo</b>	The young developing bird inside the egg before being recognized as a chick
<b>Ethnobotanicals</b>	Substances got from herbal plants purposely for treating diseases and parasites
<b>Gasp</b>	Quick deep breaths with the mouth open
<b>Hatchability</b>	The ability of incubated eggs to produce chicks
<b>Inbreeding</b>	Mating males and females which are closely related by blood
<b>Infection</b>	An attack of birds by disease-causing agents
<b>Productivity</b>	The ability to produce products for which the animal is being reared
<b>Protozoa</b>	The simplest of all animals, made up of one cell and commonly cause disease
<b>Pullet</b>	The growing female chicken before it starts laying eggs
<b>Vaccine</b>	A substance, when given to a bird, increases its resistance to a particular disease
<b>Virus</b>	A very small organism that cannot be seen by ordinary microscope and is known to cause disease

# About CAM Project

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The living situation of people in Nebbi and Pakwach districts is characterized by extreme poverty due to a high dependence on traditional subsistence agriculture that has high susceptibility to climate change. The high pressure on natural resources resulted into enormous environmental degradation (only 3.3% of the land is now forested). This situation was exacerbated by the COVID-19 pandemic as many households (58%) reported a decline in income they spent their savings (37%) and depleted their assets. Together, these factors have reduced the resilience of many households to climate, health, and economic shocks.

In order to strengthen the resilience of communities to climate, health and economic shocks, AFARD in partnership with AWO International secured EUR 913,400 from the German Federal Ministry for Economic Cooperation and Development (BMZ) to implement a 3.5-year (Oct. 2022 – March 2026) Climate Action Model Village (CAM) Project in Nebbi and Pakwach districts targeting directly 3,190 people (60% female and at least 10% individuals with special needs) composed of vulnerable smallholder farmers; primary school pupils (P5-7) and their teachers and management committees; district and sub county local government officials; traditional, religious and opinion leaders; and AFARD staffs.

The overall project goal is, “Communities in Nebbi and Pakwach Districts are resilient to climate change, health and economic shocks.” The project specific objective is, “Targeted communities in Nebbi and Pakwach districts have food and income security and serve as replicable examples for Climate Active Model Village March 2026” and this will lead to the following positive gains: 75% of target households are food secure; 65% of target households are income secure to withstand climate, health, and economic shocks; 45% of households plan their family size; Disaster preparedness interventions of CSCGs and SHECs have resulted in a 25% decline of infectious and vector-borne diseases (malaria, covid-19, cholera, diarrhoea, and gastrointestinal worms; Residents of the climate action model villages use the forest planted on 15 acres for their own food (e.g., mangoes and oranges), food preparation (firewood), and health (shade, and utilization of the bark, sap, or leaves for medicines); and 08 climate action villages serve as models for replication through knowledge sharing with local governments, networks of AFARD, universities & partners of AWO International in Uganda.

## **Project Approach**

The CAM Project is planned to empower the population of at least ten villages in Nyaravur and Alwi sub-counties to transform their villages into Climate Active Model Villages through: 1) the establishment of 15 Climate Smart Champion Groups (CSCGs) and 05 School Health and Environment Club (SHEC); and 2) capacity development of these civil society structures on sustainable agricultural intensification, income generation and management, gender equality, sexual and reproductive health and rights, preventive public health, environmental conservation, biodiversity and climate change mitigation. A cooperative will be formed to drive inclusive and sustainable value-added market participation. To attain these results, the project will use a 4-pronged approach:

1. Increasing agricultural production and productivity through intensification of production, technologies used and practices using improved agricultural inputs (seeds, livestock and ox teams) and training in climate- smart agricultural skills (using the resilience design approach) and value addition.
2. livelihood diversification for alternative income generation through promotion of





VSLA, IGA - SPM and financial literacy trainings to target households to enable them to save, identify locally viable investment opportunities, take necessary loans and start/build businesses to generate alternative income for food security and health service utilization among others.

3. Promote public health and prevent preventable diseases in schools and target communities for reduced student absenteeism and increased adult labour productivity.
4. Preserving the environment and biodiversity by changing awareness on the one hand and creating access to sustainable forest and non-timber products on the other, enabling communities to value an intact environment, take action against environmental degradation, green their villages and thus protect the climate.

### Participant Pre-Training Questionnaire

#### PLEASE COMPLETE THIS SECTION BEFORE THE COURSE BEGINS

Date

#### Instructions: Goals, Interests and Expectations Self-Assessment

Participants should be made to know that this is a purpose-driven training that should enhance their ability to achieve their personal/family development goals.

Objective of the session: To identify some individual goals for themselves and their families and align that with their interests and expectations.

My Goal. In the future, I have the following dreams for myself/my family:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

My experiences. I have faced the following challenges in reaching my dreams:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

My expectations: What I would like to get out of this training are:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



# 1. Introduction – Why poultry rearing

## 1.1. Overview of poultry production in Uganda

- Chickens are the most widely distributed livestock among households in Uganda. In 2008, at least half of all households in Uganda were owning chickens and the national chicken numbers stood at 37.2 million (MAAIF and UBoS 2009).
- Poultry production is rapidly gaining popularity. The number of chicken has been increasing by 2.8% in recent years approaching 47.6 million as of 2017, 87.7% of which were indigenous breeds (UBOS 2018).
- 99% of the households own indigenous chickens with an average flock size per household of 6 chickens. The indigenous chickens are mainly found in Eastern and Northern parts of Uganda while the exotics are more in Central Uganda.
- Other poultry species kept alongside the local chicken in the north and west Nile are ducks, turkeys, guinea fowl, and pigeons.

## 1.2. Uses of poultry

Poultry has very many uses among which are the following:

- Source of food: eggs and meat for humans.
- Source of income through the sale of the birds and their products (Figure 1).



*Figure 1: Chicken meat for human consumption (left), sale of whole live bird income (middle) and eggs (right).*

### Other uses include:

- Chicken manure (Figure 2): It is very rich in nutrients for plants.
- Chickens also supply feeds to other livestock, for example, chicken manure, bones, offals, blood, and feathers are important ingredients in animal and fish feeds.



*Figure 2: Manure from chicken house can be composted as good fertilizer for vegetable production. Learning to compost is useful to integrate poultry production with vegetable growing.*

### **1.3. Advantages of poultry keeping over other animals and crops**

Poultry keeping has several advantages over other livestock:

- The market is readily available throughout the year.
- Starting capital is relatively small when compared to other enterprises on a commercial scale.
- Poultry rearing requires little land because of their small size. People in areas where land is limited such as in urban areas or camps can also keep poultry at commercial scale.
- It is one of the key livestock industries that does not discriminate against gender in terms of ownership and nature of work.
- Chickens are acceptable to people from various cultural backgrounds and there are not many common taboos associated with eating them.
- Their small size, short generation cycle, and high-value products front them as a suitable option for food security in limited land holdings, a common feature in an era of the rapid increase of human population in Uganda today.
- Their small size also makes them suitable for solving emergency problems.
- Poultry production is not strictly weather season or soil fertility dependent like crops. Therefore, poultry offers a promising investment opportunity for rural communities.
- Poultry are easy to handle and need minimal physical energy inputs such that even children, Persons with Disabilities (PWDs), Women and HIV/AIDS victims can successfully look after them (Figure 3).





*Figure 3: Persons with disability, such as lameness, can also keep chicken. This may not be possible with large animals that need more strength.*

#### **Advantages of local chickens over other commercial poultry:**

- Local chickens are hardy and can be kept with minimum labour and other production inputs.
- They are mainly kept on the free-range system where they scavenge for their feeds.
- In the northern and West Nile regions, the meat of these birds is preferred to that of broilers. Broilers are perceived to have soft meat with less flavour and so, narrowing their markets to hotels in the region where they are deep-fried.
- Local chicken production is economically viable since the prices are very attractive, with local cocks costing between Shs. 20,000-25,000 per bird as compared to a broiler at Shs. 10,000-15,000 per bird.
- Layer poultry production can be promoted because the demand for eggs within the region and neighbouring countries exceeds the current supply. However, difficulties of accessing high-quality feed, veterinary services and intensive labour requirements limit layer production to few urban centres in the region. Therefore, local chickens remain as good alternatives for income generation and nutrition improvement.

#### **1.4. Production characteristics of local chicken**

The numbers of the indigenous chickens have remained low in communities despite the relatively high value they have in terms of the acceptability of their meat and price locally. This may be explained by the following reasons:

- These chickens are maintained on minimum or no inputs at all.
- They continue to suffer from a variety of preventable diseases, both infectious and non-infectious. The most common infectious cause of death among the chickens is Newcastle disease.

- The birds generally have low production characteristics (Table 1) such as low flock numbers with multiple age groups reared together, few eggs per clutch, low egg and chick weights, poor hatchability (as low as 40%), low chick survival with mortalities ranging from 50-90%, longer sexual maturity period and longer chick-rearing period of up to 3 months after hatching.

**Table 1: Production characteristics of local chicken**

Production parameter	Average value for local chicken
Flock size	Usually less than 30 birds per household
Eggs per clutch	6 to 20 eggs
Egg weight	37 to 45 grams per egg
Hatchability	can be as low as 40%
Behaviour	The hens are broody and after hatching, they take care of the chicks
Chick mortality	50-90%
Mature birds' mortality	1-50%
Age at sexual maturity (marked by laying of the first egg)	6-7 months (4-5 months in commercial layers)
Average length of the laying cycle	15 to 20 days
Incubation period	21 days
Chick rearing period	2½-3 months
Open period after weaning before starting to lay again	3 weeks
whole cycle from laying of the first egg to another laying	140 days

### 1.5. How to improve production characteristics of the local chicken breed

The production characteristics of local chicken can be improved when farmers are trained in basic management practices, timing (synchronization) of laying, programmed hatching and artificial brooding among others. This can improve flock numbers and provide for a quick source of income and the much-needed animal protein in human diets in developing countries. Since most people in West Nile and Northern Uganda have had experience in rearing indigenous chickens, these practices can be readily adopted when farmers are trained and followed-up to ensure the implementation of the practices.

#### Small flock size:

The numbers of birds are low mainly due to low inputs and deaths. To improve this, husbandry methods (Housing, feeds/feeding, breeds and health care) should be improved by each household that intends to keep local chicken on a commercial scale. It is good to rear different age groups separately, especially chicks should be separated and brooded away from their mothers to improve their survival.

#### Few eggs per clutch:

This index can be improved in several ways. First is to improve the breed by crossing the locally selected hens with improved or parent stock cocks for laying breeds or dual-purpose breeds. Secondly, feeding and other management practices should be improved. Thirdly, artificial incubation technologies need to be adopted to support hatching the large number of eggs laid since most improved laying birds are not broody. When improved cocks are introduced to replace local cocks,

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efforts should be made to control inbreeding by adopting regular/periodic cock exchange programs among benefiting groups.

### **Low egg weights:**

Egg weights can be improved by breed improvement and improved nutrition. Identifying cheap local feed resources will greatly improve the quality of eggs laid and the weight of birds for sale. This will also reduce the time taken for birds to reach sexual maturity. Small eggs usually have low hatchability because eggs that lose more than 18% of their water do not hatch. Small eggs have low water content and any normal loss of water during incubation will lower hatchability. In commercial layers, the minimum egg weight required for setting in the incubator is 52g.

### **Poor hatchability:**

Several factors affect hatchability including temperature, humidity, egg storage, egg size, the fertility of males, nutrition and many others.

### **Natural incubation or broodiness (sitting on eggs):**

broody behaviour is advantageous in local birds where no artificial incubation technologies are available. This broody behaviour can be adopted for programmed hatching where a hen is used to hatch several sets of eggs. However, natural brooding reduces the number of eggs laid per hen per year and the number of chicks raised per hen. Broodiness can be eliminated by careful selection and cross-breeding with improved breeds.

### **Low chick survival:**

chick losses can result from diseases and parasites, accidents, predators and bad environmental conditions. When chicks are left to move around with their mothers, they may be killed by rain, diseases acquired from older birds, predators and several others. This greatly lowers their survival. Also, natural brooding (raising the chicks) wastes the productive time of mothers. Adopting artificial brooding for 6-8 weeks before releasing chicks on the free-range will improve their survival and increase the number of laying cycles of the mothers. Also adopting disease control measures discussed in Chapter 5 and 6 of this book will improve chick survival.

### **Periodic deaths of mature birds:**

from time to time, flocks are killed by Newcastle disease. Introducing regular vaccination routine will improve the resistance of the birds against the disease and improve their survival. Newcastle disease vaccines are affordable and local communities can institute effective control programs for a particular geographical area. Other vaccination programs and disease control measures are discussed later in this book.

### **Slow growth rate:**

This is mainly due to low inputs in production and energy lost to scavenging. No deliberate breed improvement efforts may be blamed for the slow growths to some extent. Active identification of local feed resources and breed improvement should be considered to improve growth rates and weights of products from the birds. A minimum regular supplementation has been shown to increase growth and productivity by 30%.

### **Long laying time:**

The birds take 15-20 days to lay on average 12 eggs. This is explainable by the scavenging method of feeding. Birds skip certain days during laying. One needs to ensure a constant supply of feeds to laying hens. After incubation, chick-rearing periods should be taken over by the owner to free the hens to return to lay. Priming hens and making them lay around the same week makes chick-rearing quite easier and encourages proper management (all in, all out) practices.



## 2. Housing and equipment

This chapter is divided into two parts. The first part describes the elements to be taken into account when designing and building a poultry house adapted to the production objectives of poultry keepers. The second part describes the equipment that should be present in chicken houses.

### House types, building materials and specifications

#### 2.1. Why should poultry have houses or shelters?

Housing is essential to protect chicken against:

- predators (like snakes, eagles and wild animals). Young chicken are the most affected
- thieves,
- bad weather (rain, sun, very cold winds, dropping night temperatures) (Figure 4) and
- to provide shelter for egg-laying and broody hens.

A suitable or comfortable poultry house is also important for efficient production and convenience of the poultry farmer



**Figure 4:** Housing should protect against bad weather and predators (source Riise et al, 2004)

The major causes of death or losses of local chicken in the homesteads are:

- Diseases,
- bad weather,
- predators,
- accidents and
- thieves.

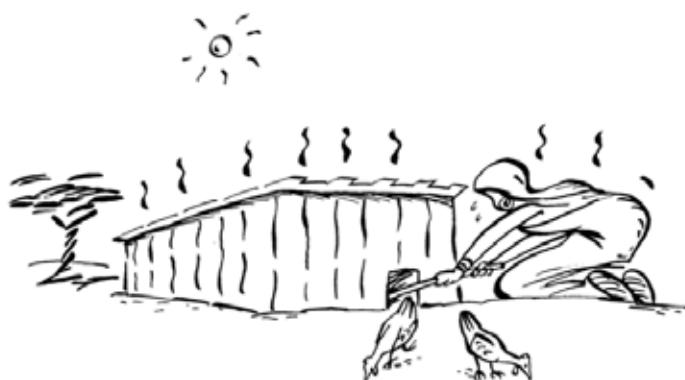
House contributes greatly to controlling these causes of death so that we get more chicken that survive for food and income.

**Note:** Before building a chicken house, you need to carefully consider the site, the materials, and importantly, the costs involved. Use of local materials should be considered as priority.

## 2.2. Choosing the right site

When choosing the right site, you should consider:

- A shady area to keep the house cool. Tall trees close to the houses provide shade and are therefore beneficial. Trees serve as a windbreak and for shade in the dry seasons. The disadvantage is that it allows flying predators to perch nearby.
- A dry raised place with a flat ground to keep the floor dry during the rainy season.
- A well-drained soil is desired. Do not build a house in a swamp or where rain water can enter the house. Water in chicken houses causes release of toxic gas, called ammonia, and germs to grow.
- Clear the grass and bushes for about 3 meters on all sides of the house to keep snakes and rats away from your chickens.
- Build chicken house near the human house for security reasons. You must be able to hear if chickens get disturbed at night by predators, or a thief who wants to steal the birds.
- The house should be built in a way that direct sunrays do not enter the house. This is important for the brooder where the local chicks will stay indoors for about 2 months before going out. This is called east-west orientation of a rectangular chicken house. Direct sun rays promote overplaying and so dust environment from litter results into respiratory diseases. Figure 5 and 6 illustrate a bad and a well-constructed chicken house.



*Figure 5: A badly constructed chicken house is placed in the sun with a low flat roof and no windows making it very hot and not well ventilated. It has a small door, which makes it difficult to access and clean it (source Riise et al 2004). On the right is an example of the house in Yumbe district.*





**Figure 6:** A well-constructed chicken house is placed in the shade, has a high roof and windows with wire mesh, providing good ventilation but preventing entrance of snakes and rats. The door is facing south or north to avoid direct sun. The door is big enough for a person to enter to clean the house frequently (source Riise et al 2004)

### 2.3. Building the house – general principles

What makes up a house? Can we call a wall of bricks, without roof, a house? how about a wall surrounding a hole inside, is it a house?

A house consists of three parts:

- the wall (including the doors and windows)
- the roof and
- the floor

#### Construction material.

- Always use cheap local materials like bamboo, wood, reeds, thatch grass, or clay bricks.

#### The wall (is built before the roof)

- The materials for the wall include: bricks, reeds, and mud (mud-wattle house) or timber offcuts.
- The inner surface of the wall should be plastered to minimize cracks and crevices which parasites like to hide in and ease cleaning and disinfection.
- The wall should be tall enough (at least 2m high) to allow the caretaker to enter the house for cleaning, egg collection and taking care chicken.
- The wall should also have openings (ventilation) like windows with bare reeds or wire mesh to allow fresh air to enter the chicken house.
- The size of the house should enough to take care of the number of chicken you intend to keep
- The roof (you cannot build a roof when there is no wall!!)
- The roof covers the house and shields it from hot sun and rain.
- Use local materials as much as possible.

- The materials for the roof include poles or timber (as frames), thatch grass or iron sheets (old or new sheets) or just papyrus cushioned by a tarpaulin.
- The builder should ensure the roof prevents leakage, direct blowing of rain into the house by the sides of the house. So the roof should extend at least 90cm away from the wall.
- Thatch grass keeps the house cool and is cheap but is prone to fire hazards, not long-lasting and rodents or snakes easily nest in them. Iron sheets are durable but transmit heat readily and are expensive.

**The floor** (a building with a pit inside is likely to be a latrine!!)

- The floor should be made smooth to ease cleaning and disinfection
- The floor can be from compacted marram or concrete. Marram is cheaper than concrete, but more difficult to clean and disinfect. Some people build raised houses with timber floors (Figure 7). Remove the bark from the wood you use, as parasites often hide behind the bark.



**Figure 7:** Raised house with slates built by youth in Pakwach. The inside has timber with spaces in between to allow removal of the droppings.

### Design to have the right climate

- A good house must have enough space for the number of chicken, good ventilation, good dry litter and disease prevention measures.
- Enough space for the chicken present. This is called stocking rate. Do not overstock, otherwise the house will be contaminated easily from chicken droppings. Stocking rate for chicken are shown in table 2 below.

**Table 2: Space allowance in chicken house (stocking rate)**

	Day 1	0.46 sq meters or 5sq ft of brooder/100 chicks
Broilers	Week 1-4	1sq ft/bird or 20 birds /sq meter
	Week 5-8	2 sq ft/bird or 5 – 6 birds/sq meter
	0 – 6 weeks	0.5sq ft/bird or 20 birds /sq meter
Layers and local chicken	7 -13 weeks	1 sq ft/bird or 10 birds /sq meter
	19 weeks onwards	1 -1.5 sq ft/bird or 5-7 birds/sq meter

**Explanation of Table 2:** A guide to stocking rate in the house. Let us take for example the space required to keep 100 layers over 19 weeks of age. If we have a house that measures 3mx2m, the area of the house will be 6m<sup>2</sup>. As in the table, the house will keep 30 chicken (minimum number) and 42 chicken (maximum number).

- Good ventilation: this is to allow fresh air into the house and stale air to escape. Good ventilation also controls the house temperature. Good ventilation also keeps the litter dry.
- Ventilation is achieved through building sidewalls for poultry houses halfway (short walls, the rest of it is a mesh) or having large windows (Figure 10). A good rearing house should have short walls (0.6 to 1metre high) and the rest should be made of wire mesh or reeds/poles.
- House for chicks should have few smaller openings, not as big as for older chicken because chicks need heat. Coldness during the rainy season and windy days can cause severe chilling and death of chicks.
- High temperature may cause deaths, drop in egg production, low shell quality and reduced weight gain. Ventilation also keeps the litter dry and reduces chances for diseases to develop.
- The walls of the house should be tall enough to keep the house cool and appropriate roofing material that reduces heat in the house should be selected.
- The width of the house should be narrow (not more than 9 meters) to enable air to pass across without stagnating in the center of the house.
- The house has to be so large that there is sufficient room for the birds, and so that the air inside does not become too heavy with humidity and gasses. Five to seven birds per square metre are recommended if they are completely housed but up to 13 birds can stay in one square metre in night housing with patches.

### **Perches and nests**

- Placing perches and nests inside the house will safeguard against most predators and help to keep the legs of the chickens and the eggs clean (see section Equipment).
- If the nests are in a quiet place in the house, the hens will feel comfortable and at ease.
- Make the nests and perches easy to remove when cleaning

### **Artificial lighting**

- For local chicken, lighting is only useful for chicks in the first week to reduce frightening in the flock.
- Light in chicken house at night in rainy season to attract insects which are source of proteins.
- Source of lamp include hurricane lamps, solar lights and other potable sources of light.

## **2.4. Chicken runs**

- Runs are enclosed areas around chicken houses that allows chicken to stay when outside the house.
- Fenced areas are also used for feeding, watering, observation of the flock, and collection of eggs (Figure 8).
- Walls of 1.5 – 2-meter high made of clay or woven mat may be used to construct fences.



- A chicken run is relatively costly, but may provide a sort of security to the farmer and is a good occasion to observe the behavior of the birds and detect possible problems.
- It is however crucial that adult birds are left scavenging outside during daytime in order to keep feed costs low.



*Figure 8: Chicken runs may be used for feeding, watering and observation of the flock (source: Riise et al 2004). The bottom photo is a poultry house with a run in Yumbe district.*

## **2.5. Shelters for the mother hen and chicks**

- After hatching, it is important to keep the hen and the chicks close together in a separate cage or room.
- The simplest solution is to use the basket (Figure 9). Such a shelter should primarily protect against adult poultry competing for feed, and against predators, and it should provide a stable environment, sheltering from sun, rain, and wind.





**Figure 9:** Shelter for chicks after hatching. Place the shelter on a mat to protect against the cold (source Riise et al 2004)

**Note:** For programmed hatching, we shall have a separate brooder to intensively manage the chicks and have a house for adult birds to sleep or incubate eggs (also called a rearing house). Alternatively, the cheap option is to have a house with two rooms-one room with specifications for brooder and the other room for old birds.

## 2.6. Brooder

- The brooder is the house for raising chicks up to 8 weeks of life.
- A brooder is built to keep the house warm for chicks to live comfortably. It should not get cold very fast and should be properly sealed so as not to allow in cold air. It should not also allow too much heat to build up inside.
- It has adequate ventilation i.e., windows and ventilators can be opened or closed when necessary

**Note:** Young chicks are very vulnerable to cold, dehydration, starvation and diseases, so care should be taken to avoid these.

## 2.7. Rearing House

- This is a house used for keeping birds after leaving the brooder up to old age.
- Such houses are important in places like camps where land sizes are small and chicken need to be kept indoors to minimize thefts and conflicts.
- The house should have adequate ventilation by constructing a short wall (about 0.5meters high) and the remaining height made of wire mesh or woven reeds (Figure 10, 11 and 12).

- In addition, there should be foot baths at the entrance of the house containing disinfectants (Figure 10).

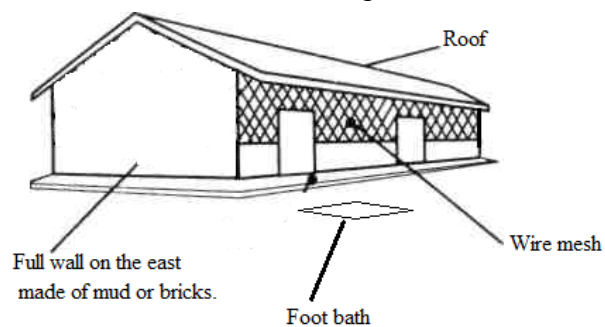


Figure 10: rearing house design



Figure 11: Example of a simple poultry house made of locally available materials

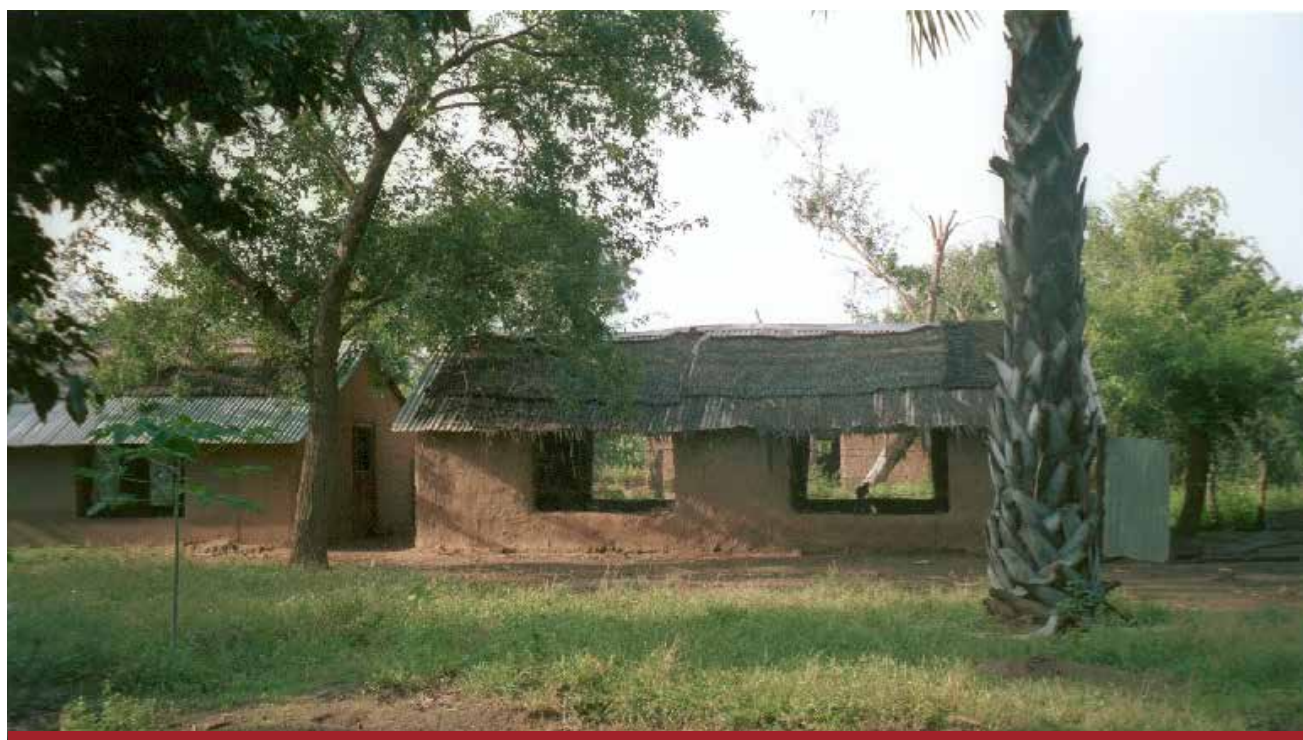


Figure 12: A good example of a chicken house for semi-intensive systems. The trees provide the shade.

## 2.8. Litter

- Various types of materials used as litter include (Figure 13):
  - coffee husks,
  - wood shavings/saw dust,
  - rice husks,
  - crushed groundnut haulms, and
  - chopped maize/sorghum stalks among others.
- The floor should be covered with at least 3-inch-thick litter.
- The litter should not be mouldy. It should be kept dry and friable by replacing wet parts and raking daily.





*Figure 13: some of the different materials used as litter in a chicken house*

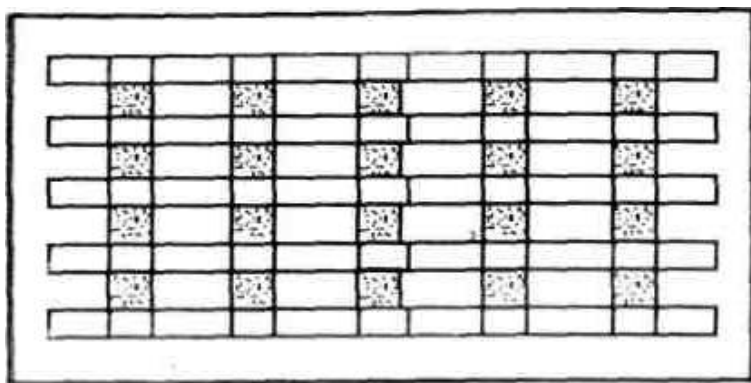
## **2.9. Management of poultry houses**

The underlying principle is to keep the house tidy, clean and safe for birds. Management practices include:

- Cleaning the area around poultry house
- Removing any dead birds found in the house, burying or burning immediately. They should not be thrown in a rubbish pit.
- Keeping unnecessary visitors away from poultry units.
- Carrying out routine repairs on the house as depreciation sets in with time.
- Fencing off the poultry houses with materials such as natural trees, wire mesh or traditional fences of woods and reeds, whichever is possible.

## **2.10. Stores (for feeds, eggs, and equipment)**

- This could also be a house (or room) for storing farm harvests.
- The feed store should be a room or a house that does not leak and minimizes entry of rats.
- The wall should be plastered and the finishing made with a slippery layer of cement (or any slippery material) to avoid rodents from climbing and parasites hiding in them.
- The door should also be fitted firmly.
- The store should have slates or raised structures on which feed/egg trays are packed to avoid contact with the floor (see Figure 14). Sacks of food should be packed in stacks with spaces between them for air circulation.
- You should always avoid the use of rat poison in the store as it can contaminate the feed. Resort to traps or cats.



*Figure 14: Rack on which feed in sacks can be piled (left) and feeds packed with spaces in between on racks (right)*

### **2.11. Sickbay/ Isolation room**

- Have a separate house where sick chicken can be isolated and treated. You could also have a separate room to quarantine new chicken brought from another farm to your home.
- In the sickbay, you keep birds which you suspect to be sick, unproductive and injured e.g., by accident or wild animals. At times sick ones can be kept in an isolation unit or sickbay from where they can be watched closely and treated or culled in case of a contagious disease.
- Birds that are very sick should be disposed of as they may not regain their production ability to the maximum.





## Equipment

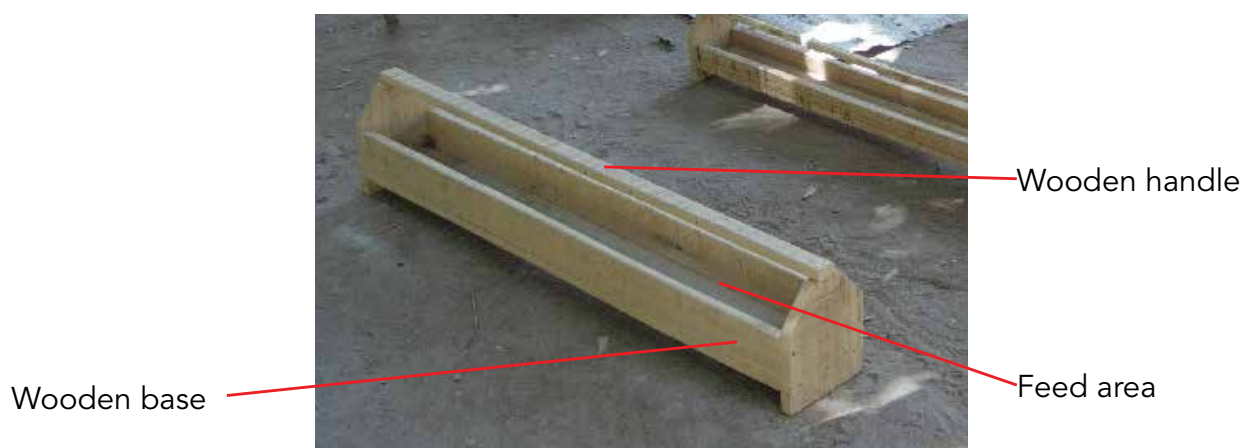
This section explains why different equipment are important for poultry rearing and the main characteristics of well-designed and cost-effective equipment.

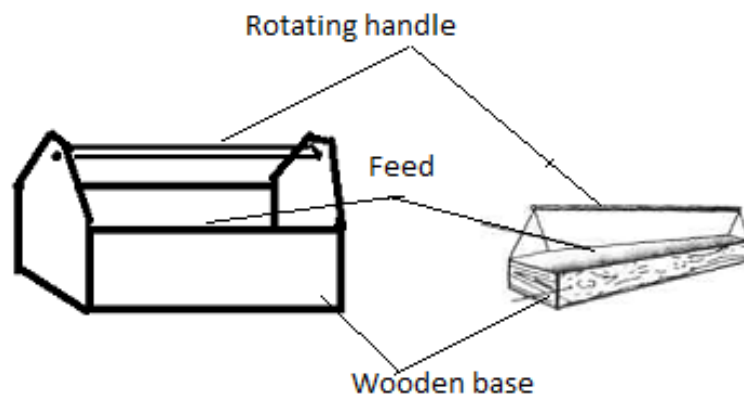
### 2.12. Feeders and drinkers

- Feeders and drinkers are similar, whether being used in free-range, improved free-range systems or small-scale confined systems. They may be linear or tubular (Figure 15 and Figure 16).



*Figure 15: Tubular feed troughs*





**Figure 16: Linear feed troughs.** A rotating handle prevent birds from roosting and defecating in the feeder

- Feeders and drinkers should always be kept clean to prevent spread of diseases.
- They should be big enough for several chicken to feed at the same time. One-meter linear trough or a 35 cm (diameter) tube feeder is big enough for 20 adult birds to eat. A similar diameter of drinker is enough for 40 chicken to drink.
- The feeders can be constructed locally as an activity in the farmer groups. A feeder should have at least the following measurements:
  - 2cm per chick along one side of the linear feeder
  - 5cm per bird for growers and
  - 12cm per bird for adult chicken.
- They should be constructed to meet the following requirements:
  - » Easy to clean and fill.
  - » It should not allow feed spillage or wastage.
  - » It should not allow feed contamination by droppings (faecal matter).



### How to make local Feeders and drinkers

- Feeders and drinkers may easily be produced out of local materials. For example, an empty tin placed upside down on a plate forms a good drinker. By keeping the tin upside down, you avoid dirt contaminating the water (Figure 17, 18 and 19).
  - Making the drinker:
    - » You start by making two small holes near the rim diagonal to each other.
    - » Pour clean water in the can.

- » Put a flat plate with a small rim on top and turn the tin and plate upside down, while pressing them against each other.
- » Gently place the drinker on the ground. The rim of the plate should be low enough for small birds to drink, but also high enough for adult birds to dip their wattles to keep them cool during hot weather.



**Figure 18:** In this example, buckets and platters purchased at the local market are used. Two holes are made at the bottom of the bucket, as in the previous example, to allow the water to come out gradually.

- Drinkers may be improvised locally from jerrycans by cutting two strips to create openings on one of the broadsides and close the lid. The opening should allow the head of a bird to pass to drink water. Place the jerrycan on the opposite side which is not cut and fill with water.
- Drinkers should not be too deep for chicks to access water and should not allow water spillage in the litter. The drinkers for chicks should be shallow to avoid drowning.
- Commercial feeders and drinkers may also be bought at the market, either in metal or plastic types (Figure 17). They are often expensive and normally not any better than locally produced feeders or drinkers.

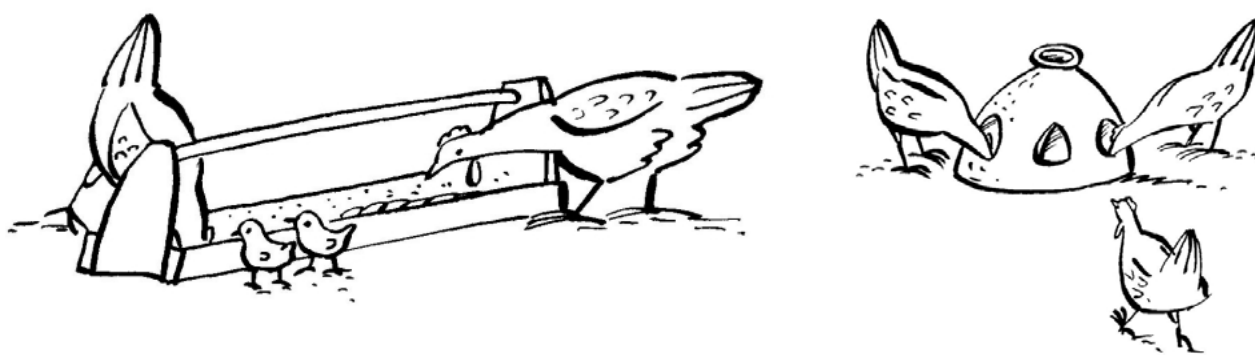


**Figure 19:** Improvised drinkers for chicken. Top is a drinker made by a female paravet in Erusi, Nebbi district

- Linear feeders are easy to make from wood, iron sheets or clay. Metallic feeders are easy to clean and disinfect. Wooden feed troughs are cheap but difficult to disinfect.
- It is important that the feeders are constructed in such a way that feed waste is avoided. Also feed waste can be decreased if feeders are not filled to the top. It is better to fill feeders just half full and then check them regularly for refills.
- Linear feeders should have a rotating bar on top to prevent birds from perching and defecating on the feed. The bar also limits the space with feed surface and so preventing birds from entering the feeders and causing wastage by scratching). More examples of how to make linear feeders and their use are shown in Figures 20, 21 and 22.



*Figure 20: Feeders will keep food clean and reduce food loss*



*Figure 21: Feeders and drinkers may also be made locally of wood, clay, or metal (source Riise et al 2004)*







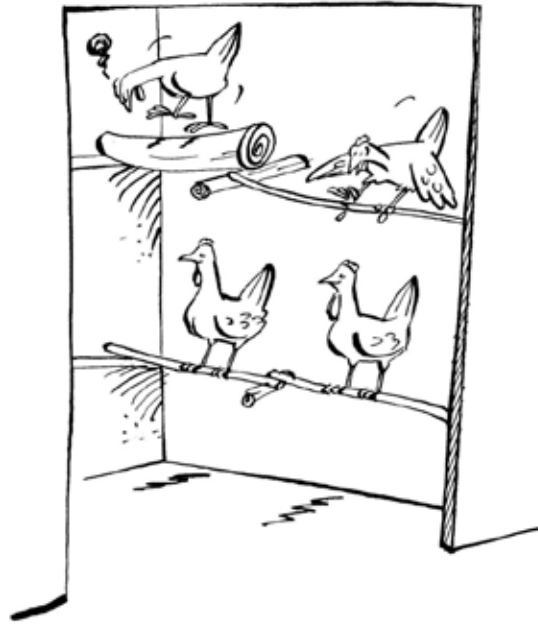
**Figure 22:** In this training session, participants learn how to construct linear feeders from wood and from iron sheets

### 2.13. Perches

- Perches (Figure 23 and Figure 24) are important for chickens to rest during night. Perches make the chickens safe, just as they would sleep in trees in the wild.
- Perches will also help the chickens keep their feet clean, since they will not get their feet contaminated in their droppings. Also, the eggs will be cleaner because the chickens will have cleaner legs when they enter the nest
- Parasites may attack poultry resting on the floor, and perches often reduce the risk of external parasites entering the feathers at night.
- To prevent attack of external parasites, the perches may be treated with oil or kerosene, where the perch meets the wall.
- Each one-meter perch may roost five adult birds.
- Perches are best made of bamboo or round sticks to accommodate for the size and structure of the birds' feet (Figure 23). They should not be too thin or too thick. If the sticks are too big or too small, the birds may fall.



**Figure 23:** Sticks should match the size of the bird's feet (source Riise et al 2004)



*Figure 24: the perches must be of the right size, whether to sick, nor to thin. Otherwise, the birds will feel uncomfortable and fall down (source Riise et al 2004)*

#### **2.14. Nests**

In many villages, nests are not provided for the hens and eventually the hens will lay their eggs on the ground or in bush, where they may be difficult to find. Some poultry farmers build nests on the ground outside the chicken houses. This should be avoided, as eggs outside houses are more exposed to predators and thieves. Figure 25 shows a nest with eggs outside a kitchen.



*Figure 25: Nest hanging on the varenda outside the house in Amuru district. The chicken is incubating the eggs but some eggs are exposed to cold air through the broken nest (arrow). This will cause some eggs not to hatch*

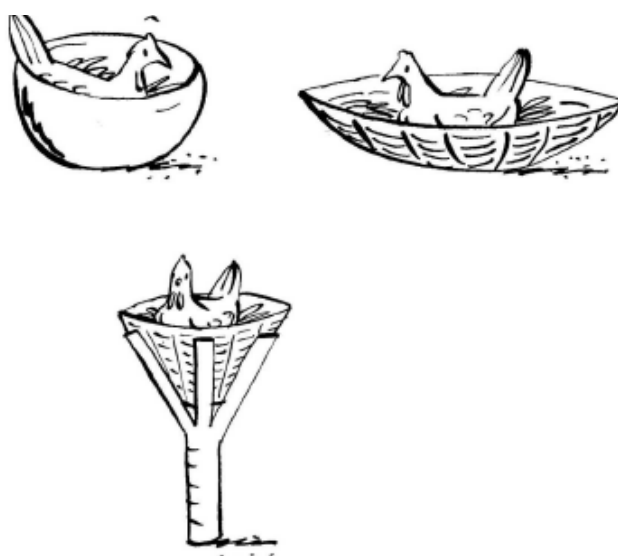


- Nests should be placed inside the chicken house and preferably above the ground.
- The nests for brooding must be individual nests, that only takes one bird at a time. The nest should be placed in a quiet and dark place, on the floor or raised above the ground to avoid dampness and they must be easily removable (Figure 26). Once the hen is broody it is necessary to remove her to a different place, e.g., to another room, to avoid other hens disturbing her, or even going broody as well.



*Figure 26: Nest for broody hens should be placed in a quiet place (source Riise et al 2004)*

- Simple nests may be clay pots, calabashes or baskets made of local fibres, cardboard, or wooden boxes, cut jerrycans, basins or shallow excavations (Figure 27).
- Nests should be of the right size for the hen to feel comfortable. A nest box will typically measure 30 x 30 x 30 cm. Don't make them too big, as the hen will not feel comfortable. A calabash or nest basket may measure 40 x 20 x 25 cm (upper diameter x height x lower diameter). A clay pot, more or less the same.



*Figure 27: Simple nests for broody hens should be easily transported (source Riise et al 2004)*

- A simple and attractive nest for the broody hen may be prepared by following these three steps (Fig. 28):
  1. Make sure that the pot or basket is clean and dry;
  2. Fill sand mixed with ashes up to 1/3 of the depth;
  3. Put clean, soft nesting material (hay or straw) on top up to 2/3 of the depth.



*Figure 28: Three steps in preparing a nest (source Riise et al 2004)*

- The sand at the bottom of the nest should be covered with enough soft litter about 5-8cm deep. The litter may be old clothes, cotton, dry grass, coffee husks, and any other soft damp-free material.
- Mixing ashes, tobacco leaves or other anti-parasitic substances with the nesting material will keep out most external parasites. External parasites in nests may reduce the hatchability of eggs, as they irritate the hen and it leaves the nest to go and scratch itself often, leaving the eggs cold.
- For several hens laying, you may have a battery of nests where more hens can lay at a time. Nest Boxes made of wood such as in Figure 29 can be constructed. They measure 30cm long by 30cm wide by 25cm high. A hole or cage on this nest caters for a bird.



*Figure 29: Battery of individual nests. The one on the left has wide entrance while the entrance of that in the right is reduced (source Riise et al 2004)*



## 3. Feeding

This chapter on feeding is divided into four parts, 1) the nutritional value of feeds, 2) the availability of feed, in particular through the development of a feeding calendar, 3) the dietary needs of poultry, and 4) how to make feed mixing at home, explains simple production techniques of insects as feed at home.

### Nutritional value of the feed

Advice on feeds and feeding will be different for free-range, improved free-range systems or small-scale confined systems of poultry production, basically due to different economic situations. In the following, we will focus only on improved free-range systems and discuss the importance of feed requirements, feed types, feed mixing, and feed costs.

#### 3.1. Why give supplementary feed?

- Chicken, like any living animals, eat to be alive, to grow and then produce (eggs/meat) or reproduce (mate and get offspring).
- Supplementary feeding is essential if you want to increase the production of meat and eggs from local poultry and improved breeds.
- Even small flocks will eventually starve during certain periods of the year, if they are fed only leftovers and the feed they find by scavenging.
- Lack of feed or water will reduce the birds' resistance to diseases and parasites, and subsequently increase flock mortality.

#### 3.2. What to feed?

- In general, poultry, like other animals, need feed containing energy and protein, as well as vitamins and minerals.
- The need for feed will change, depending on the age and status (chicks, grower, egg layer, broody hen) of the bird.
- The cheapest way to supplement the diet of your poultry, is to use local resources.
- However, many vitamins and nutrients are destroyed if stored too long or under suboptimal conditions, e.g., high humidity and heat.

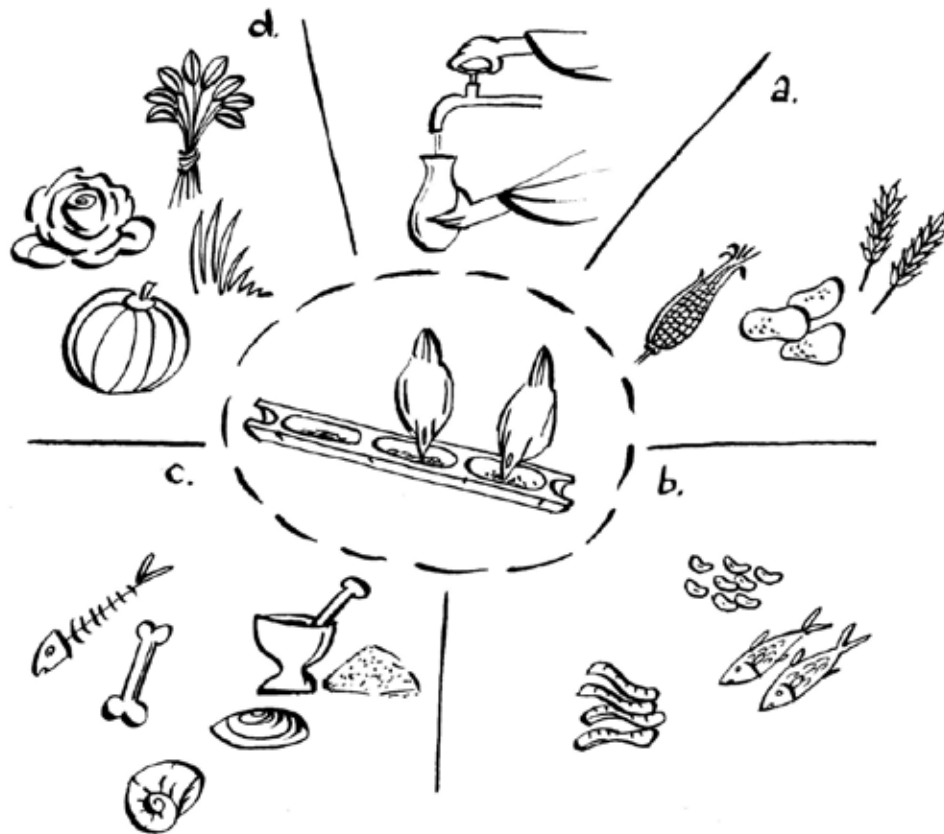
#### 3.3. Types of feeds

The nutrients that must be present in feeds are

- water
  - carbohydrates
  - fats and oils
  - protein
  - vitamins
  - minerals
- } Energy sources

When all these nutrients are provided in the feeds, then it's a balanced diet.

Depending on the type of feed, it will contain more or less energy and protein, as well as vitamins and minerals (Figure 30).



*Figure 30: Feed types divided into sources of nutrients: a = energy, b = protein, c = minerals, d = vitamins. Water should always be available (source Riise et al 2004)*

### Energy feeds

- Energy feeds are the most important feeds to maintain the body functions and keep the chicken active. Normally, at least  $\frac{3}{4}$  of a poultry diet is made of energy feeds.
- The energy in feed is mainly supplied as carbohydrates ("sugars") but sometimes fats and oils as well.
- Cereals (grains), root tubers are the most important energy feeds.
- The cereals and their waste products found in the north and west Nile regions of Uganda include maize, maize bran, rice, rice bran, millet, malwa waste, wheat waste, sorghum and kitchen/brewer's refuse from any of these.
- The root tubers include cassava, sweet potatoes, yams, plantain and banana meal.
- Roots and tubers should be soaked in water for 60 minutes or cooked before drying to remove harmful substances. The proportion in the diet should be kept below  $\frac{1}{10}$ .

### Protein

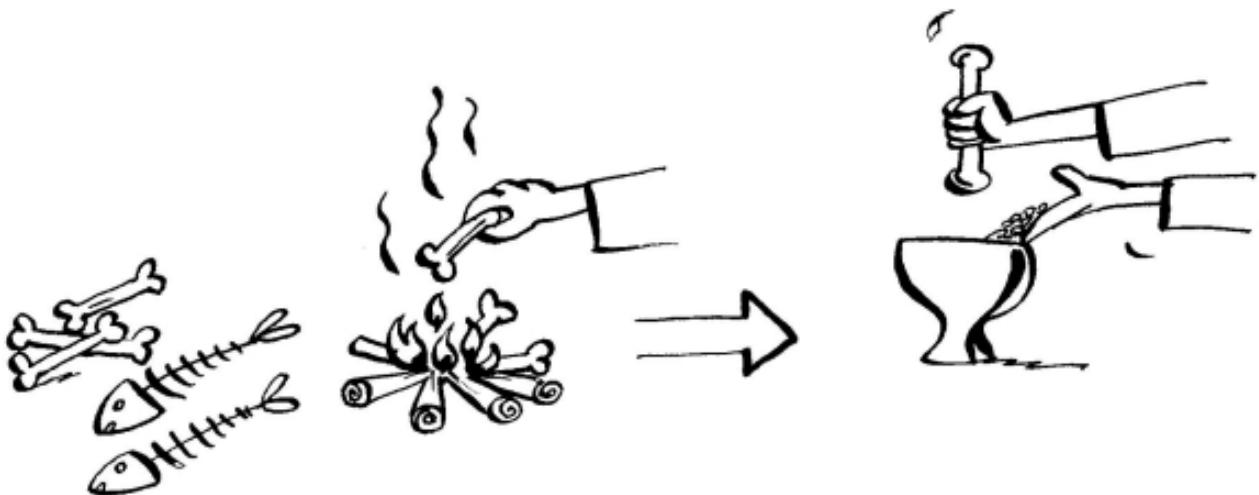
- Proteins are body building foods. They are needed for growth and keeping up a good health status.
- Normally the diet should have about  $\frac{1}{5}$  of total mixed feed made of protein-rich feeds, as they are very expensive.
- Growth of birds like in other animals is rapid when they are young, and therefore good quality proteins should be supplied for chicks to grow fast.
- A high level of protein is needed by egg-laying birds since birds release a lot of

protein in eggs.

- Protein may come from either animal sources or plants.
- Plant sources of proteins include leguminous seeds such as cowpeas, beans, and oil cakes from e.g., ground nuts, cotton seeds, palm kernels, and coconuts.
- Harmful substances are present in some protein-rich plants, e.g., beans.
- All plant-based protein sources must first be roasted or cooked like for humans before grinding and mixing. Heating removes bad substances that prevent digestion of those legumes.
- Examples of protein-rich local feeds from animal source are: maggots, termites, insects, earth worms, meat scraps, fish scraps (such as Mukene/Nkenje, fish processing wastes), fish meal, meat meal, bone meal, blood meal, feather meal. Fish and their waste products like offals are the easiest to get for chicken in areas around fishing communities.
- Insects have emerged as a good source of proteins with the potential of raising reasonable quantities for chicken in the backyard. In the rain season, chickens in the scavenging system have access to the insects as they roam around. At night, providing light in chicken houses can attract insects like white ants and flies into the chicken house. The light is best hanged above a tray of water to trap the insects. Other sources of insects that can be raised include termites and fly larvae (maggots). They can be raised by the methods described in chapter 3.4.

## Minerals

- Minerals are important for bone formation, eggshell formation and a good health status.
- The most important minerals are calcium and phosphorous. To produce strong shells for their eggs, laying hens need free access to calcium (limestone or crushed shells). Adult birds are usually able to balance their intake according to their needs.
- Examples of sources for minerals are: bone meal, crushed oyster shells, snail shells, common salt, premixes, lime and burned eggshells.
- Using bone meal or eggshells is a good way of balancing the calcium and phosphorus levels. Eggshells should always be scorched or cooked before re-use in diets to remove any disease germs, see Figure 31





**Figure 31: Scorching bones or eggs shells to produce calcium-rich bone meal (source Riise et al 2004)**

### **Vitamins**

- Vitamins are nutrients required by animals in small amounts.
- Vitamins A, B2, and D3 are considered very important because many problems arise when birds lack these vitamins.
- Sunlight and green grass or green fodder normally provide Vitamin A and D, whereas Vitamin B may come from fresh cow dung.
- Vitamin B may also be added by giving e.g., Riboflavin tablets. Additional vitamins may be given in very small quantities and purchased through drug stores or feed sellers, but this is normally not needed for scavenging poultry.
- Confined birds always need additional vitamins mixed into their feeds. In high laying birds, supplementation with factory-made vitamins is necessary. Vitamin deficiencies are common in young birds and so their feeds during brooding should be supplemented.

### **Water**

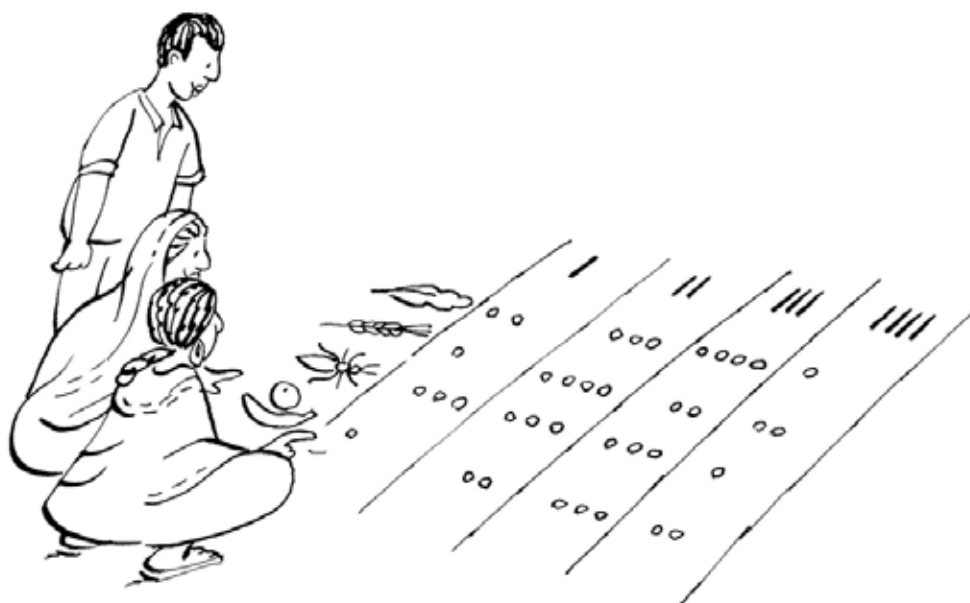
- About 60% of the bird's body and 65% of the egg is made of water.
- Clean water must be provided to poultry at all times!!!
- Often, chickens in villages are not provided water specifically for them. They drink from small ponds or dirty water after washing utensils or clothes. This may lead to the spread of diseases such as Newcastle disease or parasites.
- Water intake increases with an increase in environmental temperature. A high level of salt in the diet also increases water intake.
- Lack of water can seriously retard growth and reduce egg production, especially in hot areas, like some northern parts of Uganda. Lack of water can cause death of chicken in a day or two in confined birds.

## **Establishing a seasonal feed calendar**

- Feeds are scarce in some seasons of the year. Chickens compete with humans for food.
- It is important to plan for seasons of scarcity and store feeds when they are abundant.
- We should plan to reduce numbers of chicken in the seasons of scarcity too. For example, we should avoid raising young chickens during seasons with very limited feed supplies.
- This is possible through programmed hatching or just selling or eating the eggs if hatching is likely to be in season of scarcity.



- Maybe during some months, it is only viable to keep a few hens and a cock on maintenance level in order to start a production of chickens when feed supply increases.
- On the other hand, it may be profitable to grow some feed for chickens if they can be raised at times of the year when market prices are high.
- The seasonal calendar should be drawn in participatory way, together with the facilitator and trainees (Figure 32).



*Figure 32: Seasonal calendar (matrix) showing the types of nutrients available in each season (source Riise et al 2004)*

## Nutritional requirements and feed mixing at Home

### 3.4. Feeding Methods

- The predominant method of feeding indigenous chicken in Uganda is scavenging in the free-range system. It is a very low-cost method in terms of feed costs and labour requirements.
- The free-range system is advantageous in that poultry find the majority of their feeds by scavenging the surroundings. In the process, they pick greens, insects, earthworms, nuts, grains, and grits necessary for crushing feeds in the gizzard.
- The best time for scavenging is early morning and late afternoon, as there are most insects and less heat.
- Scavenging, however, has its disadvantages such as exposing birds to diseases and predators, birds spending energy for growth and production on hunting, worse when feeds are scarce as in dry season.
- Therefore, scavenging does not meet the daily requirements of productive birds and so the need for supplementation with mixed feeds.
- The best time for giving supplementary feed will be in the morning and in the evening, when the birds come back to the house.

- The mixed feed is presented to chicken in feed troughs near water containers.
- Ad libitum water should be provided in shady areas during the day to avoid heat stress.
- Small chicks should be kept in confinement for the first 6-8 weeks (see Chapter 7).

### 3.5. How much to feed?

- If the birds are scavenging, we supplement their diet with about 30-40 g of feed/ bird/day from week 4-6 and onwards.
- If adult birds are not scavenging, give them a feed supplement of at least 70g (seven tablespoonful) per bird per day (Table 4).

**Table 4: Amount of feed given and eaten at different ages of local poultry (source Riise et al 2004)**

Age, weeks	Amount given to each bird per day (g dry weight)	Amount eaten per day per bird (d dry weight), incl. scavenging
1 week	10-15 grams	12-15 grams
2 weeks	15-20 grams	15-20 grams
3 weeks	21-30 grams	21-35 grams
4-6 weeks	30-40 grams	35-50 grams
8 weeks	30-40 grams	55-60 grams
16-27 weeks / growers	30-50 grams	65-80 grams
28 weeks / adults	30-50 grams	100 grams

**Explanation of the table:** Chicks should be fed throughout the day at a rate of 12g per chick per day in week one, then 20g in week two, increasing by at least 5g per week until 50g per bird per day. This is for chicks in artificial brooding, the recommended method in programmed hatching.

The chicks are released out at 2 months of age and then supplemented like adult birds.

- To assure a stable egg and meat production, it is better to give a little feed on a continuous basis, than to give large quantities during harvest seasons or festivals and no feed during lean seasons.
- If feeds are too costly, you should consider reducing your flock size, rather than reducing the amount of feed given to each bird.

### 3.6. Feed mixing (concentrate) for adult birds

- In free-ranging birds, concentrate feeds are used for feeding the chicks and supplementing adult hens that scavenge for food.
- Formulating and mixing of poultry feeds may be based on simple assumptions about the nutritional requirements of the birds and the content of the feedstuffs.
- Locally available ingredients should be dried in the shade (the sun may destroy important vitamins) and grounded in a mortar before mixing.
- A good feed must have energy feeds, proteins, vitamins, and minerals. All these must be balanced.
- Energy and protein sources form the bulk of feed and so they are called base feeds in feed mixing. Minerals and vitamins are added in small amounts.



- As a common rule, for adult birds the ratio of energy to protein a diet should be 2:1, meaning, if you mix a feed of 3 kg, two kg will be energy sources (like maize, maize bran, cassava flour, etc) and one kg will be protein source like fish. Other supplements (vitamins and minerals) are then added to make the food complete (balanced diet). Box 1 gives an example on how to make a 10 kg feed mixing.

### Box 1: Example of calculation of a feed mixing

If we are to make a 10kg simple diet for supplementation in the ratio 2:1:0.5 for Energy: Protein: Vitamins and minerals, we can proceed as follows:

Energy =  $2/3.5 \times 10 = 5.7\text{kg} = 6\text{kg}$

Proteins =  $1/3.5 \times 10 = 2.9\text{kg} = 3\text{kg}$

Minerals =  $0.5/3.5 \times 10 = 1.4\text{kg} = 1\text{kg}$

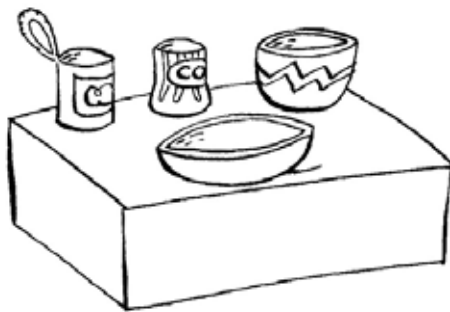
Therefore, all your energy sources like maize, maize bran, millet should equal to 6kg. Also, protein sources like fish, soybean, beans, and others should equal to 3kg. Likewise, minerals and vitamin premixes should add up to 1 kg. We can, therefore, have a simple diet as in Table 6 below.

**Table 5: A simple calculated feed formula for local birds**

Ingredient	Amount (kg)
Maize	2
Maize bran	3
Millet/brewer's waste	1
Fish	2
Soybean/beans	1
Shells (or lime)	0.5
Salt	0.25
Premix	0.25
<b>Total</b>	<b>10</b>

- Once the formula is generated as in the example in box 1 above, you then mix the feed by first mixing the small items before including them gradually into the bulk feed. This will ensure a uniform mix of the ingredients.
- Locally available containers such as tomato tins or matchboxes may be used for easy measurement of the different ingredients (Figure 33). Grams or percentages should be transferred into local quantities for field practice.





**Figure 33: Different containers (plastic bottles, tin cans or calabashes) contain different amounts (source Riise et al 2004)**

- We first mix premix and salt to get 0.5kg. Then we add that to shells to get 1 kg. Then add the 1kg formed to either 1kg of fish or millet flour. We continue the process until we mix all the ingredients into one feed of uniform color.
- You mix by a spade on a clean floor while small ingredients are mixed separately in another container like a basin. This gradual mixing of feed items is what is called progressive mixing and is recommended. The one in which you first pour bulk feeds on the floor before adding small ones will result in nutrient imbalance.
- The young chickens will need relatively more protein in their diet than adult birds, so the best solution is to mix two different kinds of rations for young and adult birds, respectively. Table 9 gives an example of a simple ration for supplementing chicks.
- If you do not want to mix two different rations, you can alternatively give a little extra supplement of a good protein source to the young chickens, e.g. maggots and termites during the first 6 weeks
- Alternatively, a chick starter ration can be used during the first 4-6 weeks of age. In this way you will ensure that the chicks are provided with everything they need during these most vulnerable weeks.
- If a mixed feed is not available temporarily, at least supplement with kitchen refuse, trapped or raised insects/earthworms, green vegetables, milling residues, offals from fish processing, blood meal.
- Dried and ground vegetables or even ruminal contents are also good alternatives for dry matter in periods of scarcity. Green vegetables bring out the deep yellow colour of the egg yolk, which some customers prefer.
- Birds fed on greens should be dozed against worms monthly. Before greens are fed to birds, they should be washed in a solution containing salt (to kill parasite eggs / larval stages) and rinsed with fresh water.
- Do not give too much common salt to chicken as it damages their kidneys.

### **3.7. Feed Storage**

- In general, you should not store mixed feed more than a few weeks to avoid contamination from mould, bacteria or get damaged by rodents. It is recommended that feed should be as fresh as possible and if possible, not stay for more than one month (maximum 3 months).
- Feeds should be piled on racks or raised structures from the floor to avoid dampness.
- The store should be leak-proof and free from vermin like rodents which cause feed wastage and disease spread.





### 3.8. Twelve simple rules for feed management

Before buying, mixing, and storing feeds, it is important to stick some underlying principles of good feed management. It is crucial to:

1. Use local feed ingredients for local birds;
2. Know the quality or feed value, and changing prices of each feed ingredient;
3. Buy missing feed ingredients, such as vitamins or protein sources locally;
4. Change the feed formulation depending on availability, quality or feed value, and changing prices;
5. Reduce the flock size in free-range systems during lean seasons and if the feed becomes too costly;
6. If you change feed and feeding level, always do it slow and gradual;
7. Mix feed ingredients uniformly in relatively small quantities to avoid too long storage time;
8. Use locally available materials such as tomato tins or matchboxes for quantifying the different ingredients to be mixed. Grams or percentages do not work in practice;
9. Store mixed feed or feed ingredients separately upon a platform approx. 30 cm above the floor;
10. Stop the entry of rats, pigeons, or other type of birds into the feed store room;
11. Make sufficient ventilation of air so that the feed ingredients are not wet due to humidity;
12. Be careful that feed ingredients, which are moldy, discolored or from which pests have eaten, are not used.

### Simple techniques for feed production in the field

- Maggots and termites are excellent and cheap sources of protein for chicken. However, they will only be a supplement to other feeds.
- Give the maggots or termites to the small chicks, as they have the biggest need for a good protein source.

### 3.9. Simple techniques for growing maggots (Source: Riise et al, 2004 MAAIF, 2019)

Maggots may be grown by a simple technique and used to supplement the diet of the young chicks (Figure 34).

- 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, and the maggots will feed on it.
- Leave the pot open during daytime and closed during the night.
- After 5-10 days (depending on temperature), when the maggots are ready to pupate, you collect the maggots by gently pouring water into the pot. The maggots will float and you can then wash them, and feed them directly to the birds.
- Remember to place the pot away from public places, as the smell at times may be offensive.



Figure 34: growing maggots (source Riise et al 2004)

### 3.10. Simple techniques for growing termites (Source: Riise et al, 2004 MAAIF, 2019)

Figure 35 shows a simple method for growing termites to be applied in dry seasons.

- Take a pot with a short neck and a capacity of at least 10 liters.
- Fill it up with cow dung and straw, and sprinkle it all with a little water.
- Set the pot upside down with the opening on dry soil.
- After one day and one night, the pot will have termites. You empty the contents in front of the hen house in the morning.

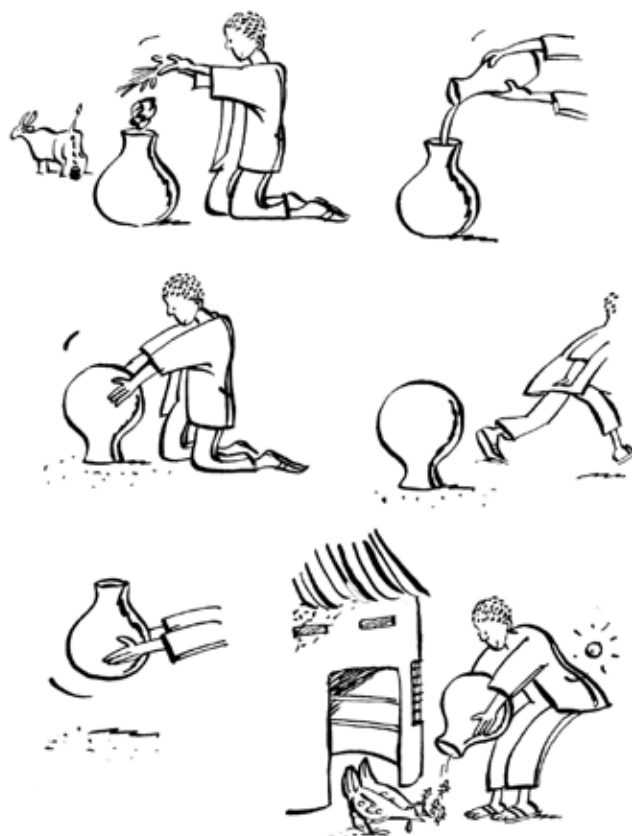


Figure 35: growing termites (source Riise et al 2004)



### 3.11 Poultry vices

Abnormal behaviors can develop in poultry flocks at any stage, whether in the brooder or adult stage. Factors that may result in vices in chicken include overcrowding, insufficient feeds, deficiency of some nutrients like protein, phosphorus and salt, imbalanced light distribution in house or just learned behavior from exposed cloaca during egg laying. Having open nests, rough handling eggs that cause them to break can promote cannibalism and egg eating. The types of vices in chicken include:

- Cannibalism (pecking one another),
- Egg eating
- Toe and vent pecking
- Feather pecking

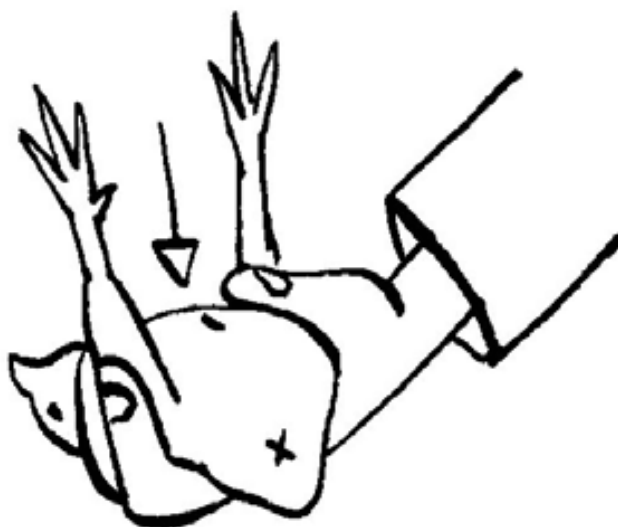
These vices may cause death of birds. For example, massive cannibalism may cause removal of intestines of fellow hen and so its death.

## 4. Breeding

- Selection of healthy and sound-looking chicken in the villages or markets is important, if you want to assure a healthy flock and a high productivity. You should therefore know how to judge the quality of different breeds in different ages and sex, based primarily on their looks, vocalizations and behavior.
- In the following, we will introduce simple guidelines on how to select a sound bird at different ages, and introduce what to consider in terms of breed selection.

### 4.1. Chicken Selection

It is important to look for different features in chicks, growers, hens and cocks. Select or buy your new birds early in the day, as stress from lack of water, feed and rest, will make most birds look rather sick and drowsy.



*Figure 36: A clean dry inward navel is a good characteristic of a healthy hatched chick (source Riise et al 2004)*

A healthy, newly hatched chick should have the following features (Figure 36):

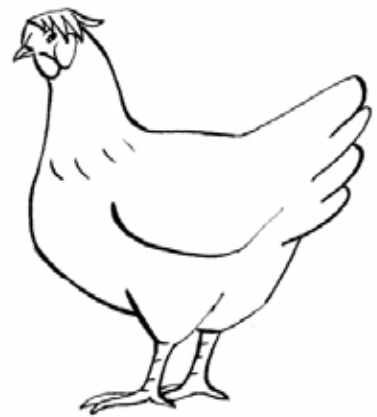
- » Well-developed body length and depth
- » Shiny, dry, thick and colored down feathers
- » Soft belly
- » Clean, dry navel
- » Thick shanks with spaced and straight toes
- » Big clear eyes
- » Lively behavior

A healthy and good grower should have the following features:

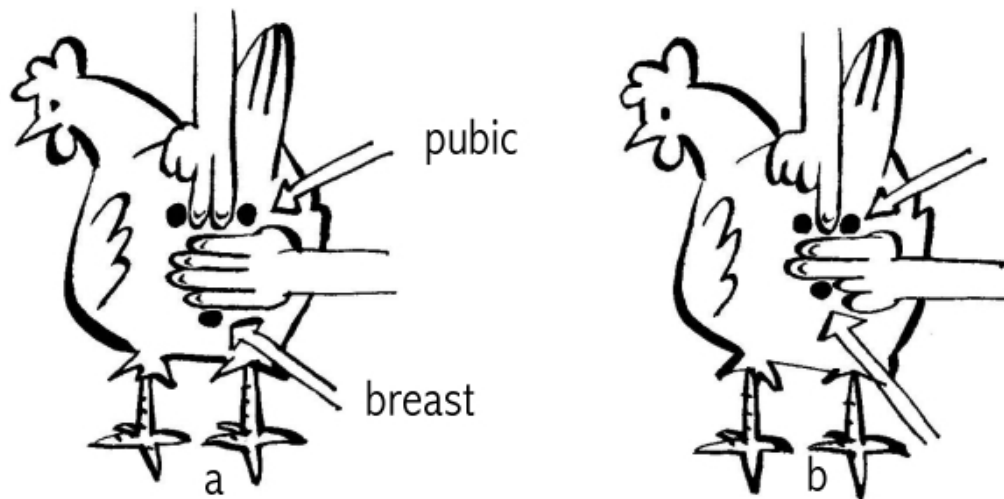
- » Should appear healthy and lively
- » Feathering shiny and normal (may depend on the breed)
- » Large size for the age
- » Eyes clear and shiny
- » Clean and dry beak and nostrils
- » Clean feathers around the vent
- » Straight legs and toes

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

- » Should appear healthy and lively (Figure 37)
- » Feathering normal for the breed
- » A red comb (more colored when in lay)
- » Eyes clear and shiny
- » Clean and dry beak and nostrils
- » Clean feathers around the vent
- » Straight legs and toes, with no signs of scaly legs
- » Legs less colored in lay
- » The breast bone should not be too sharp
- » A big broad bottom (laying status can be checked, see Figure 38).



**Figure 37: A good healthy hen**  
(source Riise et al 2004)



**Figure 38: Hen in lay (left) and outside lay (right)** (source Riise et al 2004)

In small flocks, it is relatively easy to check whether the hens are laying or not (Figure 38). 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.

A healthy and good cock should have the following features (Figure 39):

- » alert and protective nature
- » shiny and normal feathering for the breed
- » Amount of feed given and eaten at different ages of local poultry
- » clear and shiny eyes
- » clean and dry beak and nostrils
- » clean feathers around the vent
- » straight legs and toes with no signs of scaly legs
- » large size relative to the hens



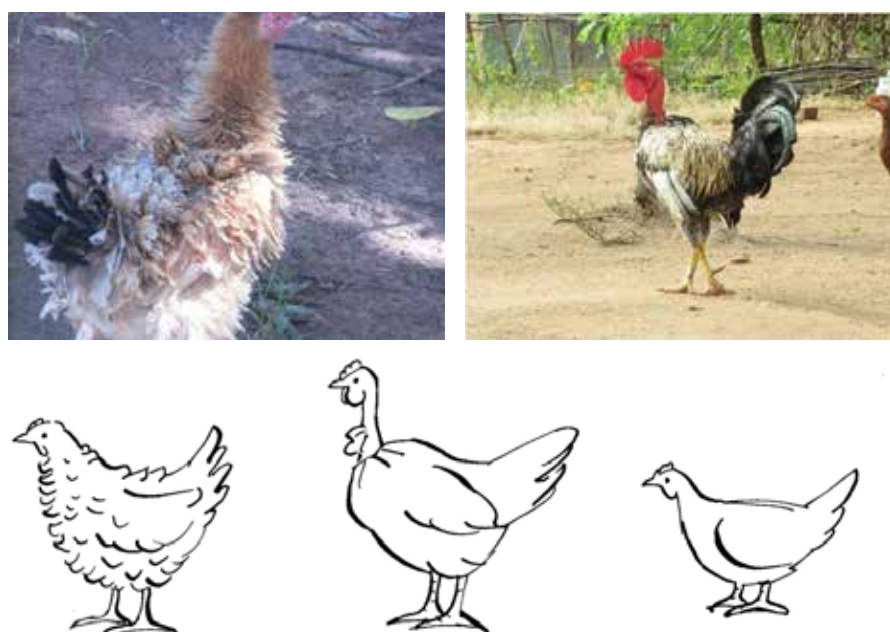


**Figure 39: Healthy cock**

It may be an advantage to keep records on the growth and productivity of each bird in order to select birds according to features such as egg production, growth (meat production) and broody behavior. Keeping records may help you select the best layers or the best mother to protect the chicks. See chapter 8 for examples on record keeping.

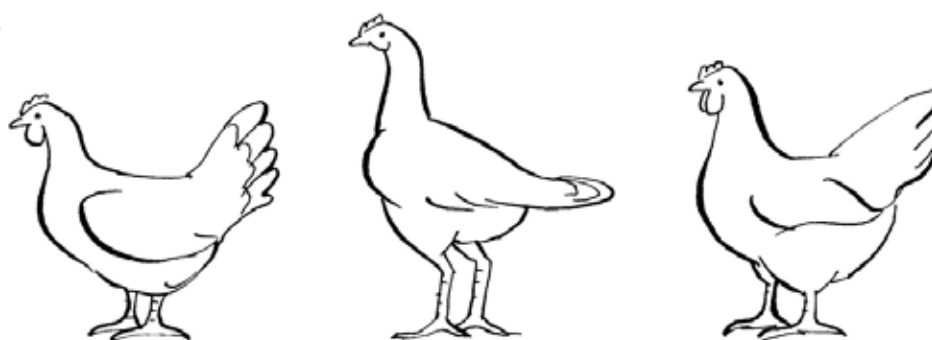
#### **4.2. Breed selection**

- When you have succeeded in improving your productivity and survival of your local free-range poultry through improved management, housing, feeding, chick protection etc., you may want to further increase productivity by introducing better breeds.
- A breed is a group of poultry with a characteristic body form and feather contours. These unique characteristics are inherited from one generation to the next. Also features such as the comb, colour of ear lobes and shank colours and length are usually determined by breed. In every breed, different varieties can occur usually determined by plumage colour. Thus, a white and a black hen may just be different varieties of the same breed.
- Figure 40 shows three different breeds commonly found in tropical regions, i.e., Frizzled Feathers, Naked-Neck and the Dwarf. Naked-Neck genes are found in almost every village, and are believed to be a natural adaptation to avoid heat stress. Frizzled feathers may look ill at a first glance, but is also common in most village-based systems. Dwarf poultry show standard colours and plumage, but tend to be 2/3 of the normal size for poultry, mostly because of the short shanks.



**Figure 40: Different breeds of chickens (frizzle feather, naked neck, dwarf) (source Riise et al 2004)**

- Chickens in industrialised systems are usually kept for two distinct purposes, that is either egg or meat production. A high productivity in either egg or meat production is a result of specialised breeding program. The so-called dual-purpose breeds are also a result of breeding programmes, and may produce more eggs and more meat than traditional birds.
- The features of birds specialised in egg production, meat production or both (dual purpose) are shown in Figure 41. Laying hens are “boat-shaped” with a long straight back and a big bottom. Meat producers (broilers) are long-legged, in a more upright position and wings in high position on the body. Dual-purpose breeds are a form in between the layers and broilers. Local breeds often have the form of a dual-purpose breed, although much less heavy in body form and size.



*Figure 41: Typical breeds producing eggs (left), meat (middle) and both (right) (source Riise et al 2004)*

- It is important to select birds, which are suited for the kind of production you have in mind, and which are suited for the conditions under which they are kept, e.g., free-range or confinement.
- The commercial sector has developed highly specialised hybrids (crosses of several breeds) of which layers can produce 300 eggs per year and broilers can reach 2 kg in 6 weeks. To obtain this high production, the hybrids have very specific requirements to management, feeding and disease management and production costs are high. They are therefore not normally suited in free-range and improved free-range systems.
- Of all chickens reared in Uganda, over 80% are indigenous chicken. Unlike the commercial layers and broilers, the breeds of our local chickens are not well defined. For this reason, it is difficult to say this breed is for Lugbara, Alur, Iteso, Acholi or even just by certain genetic features. Therefore, let us consider all our local chicken to be of the same breed since no particular feature-like uniform feather colour, comb type, shank characteristics- identifies them.
- The local chickens as stated earlier, without improvement in basic husbandry practices remain low output breeds despite having good market value. Improving their breeds- by selecting the good ones and also crossbreeding- alongside programmed hatching will help us multiply our stock easily to meet the market demand.
- In Uganda, the National animal breeding centre has recently introduced the Kuroiler breed, an Indian indigenous dual-purpose chicken. Kuroilers are heavy and fast-growing chicken without broody behaviour. They can survive on free-range like our local chicken also. They can, therefore, be used for crossbreeding with our indigenous

chicken. Fortunately, many of them have been introduced in the entire West Nile region and some parts of the north.

#### **4.3. Cross-breeding**

- Cross-breeding is mating two different breeds to produce offsprings that produce the eggs or the meat the farmer wants. Cross-breeding improves growth and production. For example, mating kuroilers and local birds results in offsprings that grow faster and lay more eggs. But the offsprings also often lose the habit of incubating eggs. Additionally, the offsprings are often more resistant to local disease conditions than the parent kuroiler.
- To increase production from local chickens, crossbreeding with other breeds can be practiced. It is however, important to consult a veterinarian, who may recommend suitable and available breeds to increase egg production, growth or both. It is also important to be aware that the offspring will obtain different qualities from the parents that are pure breeds.
- It is also important to stress that if a cross-breed is introduced at village level, it is crucial that management, feeding and health protection schemes are improved.



## 5. Diseases and health management





- Selection of healthy and sound-looking chicken in the villages or markets is important, if you want to assure a healthy flock and a high productivity. You should therefore know how to judge the quality of different breeds in different ages and sex, based primarily on their looks, vocalizations and behavior.
- In the following, we will introduce simple guidelines on how to select a sound bird at different ages, and introduce what to consider in terms of breed selection.

### Recognizing sick poultry and preventing diseases

- Birds that are well managed, well-fed and vaccinated against the common diseases usually remain healthy and produce well.
- Drugs do not replace good management and are not a guarantee that disease outbreak will not occur.
- When administering drugs, you should always follow the instructions of the manufacturer or veterinary personnel near you. In an outbreak of diseases, always seek assistance from veterinary personnel as most poultry diseases present with general signs and may require further methods for diagnosis.

#### 5.1. Characteristics of healthy and unhealthy chickens

It is very important for the farmer to learn how to detect an unhealthy or sick bird, so he can initiate the right action. In Table 6 below, you will find the main characteristics of healthy and unhealthy birds.

 	 
Healthy birds	Unhealthy birds
Alert and on guard	Tired and lifeless, listlessness, drowsiness
Bright eyes and comb	Dull eyes and comb
Walk, run, stand, and scratch continuously	Sit or lie down, droopy wings, body weakness
Eat and drink normally	Eat and drink less (anorexia) dehydration, emaciation (loss of weight)

Lay eggs normally	Lay less or stop laying eggs
Smooth and neat feathers	Ruffled and loose feathers
Soft compact droppings	Wet droppings with blood or worms, diarrhea (whitish or greenish faeces which may contain mucous) and dirty/matted feathers around the cloacae (vent).
Breath quietly	Increased respiratory rate, laboured breathing, cough, sneeze and breathe noisily, mucous discharge from the mouth and nostrils Bluish-purple (also called cyanosis) combs and skin due to oxygen deficiency in the blood
Normal wattles, sinuses, leg and wing joints	Swollen wattles, sinuses, leg or wing joints, footpads & sternal bursa.
No shivering	Fever as shown by shivering
Normal posture of the head or the body	Neck tilting (Torticollis), convulsions and tremors.
	Sudden death

**Note:** It is important to isolate unhealthy or sick birds from the healthy flock in order to ensure minimum of losses. If you find an unhealthy or sick bird, isolate the chicken and call for the veterinarian or health assistant for disease identification and further advice. If the bird dies, burn it or bury it. You should remove dead birds, so that the germs are not left on the ground to be passed on to other birds.

## The main diseases, their symptoms and treatments

### 5.2. Disease types

Diseases of chicken can be classified according to causes into viral bacterial, parasitic, fungal and other disorders (nutritional, poisoning). The different types of diseases have different control or cure methods, as described in the Table 7 below:

**Table 7: disease types and possible treatments (adapted from Riise et al, 2004)**

Disease type	Possibilities for control or cure
<b>Virus</b>	Viral diseases <u>cannot be cured</u> , but <u>may be prevented</u> or controlled if the animals are vaccinated before the disease occurs in the flock. If the disease is present in the flock, vaccinations might increase the severity of the disease, ultimately killing the birds. So, <u>DO NOT</u> vaccinate sick birds.
<b>Bacterial</b>	Many bacterial diseases <u>can be treated</u> with the use of antibiotics. It is important to diagnose the disease in order to choose the right antibiotic.
<b>Parasites</b>	Most parasites <u>can be treated</u> with traditional and conventional medicines (anthelmintics = dewormers).
<b>Fungus</b>	Fungal diseases might be treated with antibiotics.
<b>Nutritional diseases/ disorders</b>	Nutritional diseases or disorders are caused by a wrong feed composition. Depending on the disease it can be prevented by <u>mixing the right feed with minerals and vitamins</u> , or giving access to a diversity of feedstuffs from the surroundings, e.g., green grass and fresh cow dung.





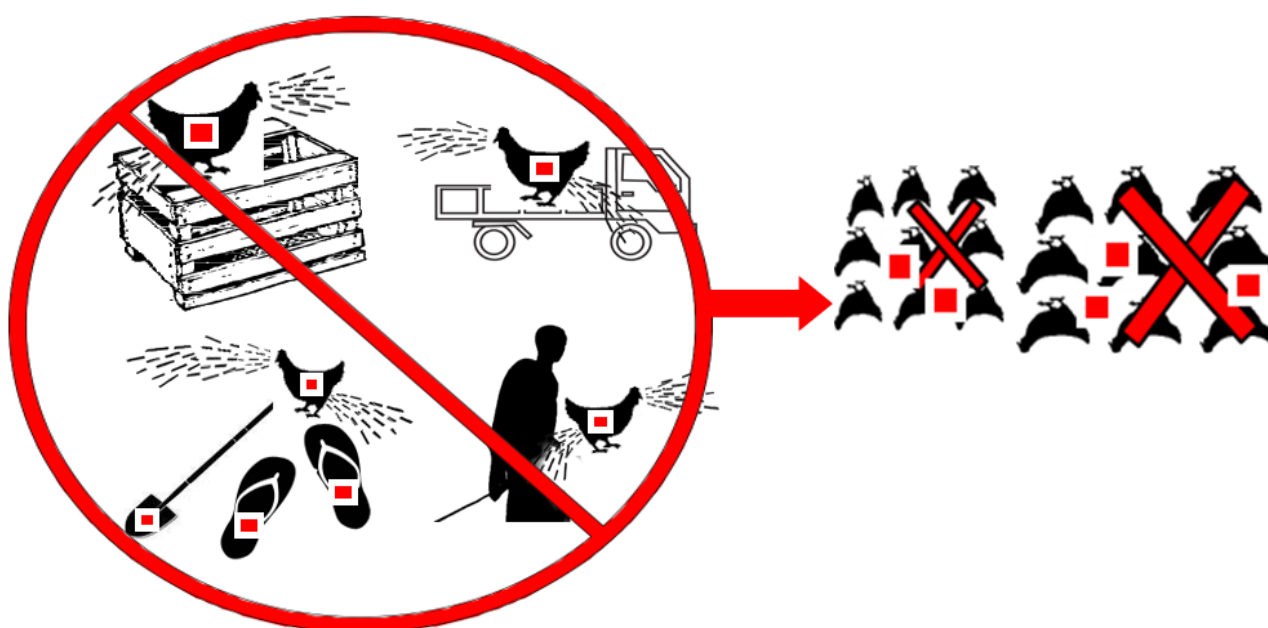
### 5.3. Important diseases of local chicken in Uganda

The common infectious diseases of local poultry reported in Uganda are Newcastle disease, Fowl pox, Gumboro disease, colibacillosis, and other bacterial infections. Some other diseases have not been reported in local chicken but they cannot be ruled out due to scarcity of veterinary and diagnostic services in the rural areas. Some of them have been described in this manual but the owner is advised to consult a veterinarian before treatment.

The parasitic diseases include coccidiosis, roundworms and tapeworm infestations and external parasites like mites and fleas. Nutritional deficiency, especially vitamin and mineral deficiencies have been reported.


#### Common means of spread of the disease

Diseases can be spread by introducing sick birds into the flock or by persons, their foot wears/clothing or even on vehicles used transport chicken and their products. A pictorial illustration of diseases is shown in Figure 42 below.




*Figure 42: Transporting infected chickens will spread the Newcastle disease and other contagious infectious disease to other chickens*


## 5.4. Infectious diseases

<b>Newcastle Disease (ND)</b>	<ul style="list-style-type: none"> <li>• ND is the commonest chicken disease in homesteads in Uganda.</li> <li>• It affects all age groups with high death rates (30-80%) and is most common in the dry season, particularly the January to March.</li> <li>• The disease spreads mainly through oral and respiratory discharges and droppings of infected birds. Other ways of spread can be through clothes of people, other poultry, equipment, pets, and rodents.</li> </ul>
<b>Cause</b>	<ul style="list-style-type: none"> <li>• Virus</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>• Loss of appetite, droopy wings, dullness and birds hide their heads under the wings.</li> <li>• Greenish-yellow and sometimes bloody diarrhoea</li> <li>• Respiratory signs such as noisy breathing, sneezing, coughing and gasping.</li> <li>• Discharges from nostrils and eyes</li> <li>• Muscular abnormalities like twisted neck Figure 43, stiffness and prostration.</li> </ul> <div data-bbox="413 752 1254 1111">  </div> <p>Figure 43: Bird with twisted neck (source Riise et al 2004)</p> <ul style="list-style-type: none"> <li>• Central nervous signs like tremors, compulsive movements, and death.</li> <li>• Drops in egg laying. Eggs are of low quality and may be soft-shelled, roughened, or deformed. Production resumes slowly, or not at all, depending on the stage of lay at the time of infection</li> <li>• High death rates</li> </ul>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>• Vaccination is the only way to control ND. A vaccination program should be adopted and strictly adhered to (see chapter 6)</li> <li>• Avoid introducing new birds into your stock. If new birds are nevertheless introduced, a two-week quarantine period should be applied.</li> <li>• If any birds are affected, get rid of the whole flock. If a few chickens survive, they will become carriers for some time, likely to infect new birds.</li> <li>• A high standard of sanitation should be practiced and avoid the introduction of disease in the flock.</li> <li>• Do not keep chickens and guinea fowl together as they are healthy carriers and can transmit the disease to poultry.</li> <li>• Newcastle Disease is a reportable disease. All suspected outbreaks of the disease must be reported to animal health authorities immediately.</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>• No treatment as it is a viral disease</li> </ul>
<b>Fowl pox</b>	<ul style="list-style-type: none"> <li>• Spread by contact.</li> <li>• Birds of all ages can be affected but it's of more danger to chicks and laying birds</li> </ul>




<b>Cause</b>	<ul style="list-style-type: none"> <li>• Virus</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>• Wart-like nodules/ scabs are common on combs, wattles and around the eye/ base of the beaks. Eyelids can be closed by these nodules (cutaneous form). Another form attacks the mouth or upper airways, where white nodules are seen in the mouth, tongue, throat, nostrils, and eyes (Figure 44). This causes more deaths as the birds cannot eat and/or drink.</li> </ul> <div data-bbox="375 526 1066 869" data-label="Image"> </div> <p>Figure 44: Photo on the left (1) has drawings of scabs on the head (comb and wattles). On the right, is a photo of chicken with pox scabs on the head that extended to inside the mouth.</p> <ul style="list-style-type: none"> <li>• Drop in egg production.</li> <li>• Death rate with fowl pox is generally low and deaths are mainly due to suffocation and starvation.</li> </ul>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>• Vaccination is recommended and highly effective. Usually done at 4 – 8 weeks of age. See Chapter 6 on vaccination for a detailed explanation on how to vaccine against fowl pox.</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>• No specific treatment for fowl pox since it is a viral disease.</li> <li>• However, removing the scabs on the head with cotton wool moistened in iodine and giving Oxytetracycline 25% in drinking water for 5 days improves survival.</li> </ul>
<b>Gumboro disease (Infectious Bursal Disease, IBD)</b>	<ul style="list-style-type: none"> <li>• Usually occurs in large flocks kept in confinement. Not common in small-scale village-based systems.</li> <li>• However, the disease is of increasing importance these days in chicks of local poultry</li> <li>• Generally, it occurs in chicks between 3 – 6 weeks of age.</li> <li>• Mainly affects the gland called the bursa of Fabricius which is one of the most important immune organs located around the cloaca</li> <li>• The disease can be spread by contact with contaminated materials and through various parasites that pick up and carry the virus.</li> </ul>

<b>Cause</b>	<ul style="list-style-type: none"> <li>• Virus</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>• Signs observed only after 3 weeks of age. Sudden and high morbidity rate. The number of affected birds is very high in the flock</li> <li>• The number of deaths is usually low although it can be substantial (approaching 90%) if husbandry is poor. Death in a flock usually peak and recedes within a week of onset.</li> <li>• Diarrhoea that may be white but occasionally,</li> <li>• there is passing of blood and straining during defecation.</li> <li>• Depression, lack of appetite, ruffled feathers,</li> <li>• and a droopy appearance.</li> <li>• Vent pecking is common.</li> <li>• Post-mortem is required to establish the actual diagnosis of the disease by the veterinarian.</li> </ul>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>• Vaccination (see chapter 6 on vaccinations)</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>• No specific treatment available as it is a viral disease.</li> <li>• However, good husbandry like adequate temperature and broad-spectrum antibiotics may reduce the severity of the disease.</li> </ul>
<b>Infectious Bronchitis (IB)</b>	<ul style="list-style-type: none"> <li>• Spread rapidly and can affect 100% of birds in a flock with varying severity.</li> </ul>
<b>Cause</b>	<ul style="list-style-type: none"> <li>• Virus</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>• Gasping, coughing and sneezing</li> <li>• Discharges from nose and eyes.</li> <li>• In chicks: weakness, depression, and huddling near heat sources. Mortality in young chicks is usually negligible unless the disease is complicated by another infectious agent like bacteria.</li> </ul> <p>In laying birds, egg production decreases (up to 50%) and eggs have ragged shapes (Figure 45). Effects on production can last 6-8 weeks or longer.</p>  <p><b>Figure 45: Eggs with abnormal shapes due to Infectious bronchitis (Source; AAAP). It is sometimes difficult to differentiate infectious bronchitis and mild Newcastle disease from appearance of egg shapes alone.</b></p>

<b>Prevention</b>	<ul style="list-style-type: none"> <li>Vaccination. Vaccines are either separate or combined with that for Newcastle disease.</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>No specific treatment, as it is a viral disease.</li> <li>A broad-spectrum antibiotic can help because the disease is usually complicated by bacterial infections.</li> <li>For baby chicks with the disease, it may be helpful to increase the room temperature, encourage the birds to eat and correct any apparent management deficiencies.</li> </ul>
<b>Colibacillosis (Navel ill)</b>	<ul style="list-style-type: none"> <li>Disease of poor hygiene.</li> <li>Spreads through fecal contamination. Birds infected by direct contact with dirty litter or contaminated eggshells. Not transmitted from bird to bird.</li> </ul>
<b>Cause</b>	<ul style="list-style-type: none"> <li>Environmental disease caused by common bacteria, present in the intestine of birds and mammals</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>Common among newly hatched chicks: infection in the stomach region.</li> <li>Symptoms in older birds: <ul style="list-style-type: none"> <li>» respiratory distress</li> <li>» infection in the egg organ with stop of egg production,</li> <li>» enlarged and swollen navel (Figure 46)</li> <li>» diarrhea with the pasting of feathers around the vent.</li> </ul> </li> </ul> <div data-bbox="521 1021 1295 1332">  </div> <p><b>Figure 46: Birds with navel ill or colibacillosis. The abdomen is distended and there is scab at the navel</b></p>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>Vigorous sanitation program in the poultry house and control dust in the poultry house.</li> <li>Avoid stress from other diseases and parasites.</li> <li>Clean and disinfect waterers and feeders and avoid fecal contamination of these.</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>Treatment of sick chicks might be possible with antibiotics (tetracyclines, enrofloxacin, neomycin, sulfa drugs and others).</li> <li>Treatment is usually effective if given early.</li> </ul>



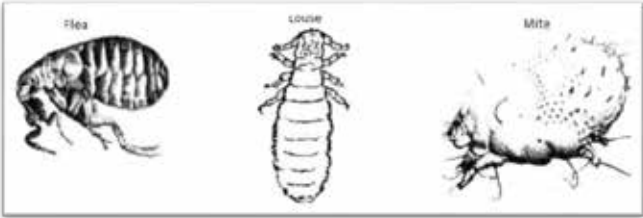



<b>Brooder pneumonia (Aspergillosis)</b>	<ul style="list-style-type: none"> <li>• Acquired by breathing in (inhalation) of fungal spores from mouldy feed or litter.</li> <li>• Not transmitted from bird to bird.</li> </ul>
<b>Cause</b>	<ul style="list-style-type: none"> <li>• Fungus</li> </ul>
<b>Signs and symptoms</b>	 <p>Disease attacks lungs, air sacs and liver. Signs include difficulty in breathing, gasping (Figure 47), blindness and abnormal behaviour when the brain gets involved.</p>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>• Good ventilation in the house where birds sleep or are reared.</li> <li>• Litter should always be dry and friable. Caked litter should be removed to prevent the growth of fungus.</li> <li>• A fresh feed should be fed. Do not give mouldy feed to the birds.</li> <li>• Use Copper Sulphate following manufacturer guides to decontaminate the litter.</li> </ul>


#### NOTE:

- Most of the infectious diseases present with general signs and so post-mortem examination is very useful in disease diagnosis. Seek the help of a veterinarian near you.
- Birds should not be slaughtered before the withdrawal period of the drugs for human consumption. Follow the manufacturers' instruction about withdrawal period and dosage of drug for the given condition you are treating.
- Most drugs come in trade names, so you should find from the drug seller the true drug name for the right treatment.



## 5.5. External parasites


External parasites	<ul style="list-style-type: none"> <li>Attacks all ages any time, but occurs more frequently in humid chicken houses with bad hygiene</li> </ul>
Cause	<ul style="list-style-type: none"> <li>The common external parasites include fleas, lice and mites (Figure 48).</li> <li>The most common mites of poultry include feather mites, scaly leg mites, red mites, and many others. All these parasites suck blood and cause discomfort by the birds.</li> </ul>  <p><b>Figure 48: The common external parasites of chicken</b></p>
<p>Signs and symptoms</p> <p><b>Figure 49 typical behaviour of poultry disturbed by external parasites (source Riise et al 2004)</b></p> 	 <p><b>Figure 50: Stick tight flea on the upper eyelid of this layer hen.</b></p> <ul style="list-style-type: none"> <li>Lice and Stick-tight flea can be seen around eyes and nose, on the wattles and combs (Figure 50). Fleas can be seen on the belly.</li> <li>Adult birds are clearly disturbed and spend a lot of time pecking and polishing feathers (Figure 49).</li> <li>Young chicks may die from anemia.</li> <li>Scaly leg mites are small creatures that hide/burrow on the shanks of birds causing rough scaly or thickened legs with clear scales (Figure 51) and wounds sometimes.</li> <li>Red mites feed mostly at night and may not be found on the birds during the day (hide in the cracks or joints of roosts or nests at daytime) Inspection at night is usually necessary to confirm an infestation.</li> <li>If not treated, mites, lice, fleas, ticks will cause weight loss and possibly loss of feathers due to the parasites sucking blood and to skin irritation.</li> <li>Sometimes, they lead to claws and/or body pecking symptoms</li> </ul>  <p><b>Figure 51: Scaly legs due to burrowing mites in three stages. Number 1 is a normal leg, number 2 and the photo show early stage of the mite infestation while number 3 shows severe case.</b></p>

Prevention	<ul style="list-style-type: none"> <li>Ashes and Sulphur powder may be used where the hens do dust bathing. Nests may be protected by putting a few tobacco leaves mixed with ashes in the nest-</li> </ul>
Treatment 	<p>Dust the birds with available anti-parasitic powders like Sevin dust (Figure 52). Ideally, do this in the evening when the birds are going to sleep. (See chapter 6 for details)</p> <p>Replace the litter (in heavy infestation) and dust the house with insecticide, ash or oil, paying particular attention to the cracks and crevices.</p> <ul style="list-style-type: none"> <li>Against fleas: Smear some Vaseline mixed with little paraffin directly on the fleas. Avoid getting paraffin into contact with the eyes, or apply a little pye-grease on the affected parts</li> <li>Against scaly leg mites: Dip the legs daily in kerosene (paraffin) mixed with (waste engine or cooking oil (in the ratio of 1:1) or in an insecticide daily, until the scales disappear (at least 2 weeks). Wash the legs with soapy water before dipping.</li> </ul>
House flies and their relatives	<ul style="list-style-type: none"> <li>Non-biting flies on poultry farms which have poor sanitation</li> <li>Flies are a vector of many chickens and human diseases through their feeding habits</li> </ul>
Cause	<ul style="list-style-type: none"> <li>Intensive farms produce a lot of manure which must be properly managed without allowing fly multiplication.</li> </ul>
Prevention	<ul style="list-style-type: none"> <li>Dispose of manure by burying or giving it away to crop farmers.</li> <li>Keep litter in poultry houses dry.</li> </ul>



## 5.6. Internal Parasites

The most common internal parasites are coccidian protozoa, roundworms and tape worms.

<b>Coccidiosis</b>	<ul style="list-style-type: none"> <li>This is one of the devastating diseases of housed birds, especially chicks.</li> <li>The birds get infected when they pick eggs of the parasite from contaminated litter.</li> <li>Coccidiosis in poultry affects the intestines.</li> <li>The disease occurs when litter management is not proper (leaving wet litter in the house).</li> </ul>
<b>Cause</b>	<ul style="list-style-type: none"> <li>Protozoa (small internal parasite)</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>Affected birds are dull with no appetite (Figure 53), weak, dehydrated and thin.</li> <li>Diarrhea with blood tints in the advanced stage of the disease. At this time the disease has reached a critical level and losses are high.</li> <li>Death in young chicks. If the chicks survive, they will remain thin and be late in laying.</li> </ul>  <p><b>Figure 53: dull and weak bird with blood-tinged faeces</b></p>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>Avoid overcrowding and provide adequate ventilation.</li> <li>Avoid different age groups of birds in the same house, as the disease may spread from adults to young chicks.</li> <li>Avoid unhygienic conditions e.g., wetting the litter.</li> <li>Buy feed and water troughs which cannot easily be made dirty or allow spillage of water on the litter. Remove any wet litter around the drinkers and keep litter dry and friable</li> <li>Give coccidiostats e.g., sulpha, amprolium every two weeks till when brooding is over for local birds</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>Anticoccidials in drinking water or feed as recommended by the vet or manufacturer</li> <li>Birds whose intestinal walls are severely damaged by the parasite often die despite treatment. Therefore, prevention of coccidiosis outbreak is the most important in managing this disease.</li> </ul>

<b>Roundworms Tapeworms</b>	<ul style="list-style-type: none"> <li>Internal parasites are very common in all ages in the village-based production systems.</li> </ul>
<b>Cause</b>	<ul style="list-style-type: none"> <li><b>Roundworms</b> (<i>Ascaridia galli</i>) are found in small intestines. They are round, white or yellowish-white and 1-4 inches long (Figure 54). The worms can cause intestinal obstruction and death of the chicks.</li> </ul> <div data-bbox="378 358 1358 618" data-label="Image"> </div> <p><b>Figure 54: Roundworms (<i>Ascaridia galli</i>) in the small intestine of chicken. In this case, the intestine was blocked by a bunch of these worms and the chicken was very weak.</b></p> <ul style="list-style-type: none"> <li><b>Gapeworms</b> (<i>Syngamus trachea</i>) lodges in the windpipe/trachea and Causes gaping/gasping in birds.</li> <li><b>Caecal worms</b> are found in the caecum. They are harmless to chicken but are carriers of poultry diseases like the blackhead of turkeys</li> <li><b>Tapeworms:</b> Chicken gets these worms by eating snails, earthworms, and flies carrying the tapeworm. They cause anemia, poor growth, and decreased production.</li> </ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"> <li>Poor health, weight loss, drops in egg production, and bloody diarrhea. The worms can also be seen in the faeces.</li> </ul>
<b>Prevention</b>	<ul style="list-style-type: none"> <li>Careful hygiene may prevent heavy infection</li> <li>Avoid overcrowding and if rearing chicken intensively, provide fresh litter when introducing new poultry stock.</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>The best treatment is adding anthelmintics in the drinking water once or twice a year, or once every month. The common anthelmintics for chicken in Uganda are levamisole (leviworm®, Levacide® poultry) and piperazine (ascarex®, piperamentic®) (Figure 55). Albendazole is also used at times when tapeworms are present.</li> </ul> <div data-bbox="427 1576 769 1843" data-label="Image"> </div> <p>Piperazine here sold as Ascarex</p> <div data-bbox="963 1529 1134 1843" data-label="Image"> </div> <p>Levamisole, here sold as Levacide poultry</p> <p><b>Figure 55: Some of the dewormers for chicken on Ugandan market</b></p>



### 5.7. Vitamin deficiency

<b>Vitamin deficiency diseases</b>	Vitamins are nutrients required by animals in small amounts. Vitamin deficiencies are common in young birds and so their feeds during brooding should be supplemented.
<b>Cause</b>	<ul style="list-style-type: none"><li>• Lack of nutrients in the feeding</li></ul>
<b>Signs and symptoms</b>	<ul style="list-style-type: none"><li>• Retarded growth, rickets and leg weakness, swollen joints (hock joints, joints of ribs plus others),</li><li>• Nervous signs (e.g., inclination in movement, paralysis),</li><li>• Discharge from nose and eye, white stuff covering eyeball</li><li>• Pustules in mouth</li><li>• Decreased egg production, poor hatchability</li><li>• Curled toes and other nonspecific signs</li></ul>
<b>Prevention/ treatment</b>	<ul style="list-style-type: none"><li>• Supply vitamin powder in water or buy vitamin/mineral powders (premix) in feed and provide greens to birds.</li><li>• Note: In scavenging local chicken, vitamins are obtained from vegetables that they eat, in commercial intensive chicken deficiency may result from insufficient levels of vitamins in the diet or when feeds have overstayed or gone bad.</li></ul>

### 5.8. Poison and Toxins

- These include drugs (overuse of drugs), disinfectants, chemicals (feed additives, salt), fumigants, fungal toxins, insecticides, and rodenticides.
- Avoid circumstances that can lead to the ingestion of the poisons.

### 5.9. Prevention of diseases

Diseases are everywhere and will attack birds at all ages causing heavy losses. Careful management will prevent many diseases and save costs from treatments and disinfection. Disease entry into poultry flock can be prevented in the following ways:

- » Give the chicken the right feed and clean water, in particular for young birds;
- » Build shelters against wind and rain;
- » Clean houses regularly and apply lime wash on the floor and the walls;
- » If necessary, provide dry litter regularly;
- » Do not put too many birds together;
- » Different species of poultry, for example hens, turkeys, pigeons, ducks and guinea fowls should be kept separate;
- » Separate chicks from adult birds except from the mother hen;
- » Vaccinate chicks against the most important diseases and revaccinate if necessary;
- » Isolate and treat sick birds – if medication is not available then kill the sick birds;
- » Burn or bury killed birds.

Chicken that are not well managed will have many diseases in the flock (Figure 56).



Figure 56: Bad management = disease (source Riise et al 2004)

### Housing and Space

Overcrowding of chicken in a small house and outdoor space leads to vices such as pecking. Overcrowding also results in increased contamination of the environment by chicken manure and may therefore lead to disease outbreaks. An adult bird requires at least 5 square meters of outside space. Therefore, keep only the numbers that fit comfortably in the available space.

### Hygiene

Dry and clean housing is essential for diseases not to spread or develop. Once in a while after cleaning, houses and shelters should be disinfected with lime wash. It is best to slaughter hens that are too thin and do not grow or produce eggs any more, as they do not resist diseases well and can pass diseases to poultry in good health. If a disease persists on the farm, depopulate the whole flock, clean, disinfect and rest the house for some time (at least two months) and then restock. Example of a common disinfectant is in Figure 57. The instructions of how to use the disinfectants are usually written on the bottle and a small paper inserted with the package.



Figure 57: common disinfectant

### **Mixed species or age groups**

Other species of birds may carry diseases without showing any signs of being ill. For example, ducks, guinea fowls, and turkeys can pass on diseases to hens, or vice versa. The best way to avoid spreading diseases from one species to another is to keep them separate in different cages, baskets or houses. Always keep domesticated birds as far away from wild birds as possible. Also do not mix the chicks and adult chicken together to avoid transmission of disease from the adult to the young. Do not buy chicken from roadside or markets as breeding stock. They may carry diseases. Also, chickens that you take to market and are not bought should not be returned to the home stock.

### **Feeding**

Well-fed birds resist diseases better. Supplementary feeding, in particular for small chicks, is one of the most important means of preventing diseases. Feeds should always be stored in a dry and clean place, as they may easily get contaminated and spread diseases.

### **Clean Water**

Clean water from a well, not a pond, is important to avoid the spread of waterborne diseases, such as Fowl Cholera and Avian Influenza (AI). If a highly contagious strain of AI is present in the environment strict care should be taken to avoid water potentially contaminated by wild birds.

### **Vaccinations**

Viral diseases do not have drugs for treatment in chickens. Diseases such as Newcastle disease and fowl pox should be vaccinated against regularly (see chapter 6)

## 6. Disease prevention calendar and community vaccination

### 6.1. Medication

Some diseases may be cured by drugs. Parasitic diseases, such as lice or worms may be cured by use of anti-parasitic drugs or by applying simple methods such as baths in oil. Some bacterial diseases causing diarrhea, may be cured with antibiotics but this should only be done under the supervision of a veterinarian! For viral diseases there is no treatment. But the viral diseases may often be prevented by vaccination.

**Note:** The old saying that “prevention is better than cure” is true for poultry diseases and parasites. This can be got by vaccination and good husbandry practices.

### 6.2. Vaccination

- Vaccines protect birds from diseases and should be done before the disease breaks out (Figure 58).
- All chicken should be vaccinated against the most common viral disease(s) in the area. Vaccination schemes at village level should cover Newcastle Disease and Fowl Pox.
- Other viral diseases such as Gumboro and Infectious Bronchitis may be covered by vaccination, but they are often less important at village level.
- A bacterial disease such as Fowl cholera may also be prevented by vaccination.
- Poultry should be vaccinated when they are very young, and before they have begun to lay eggs. Most young birds that have not been vaccinated do not resist diseases, and often die.
- Vaccines should only be given to healthy birds. If you vaccinate a sick bird, you may kill the bird.
- Anthelmintics against internal parasites should be given two weeks before vaccination, to improve the effect of the vaccine.
- Vaccines should be stored properly in the cold/cool environment, usually at 2-8 °C.
- Vaccines should be used promptly (within 2½ hours) after reconstitution (dilution). Always follow the manufacturer’s guidelines when you are using vaccines or contact a veterinarian for guidance.



Figure 58: Do not vaccinate sick birds

### 6.3. Vaccination methods

There are four fundamental ways of vaccinating birds:

<b>1. Eye drops</b>	Most vaccines in Uganda are administered by this route (Figures 60 and 61). Sometimes by nose or mouth drops. Examples of vaccines given as eye drops include Newcastle disease, Gumboro disease and infectious bronchitis
<b>2. Injections</b>	The vaccines of chicken given by injections into the muscle of the neck, breast or the thigh include Marek's disease vaccine and Fowl typhoid vaccine. But these are more in exotic birds kept in intensive system.
<b>3. Skin piercing</b>	In this category, we have only fowl pox vaccine for local poultry in Uganda. It is injected in the skin of wing web using a forked needle
<b>4. Orally (in feed or water)</b>	Any of those that are administered by eye drop can be administered in water. This method is used for confined systems. For scavenging poultry, you should avoid mixing vaccines with drinking water or feed, as it is difficult to give the right dose. Research have shown that protection against e.g., Newcastle Disease is highly variable if vaccine is given through water or feed. Giving the right dose is essential for the vaccine to work properly.



Figure 60: Vaccination by eye drop

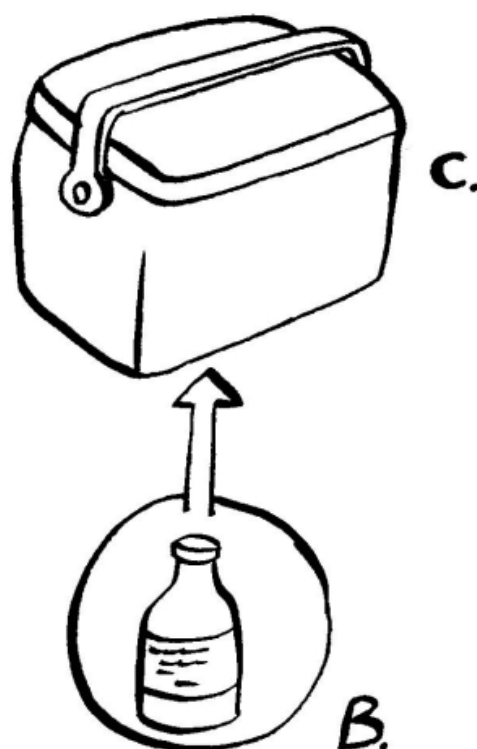


Figure 59 store vaccines in a cool box during vaccination campaigns (source Riise et al 2004)



- A too high dose of a live vaccine may kill a young chick, whereas a too low dose will not give adequate protection. Thus, it is important to consult a veterinarian for further advice before carrying out a vaccination.
- Most vaccines must be kept in the refrigerator between 4 and 8°C and never frozen.
- When going to the field, vaccines must be stored in a cool box or wrap in a damp cloth, and not exposed to sunlight (Figure 59).
- Vaccines should not be used after the expiry date.
- Once a vaccine has been opened, it should be used immediately and not stored for use the following day.

### Vaccination program for local chicken

The table below give an indication on which vaccination program is recommended for local chicken in Uganda. It is recommended to plan the exact timing of vaccination in a collaborative way with the local population, depending on the outbreak of the main disease, for example by producing a disease prevention calendar.

**Table 8: Vaccination Schedule for local chicken**

Age (weeks)	Type of Vaccine	Route of administration	Dose	Comments
7 days	Newcastle + Infectious bronchitis (IB)	Eye drop	One drop per eye	Very important
14 days	Gumboro	Eye drop	One drop per eye	Optional
21 days	New castle + IB	Eye drop	One drop per eye	Optional
28 days	Gumboro	Eye drop	One drop per eye	Optional
6 <sup>th</sup> week	Fowl pox	Wing web skin piercing	Scoop of vaccine in needle eye, one wing pierced once.	Very important
8 <sup>th</sup> week	Newcastle	Eye drop	One drop per eye	Important
5 <sup>th</sup> month	Newcastle + IB	Eye drop	One drop per eye	Very important
Every after 3 months	Newcastle	Eye drop	One drop per eye	Very important

### How to administrate vaccine by eye drop (example against Newcastle disease)

- There are about 16 ND vaccine brands currently in use in Uganda including Hipraviar-B1/H120® (ND & IB), Hipraviar-S® (ND), Newcastle Disease Vaccine®, ORNIPEST, ORNIPRIM and others. Generally, there are many trade names of ND vaccines and they keep changing overtime with entry of new stockists. Therefore, only asking for Newcastle disease vaccine for the number of birds owned is usually enough to buy the vaccine plus the diluents.
- Vaccines should be given either early morning, before letting the birds out of the chicken house or when the local birds are easy to catch resting in the trees.
- Correct dilution of the vaccine is critical. The necessary diluent is sold together with the vaccine with the instruction to dilute. Please carefully follow these instructions.





**Figure 61: Eye drop administration.** When using an eye-dropper, hold it in a vertical position. They are calibrated according to the size of the drop that forms when a dropper is held in a vertical position (source Riise et al 2004)

- Immunity does not develop immediately after administration of the vaccine. One to two weeks is required for full immune response to occur.
- Chicken should be vaccinated at least one month before an outbreak is likely to occur: ask local village poultry farmers when ND outbreaks are most common and plan vaccination campaigns in a collaborative basis (e.g., participatory disease calendar, see part 1).
- Immunity will diminish if chickens are not revaccinated. Chickens are best vaccinated at least three times a year.
- Chicken should be given a booster dose 2-4 weeks after primary vaccination, with re-vaccination at 3 months intervals.
- Vaccination of village chicken poultry flocks at 3-4 months intervals will also provide protection for newly hatched chicks.

#### **Procedure for vaccination against fowl pox:**

- Fowl pox vaccines currently in use in Uganda include Hiprapox®, Fowl Pox Vaccine® and others. The brands keep changing overtime, but during purchase, one needs to ask for fowl pox vaccine. The vaccine is sold together with the water for dilution and forked needle.
- The common vials on the market are for 500 and 1000 chickens.
- The following procedure must be followed to dilute the vaccine and vaccinate the chicken:
  - » Draw 20 mls of the water for dilution into a clean syringe (Figure 62).
  - » Transfer the water into the solid vaccine in the bottle by piercing through the rubber cap.
  - » Once dissolved, draw all the content with the syringe and mix thoroughly.
  - » Transfer the mixture into a clean cup and keep in cool box with ice.
  - » With the help of an assistant holding the chicken, stretch the wing, dip the forked needle eyes into the vaccine and pierce through the wing web, taking care to avoid feathers, bones, and large blood vessels (Figure 63).

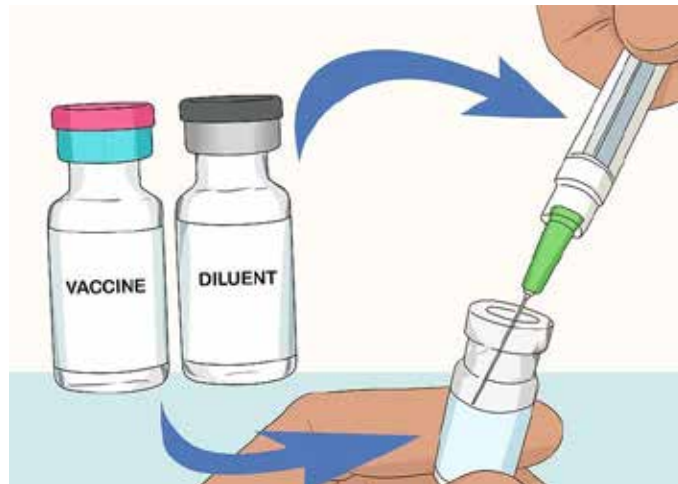


Figure 62: Dilution of Fowl pox vaccine



Figure 63: place of injection by piercing the skin of the wing. The wing web is located near the bone where the wing connects to the body. You may pluck a small patch of the feathers so that you can properly administer the vaccine (source Riise et al 2004 and wikihow)

- » Put down the bird, get another one, pierce in the same way, until all the birds are covered.
- » Check the injection site in some selected birds after three days to see whether the vaccination was effective.
- » When well done, there will be small swelling at the injection site but none when not properly done.
- One well done vaccination is enough for the lifetime of the chicken. You will only repeat vaccinations for young or new stock.



Figure 64: Performing wing web skin piercing using a wing web needle after dipping it into the diluted fowl typhoid vaccine.

#### **6.4. Vaccination costs**

The costs of vaccines vary widely in Uganda depending on the location. Vaccines are cheaper in central Uganda than any other part of the country. This is due to city status of Kampala associated with many veterinary stockists and relatively more reliable electricity for cold storage of vaccines. Also, the central region has the large commercial poultry farms that use most of the poultry vaccines and drugs. For example, 500 dose vial of Newcastle disease vaccine costs on average Shs. 7000 in Kampala but the price in Arua is Shs. 15,000. The same dose vial of fowl pox vaccine costs Shs. 9000 in Kampala and Shs 18000 in Arua. These vaccines are sold together with the dilution fluid and eye droppers or syringes with needles. Vaccine carriers having ice packs are used for carrying the vaccines from the shops to the farms. The person buying the vaccine must carry his or her own vaccine carrier. The labour costs for vaccination vary among the vaccinators. It is between Shs. 50 to 300 per chicken in some villages of northern Uganda.

## 7. Programmed hatching

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### 7.1. Definition and advantages of programmed hatching

Programmed hatching is a method of using hens to incubate eggs for more than one batch and the chicks are raised as a batch of the same age. In short, the hens are used as incubators for many eggs from different hens. Programmed hatching is a fast and cheap way of increasing numbers of chickens on a farm. The essence of the program is the timing (synchronization) of hatching by a group of local hens to produce large numbers of day-old chicks of the same age or age bracket. The advantages include:

- Many chicks are hatched on the same day and so it is easier to vaccinate and manage the birds.
- Batch formation of the birds is easier, which makes it also easier to feed in groups.
- Farmers can plan in advance when to market the birds (timing festive seasons for good markets).
- No incubators are required hence the innovation is appropriate for rural areas.
- Birds may hatch up to seven times a year compared with two or three times with ordinary incubation and chick-rearing by hens.
- Chicks are produced at cheaper costs since farmers don't need to transport them from distant towns, as is the case with commercial chicks.
- The programmed hatching approach has the potential of quickly tripling original stock numbers in a year when practiced diligently. Crossbreeding more productive poultry strains such as Kuroilers with the local chickens, on the other hand, can improve egg numbers, sizes and body weights of the subsequent offspring. This offers the additional advantages of ease of management and disease resistance of the indigenous breed.

### 7.2. Raising the flocks for programmed hatching

It is easy to start programmed hatching with the same age group of hens raised together or hens that start laying around the same time. Otherwise, it is sometimes challenging to start the program. To begin the program, one can choose among the following options:

- Buy chicks or pullets of the same age bracket (not exceeding one-month age difference) from a known source. Raise them together under the same management until the start of egg-laying.
- Select pullets from your flock in similar age bracket not exceeding one-month age difference and raise them specifically to start programmed hatching. It must be pullets from parents with desired traits.
- Wean already brooding hens around the same time and raise the chicks by yourself. Introduce cocks to the weaned hens a week after, to stimulate breeding activities.

In all these options, we are interested in having hens that will start laying around the same time so that we reap the benefits of programmed hatching stated above. So, hens are the most critical limiting stock to acquire. Cocks can be introduced only when you are about a week to start the program. A cock should not stay in the place for more than 6 months to prevent inbreeding.

The stock for the program should be cared for in terms of supplementary feeding, disease prevention e.g., by vaccinations and control of inbreeding.





### 7.3. Synchronization of hens, managing egg-laying and incubation process

- To synchronize hens in this program means making them start laying around the same time or hatch around the same time. Synchronization is challenging in local birds with different ages but a reasonable level can be achieved.
- If we start with chicks or pullets of the same age, we wait until 30% of them start to lay and introduce the cocks. Or the cocks may be introduced when the pullets are at 5 months of age. Remember egg laying can start even without the cocks being present.
- The other alternative is to remove cocks from an existing flock and re-introduce them when at least 5 hens have just started laying. Also, remember that one mating can result into fertile eggs for three days.
- If we have hens moving around with their chicks, we have to separate them and raise the chicks indoors. We then introduce cocks to the separated hens a week after the weaning.
- To ensure high fertility of the eggs, it is recommended to keep one cock for every eight hens.
- Each hen is given its own laying nest. The nests should be numbered for hen identification and production records. The nests should not allow for the neighbour's eggs to be seen when a hen is sitting on its eggs.
- Once a hen starts to lay, the first egg is removed, boiled, marked with a pencil and placed back into the nest as a decoy. Boiling the egg reduces the chances of spoilage and egg bursting to contaminate others.
- Every day, the eggs laid are removed and the date of removal is marked with a pencil on the broad side of each egg. The eggs are put on clean egg trays with broad ends facing up and stored in a secure, cool and humid place, for example in a box in a hole in the floor of the coolest part of the house.
- Eggs should be fresh before incubation. The age of eggs should be no more than 7 days, when stored in a cool place.
- Usually, after a while, one bird starts incubating by staying overnight on the boiled egg. This bird is not given any fertile eggs but is left to sit on the decoy (marked boiled egg) for about ten days or until others start to incubate. After about ten days from when the first bird started sitting on the egg, most other hens will have started sitting on their decoy eggs as well.
- All incubating hens are then given 10 to 12 fertile eggs each, starting from the ones which were laid last. Eggs from a hen do not have to be incubated by the hen that laid them. So, they can be placed randomly.
- To obtain the best incubation result, the eggs selected for incubation should be of average size and normal shape for the breed. When giving eggs for hens to sit on, avoid the following types of 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 or with any abnormal eggshells (including cracks). If there are cracks in the shell, the loss of moisture from the egg can be too high and the embryo may die. There is also a risk of bacteria entering the egg,

which may lead to unhealthy or dead embryos.

» Very dirty eggs (with droppings or manure on them).

- Sanitation of laying nests is important, as well as food and water for the incubating hens. Also important is external parasite control in incubating birds.
- During incubation you should always check, which eggs are fertile and which are non-fertile. Fertile eggs very quickly develop blood vessels, which may be seen against a sharp light from a torch after one week of incubation already (See figures Figure 65 and Figure 66).

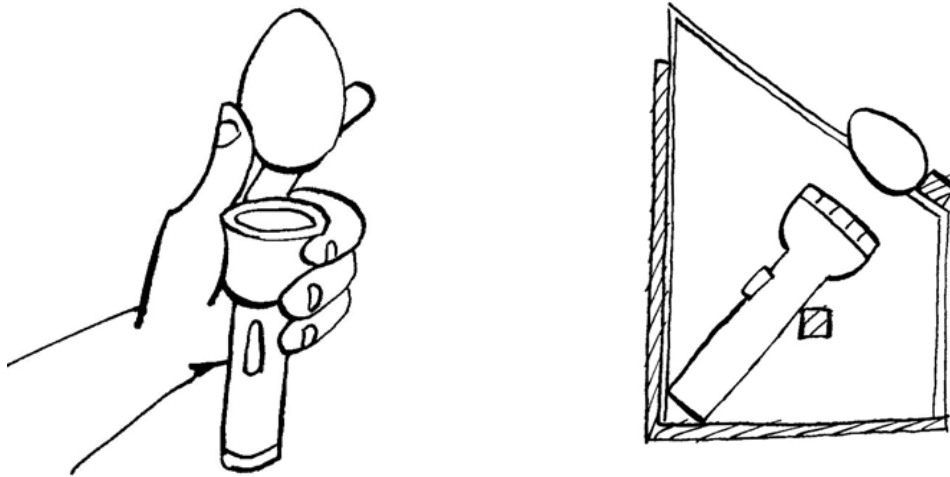


Figure 65: Home-made candles using either your hand or a wooden box, and a torch

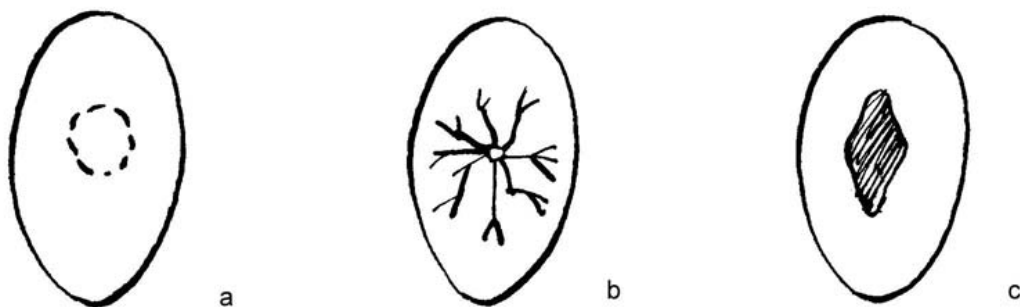
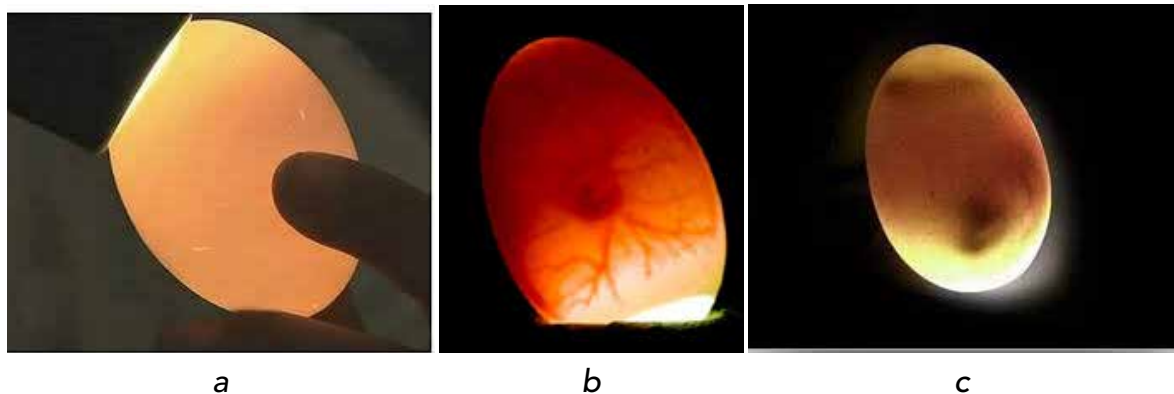


Figure 66: Identification of infertile eggs (a), fertile eggs (b) and eggs with dead (source Riise et al 2004)



- After 7-10 days of incubation the eggs can be candled and the infertile eggs and eggs with dead embryos can be removed from the nest. Figure 58 shows two simple candles and figure 59 shows how fertile eggs, infertile eggs and eggs with dead embryos are identified at the age of 7 days. When candling, a fertile egg has visible blood vessels and a dark spot that is the embryo. The blood vessels can be more or less developed depending on how strong the embryo is. If the embryo is dead, it is seen as a ring of blood around the embryo. An infertile egg has an enlarged air cell and the yolk causes an obvious dark area in the egg. It is important that infertile eggs and eggs with dead embryos are removed from the nest as they will decompose and may break and spoil the fresh eggs under incubation.
- When you want the birds to hatch on Thursdays, they are given the eggs on Wednesday evening, exactly three weeks earlier. The method works because chickens don't count the eggs which they incubate nor the number of days they have sat on the eggs.
- Removal of chicks must be in the dark before the hen leaves a nest, otherwise, it may not incubate the next set of eggs.
- After removing the hatched chicks, the hens can be given a new batch of fertile eggs to sit on if desired.

#### **7.4. Management of the chicks and brooding**

- When the chicks are removed from the hens they are placed in a brooding area.
- The period in the brooder is from hatching to 6 – 8 weeks for local birds.
- Brooding is the most delicate stage in the life of the chicks because they are very vulnerable to diseases and other stressful conditions. Heavy losses may occur in this period when not done correctly. If the brooding methods are satisfactory, mortality in chicks should not exceed 5% during the first 8 weeks of life. Farmers should, therefore, be very careful during brooding.

The following activities should be carried some weeks before chicks arrive:

##### **Preparation of the Brooder to receive the chicks**

- Construct a brooder (see chapter 2) or carry the necessary repairs on the existing building. Ensure that the house does not leak- rainwater does not enter the windows-, the house does not let in draughts (cold wind) and rodents or predators. It may be necessary to block some windows with papyrus mats, cardboards or old sack to reduce draughts and regulate ventilation. Do not use polythene material to block, as it does not allow air circulation through them.
- Acquire hurricane lamps or gas lamps as sources of light if necessary. The target should be to provide bright light with which you can also read newspapers in the room, at the level of the chick. Hang the lamps to provide uniform light in the brooder.
- Clean and disinfect the brooder (see chapter 6). If it has been used before, remove the old litter. Wash and clean the whole room, the outside concrete runs, and equipment inside. The house is left for 2-4 weeks to fallow (idle) before bringing in a new batch. This ensures that most disease agents die.
- The sharp corners of the brooder should be rounded to prevent the chicks from piling in corners and suffocating.

## Litter and feeding management in the first days

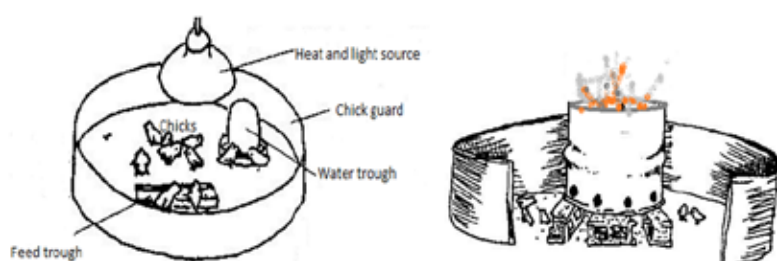
- Coffee or rice husks or any other good litter material are poured on the ground to form a deep (3-4 inches) litter.
- The litter should not be damp and mouldy nor should it be dusty.
- During the first week, the husks are covered with paper/feed sacks. This ensures that the chicks that have not developed their olfactory sense do not mistake the litter for food and eat it, causing impaction. The newspaper also reduces the chances of navel infection in the first few days of life. Do not use polythene paper to cover the litter because it does not absorb water from droppings or spillage from water troughs.
- To teach the chicks to feed, the first three days' chick feed is placed as mounds on the paper.
- The next three days, feed is provided in a new and unused carton of egg trays
- After that, feeding troughs adapted to the size of the chicken are provided (see chapter 2).

## Heating the brooder

- Chicks have higher temperature requirement. When they are brooded naturally, the hen knows exactly how to adjust the temperature. In the case of programmed hatching, a source of heat shall be provided to the chicken in the first weeks of life.
- The brooder is heated for at least 12-24 hours (3 hours in emergencies) before the chicks are stocked in.
- A cheap source of heat for the chicks is provided through charcoal or charcoal briquettes.
- To make a charcoal briquette, charcoal powder (waste) is mixed with sticky soil and moulded in balls which are then left to dry and become hard.
- The briquettes are lighted and placed in a clay pot which is placed on some stones in the brooding area.
- When the chicks are small, they need to be kept together and close to the heat source through a chick guard.
- A chick guard is a circle of plywood, cardboard, plastic, papyrus mat or wire mesh, can be made around the heat source if the brooder is large (Figure 67 and Figure 68). It limits the movement of chicks away from the heat source. The chick guard is 3m in diameter and at least 2ft high for every 200 chicks

## Monitor the temperature using the behavior of chicks.

When the temperature is high, chicks will run away from the heat source and breathe rapidly with open mouth. When the temperature is low, they will gather around the heat source. The chicks distribute evenly in the house when the temperature is normal or uniform. The temperature requirements of the chicks decrease quickly over the 4-6 weeks of life.



*Figure 67: Chick guard or ring made of cardboard. This helps to keep chicks not to stray away*



*Figure 68: Actual set up of a brooder for local birds. Design of a local brooder with clay pot heater and chicks are randomly distributed showing adequate heat*



## 8. Marketing

### 8.1. Marketing

At local markets cocks and hens are sold at different prices depending on factors such as demand (high during festivals), size and weight, plumage and colour (often a higher price for chicken with yellowish shanks). Cocks are usually higher priced at the market than hens. In most regions, local birds are also higher priced than exotic birds. Also, local eggs are often higher priced than imported eggs, despite their smaller size. Taste and texture of meat and eggs are major reasons for the higher price of local products.

### 8.2. Eggs

- The marketing of eggs should be done promptly to avoid spoilage and loss of income.
- Collect eggs from the nesting boxes at least once, but rather two times a day, and store them in a dark and cool place.
- Eggs should normally not be cleaned, but kept clean in the nests. If they are dirty, clean the eggs with a clean, dry sponge or cloth, and sell the eggs immediately. Cleaning eggs with water may disturb the natural protection of the shell and introduce infections to the egg.
- Eggs are transported in trays (box or plastic-type). Good transportation and advertisement are necessary for marketing the eggs.
- They can be sold as fresh whole eggs (Figure 69) or egg products (processed/ready-to-eat form). Conversion into various products fetches more money than the fresh form.
- The prices of eggs are affected by supply in the market, size of eggs and cost of production.
- Sell eggs in the market 2-3 times a week, so you get a good name for selling fresh eggs.
- Always keep records of your production and sale, as explained in the next section (of keeping records).



Figure 69: Eggs for sale (source Riise et al 2004)

### 8.3. Whole birds

- Non-productive hens should be culled and sold for meat.
- Old layers above 3 years should also be sold off for meat.
- Cockerels should be sold as soon as they attain a fair weight. Cocks may be sold any time when they attain market weights of 1.8 to 2kg.
- It is advisable to sell off cocks every six to seven months to avoid inbreeding.
- Birds may be sold alive or as dressed carcasses as the particular market demands. No live bird should be returned from the market, as this is a major cause of transfer of diseases.
- When you want to catch the birds, do it in the house in the late evening during sleep, or attract them with feed, or by using a long stick or a piece of metal wire, bent at the end.
- Formation of farmers' associations and seeking joint solutions to market problems may be of help when production is in surplus.
- Establish good communication with hotels, training institutions, and retail operators to provide a quick market for your products.

### 8.4. Principles of profit maximization in poultry enterprise

Any business person aims at making maximum profits from the enterprise. As keeping local birds become commercial, the farmer must pay attention to the cost of inputs (e.g., feed, vaccine, equipment, etc.) and expected revenue from outputs (e.g., from selling poultry, eggs). If expenses are less than income, there will be a profit. If not, the farmer will lose money.

### 8.5. Business plan / Economic analysis

Before you start a poultry production, you should calculate if it is economically feasible to do so, thereby making the right decisions about the production type and the type of interventions you may start with. For that, you need to know the market situation, the costs (investment costs, running costs) and expected revenue for the different products.

The revenue or income is all the money you earn in relation to your poultry (Figure 70), that is:

Income from sale of live (or slaughtered) birds, e.g., growers, cockerels or spent hens;

- Income from sale of eggs;
- Value of eggs or poultry eaten or given away.
- To this you may add the value of standing stock, e.g., the flock you have built up, that you will not sell, but which is the foundation of your future income.
- Poultry manure also represents a value when given to your plants. It provides many nutrients to the plants, and you may reduce cost for buying fertilizer

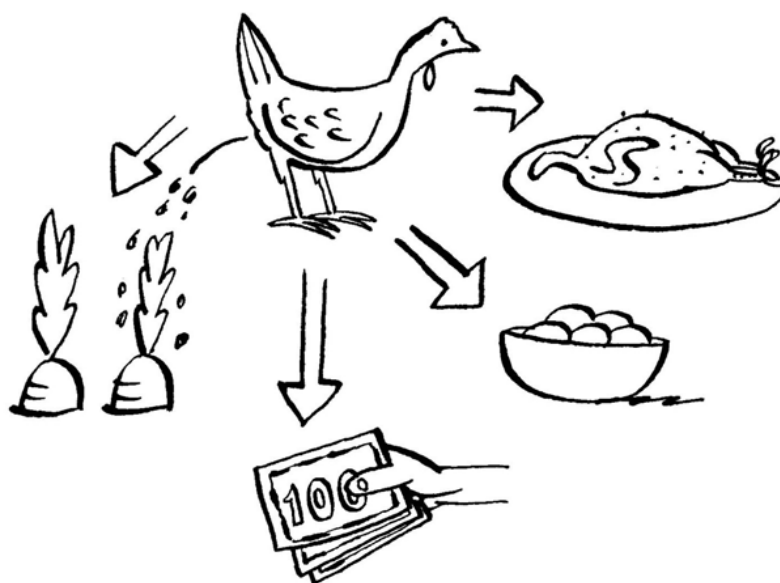


Figure 70: The revenue from poultry may be in terms of meat, eggs, money or manure (source Riise et al 2004)

The costs involved are all the expenses you have in relation to your poultry.

- » Materials for constructing shelters or poultry houses; depreciation and repairs on them.
- » Equipment (water troughs, feeders, feed mill, nests, overcoats, heater, etc.) and depreciation on them.
- » Repayment of loans and interests
- » Growers, hens or cocks;
- » Fertile eggs for incubation;
- » Day old chicks;
- » Supplementary feed, vitamins or minerals; (If you feed with crops that could otherwise be sold, this also represents a value and should be included in the calculation)
- » Vaccines and medicine;
- » Labour and technical advice.

In order to calculate the profit in your enterprise, you should estimate costs and revenues on a monthly or an annual basis and produce a simple business plan or cost-benefit analysis e.g., by using the following chart.

**Table 17: simple chart for reporting costs and income from poultry production and perform a cost-benefit analysis**

COST BENEFIT RECORD KEEPING CHART			
Date	Item	Cost (Ug. Shs)	Income (Ug. Shs)
		Total	Total
<b>Total income – total cost = Profit</b>			

**Profit** = income from sales – costs



## **8.6. How can the costs be reduced and profits be increased?**

In village poultry, where the outputs are usually low, the inputs should also be kept low. This means that expenses for buildings, other equipment and feeding should be kept at a minimum. Small shelters may be built of local materials without high costs. To realize profits, the farmer should observe the following points among other things:

### **Efficient use of feed**

- Feeding constitutes 60 to 70 % of total costs in poultry keeping. Getting a cheap source that does not compromise the growth and production of the birds should be sought.
- Feed wastage should be avoided by providing feeders that prevent birds from spreading feeds to the litter. Do not fill troughs to the brim unless they are automatic feeders.
- Ensure that theft of food and ingredients do not occur especially when you mix your own feeds. This is by ensuring proper records and security checks.
- Stores should be constructed to prevent rodents and animals from eating the feeds. There should be no water leakage in the store as to cause feed spoilage.
- Non-productive birds are an unnecessary burden in a poultry flock and should be culled to save feeds.
- Buy feeds only to last for 2-3 weeks period to avoid feed spoilage and nutrient deterioration.
- Buy feeds from reputable suppliers who provide feeds with the correct weight and nutrient contents as stated on the labels.
- You can also make feeds on farm to save a lot of costs. Try to identify cheap sources of feeds locally.
- Birds older than 8 weeks of age should be released and only supplemented on what they have scavenged on to reduce costs.

### **Targeting the correct time of the year and certain markets**

- Produce poultry in periods coinciding with good markets.
- For example, producing birds for meat around festive seasons of different cultural/religious groups, periods of workshops by organizations, for hotels, schools and other events of social gatherings will guarantee an all-round market.
- This is possible with programmed hatching and batch rearing. Also ensure that birds produce to the maximum.

### **Disease control**

- Follow disease control measures strictly. A disease outbreak may reduce the number of birds drastically and you will also spend money on drugs, disinfectants, vaccines, veterinary consultations, fresh litter, and many other contingencies. Imagine running a poultry business on a loan and disease reduces your investments to nothing?
- The total number of birds lost in a flock in a year should not exceed 12% for profitable production.

### **Use good quality labour**

- It is a false economy to use cheap untrained labour to manage your birds. Unskilled

labour can quickly render the flock non-productive and non-profitable.

- The person working in a poultry unit should know feeding techniques, light regulation (for laying birds), disease prevention, culling birds, general management and good record keeping. An untrained labour is a great risk to your business and can create many non-productive birds. It is also the reason the owner should know poultry management practices.

### Using good productive breeds

- Getting cheap birds from unreliable sources is false economy. Start your flock with breeds with known production performance or select the good performers and rear them.
- Attempt to improve the local breeds by crossbreeding so as to improve their productivity.

### 8.7. Record Keeping

To manage a poultry production, you have to keep detailed records on a daily or weekly basis to show whether it's making profits or not (Figure 71).

- From the records, you can tell if the birds are producing normally and if not, you can easily find why.
- Keep simple records that are easy to fill, read and follow.
- Records should be kept about:
  - » egg production
  - » eggs set for incubation
  - » number of chicks hatched and those that reach maturity-chicken sales
  - » the number of hens, cocks and other age groups
  - » mortality
  - » average weights
  - » feed intake and/or feed supplements,
  - » drug treatment and vaccination records
  - » batch/flock performance



*Figure 71: Keep records that can easily be understood and update records regularly*



**Table 19: A record card for Brooder**

Date of Hatch ..... Number of incubating hens .....							
Number of eggs set ..... Number of chicks hatched .....							
Age	Date	No culled	Number Dead	Total remaining at end of week	Feed consumed (Kg)	Average weight of chicks	Treatments, Activities, Remarks, (Drugs, Cause of Death, litter added, etc)
Week 1							
Week 2							
Week 3							
Week 4							
Week 5							
Week 6							
Week 7							
Week 8							

**Table 20: Production Records of the hens**

Number of Hens .....Number of hens laying.....						
Number of Cocks .....Number of cocks mating.....						
Hen/Nest number	Start date of lay	End date of lay/ start of incubation	Eggs laid in total	Eggs Hatched	Eggs not Hatched	Reasons of not hatching
Hen 1						
Hen 2						
Hen 3						
Hen 4						
Hen 5						
Hen 6						
Hen 7						

**Table 21: Vaccination record**

Date	Vaccine used	Number of birds vaccinated	Method of vaccination	Price of vaccination	Next vaccination date and Vaccine to use

**Table 22: Flock Numbers (count weekly if possible, then monthly)**

Date	Weeks	Hens (from laying onwards)	Pullets (8 weeks to laying 1 <sup>st</sup> egg)	Cocks (from 7 months and above)	Cockerels (2 to 7 months)	Chicks (all birds less than 2 months)	Remarks
	Week 1						
	Week 2						
	Week 3						
	Week 4						
	Month 2						
	Month 3						
	Month 4						
	Month 5						

**Table 23: Record keeping for small-scale chicken production Material and feed (Riise et al, 2004)**

Name:			Day:
Record	Numbers	Price	Comments
Baskets			
Shelters			
Chicken houses			
Nests			
Feeders			
Drinkers			
Other materials			Type, quality
Feed			Type, quality
Feed stuffs			
Formulated feeds			
Vitamins, Minerals			
Medicine			



## 9. Evaluation

Participant Post-Training Questionnaire				
PLEASE COMPLETE THIS SECTION AFTER THE COURSE IS OVER				
Date				
Course Evaluation				
😊😊	😊	😐	😞	😞😞
Very good	Ok	So-so	Not ok	Very bad
1a. How do you rate the overall training? (Use the above symbols)				
1b. Was your expectations met? How?				
2. Which 3 topics were most useful to you and why?				
Topics	Why			
3. Are there additional training or skills that would prepare you?				
4. What recommendations do you have for improving the program?				
5. Any other information that can improve on the training?				

# Training Register

Names of group member (pick from group register)	Modules (Insert the name of module and date the training was conducted and tick the name of everyone who attended)					
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						





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