

DEVELOPMENT INITIATIVE FOR NORTHERN UGANDA (DINU)

ACTION FOR LIVELIHOOD ENHANCEMENT IN NORTHERN UGANDA (ALENU)

LOCAL POULTRY PROGRAMMED HATCHING MANAGEMENT TRAINER'S GUIDE



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Foreword

Local chicken production has been identified as one of the livestock enterprises with great potential for reducing poverty and malnutrition among rural communities of northern and West Nile regions of Uganda. Almost all households in the region have been found to rear local chicken which they have used to solve family-related problems.

Although the main aim of rearing the chicken is not for economic activity to make profits, with the increasing demand for local chicken, this is an opportunity that needs to be tapped in the region for farmers to increase their income and improve their standards of living. Although this is the desire of every poultry farmer, the aim is not always realized. This is because of many factors such as diseases, predators, poor husbandry practices and lack of appropriate skills to improve them. With the readiness to learn and change for the better, any farmer will succeed. “Success is deciding from the start what end result you desire and creating circumstances to achieve it” - (Marker Victor Hansen).

So this manual has been written to propel poultry farmers to success by equipping them with basic knowledge and skills in local poultry husbandry and programmed hatching to improve livelihoods of poultry farmers.

Dr. Alfred Lakwo
Executive Director, AFARD

Preface

This manual gathers existing knowledge on how to improve village poultry production systems with relatively few 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 rapidly 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 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. In each chapter, in addition to the learning objectives and content of the topics covered, exercises and activities are proposed to 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., is 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 and Disclaimer

This manual was developed by Wilfred Eneku of Makerere University College of Veterinary Medicine and Biosecurity and Pascale Waelti of Bern University of Applied Sciences, School of Agricultural, Forest and Food Sciences HAFL for the consortium consisting of four NGOs (Caritas Switzerland, Advance Afrika, Agency for Accelerated Regional Development, and Gulu Women Economic Development and Globalization) for the implementation of the Action for Livelihood Enhancement in Northern Uganda (ALENU) Project that is funded under the Development Initiative for Northern Uganda (DINU), a government of Uganda programme supported by the European Union (EU) and supervised by Office of the Prime Minister.

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

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

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

About ALENU PROJECT

Under the Development Initiative for Northern Uganda (DINU), a Government of Uganda programme supported by the European Union (EU) and supervised by Office of the Prime Minister, Caritas Switzerland has received a grant to implement the Action for Livelihood Enhancement in Northern Uganda (ALENU). ALENU is implemented by a consortium consisting of four NGOs (Caritas Switzerland, Advance Afrika, Agency for Accelerated Regional Development, and Gulu Women Economic Development and Globalization).

Objectives and Results

ALENU is a 40-month action that focuses on improving livelihoods through increased and diversified food production, enhanced market opportunities and better maternal and child nutrition in six districts of the West Nile and Acholi sub-regions. Its overall objective is, “to consolidate stability in Northern Uganda, eradicate poverty and under-nutrition and strengthen the foundations for sustainable and inclusive socio-economic development.” And the specific objective is, “to increase food security, improve maternal and child nutrition, and enhance household incomes through support to diversified food production and commercial agriculture and through improving household resilience (notably to climate change) and women empowerment. The three main result areas are: Result 1.1: Increased production of diversified food; Result 1.2: Increased market accessibility; and Result 1.3: Improved nutritional status

Districts and Sub Counties

Agago (Wol and Lokole); Amuru (Amuru and Lamogi); Omoro (Odek and Lakwana); Nebbi (Erussi and Atego); Pakwach (Pakwach and Panyimur); Zombo (Kango and Athuma)

Main Activities

Result 1.1: Increased production of diversified food
Select HHs; develop Family Development Plans; develop seasonal Production and Marketing Plans; set up group demonstration gardens; conduct farmer field school sessions; facilitate outreaches by local government extension staff; organize seasonal agro-input fairs; build capacity of agro-input suppliers; form commodity-based cooperatives; train VSLA Mentor; train Farmer Group (FG) members in VSLA; link SACCOs/ progressive FGs with formal banks.
Result 1.2: Increased market accessibility
Provide FGs with Business Development Services; organize/ promote sub-county farmer markets; facilitate learning visits to model farmers/private sector actors; create added value for commodities; organize a multi-stakeholder platform and annual cross-sector dialogues; achieve progress in certification, quality control, branding and contracting.
Result 1.3: Improved nutritional status
Train VHTs/Health Workers on good nutrition practices, child health, family planning and WASH; empower cultural and religious leaders to sensitise community; increase access to prevention and curative health services; improve nutrition and sanitation practices at HH level; train VHTs on family planning, provide family planning services; conduct annual couples conference and community dialogues on family planning/GBV; conduct community dialogues for out-of-school adolescents on sexuality/ family planning, provide health services; advocate for supplies of FP commodities; facilitate debating clubs and youth peer groups in schools; collaborate with faith-based medical bureau.

Approaches

- **Holistic Family-Centered Approach:** All household members will benefit from a combination of bundled services customized to meet their specific needs, address their vulnerabilities and strengthen their capacities at the collective and the individual level and in view of reducing poverty and malnutrition.
- **Village Savings and Loan Association (VSLA) and Linkage Banking:** Provide simple savings and loan facilities in a community that does not have easy access to formal financial services. Strong VSLAs will be registered at district level and linked to formal financial institutions or federated into SACCOs for better financial inclusion.
- **Farmer Field School (FFS) with Peer-to-Peer Demonstration-based Extension Approach:** Promote practical knowledge among smallholders on improved technologies through participatory, experimental, problem solving and discovery-based learning and hence increase yields, food adequacy and collective marketing for better market positioning.
- **Market Systems Development (MSD) and Value Chain Approach (VCA):** Make markets work for the benefit of the poor by tackling the underlying causes of market failure and strengthening the functions of market actors as well as the rules and norms that govern the market system.
- **Agro-ecology:** Apply ecological and social concepts and principles to the design and management of food and agricultural systems to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system (FAO).

Key stakeholders

Stakeholder	Role
Target farmers and their households	Main beneficiaries, participate in selection of market commodities and peer-extension agents (CBTs, Poultry Paravets, Agroecology Champions, VSLA Mentor and Market Committee Members), various capacity building activities and monitoring and learning meetings
Local Governments	Oversee implementation of activities and align the Action with the district priorities, involved from planning stage and play a major role throughout the implementation as advisors, extension workers, or beneficiaries of capacity building
Community members	(VHTs, cultural and religious leaders, senior women and male teachers, youth Mentors), contribute to changing attitudes and practices, involved at all project cycle stages.
Private sector	Expand market system and offer production inputs (seeds, tools, etc.), loans, services (market information, advisory service, quality control, vet services etc.), transport and, as traders and processors, purchase the products of target farmers and farmer groups
Advance Afrika, AFARD, Gwed-G	Local implementing partners, in charge of implementation based on a mix of geographical and technical division of responsibilities
Caritas Switzerland	Consortium coordinator and donor, ensures independent project supervision, in charge of MEL and quality assurance including capacity building of co-applicants, and the development of a network of strategic contacts with development partners
Ugandan Government	Supervising (OPM) and contracting authorities (National Authorizing Officer/ Ministry of Finance, Planning and Economic Development)
EU	Main donor

1. Introduction

why poultry rearing

A. Learning objectives

After completing this module, participants will:

- have an overview of poultry production in Uganda and their challenges
- understand the benefits of poultry keeping for income and nutrition
- know the different possible production systems
- have an idea of challenges affecting smallholder poultry production and how to overcome them

B. Duration

0.5-1 hour

C. Learning aids

Flip chart, pens

D. Activities and exercises

No specific activities and exercises. The facilitator will introduce the topic, before continuing with the next chapter.

E. Content

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 & 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 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.
- Employment for the farmer and workers on the farm.
- A properly managed farm attracts visitors and learners who pay a fee to learn good management methods.
- Gifts and dowry payments
- Traditional functions such as cleansing and offerings or sacrifices
- Cocks are used widely in estimating time

- Chicken also supply feeds to other livestock, for example, chicken manure, bones, offals, blood, and feathers are important ingredients in animal and fish feeds.

Other uses include:

Chicken manure is used widely in soil fertility improvement and fertilization of fish ponds.

- Chicken feathers are used in making various items such as pillows, jackets and various ornamentals.
- Chicken kills various dangerous animals including caterpillars and biting insects.
- Chickens are also used in entertainment, for example, cockfights are emerging entertainment in many parts of the world.

1.3. Advantages of poultry keeping and local chicken

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. Individuals in areas where land is limited such as in urban areas 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.
- 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.
- The cost of Veterinary inputs is small when compared to other livestock enterprises.
- 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 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.

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 indices can be **improved** when farmers are trained in basic management practices, synchronization of laying, programmed hatching and artificial brooding among others. This can improve flock numbers (Table 2) 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, 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.

Table 2: A comparison of Programmed hatching and the common free-range system

Item	Common free-range system	Programmed hatching with artificial brooding
Age at puberty	7-8 months	5-6 months
Average number of eggs laid	12 eggs (laid in 12-15days)	12 eggs (laid in 12-13 days)
Incubation period	21 days	21 days
Average chick rearing period	3 months	0 (self brooding)
Weaning to start of lay	1 week	2-3 weeks
Average length of cycle of lay from first egg to start of next lay	4.5months	2 months
Average number of lay cycles per year	2.5 times	5 times
Average number of chicks hatched	10	10
Average number of pullets & cockerels weaned	3	7
With 5 hens and 1 cock, the number of weaned chicks per year	$3 \times 2.5 \times 5 = 37$	$7 \times 5 \times 5 = 175$

From the table 2, 5 hens and one cock on free-range without much input will atmost have 37 offsprings without considering the grand-offsprings. However, this is not the case in the home steads where average number of chicken per household is 6 chickens. With programmed hatching, the estimated number of offsprings without grand-offsprings is 175. This has been demonstrated before, however, the consistency of production should be ensured.

Note: This comparison is based on case study of a previous beneficiary of programmed hatching in Yumbe district. Programmed hatching is presented in chapter 7 of this manual.

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 poultry equipment that belongs in any good poultry house, such as perches, nests, watering and feeding troughs. It is advised to allocate half a day of training for each part.

Part 1: House types, building materials and specifications

A. Learning objectives

After completing this module, participants will:

- understand why simple protection is important in poultry farming.
- know different types of local housing
- know the different criteria for designing a good quality poultry house adapted to the needs of their chickens
- know what kind of material is to be used in the construction of poultry houses, and where these materials can be found or purchased
- be able to design and build or improve their own poultry house

B. Duration

3-4 hours

C. Learning aids

- Drawings of different housings, pens and protections for poultry and chicks (the illustrations presented in this manual can be printed in larger format)
- Common materials used in the construction of simple protections and housing
- If possible, the training site should be close to local poultry farms that can be easily reached on foot by participants for group work (see Part D).

D. Activities and exercises

Introduction (10 min)

The facilitator asks the farmers to work in small groups and together try to answer the following questions: Why does poultry need physical protection, such as chickens and houses? What are the characteristics of a good house/shelter?

Farm walks (30-60 min)

Each participant subgroup visits two farms close to the training site and looks for good and bad examples of simple protection or housing. They will need to identify the good and bad aspects of the protective measures and management practices used to protect the chicks during the night and during the day. In addition, they should note the materials used for the poultry houses and runs or simple protective devices. Finally, the farmers will have to observe the external conditions, such as the climate, that are related to the construction and

use of the housing or other protections for the chicken and chicks. The following checklist can be used by the participants to observe poultry protection and houses:

- What kind of protective equipment and housing is used?
- Where is it placed?
- What's the shape?
- What materials are used?
- Are the birds protected from predators, thieves and bad weather?
- Is the access easy for the farmer?
- Is it well ventilated?
- Is cleaning easy?
- Why do farmers choose (or not) to have chicken houses?
- Did the farmer pay for the construction? What were the costs?
- Is there a fenced area, where the chickens can run free (a pen)? What is the size?
- How does the farmer use the place?

Note: *this farm walk can be merged with the farm walk for equipment described in Part 2 of this chapter.*

Restitution by the participants and discussion (60 min)

One participant from each group will make an oral presentation and/or simple drawings of the poultry houses and runs they have seen. The groups will then discuss the results, focusing on what could be improved. The presentations focus on the good and bad things identified about housing. Possible improvements will then be discussed.

Group work and discussion (30 min)

The facilitator should first gather examples of common materials used in the construction of simple protections and housing. Different simple protection and housing are presented by the facilitator (a drawing, or better still a locally made simple protection). Participants will then be asked to answer the following questions for each type:

- Can this be done locally? What is the cost?
- Are there alternative materials that can be used?
- How much work and skill is involved in building simple protections (such as baskets), chicken houses, or runs?

Summary by the facilitator (10-30 min)

The facilitator summarizes the importance of housing (using elements presented in the previous chapter). The drawings presented in this chapter can be used to illustrate the important functions of poultry houses and pens.

E. Content

2.1. Why should poultry have houses or shelters?

Housing is essential to protect against predators, thieves, rough weather (rain, sun, very cold winds, dropping night temperatures) 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. In the following, we will discuss the simple guidelines for size and type of chicken house, site selection, and lastly the equipment needed for rearing (in the second part of this chapter).



Figure 1: housing should protect against bad weather and predators (source Riise et al, 2004)

Depending on which system of production is to be adopted, the availability of materials, weather, and tradition, you will find different types of poultry houses and shelters in tropical regions. The choice of chicken house should be based on the estimate of the costs, the durability, and the immediate gain of using a house for the poultry. Before building a chicken house, you need to carefully consider the **site**, the **materials**, and importantly, the **costs** involved.

Figure 2 and Figure 3 below illustrates a badly and a well-constructed chicken house.

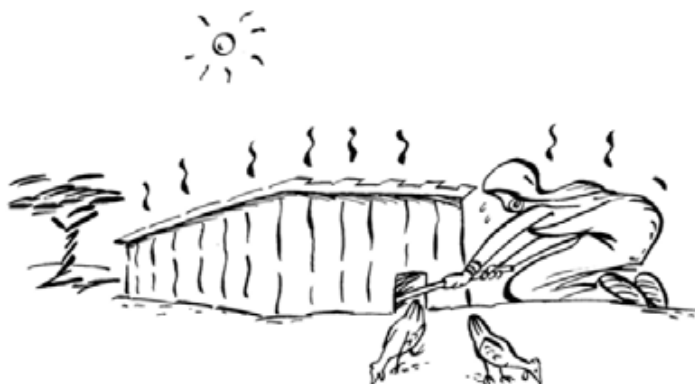


Figure 2: A badly constructed chicken house is placed in the sun with a low flat roof and no windows making it very hot and badly ventilated. It has a small door, which makes it difficult to access and clean it (source Riise et al 2004)



Figure 3: 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)

2.2. Choosing the right site

When choosing the right site, you should consider:

- A **shady** and **dry** place on flat ground to keep the floor dry during the rainy season.
- A **well-drained** soil is desired. The house should not be located near swamps or in places of poor drainage where the house can get damp. The area must not get flooded during heavy rains. The chickens can drown. Furthermore, it is very detrimental to have wet floors in a chicken house, it leads to many diseases. A sloping hillside provides good drainage and affords some protection also.
- It may be necessary to dig a drain around the house, or to raise the ground first. Alternatively, the house can be elevated from the ground.
- **Trees and bushes** close to the houses provide shade and are therefore beneficial. Trees serve as a windbreak and for shade in the dry seasons and protect from flying predators.
- Clear the grass and bushes for about 3 meters on all sides of the house to keep snakes and rats away from your chickens. In wooden houses, use slatted, raised floors to remove droppings and avoid predators.
- It is also for security reasons important to have the chicken house near the house. You must be able to hear if chickens get disturbed at night by predators, or a thief who wants to steal the birds.
- Avoid noisy places (e.g. near piggery units) to avoid the excitement of birds and deposition of yolk outside the reproductive tract.
- The **orientation** of a chicken house has to take into consideration the movement of the sun and the dominating winds, making the house naturally shaded and ventilated at certain times of the day. The short axis (widths with the full wall) of the house should be in East-West direction to avoid direct sun rays into the poultry house. Direct rays promote overplaying and so dust environment from litter results into respiratory diseases.

2.3. Building the house – general principles

Construction material.

- Always use cheap local materials like bamboo, wood, reeds, thatch grass, or clay bricks.
- The house roof may be made of timber or poles and covered with iron sheets (new or old), thatch grass, or just papyrus cushioned by a tarpaulin. It should be constructed in such a way to avoid leakage and to minimize the wetting of the inside by rain when the wind blows by extending an overhang of 90 cm to 1m to cover the veranda (along the long axis of the house).
- The roofing materials all have their own advantages and disadvantages. 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 wall may be from 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 floor may be of concrete or murram ramped and the surface made easy to sweep with minimal dust. Cleaning will be easier if the floor in wooden houses is covered with slats.
- Remove the bark from the wood you use, as parasites often hide behind the bark.

Design to have the right climate

- Chicks of 1-4 weeks of age require warmth while adult birds should be kept in room temperature (20-25°C).
- During the rainy season, rain and wind may cause severe chilling.
- **High temperature** may cause deaths, drop in egg production, low shell quality and reduced weight gain. It increases water intake, leading to increased frequency of defecation that affects litter quality. A combination of high temperatures and high humidity may kill young chicks. Birds in houses with much heat usually open their mouths and breathe rapidly with extended wings.
- Heat, humidity, and harmful gasses may be considerably reduced through **good ventilation** and **insulation** of the house or shelter.
- 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 (see previous section).
- Poultry houses should have free air circulation to reduce excessive heat, too much moisture and remove toxic gases. Ventilation is achieved through building sidewalls for poultry houses halfway (short walls, the rest of it is a mesh) or having large windows (Figure 7). An ideal rearing house should be built to half walls (0.6 to 1 metre high) and the rest (1.4 to 1 metre high respectively) to be made of wire mesh or locally weaved material to appear like a mesh. The use of wired windows with a small diameter enables to avoid predators.
- A hole in the top of the house may ensure good ventilation. These measures will also give light, making it easier to work in the house. However, make sure winds will ventilate the house without making chickens or hens cold.
- The house should ideally be narrow for air to pass across without stagnating in the centre.
- 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. 5 to 7 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 part 2: 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

- Lighting induces sexual maturity in young females (pullets) and continuous supply of light makes birds eat and grow fast.
- In extensive and semi-intensive system, lighting is not necessary. However, it can be interesting at night in the rainy season to attract insects.
- Lighting facilities should be available in the house of intensively managed poultry, like brooders, in programmed hatching (see chapter 7).

2.4. Chicken runs

The semi-intensive system has a house with a fence that surrounds a run (open grassed area) where the birds relax at day time. Fenced areas are also used for feeding, watering, observation of the flock, and collection of eggs (Figure 4). 1.5 – 2-metre-high walls made

of clay or woven mat are constructed as 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 4: Chicken runs may be used for feeding, watering and observation of the flock (source: Riise et al 2004)

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 5). 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 5: Shelter for chicks after hatching. Place the shelter on a mat to protect against the cold (source Riise et al 2004)

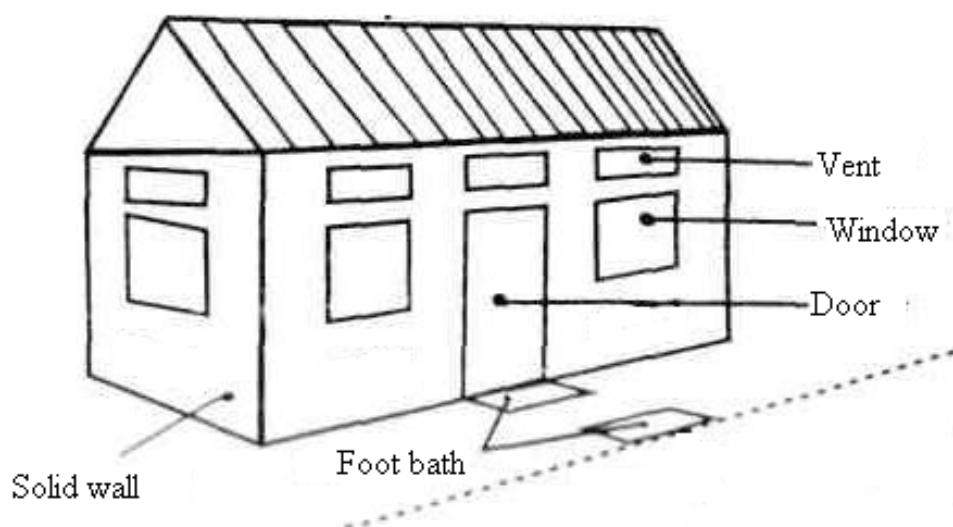
In programmed hatching, we shall have a separate brooder to intensively manage the chicks and have a house for adult birds to sleep or incubate eggs (also called a rearing house). Alternatively, the cheap option is to have a house with two rooms-one room with specifications for brooder and the other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

2.6. Brooder

If programmed hatching is applied, the chicken will be managed separately the first 4-8 weeks of life. (see chapter 7). The same rules as those presented above for the construction of a poultry house must be applied to the brooder. In addition, the brooder should:

- Conserve heat, that is, 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.
- Has adequate ventilation i.e. windows and ventilators can be opened or closed when necessary
- Should be leak-proof, that is, should not allow rainwater to sip into the house and the rain should not splash into the house from the sides.
- Should have room for expansion as the chicks grow and should prevent vermin and rodents from entering inside. This can be achieved by having a mesh on the windows. A sketch of the brooder is in Figure 6.

Figure 6: Brooder design



2.7. Rearing House

In intensive systems, such as in programmed hatching, a rearing house is also necessary. This is a house used for keeping birds after leaving the brooder up to disposal or egg. The same rules as those presented at the beginning of this chapter for the construction of a poultry house must be applied to the rearing house. In addition, there should be foot baths at the entrance of the house containing disinfectants (figure 7).

Figure 7: rearing house design

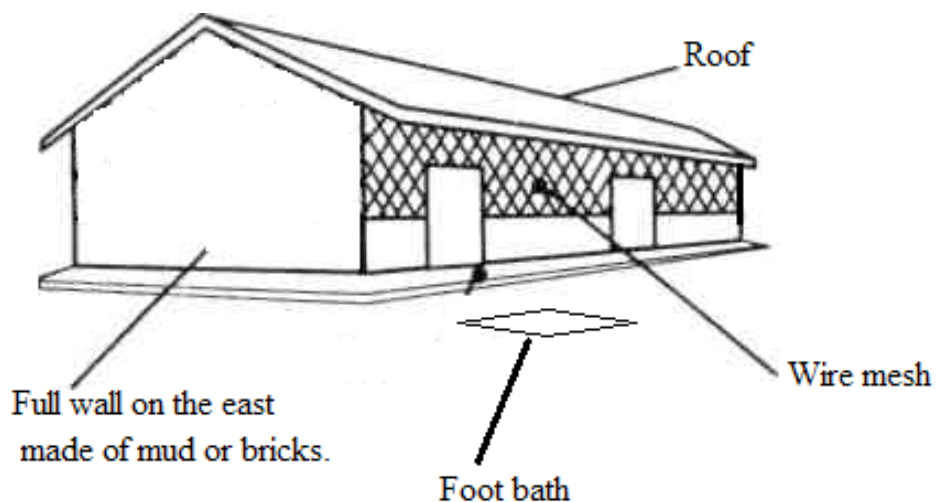




Figure 8: Example of a simple poultry house made of locally available materials



Figure 9: a very good example of more elaborated house for semi-intensive systems. Shade is provided by the trees.

2.8. Litter

- Various types of materials used as litter include coffee husks, wood shavings, rice husks, crushed groundnut haulms, and chopped maize/sorghum stalks among others.
- The floor is first covered with the litter to a depth of 3 inch (to avoid burial of chicks) and is gradually increased to 6 inch, by adding more litter every 2-3 weeks.
- The litter should not be mouldy. It should be kept dry and friable by replacing wet parts and raking daily.

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 natural trees or wire mesh, if possible.

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

- The feed store should be a room or a house that does not leak and is burglar & vermin proof.
- The wall should be plastered and the finishing made with a slippery layer of cement (or any slippery material) to avoid rodents 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 (Figure 10). 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.

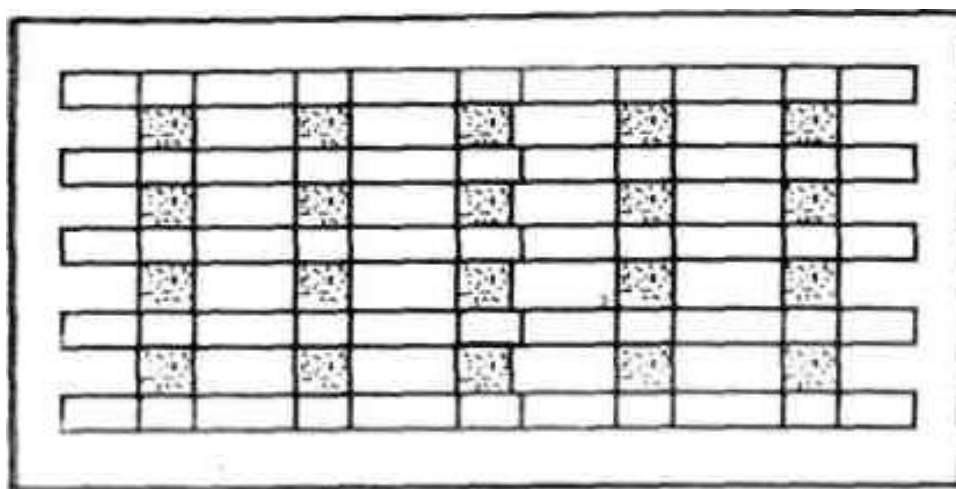


Figure 10: Rack on which feed in sacks can be piled

2.11. Sickbay/ Isolation room

- A sickbay room can be constructed on each rearing house so that you don't mix birds from different houses. This is a disease control measure.
- In the sickbay, you keep birds which you suspect to be sick, unproductive and injured e.g. by pecking. 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.

Part 2: Equipment

A. Learning objectives

After completing this module, participants will:

- Understand the functions of various equipments
- Know how to build simple equipments, such as feeders, drinkers, perches and nests made from local materials and have put it into practice

B. Duration

3-4 hours

C. Learning aids

- Examples and drawings of different equipments (perches, feeders, drinkers and nests) for poultry and chicks (the illustrations presented in this manual can be printed in larger format)
- Common materials used in the construction of these equipments for the practical exercise and schemes for their construction.
- If possible, the training site should be close to local poultry farms that can be easily reached on foot by participants for group work (see Part E).

D. Activities and exercises

Introduction (10 min)

To make sure that everyone understands the topic, the facilitator will ask the farmers to speak for 5 minutes in small groups and together to answer the following questions: What equipment do you use for your poultry? What is it made of?

The facilitator will then initiate a brainstorming exercise in plenary for 5 minutes, where all participants will be able to share experiences with simple equipment and tools.

Farm walk (30-45 min)

Participants will visit farms that are easily accessible on foot in groups of 4-5 people. They will list the equipment used by poultry keepers. In particular, they will indicate whether feeders, drinkers, perches and nests are used on the farms. The following questions can be used as a checklist:

- Do farmers use perches, drinking troughs, feeders and nests? Describe orally or show drawings of the different types used.
- Why and why not do farmers use perches, waterers, feeders and nests?
- Do the chickens use the equipment? If not, why not?
- Have problems been observed with the use of equipments?
- Did the birds lose food and dirty the water? Why and why not?
- Were the nests well-built and clean? What were the perches like?
- How were the perches, drinkers, feeders and nests constructed? Where was the material found or purchased?
- What was the price of the nests, drinkers and feeders purchased or the cost of the materials used to make perches, feeders, nests and waterers?
- Is the material used to make perches, feeders, nests and drinkers available locally?

If possible, groups can bring back nests, drinkers and feeders from the farms visited. If not, they can try to draw sketches of them, indicating which equipment was produced by the farmers themselves, and which equipment was purchased.

Note: *this farm walk can be merged with the farm walk for House types described in Part 1 of*

this chapter.

Restitution in plenary: presentations by the participants (30 min)

One or two participants from each group will make an oral presentation with supporting drawings and/or examples of equipment borrowed from farms. The groups discuss their different findings. In this way a common understanding of the situation will be reached and the group will identify bad and good characteristics of equipments.

During the discussion, the following questions will be addressed:

- Do the farmers provide feeders, drinkers, perches and nests to the Chickens?
- Why or why not farmers use this equipment?
- Do chickens use this equipment? If not, why not?
- Have they observed any problems with the use of feeders, drinkers, perches and nests?

Construction of poultry production equipment (30-60 min)

In this activity, participants will try to build feeders, drinkers, nests or poles themselves (Figure 11).



Figure 11: In this training session, participants learn how to construct feeders from wood and from iron sheets

The facilitator will gather the basic materials and tools needed and explain the basic principles for building these equipments. For this purpose, he will refer to the indications and drawings presented in part “E. Content”. He will show himself how to build this equipment (in particular drinker and feeders) or supervise its construction by the participants.

The facilitator can also show how to construct and install nests for egg laying or brooding, following indication explained in Figure 16 and the corresponding chapter below.

Facilitator's Summary (10 minutes)

The facilitator summarizes the results of the working groups. He may explain in some details what are characteristics of good equipment, based on the theory and drawings presented in part E. Content.

E. Content

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

2.12. Perches

- Perches (Figure 12 and Figure 13) 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 stuck in their droppings. Also, the eggs will be cleaner because the chickens will have cleaner legs when they enter the nest
- Diseases and 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 12). They should not be too thin or too thick. If the sticks are too big or too small, the birds may fall (Figure 13).



Figure 12: Sticks should match the size of the bird's feet (source Riise et al 2004)

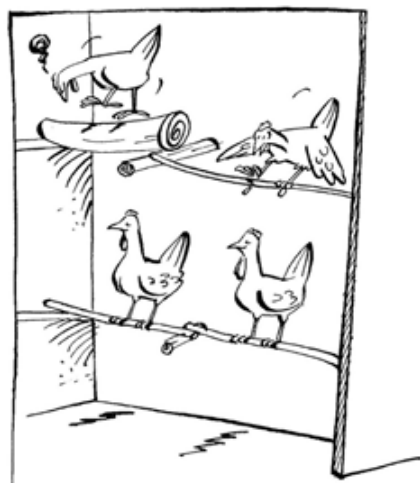


Figure 13: the perches must be of the right size, whether to thick, nor to thin. Otherwise, the birds will feel uncomfortable and fall down (source Riise et al 2004)

2.13. Nests

In many villages, nests are not provided for the hens and eventually the hens will lay their eggs on the ground, in high grass (bush) or in natural shelters, 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.

- Nests should be placed inside the chicken house and preferably above the ground.
- There must be 1 nest for every 5 hens.
- The nests for brooding on the other hand must be individual, 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 14). Once the hen is broody it is necessary to remove her to a different place, e.g. the farmer's house, to avoid other hens disturbing her, or even going broody as well.

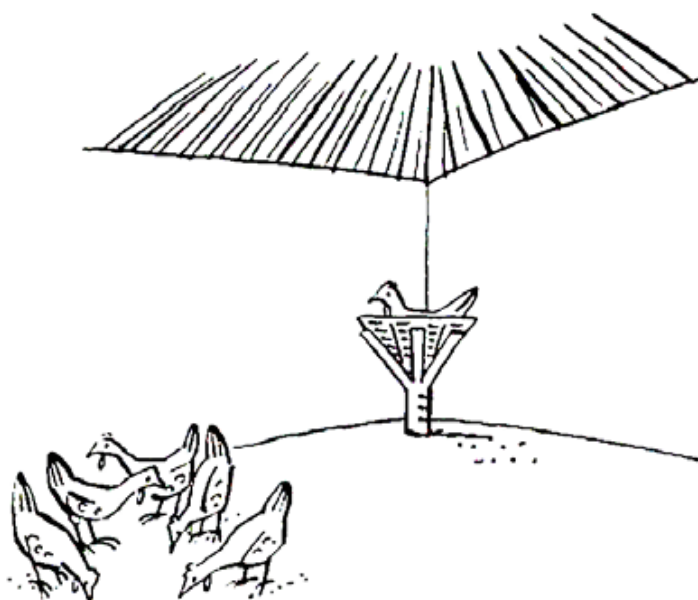


Figure 14: Nest for broody hens should be placed in a quiet place (source Riise et al 2004)

- Simple nests may be clay pots, calabashes or baskets made of local fibres, cardboard, or wooden boxes, cut jerrycans, basins or shallow excavations (Figure 15).
- 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.

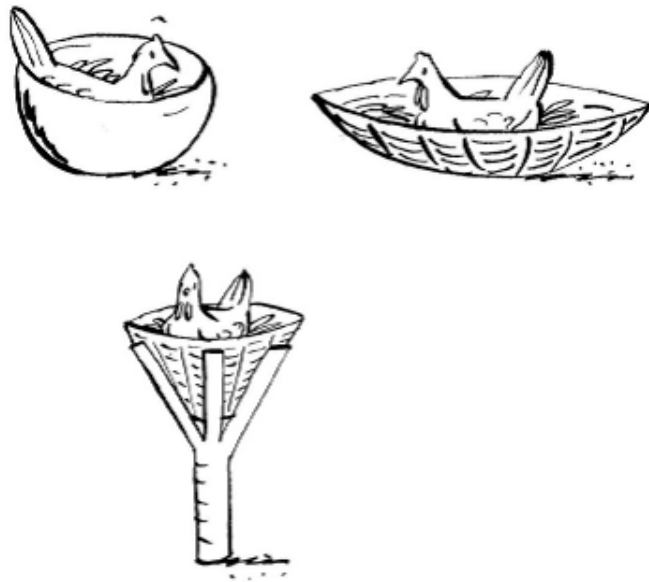


Figure 15: Simple nests for broody hens should be easily transported (source Riise et al 2004)

- A healthy and attractive nest for the broody hen may be prepared by following these three steps (Fig. 16):
 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 16: Three steps in preparing a nest (source Riise et al 2004)

- The floor of the nest should have enough soft litter about 5-8cm deep and air gaps for ventilation. The litter may be old clothes, cotton, dry grass, coffee husks, and any other soft damp-free material.
- Nesting material should be changed at least once a week. You should ensure that the rim is 1/3 of the depth to make the hen feel secure, and if necessary put “dummy eggs” (e.g. boiled or stone eggs) in the nest, to attract a hen.
- 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 the hen will use too much time and energy leaving the nest, cleaning and scratching her body, leaving the eggs cold.
- Providing nests also makes it easier to collect eggs. You may avoid dirty and cracked eggs, if the eggs are collected twice a day. Collect eggs at the same time every day, in the morning and the evening. Removing eggs continuously is important if you want to avoid that the hens become broody, as broody hens stop laying eggs.
- For laying you may have a battery of nests where more hens can lay at a time (Figure 17). Nest Boxes made of wood such as below 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 17: 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)

2.14. Feeders and drinkers

Feeders and drinkers are the same, whether being used in free-range, improved free-range systems or small-scale confined systems. They may be linear or tubular (Figure 18 and Figure 19).

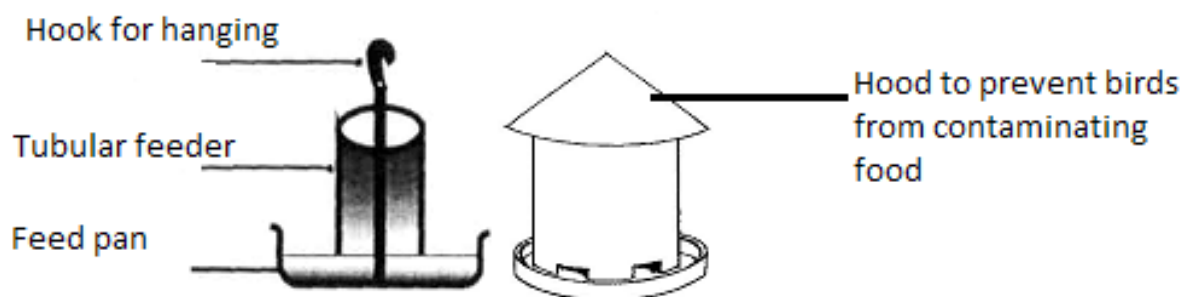


Figure 18: Tubular feed troughs

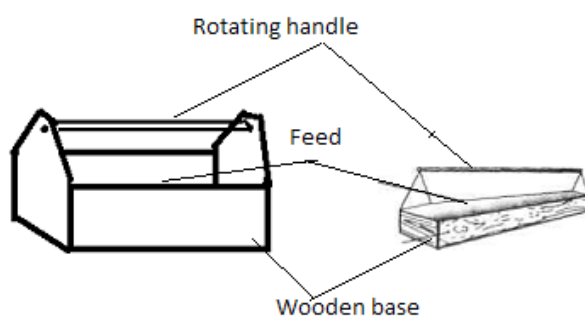


Figure 19: linear feed troughs. A rotating handle prevent birds from roosting and defecating in the feeder

- Feeders and drinkers should always be kept clean to prevent spread of diseases.
- They should be big enough for all birds of the same age to feed at the same time. One metre trough or a 35 cm (diameter) tube feeder is big enough for 20 adult birds to eat and for 40 to drink.
- Allow 2cm per chick and 5cm per bird for growers and adults as space requirement for drinking.
- The feeders 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).



Figure 20: Simple drinker made of an old tin can and a plate (source Riise et al 2004)

- Feeders and drinkers may easily be produced out of local materials: An empty tin placed upside down on a plate forms an excellent drinker. By keeping the tin upside down, you avoid dirt contaminating the water (Figure 20 and Figure 21). 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 21: 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 (which can allow the head of a bird to pass to get water) on one of the broadsides and closing the lid. Place the jerrycan on the opposite side which is not cut.
- 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 22). They are often expensive and normally not any better than locally produced feeders or drinkers.



Figure 22: Commercial drinker/feeder in plastic or metal (source Riise et al 2004)

- 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).



Figure 23: Feeders will keep food clean and reduce food loss (source Riise et al 2004)



Figure 24: Feeders and drinkers may also be made locally of wood, clay, or metal (source Riise et al 2004)

3. Feeding

This chapter on feeding is divided into four parts. Part 1 covers the nutritional value of feeds. Part 2 discusses the availability of feed, in particular through the development of a feeding calendar. Part 3 addresses the dietary needs of poultry and how to make feed mixing at home. Part 4 explains simple production techniques of insects as feed at home. These 4 parts can be treated during 4 different half-day training sessions or grouped into 2 half-day sessions.

Part 1: Nutritional value of the feed

A. Learning objectives

After completing this module, participants will:

- understand why it is important to give supplementary feeding to their chickens
- identify locally available feed suitable for chickens.
- know the relative nutritional value of various local foods

B. Duration

3-4 hours

C. Learning aids

- If possible, the training site should be close to local poultry farms that can be easily reached on foot by participants for farm walks (see Part D).
- Different feeds suitable for chicken. You can also ask in advance the participants to bring with them feeds they use at home for their chicken.

D. Activities and exercises

Short introduction (5 min)

The facilitator will shortly introduce the day's theme and the purpose of the first farm walk.

Farm walks (30-45 min)

Subgroups of participants should go to the nearby households and find five different feeds, which they think are suitable for chickens. Sub-groups may also ask local farmers or bring feeds, which they use themselves or can imagine could be a good chicken feed. The exercise may be planned in advance by asking participants to bring feeds with them to the day's session.

Practical group work on feed types (60 min)

The subgroups of participants are asked to divide the collected feeds according to the main type of nutrients: energy feeds, protein feeds (strength), minerals (hardness) or vitamins (disease protection). Figure 28 can be explained and use to divide the feeds:



Figure 25: Participants divide the collected feeds into groups of nutrients (source Riise et al 2004)

Participants' presentation and discussion (30 min)

Two or more subgroups will make oral presentations of which types of feed belong to which source. The presentations should be supported by the feed found during the farm walk. The groups will discuss their findings in the present situation. Finally, the facilitator will summarise and identify the subjects, which need further attention. The discussion should include the following questions:

- What do chickens eat when scavenging in the villages?
- Do you feed the chickens in the household? What do you feed them?
- What are suitable feeds for chickens?
- What feeds are also used for human food and how does that affect their use for chickens?
- Are there other uses of some of the feeds or example for other animals, cash crop?
- Of the identified feeds, which ones supply protein, energy, vitamin and minerals, respectively?
- Is it an option to grow crops as feed for chickens?

Facilitator's summary (15 min)

The facilitator should explain why it is important to give supplementary feed and present how feeds can be characterised according to their nutritional content and the participants should understand that chickens need feeds from all groups illustrated in Figure 26.

E. Content

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 offsprings).
- 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, as 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 sub-optimal conditions, e.g. high humidity and heat. Knowledge of the quality and source of different feedstuffs is thus important, to reduce the risk of bad feeding.
- The composition and availability of feeds will vary, depending on the season, site location and farming systems.

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 26).

Energy feeds

- Energy feeds are the most important feeds to maintain body temperature and exercise levels of the birds. Normally, at least **¾ 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, grain, roots, and 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.
- 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 1/10.
- Fat is also a good source of energy, in particular in hot climates, as the heat produced during metabolism is less than from traditional energy feeds, e.g. cereals.
- Sources of fat include tallow (fat from beef or mutton), lard, oil cake meals (soybean, sunflower), poultry fat, fish oil, restaurant grease. Insects with a lot of fats are also a good source of energy as well as proteins.
- However, fat should only be given in small amounts, i.e. **less than 1/10 of the total diet.**

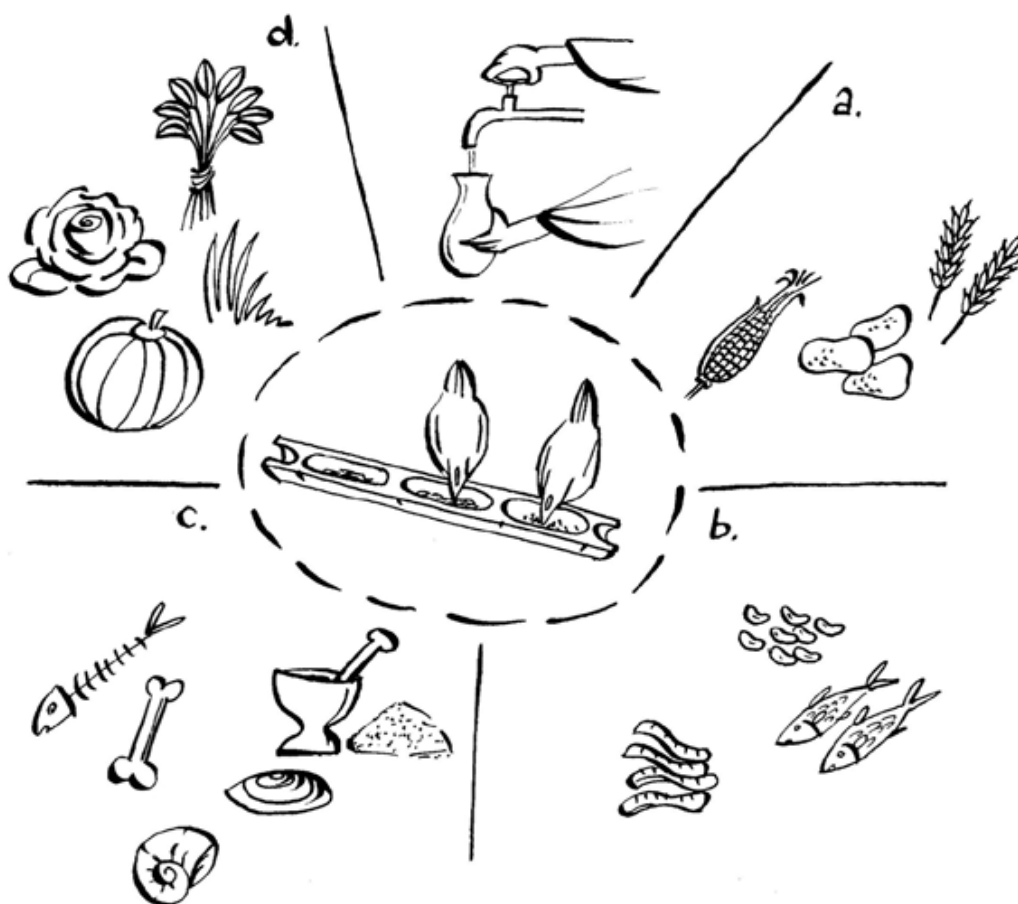


Figure 26: Feed types divided into sources of nutrients: a = energy, b = protein, c = minerals, d = vitamins. Water should always be available (source Riise et al 2004)

Protein

- Proteins are body building foods. They are needed for growth and keeping up a good health status.
- Normally no more than 1/5 of a diet is 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.
- A high level of protein is needed by egg-laying birds since birds release a lot of it 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, and the proportion in the diet should thus be kept low. The level depends on the type of plant, and whether the feed is being prepared before feeding.
- All plant-based protein sources must first be roasted or cooked as though for humans before grinding. This removes bad substances in them that prevent the digestion of the proteins by birds and animals.
- Examples of protein-rich local feeds from animal source are: maggots, termite eggs, insects, 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 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.
- If you add phosphorous rich feeds, it should be balanced with calcium, since too high levels of one may cause deficiency of the other.
- 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 27.

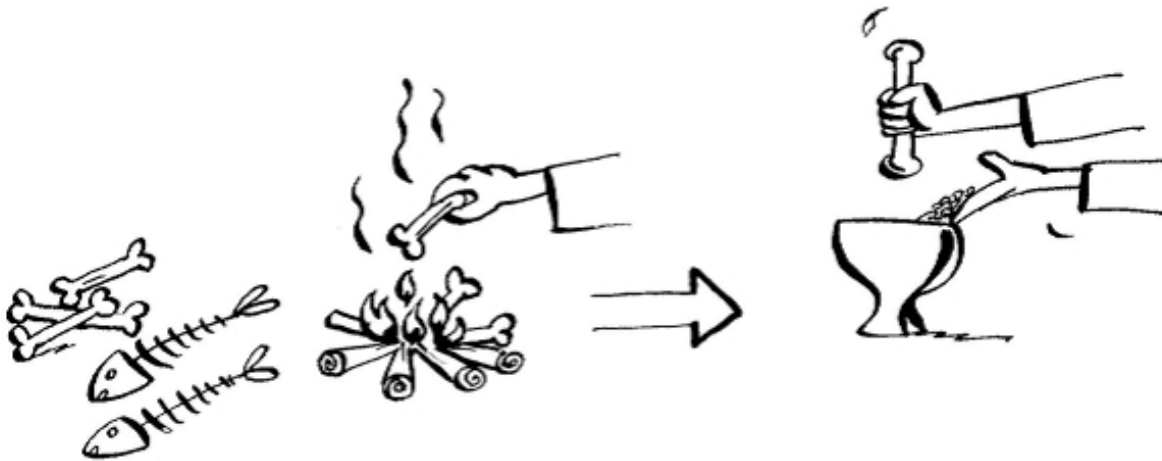


Figure 27: Scorching bones or eggs shells to produce calcium-rich bone meal (source Riise et al 2004)

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 ruin egg production, especially in hot areas, like some northern parts of Uganda. In severe cases, lack of water can cause death in a day or two in confined birds.

Part 2: Establishing a seasonal feed calendar

This module can be addressed directly after module 3.1.

A. Learning objective

After this module, participants will:

- pay attention to seasonal changes in the feed supply for chickens
- know what types of feed are available in different seasons
- identify and discuss different strategies for dealing with diverse feed supplies

B. Duration

1-2 hours

C. Learning aids

- Different feeds suitable for chicken. You can also ask in advance the participants to bring with them feeds they use at home for their chicken
- A ground where it is possible to draw a matrix
- Large sheet of papers and cards, felt-tip pens
- Stones or dry beans or small sticks in large quantities

D. Activities and exercises

The main activity to address in this topic is to produce together with the participants a seasonal feed calendar.

Introduction (15 min)

- a. Identify together with the participants the major seasons in a year. What are their characteristics?
- b. Make a list with the participants of the major types of feed available for chicken in the surrounding. The list can be made with drawings, or you can ask the participants to bring example of feeds, or you can have prepared examples of these feeds.

Practical group work (60 min)

- a. When the participants have agreed upon the seasons and their characteristics, the facilitator will draw a matrix calendar on the ground (or on a very large sheet of paper) showing each season of the year on one axis and the major feed types on the other axis as shown in Figure 28.
- b. The facilitator will introduce the exercise and the rules. Sufficient sticks and stones should be available. Each subgroup will take turns in placing sticks or stones relative to the amounts of the different types of feed available in the surroundings for scavenging in the different seasons.

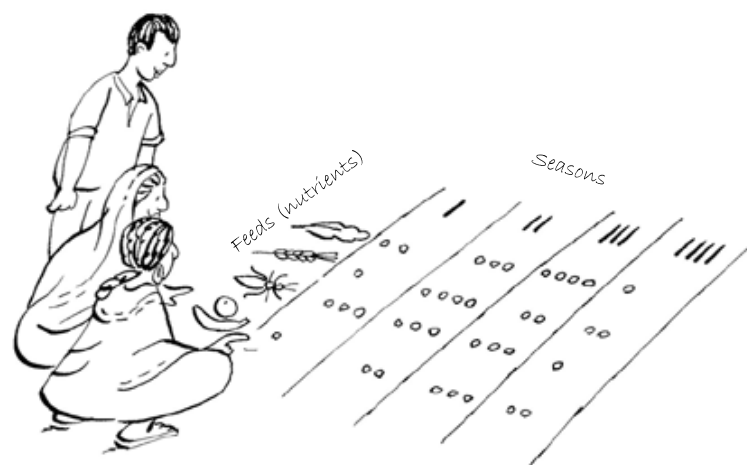


Figure 28: Seasonal calendar (matrix) showing the types of nutrients available in each season [source Riise et al 2004]

Summary and discussion (20 min)

After this exercise, farmers will have a common picture on feed availability during the year and an understanding of the varying feed supply during the different seasons and months. The following questions should be discussed:

- Are there major differences in feed supply during the year?
- During which times of the year is feeding likely to be a problem and a limiting factor in production?
- During which months supplementary feeding is needed mostly and during which seasons chickens are easy to feed.
- Which poultry production strategies are people using at the moment to cope with varying feed supplies?
- Can you think of any other strategies to cope with varying feed supplies, for example only producing chickens in those parts of the year when feed supplies are plenty?

E. Content

Elements of the content presented in the previous sub-chapter (Part 1) can be addressed after this exercise (reminder of the nutritional value of feed and of the different types of nutrients). In addition, the following points can be addressed:

- Feeds are a limiting factor to production at least during part of the year and chickens compete with humans for food.
- It is important to analyse the scavenging feed resource base in relation to the chickens' requirements. Only by understanding the variability during the year can production and feeding be planned in the most cost effective way. For example, it should be avoided to raise young chickens during seasons with very limited feed supplies. Strategies should be considered to fit the production to the feed supply.
- 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. In many areas growing feeds for chickens is however very difficult during drought seasons, where feeds are used for human consumption as well.

Part 3: Nutritional requirements and feed mixing at Home

A. Learning objectives

After completing this module, participants will:

- understand that different age groups have different feeding needs.
- know different techniques on feed mixing
- understand that complementary feed amounts should be limited to ensure better use of the feed resources of the scavenging hen

B. Duration

2 hours

C. Learning aids

- small local containers that may be used for measuring feeds (ask participants to bring containers they would use)
- scale to weight the different amount of feeds
- ingredients to prepare feed mixing with the participants
- other tools and containers necessary for the preparation of the mixture, sacks and bags

D. Activities and exercises

Introduction and group discussion (20 min)

The facilitator should initiate a discussion on the requirements of different age groups. It is important that farmers understand that, if feeds are scarce, young chickens should be given priority over adult hens and cocks. Young chickens need to grow and therefore need more energy and especially more protein. Farmers will discuss the following questions:

- Do you give your chickens, hens and cocks different amounts or types of feed?
- Can you think of methods to secure young chickens a bigger share of the feed?
- Have you ever thought about keeping fewer birds during seasons of low feed supply?

Facilitator's presentation (10 min)

The facilitator should present techniques on how to mix feed for chickens at home.

Beforehand, the farmers have been asked to bring small local containers that may be used for measuring feeds. The facilitator should now demonstrate how local containers: cups, tins, plates can be used to mix feed and quantify the feed amounts given (Figure 29). Feed Storage in part "E. Content" shows how a simple ration for supplementing chicks that can be mixed using local containers. The ration should be modified according to what feed supplies are locally available. Different rations are proposed in part "E. Content".

As a rule of thumbs: young chickens need relatively more protein than adult birds. Therefore, feed for young chickens can be mixed of 3 parts protein and 7 parts energy. In comparison feed for older birds can be mixed of 2 parts protein and 8 parts energy. The mineral and vitamin premixes are then added.

Practical group work (60 min)

It is important that farmers now try to mix feed themselves and understand how any type of container of a suitable size can be used, see Figure 29. The participants should therefore choose some containers, which they know and would like to use. Then they should try to mix e.g. 3 parts of feed using 1-part protein-rich feed resources and 2 parts energy feed resources. The groups should also try to mix some feed with more ingredients. The facilitator should

have made calculations to mix a feed similar to the one shown in Table 9, so participants also try to mix in a vitamin and a mineral source. The detailed process is described after this table.

Group work (20 min)

Farmers will be asked how much feed they would give daily to a flock of eight to ten birds, and how they will feed them in practice. They will be given the choice between A: one tin of 320 g mixed feed in the morning and one tin of 320 g in the afternoon, B: half a tin (160 g) in the morning and half a tin (160g) in the afternoon, or C: Two tins of 2 x 320 g in the morning or the afternoon.

3.4. They will discuss the different options and experiences.

Summary: The right answer is B, only give 30-40 g/bird/day, and give a little in the morning and a little in the afternoon, as they need to be hungry in the morning before letting them out to scavenge and need a little in the evening to attract them to the house.

Facilitator's summary and discussion (20 min)

Lastly the facilitator should summarise the importance of using small containers with well-known quantities to mix and distribute feeds.

E. Content

3.5. 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.
- In the free-range or improved free-range systems, the economic advantage is based on the poultry finding a majority of their feeds scavenging the surroundings, such as greens, insects, earthworms, nuts, grains, and grits necessary for crushing feeds in the gizzard.
- This so-called scavenging feed resource base (SFRB) will change over the seasons and depend on the climate, geography and farming systems of the areas on which the poultry scavenge for feeds. Depending on the season, the chickens may find nearly all they need in the surroundings (e.g. during harvest) or close to nothing (during lean season).
- In this system, adult hens and cocks should always be given enough time and space for finding feed in the surroundings (scavenging).
- 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 4-6 weeks (see Chapter 7).

3.6. How much to feed?

- If the birds are scavenging, you should limit the quantity you give to local birds to no more than 30% - 50% of their full intake as an adult (see Table 3 for feed levels and

needs). In general, this means giving maximum of 30-40 g/bird/day from week 4-6 and onwards, gradually reducing the supplementary feeding.

- If adult birds are not scavenging, give them a feed supplement at a rate of at least 70g (seven tablespoonfuls) per bird per day.

Table 3: 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

- Chicken 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.

3.7. How to feed?

- It is important to use simple local measures to administer your feeds.
- By using Table 34, you can calculate how much feed to use. Table 45 shows an example on how to calculate how much is needed per day based on a flock of 1 cock, 4 hens and 15 three week old chicks.

Table 4: Example of a calculation on how much feed is necessary per day (source Riise et al 2004)

1 Cock: 35g.	=	35
4 Hens: 4 x 35g.	=	140
15 Chicks: 15 x 25g	=	375
Total:	=	at least 550 grammes per day

- If you use a container (e.g. a tomato tin or a cup) and measure how much the container holds when full, it is easy to calculate how many containers of feed you need to feed every day. If the container holds 750 g of feed, you will need to fill the container only $\frac{3}{4}$ full.
- To keep the birds hungry for scavenging, you should give no more than half in the morning, which is then equal to an almost half full container.
- To avoid competition, you give a little more than half of this to the small chicks under a separate shelter. Then you feed the hens and finally, before the feeder is empty you give the cock. If you give the cock at first, he will eat too much and leave little to the others, and you will gain very little. If the cock is hungry, he will be better at finding feeds in the surroundings.

3.8. Commercial diets (concentrate)

- If your production is based on improved breeds for egg production, different types of commercial diets may be given: usually they are divided into three distinct categories, with decreasing amount of protein, e.g.:
 - A. Starters' diet: high in protein; from hatch up to 4 to 6 weeks of age;
 - B. Growers' diet: medium in protein; up to 20 weeks;
 - C. Layers' diet: lower in protein; hens from 20 weeks.
- If you consider buying commercial feeds, you have to calculate whether it is profitable to do so. If the price of eggs or meat is lower than the price of feed, it does not pay.
- Avoid giving commercial feeds to local breeds, as it is rarely profitable. Only during the first four to six weeks of age, you may consider giving premixed supplementary feed bought in the market. Otherwise, it may be more profitable to produce complementary feed mixing at home.

3.9. 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.
- Mixing and formulation of poultry feeds may be **based on simple assumptions about the nutritional requirements of the birds and the content of the feedstuffs**. Or it may be calculated by use of computers and of so-called Least Cost Formulation Programme.
- 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 (Table 5). Minerals and vitamins are added in small amounts.

Table 5: example of protein and energy sources. + = low, ++ = medium, +++ = high content (source Riise et al 2004)

Feed ingredient	Protein	Energy
Cassava tuber	+	+++
Sweet potato tuber	+	+++
Millet bran	+	++
Rice hulls	+	+
Rice bran	++	++
Sorghum bran	+	++
Maize bran	+	+
Sorghum grain	++	+++
Sesbania leaves	++	+
Cowpeas	++	+++
Chickpea	++	+++
Cotton seed oil cake	++	++
Sesame oil cake	+++	+++
Groundnut oil cake	+++	+++
Soya bean meal	+++	++
Maggots	+++	++
Fish meal	+++	++
Meat and bone meal	+++	++
Blood meal	+++	+++

- 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 6: 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
Total	10

- 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 quantification of the different ingredients (Figure 29). Grams or percentages should be transferred into local quantities for field practice.

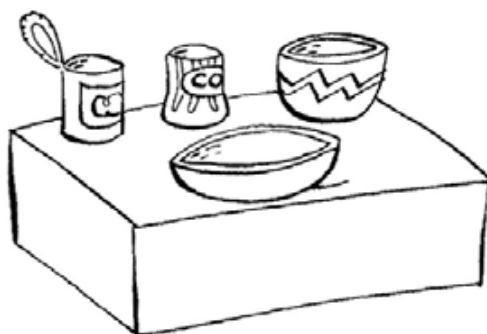


Figure 29: Different containers (plastic bottles, tin cans or calabashes) contain different amounts (source Riise et al 2004)

- 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 colour.
- 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.

Table 7: example of simple ration for supplementing chicks (source: Riise et al 2004)

Ingredient	Quantity
Crushed sorghum/millet grain or maize	1 tin (an empty 1 Kg tomato tin)
Sorghum bran or millet bran	1 tin
Groundnut Cake	2 match boxes
Sea shell or bone meal/salt mix	1 match box (1 salt with 13 bone meal)
Fish meal	2 match boxes
Sesbania or leucenae leaves	2 match boxes

- Further examples of diets are given in Tables 10 and 11.

Table 8: example of composition of 1 kg feed mixture for local chickens at different ages (source Riise et al 2004)

Ingredients	Cereals: millet bran, sorghum bran, rice bran (g)	Oil cake, e.g. ground nut or sesame (g)	Meat, blood, or fish meal (g)	Cassava, tubers (g)	Total (g)
0 - 8 weeks	700	200	100	-	1000
9 -20 weeks	650	150	50	150	1000
20 weeks	600	100	100	200	1000

Table 9: Examples of diets for chicken (layers, grower 7-20 weeks and chicks 0-6 weeks). Contents of 1 kg (source Riise et al 2004)

Ingredients	Rice hulls (g)	Rice bran (g)	Sorghum bran (g)	Sorghum grain (g)	Millet bran (g)	Millet grain (g)	Soya bean meal	Fish meal (g)	Ground nut oil cake	Cassava tuber (g)	Bone meal
Asia Layers	200	600					150	50			Ad lib
Growers	300	500					100	100			Ad lib
Chicks		300		400			150	150			
East Africa Layers			400	400					200		Ad lib
Growers			500	300					200		Ad lib
Chicks			100	600					300		
West Africa Layers					300		300			400	Ad lib
Growers					400		300			300	Ad lib
Chicks						600	100	100		200	

- There can be problems in using too high concentrations of some feedstuffs. Harmful substances in some feeds can cause problems if fed in excessive amounts, or they may contain anti-nutritional components and should not be in raw form, see Table 10.

Table 10: Problems related to some feeds (source Riise et al 2004)

Feed stuff	Problems
Fish meal	Can give a fishy taste to meat and eggs Can contain excessive amounts of salt
Cassava tubers	Contains cyanide, which is toxic, and the tubers must be sliced and dried in the sun before fed to chickens
Oil seed cakes	Can contain excessive amounts of oil and fibre, which lower digestibility of the feed
Beans and peas	Contain a number of anti-nutritional components and should be dried in the sun or cooked for a short period (chick pea and pigeon pea are exceptions and can be fed raw after crushing)

- It is important to realise that the nutritional requirements of the birds may be met in many ways by offering a large variety of feed ingredients. Final decisions on which feed ingredients to use in which seasons, will depend on the availability, quality, and not least the price.
- Table 11 and Table 12 give you an example of how to calculate the price of feed based on local feedstuffs.

Table 11: Examples of poultry feed prices and quantity (adapted from Riise et al 2004)

Ingredient	Price (Ugandan Shillings/kg)	Kg in Tomato-tin
Maize	800	505
Wheat bran	400	320
Soya cake	2800	467
Fish meal	3800	500
Sea shell/salt mix	400	587
Dry Sesbanian leaves	Found locally	125

Table 12: Simple feed price calculation based on feed price and ingredients and quantities for supplementing free-range growers and adults (adapted from Riise et al 2004)

Ingredient	Local containers	Quantity (g)	Price (Ugandan Shillings)
Wheat bran	50 tomato tins	50 x 320 g	= 16 kg x 320 = 5120
Soya cake	2 tomato tines	2 x 467 g	= 0.934 kg x 2800 = 2615.2
Fish meal	2 tomato tines	2 x 500 g	= 1kg x 500 = 500
Sea shell/salt mix	1 tomato tin	587 g	= 0.587 kg x 587 = 344.6
Sesbania leaves	2 tomato tines	2 x 125 g	0
Total	1 bag	18.8 kg	8579.8 Ugandan Shillings
Price/kg			456.4

- 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 green 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.

3.10. Feed Storage

- Large ready-mixed quantities should only be stored, if adequate storage capacities are assured (see under “Twelve simple rules” in this chapter). In general, you should not store mixed feed more than a few weeks to avoid contamination from mould, bacteria or rodents or go bad (rancidity). 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.

3.11. Twelve simple rules for feed management

Before buying, mixing, and storing feeds, it is important to understand 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 mouldy, discoloured or from which pests have eaten, are not used.

Part 4: Simple techniques for feed production in the field

A. Learning objectives

After completing this module, participants will:

- know simple feed production techniques to produce protein-rich feeds (maggots and termites)
- be able to identify local materials for the production of protein-rich feedstuffs

B. Duration

1-2 hours

C. Learning aids

Materials and equipment necessary for the production of termites, maggots (see part E. Content)

- Blood, offal, straw, cow manure and water
- large open pot.
- pot with a short neck and a capacity of at least 10 litres

D. Activities and exercises

Introduction – Brainstorm (10 min)

The facilitator can discuss the following questions with the participants:

- What are the experiences of the participants on the use of simple production and collection of maggots and termites?
- What were the strengths and weaknesses and opportunities experienced?
- What were the major problems encountered?
- Why did they not experience the methods?

Practical presentation and discussion (50 min)

- Participant subgroups should identify local materials and prepare equipment shown in Figure 30 and Figure 31 which may be used for production of protein rich feeds (termites and maggots). The facilitator may demonstrate how to prepare pots for maggot and termite production.
- The participant subgroups should discuss, whether anyone would like to learn termites or maggot production at home over the next couple of days or weeks in order to establish, if the techniques can be used in the local environment. It may be necessary to modify some of the techniques to suit the present conditions.
- The groups will discuss their products and how they think the techniques will work and contribute to cheap feeding of chickens. Availability of materials, suitability and costs of the techniques should be discussed. Maybe suggestions for alternatives under the given local conditions will arise. Finally, the facilitator will summarise and identify the subjects, which need further attention.
- After approximately one week the effectiveness of the techniques should be evaluated again. Maybe some adjustments are needed or maybe other techniques are more suited in this area.

E. Content

- Maggots and termites are excellent and cheap sources of protein in the improved free-range systems. 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.

3.12. 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 30).

- 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 30: growing maggots (source Riise et al 2004)

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

Figure 31 shows a simple method for growing termites to be applied in dry areas.

- Take a pot with a short neck and a capacity of at least 10 litres.
- 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 sandy soil.
- After one day and one night, the pot will be full of termites and you may empty the living contents in front of the hen house in the morning.

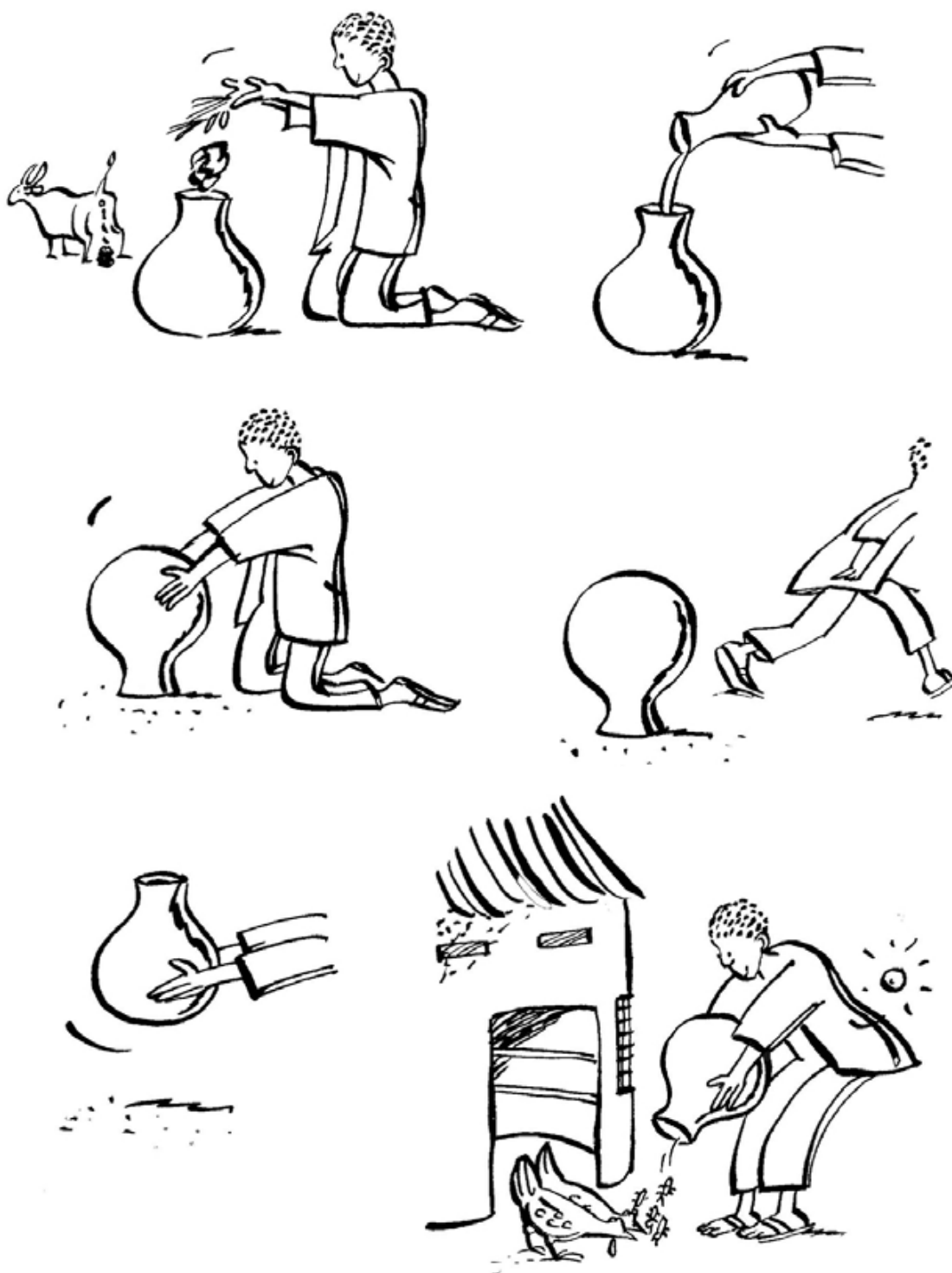


Figure 31: growing termites [source Riise et al 2004]

4. Breeding

A. Learning objectives

This module focuses on selecting the best breeds, birds and eggs for breeding and production. After completing this module, participants will know:

- the different breeds available and which breed is adapted to which purpose;
- the criteria used to select breeding birds;
- the criteria used to select eggs for incubation and take care of them;
- the measures to be taken to maintain a good breeding flock (including management of the laying hens).

B. Duration

2-3 hours

C. Learning aids

- If possible, the training site should be close to local poultry farms that can be easily reached on foot by participants for farm walks.
- Examples of good and bad eggs.
- Pictures of chicks and poultry or living examples of chicks / poultry.

D. Activities and exercises

Farm walks (60 min)

The participants will visit nearby farms in sub-groups and try to identify chickens of different ages and types locally available. They will try to identify good and bad characteristics of these birds and may discuss with the farmers on the strengths and weaknesses of the different breeds. They should identify different characteristics for healthy and good birds and good quality eggs. The following questions may be addressed during these farm walks:

- Which breeds are available in the village? What are their characteristics, in terms of size, colour, plumage, legs, comb, and wattles?
- At what age do they develop distinct sexual characteristics, and what are they?
- When do they lay eggs? How many? What is the price of the hens, cockerels and eggs on the market?
- Are there one or more preferred chicken breeds in the area? Why are these types of birds popular? What are the advantages and disadvantages of this breed?
- Where do you obtain the birds or do you produce your own breeding birds?
- For how long do you keep the same cock? Do you produce your own cock or do you buy it (from where?)
- Do you select eggs for hatching or are the hens allowed to sit on all eggs?
- If you select eggs, which procedure do you then use and how do you store the eggs?
- Can you suggest some ways to improve animals and eggs?

Group presentations (30 min)

The sub groups will present their findings and subsequently discuss what are the advantages and disadvantages of keeping the various ages and types of birds. Some of the questions addressed in the farm walk can be discussed more in depth by the group.

Finally, the facilitator will summarise using the drawings in the content part.

E. Content

- Selection of healthy and sound-looking animals 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 behaviour.
- 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.



A healthy, newly hatched chick should have the following features (Figure 32):

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

Figure 32: A clean dry inward navel is a good characteristic of a healthy hatched chick (source Riise et al 2004)

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
- Feathering normal for the breed
- A red comb (more coloured 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 coloured in lay
- The breast bone should not be too sharp
- A big broad bottom (laying status can be checked, see Figure 34).

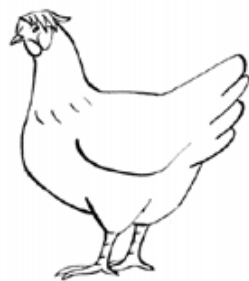


Figure 33: A good healthy hen (source Riise et al 2004)

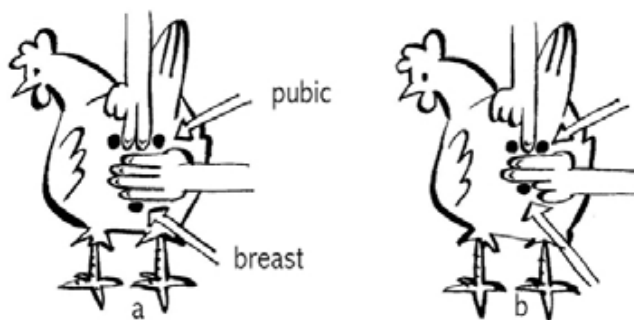


Figure 34: Hen in lay (left) and outside lay (right) (source Riise et al 2004)

In small flocks, it is relatively easy to check whether the hens are laying or not (Figure 34). 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 35):

- alert and protective nature
- shiny and normal feathering for the breed
- 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 35: A good healthy cock (source Riise et al 2004)

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 behaviour. 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 36 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.

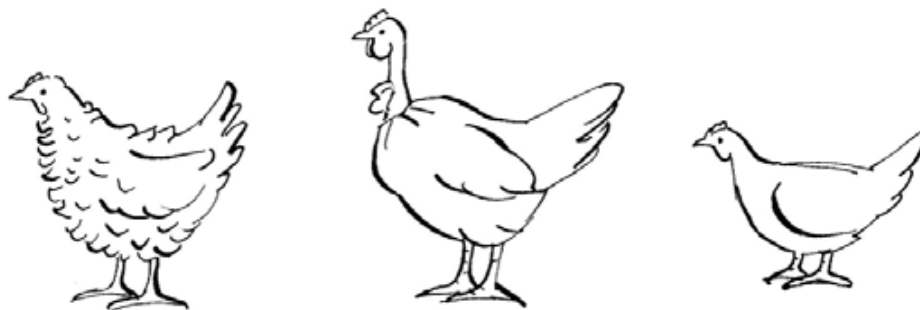


Figure 36: Different breeds of chickens (frizzle feather, naked neck, dwarf) (source Riise et al 2004)

- 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 37. 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.

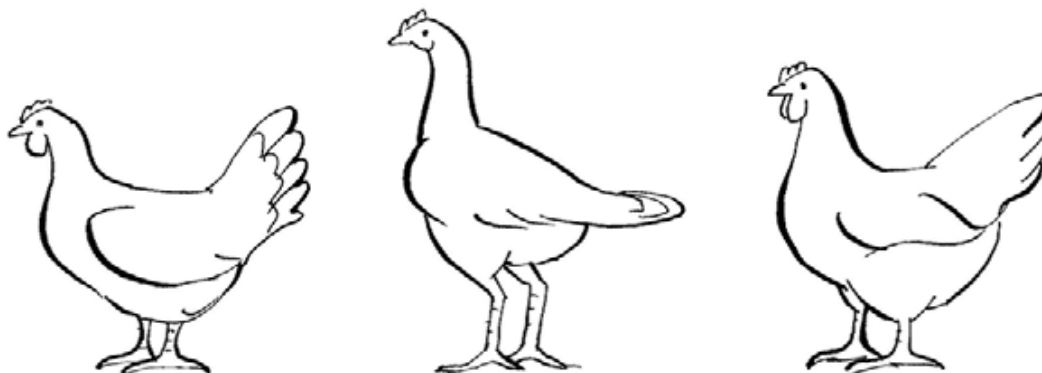


Figure 37: Typical breeds producing eggs (left), meat (middle) and both (right) (source Riise et al 2004)

- 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

- To increase production from local chickens, crossbreeding with other breeds can be practiced. It is however, important to consult professional breeders or breeding companies, who may recommend suitable and available breeds to increase egg production, growth or both. It is important to be aware that the offspring will obtain different qualities depending on whether the cock or the hen of the new breed is used. This is because some qualities are sex-linked and thus it is important to consult a breeder.
- 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

This chapter is organized in two parts. Part 1 explains how to recognize sick chicken and prevent diseases in general. Part 2 describes the main diseases, their symptoms, treatments and prevention measures in details. Vaccination and deworming will be addressed in chapter 6.

Part 1: Recognizing sick poultry and preventing diseases

A. Learning objectives

After completing this module, participants will know:

- how to identify sick and unhealthy chickens in the flock;
- the various diseases encountered in the environment and their symptoms;
- the time when the different diseases appear most frequently;
- the importance of preventing the development of diseases and pests;
- the measures to be taken to prevent diseases;
- how to care for sick and unhealthy chickens;

B. Duration

2-3 hours

C. Learning aids

- Drawings of healthy and sick birds, disease calendars and vaccination charts
- Accessible chicken from nearby local poultry farms that can be easily reached on foot by participants for group work

D. Activities and exercises

Introduction– Brainstorm (5 min)

Participants are asked to name characteristics of a healthy and a diseased bird. How do they recognize sick birds in their flocks?

Farm walks (45 min)

Participant subgroups should each visit a household and assess the chicken flock using simple observational sheets. Table 13 can be distributed to them) and note symptoms of good and bad health in the flock on the day of the visit. They should record how many chickens look healthy and how many look unhealthy and which are the symptoms. The approximate age of the affected chickens should be noted. The participants' subgroup should also ask the farmer what he does when he discovers a sick or unhealthy bird. They will look at what preventive measures he/she takes, identify traditional examples of disease prevention, management, hygiene measures, or lack of them. The subgroup should look at good local ideas and note examples of poor hygiene, poor housing and diseased animals. The owners should be asked what they use for prevention or treatment against diseases.

Participants' presentation (30 min)

A member from each group should present their findings from the farm walk verbally and list the disease symptoms they observed. Together, the farmers can then make a list of most important disease symptoms and which age groups seems to be affected the most. They should also list the local names of the diseases. The facilitator should now follow up the presentations by suggesting which diseases they are probably talking about. He/she should also explain briefly about the prevention and treatment methods. This is a difficult task as many poultry diseases have similar symptoms. The facilitator should make it clear to the farmers that it is important to call a veterinarian or health worker in order to take the right action against the disease. As a minimum the most important diseases, such as Newcastle Disease and Fowl Pox, internal and external parasites should be mentioned together with their symptoms, and which age groups they mainly affect. Locally it could be other diseases than those mentioned here, in which case those diseases should be dealt with instead.

Discussion (30 min)

The participants and the facilitator should now discuss the following questions:

- Which type of diseases (symptoms) seems to be the most important in our area?
- How are these diseases prevented and treated traditionally?
- Which prevention and treatment methods are recommended by veterinarians?
- How are sick birds handled?

The facilitator should also mention that a very important factor in order to avoid disease outbreaks is the daily management of the chickens (see part E. content). Good hygiene, access to clean water, feed supplements and isolation of sick birds are all important factors that maintain healthy birds.



E. Content

- 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 will only keep down infections but are no 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 more detailed 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 13 below, you will find the main characteristics of healthy and unhealthy birds.

Table 13: Characteristics of healthy and unhealthy birds (source Riise et al 2004)

	
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

It is important to isolate unhealthy or sick birds from the healthy flock in order to ensure a minimum of loss. If you find an unhealthy or sick bird, isolate the animal 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 the other birds.

Part 2: The main diseases, their symptoms and treatments

5.2. Disease types

Diseases of chicken can be classified 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 below:

Table 14: disease types and possible treatments (adapted from Riise et al, 2004)

Disease type	Possibilities for control or cure
Virus	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.
Bacterial	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.
Parasites	Most parasites <u>can be treated</u> with traditional and conventional medicine (anthelmintics).
Fungus	Fungal diseases might be treated with antibiotics.
Nutritional diseases/ disorders	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.


5.4. Infectious diseases

Newcastle Disease (ND)	<ul style="list-style-type: none">▪ ND is the commonest chicken disease in homesteads in Uganda.▪ It affects all age groups with high death rates (30-80%) and is most common in the dry season, particularly the January to March.▪ 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.
Cause	<ul style="list-style-type: none">▪ Virus

<p>Signs and symptoms</p>	<ul style="list-style-type: none"> ▪ Loss of appetite, droopy wings, dullness and birds hide their heads under the wings. ▪ Greenish-yellow and sometimes bloody diarrhoea ▪ Respiratory signs such as noisy breathing, sneezing, coughing and gasping. ▪ Discharges from nostrils and eyes <p>Muscular abnormalities like twisted neck Figure 38, stiffness and prostration.</p> <div data-bbox="459 552 782 888">  </div> <div data-bbox="815 573 1159 863">  </div> <p>Figure 38: Bird with twisted neck (source Riise et al 2004)</p> <ul style="list-style-type: none"> ▪ Central nervous signs like tremors, compulsive movements, and death. ▪ 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
<p>Prevention</p>	<ul style="list-style-type: none"> ▪ Vaccination is the only way to control ND. A vaccination program should be adopted and strictly adhered to (see chapter 6) ▪ Avoid introducing new birds into your stock. If new birds are nevertheless introduced, a two-week quarantine period should be applied. ▪ 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. ▪ A high standard of sanitation should be practiced and avoid the introduction of disease in the flock. ▪ Do not keep chickens and guinea fowl together as they are healthy carriers and can transmit the disease to poultry. ▪ Newcastle Disease is a reportable disease. All suspected outbreaks of the disease must be reported to animal health authorities immediately.
<p>Treatment</p>	<ul style="list-style-type: none"> ▪ No treatment as it is a viral disease
<p>Fowl pox</p>	<ul style="list-style-type: none"> ▪ Spread by contact. ▪ Birds of all ages can be affected but it's of more danger to chicks and laying birds
<p>Cause</p>	<ul style="list-style-type: none"> ▪ Virus

<p>Signs and symptoms</p>	<p>Wart-like nodules/ scabs are common on combs, wattles and around the eye/base of the beaks (Figure 39). Eyelids can be closed by these nodules (cutaneous form).</p> <p>Another form attacks the mouth or upper airways, where white nodules are seen in the mouth, tongue, throat, nostrils, and eyes (Figure 39). This causes more deaths as the birds cannot eat and/or drink.</p> <div data-bbox="423 436 1365 680">  </div> <p>Figure 39: Photo on the left (1) has scabs on the head blocking the eyes. On the right side, thick adherent scab in the mouth and external nodule between the eye and nostril can be seen. These are features of fowl pox</p> <ul style="list-style-type: none"> ▪ Drop in egg production. ▪ Death rate with fowl pox is generally low and deaths are mainly due to suffocation and starvation.
<p>Prevention</p>	<ul style="list-style-type: none"> ▪ 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.
<p>Treatment</p>	<ul style="list-style-type: none"> ▪ No specific treatment for fowl pox since it is a viral disease. ▪ 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.
<p>Gumboro disease (Infectious Bursal Disease, IBD)</p>	<ul style="list-style-type: none"> ▪ Usually occurs in large flocks kept in confinement. Not common in small-scale village based systems. ▪ However, the disease is of increasing importance these days in chicks of local poultry ▪ Generally, it occurs in chicks between 3 – 6 weeks of age. ▪ Mainly affects the gland called the bursa of Fabricius which is one of the most important immune organs located around the cloaca ▪ The disease can be spread by contact with contaminated materials and through various parasites that pick up and carry the virus.
<p>Cause</p>	<ul style="list-style-type: none"> ▪ Virus

Signs and symptoms	<ul style="list-style-type: none"> Signs observed only after 3 weeks of age. Sudden and high morbidity rate. The number of affected birds is very high in the flock 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. Diarrhoea that may be white but occasionally, there is passing of blood and straining during defecation.  <ul style="list-style-type: none"> Depression, lack of appetite, ruffled feathers, and a droopy appearance. Vent pecking is common. Postmortem is required to establish the actual diagnosis of the disease by the veterinarian.
Prevention	<ul style="list-style-type: none"> Vaccination (see chapter 6 on vaccinations)
Treatment	<ul style="list-style-type: none"> No specific treatment available as it is a viral disease. However, good husbandry like adequate temperature and broadspectrum antibiotics may reduce the severity of the disease.
Infectious Bronchitis (IB)	<ul style="list-style-type: none"> Spread rapidly and can affect 100% of birds in a flock with varying severity.
Cause	<ul style="list-style-type: none"> Virus
Signs and symptoms	<ul style="list-style-type: none"> Gasping, coughing and sneezing Discharges from nose and eyes. 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. <p>In laying birds, egg production decreases (up to 50%) and eggs have ragged shapes (Figure 40). Effects on production can last 6-8 weeks or longer.</p>  <p>Figure 40: 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.</p>
Prevention	<ul style="list-style-type: none"> Vaccination. Vaccines are either separate or combined with that for Newcastle disease.


Treatment	<ul style="list-style-type: none"> ▪ No specific treatment, as it is a viral disease. ▪ A broad-spectrum antibiotic can help because the disease is usually complicated by bacterial infections. ▪ 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.
Collibacillosis (Navel ill)	<ul style="list-style-type: none"> ▪ Disease of poor hygiene. ▪ Spreads through fecal contamination. Birds infected by direct contact with dirty litter or contaminated eggshells. Not transmitted from bird to bird.
Cause	<ul style="list-style-type: none"> ▪ Environmental disease caused by common bacteria, present in the intestine of birds and mammals
Signs and symptoms	<ul style="list-style-type: none"> ▪ Common among newly hatched chicks: infection in the stomach region. ▪ Symptoms in older birds: <ul style="list-style-type: none"> ✓ respiratory distress ✓ infection in the egg organ with stop of egg production, enlarged and swollen navel (Figure 41) <p>diarrhea with the pasting of feathers around the vent.</p> <div data-bbox="557 1106 1282 1398">  </div> <p>Figure 41: Birds with navel ill or colibacillosis. The abdomen are distended and there is scab at the navel</p>
Prevention	<ul style="list-style-type: none"> ▪ Vigorous sanitation program in the poultry house and control dust in the poultry house. ▪ Avoid stress from other diseases and parasites. ▪ Clean and disinfect waterers and feeders and avoid fecal contamination of these.
Treatment	<ul style="list-style-type: none"> ▪ Treatment of sick chicks might be possible with antibiotics (tetracyclines, enrofloxacin, neomycin, sulfa drugs and others). ▪ Treatment is usually effective if given early.

Pullorum disease (Bacillary White Diarrhoea)	<ul style="list-style-type: none"> ▪ Usually in young chicks. ▪ A common disease of chicks transmitted through eggs from their mother ▪ After hatching, the disease can be transmitted to other chicks through pecking contaminated equipment, food, and breathing.
Cause	<ul style="list-style-type: none"> ▪ Salmonella (bacteria)
Signs and symptoms	<ul style="list-style-type: none"> ▪ White diarrhea and high death rates in young birds while adults show no signs but can be carriers. ▪ Chicks walk with difficulty, show big bellies and drag their wings. ▪ Chicks have ruffled feathers, appear sleepy, don't eat, gather around heat source and make shrill (high pitched) sounds. Birds have swollen leg joints and are often stunted.
Prevention	<ul style="list-style-type: none"> ▪ When the disease occurs, improve sanitation, provide optimum room temperature. ▪ If illness occurs, isolate or kill and burn the birds to avoid further contamination. ▪ Do not use eggs for hatching from hens that have been ill
Treatment	<ul style="list-style-type: none"> ▪ Treatment with sulpha drugs and other broad-spectrum antibiotics would be possible. ▪ However, treatment not recommended because it causes the development of carrier states and is not recommended.
Fowl Typhoid	<ul style="list-style-type: none"> ▪ Semi-mature (over 2 months) and older birds are the most affected. ▪ Egg transmitted disease ▪ Can also be transmitted between adults, through feeds, water, and equipment contaminated by droppings. ▪ Personnel, wild birds, rodents and flies may also transmit from one place to another.
Cause	<ul style="list-style-type: none"> ▪ Salmonella
Signs and symptoms	<ul style="list-style-type: none"> ▪ High body temperature, tiredness, green diarrhea, pale (blue) and shrunken combs/wattles and high mortality (sudden death). ▪ The disease may persist for a month.
Prevention	<ul style="list-style-type: none"> ▪ Vaccines are available and administered into muscles at 3 months of age ▪ Prevention through strict hygiene and culling of ill hens. ▪ Do not buy chicks from unknown sources, and do not use eggs for hatching from hens that have been ill.
Treatment	<ul style="list-style-type: none"> ▪ Prevention and treatment are similar to Pullorum disease (both diseases are caused by Salmonella bacteria). The heat source is not necessary for adult birds.

Fowl Cholera (pasteurellosis)	<ul style="list-style-type: none"> ▪ Affects mostly semi-mature and mature birds ▪ Infection through contaminated feed and drinking water. ▪ Cats and rodents can spread the disease while infected birds can spread the disease through contaminating feeds and water and cannibalism of dead birds. ▪ Fowl cholera is more likely to occur in birds that are stressed by such things as poor sanitation, parasitism, malnutrition, and other diseases.
Cause	<ul style="list-style-type: none"> ▪ Bacteria
Signs and symptoms	<ul style="list-style-type: none"> ▪ <u>Acute form</u>: sign appear in a short time: sudden death, greenish-yellow diarrhoea, discharge from mouth, ruffled feathers, reduced appetite, lameness, difficult breathing and decreased egg production. Often, dead birds are found in the nests and death toll rises quite fast. ▪ <u>Chronic form</u>: long standing state: swelling of joints, foot pads, wattles (Erreur ! Source du renvoi introuvable.) and areas around the eyes causing them to close. Birds may have head tilting to one side when one ear is affected. <div data-bbox="518 924 1252 1215" data-label="Image"> </div> <p>Figure 42: Birds with swollen wattle in chronic Fowl cholera (Source: (Porter & Lane, 2006)). A section through the swollen wattle (picture left) reveals dry pussy material</p>
Prevention	<ul style="list-style-type: none"> ▪ Vaccines exist but unavailable in Uganda. ▪ Strict hygiene ▪ Control rodents and keep cats out of poultry house or feed stores. ▪ Recovered birds are carriers and hence a source of infection Kill and burn affected birds ▪ Purchase clean birds since the disease is not transmitted through eggs.
Treatment	<ul style="list-style-type: none"> ▪ Sulpha drugs, Tetracyclines, Streptomycin, Erythromycin or other broad-spectrum antibiotics can be used in the acute form of the disease under instructions of a Veterinarian. ▪ However treatment is not recommended as recovered birds are carrier (?)

Infectious Coryza	<ul style="list-style-type: none"> Respiratory disease that spreads quite rapidly but with low mortality. Transmitted by close contact since the bacteria do not survive for long outside the body of the bird.
Cause	<ul style="list-style-type: none"> Bacteria
Signs and symptoms	<ul style="list-style-type: none"> Discharge from nostrils, swollen face, eyes and wattles. <p>Adherence of eyelids, fluid accumulation (oedema) in the face sometimes in the wattles. Later, some of the birds may have swollen areas just in front/below the eye with some cheesy/pussy content (Figure 43).</p> <div data-bbox="544 518 1255 810" data-label="Image"> </div> <p>Figure 43: Birds swollen areas around the eye (Source: AAAP). Swelling mainly below the eye and contains pus.</p> <ul style="list-style-type: none"> Respiratory noises and diarrhea. Reduced egg production in laying flocks with affected birds appearing thin with breathing problems.
Prevention	<ul style="list-style-type: none"> This is mostly a disease of management so practice better hygiene and practice all-in all-out system to break the cycle of transmission.
Treatment	<ul style="list-style-type: none"> Sulpha drugs, tetracycline, Streptomycin on prescription by a veterinarian

Chronic Respiratory Disease (Mycoplasmosis)	<ul style="list-style-type: none"> The disease affects all age groups of birds but signs are commonly seen in semi-mature and mature birds. Can be transmitted through eggs laid by infected hens. Can also be transmitted through air droplets, contamination of feed, water or environment.
Cause	<ul style="list-style-type: none"> Bacteria
Signs and symptoms	<div data-bbox="479 1518 699 1675" data-label="Image"> </div> <ul style="list-style-type: none"> Respiratory signs (especially cough) which is persistent for a long time in the flock. Eye and nose discharge, reduced appetite, drop in egg production among laying birds. Signs usually develop slowly in the flock and may persist for weeks or months.



Prevention	<ul style="list-style-type: none"> ▪ Buy chicken without a history of chronic cough ▪ Improve the management (improve ventilation), husbandry, or nutrition ▪ Eliminate all possible sources of stress.
Treatment	<ul style="list-style-type: none"> ▪ Antibiotics e.g. Tylosin and tetracyclines can be used in drinking water but recurrence of the disease is common. Treatment therefore not recommended as carrier states develop
Brooder pneumonia (Aspergillosis)	<ul style="list-style-type: none"> ▪ Acquired by breathing in (inhalation) of fungal spores from mouldy feed or litter. ▪ Not transmitted from bird to bird. ▪ Fungus
Cause	
Signs and symptoms	<div>  <p>Disease attacks lungs, air sacs and liver. Signs include difficulty in breathing, gasping (Figure 44), blindness and abnormal behaviour when the brain gets involved.</p> <p>Figure 44: Chicks affected by aspergillosis showing respiratory problems (difficult breathing).</p> </div>
Prevention	<ul style="list-style-type: none"> ▪ Good ventilation in the house where birds sleep or are reared. ▪ Litter should always be dry and friable. Caked litter should be removed to prevent the growth of fungus. ▪ A fresh feed should be fed. Do not give mouldy feed to the birds. ▪ Use Copper Sulphate following manufacturer guides to decontaminate the litter.

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"> Attacks all ages any time, but occurs more frequently in humid chicken houses with bad hygiene
Cause	<p>The common external parasites include fleas, lice and mites (Figure 45).</p> <ul style="list-style-type: none"> The most common mites of poultry include feather mites, scaly leg mites, red mites, and many others. All this parasites such bloods and cause discomfort by the birds. <div data-bbox="509 457 1208 680"> </div> <p>Figure 45: The common external parasites of chicken</p>
<div data-bbox="256 877 428 1436"> </div> <p>Figure 46: typical behaviour of poultry disturbed by external parasites (source Riise et al 2004) Signs and symptoms</p>	<div data-bbox="532 730 850 1050"> </div> <p>Figure 47: Stick tight flea on the upper eyelid of this layer hen.</p> <p>Lice and Stick-tight flea can be seen around eyes and nose, on the wattles and combs (Figure 47). Fleas can be seen on the belly.</p> <p>Adult birds are clearly disturbed and spend a lot of time pecking and polishing feathers (Figure 46).</p> <p>Young chicks may die from anemia.</p> <p>Scaly leg mites are small creatures that hide/burrow on the shanks of birds causing rough scaly or thickened legs with clear scales and wounds and crippled in their appearance (Figure 48).</p> <ul style="list-style-type: none"> 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. 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. Sometimes, they lead to claws and/or body pecking symptoms <div data-bbox="565 1680 974 1898"> </div>

<p>Signs and symptoms</p>	<ul style="list-style-type: none">  <p>Figure 48: Scaly legs due to burrowing mites in three stages (source Riise et al 2004)</p>
<p>Prevention</p>	<ul style="list-style-type: none"> 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-
<p>Treatment</p>  <p>Figure 49: Common parasiticide powder for dusting poultry and their dwellings</p>	<p>Dust the birds with available anti-parasitic powders like Sevin dust (Figure 49). 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. (see chapter 6 for details)</p> <ul style="list-style-type: none"> <u>Against fleas</u>: Smear some vaseline mixed with little paraffin directly on the fleas. <u>Avoid getting paraffin into contact with the eyes, or apply a little pye-grease on the affected parts</u> <u>Against scaly leg mites</u>: 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.
<p>House flies and their relatives</p>	<ul style="list-style-type: none"> Non-biting flies on poultry farms which have poor sanitation Flies are a vector of many chicken and human diseases through their feeding habits
<p>Cause</p>	<ul style="list-style-type: none"> Intensive farms produce a lot of manure which must be properly managed without allowing fly multiplication.
<p>Prevention</p>	<ul style="list-style-type: none"> Dispose of manure by burying or giving it away to crop farmers. Keep litter in poultry houses dry.

5.6. Internal Parasites

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

Coccidiosis	<ul style="list-style-type: none">▪ This is one of the devastating diseases of housed birds, especially chicks.▪ The birds get infected when they pick eggs of the parasite from contaminated litter.▪ Coccidiosis in poultry affects the intestines.▪ The disease occurs when litter management is not proper (leaving wet litter in the house).
Cause	<ul style="list-style-type: none">▪ Protozoa (small internal parasite)
Signs and symptoms	<ul style="list-style-type: none">▪ Affected birds are dull with no appetite, weak, dehydrated and thin.▪ 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.▪ Death in young chicks. If the chicks survive, they will remain thin and be late in laying.
Prevention	<ul style="list-style-type: none">▪ Avoid overcrowding and provide adequate ventilation.▪ Avoid different age groups of birds in the same house, as the disease may spread from adults to young chicks.▪ Avoid unhygienic conditions e.g. wetting the litter.▪ 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▪ Give coccidiostats e.g. sulpha, amprolium every two weeks till when brooding is over for local birds
Treatment	<ul style="list-style-type: none">▪ Anticoccidials in drinking water or feed as recommended by the vet or manufacturer▪ 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.

Roundworms Tapeworms	<ul style="list-style-type: none"> Internal parasites are very common in all ages in the village based production systems.
Cause	<p>Roundworms (<i>Ascaridia galli</i>) are found in small intestines. They are round, white or yellowish-white and 1-4 inches long (Figure 50). The worms can cause intestinal obstruction and death of the chicks.</p>  <p>Figure 50: 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.</p> <ul style="list-style-type: none"> Gapeworms (<i>Syngamus trachea</i>) lodge in the windpipe/trachea and Causes gaping/gasping in birds. Caecal worms are found in the caecum. They are harmless to chicken but are carriers of poultry diseases like the blackhead of turkeys Tapeworms: Chicken gets these worms by eating snails, earthworms, and flies carrying the tapeworm. They cause anemia, poor growth, and decreased production.
Signs and symptoms	<ul style="list-style-type: none"> Poor health, weight loss, drops in egg production, and bloody diarrhea. The worms can also be seen in the faeces (Figure 15).
Prevention	<ul style="list-style-type: none"> Careful hygiene may prevent heavy infection Avoid overcrowding and if rearing chicken intensively, provide fresh litter when introducing new poultry stock.
Treatment	<ul style="list-style-type: none"> 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®). Albendazole is also used at times when tapeworms are present. <div style="display: flex; align-items: center; justify-content: space-around;">  <div style="text-align: center;"> <p>Piperazine here sold as Ascarex</p> </div>  <div style="text-align: center;"> <p>Levamisole, here sold as Levacide poultry</p> </div> </div>

5.7. Vitamin deficiency

Vitamin deficiency diseases	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.
Cause	<ul style="list-style-type: none">▪ Lack of nutrients in the feeding
Signs and symptoms	<ul style="list-style-type: none">▪ Retarded growth, rickets and leg weakness, swollen joints (hock joints, joints of ribs plus others),▪ Nervous signs (e.g. inclination in movement, paralysis),▪ Discharge from nose and eye, white stuff covering eyeball▪ Pustules in mouth▪ Decreased egg production, poor hatchability▪ Curled toes and other nonspecific signs
Prevention/treatment	<ul style="list-style-type: none">▪ Supply vitamin powder in water or buy vitamin/mineral powders (premix) in feed and provide greens to birds.▪ 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.

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.



Figure 51: 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.

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



Figure 52: common disinfectant

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

This chapter is organized in 3 Parts. The first part describes how to produce in a collaborative way a disease prevention calendar and how to organize a community vaccination campaign. The second part explains how to carry out deworming and dusting of chicken and building. The third part explains how to perform vaccination.

Part 1: Participatory epidemiology

A. Learning objectives

After completing this module, the farmers will have exchanged knowledge on:

- The various diseases encountered in the environment
- The time when the different diseases appear most frequently

A collaborative disease prevention calendar will be elaborated.

B. Duration

2 hours

C. Learning Aids

- A ground where it is possible to draw a matrix.
- Large sheet of papers and cards, felt-tip pens.
- Stones or dry beans or small sticks in large quantities

D. Activities and exercises

Practical group work (45 min)

In small groups, farmers should list all the chicken diseases they know. They can use the local names for the diseases or the official names. Some diseases farmers can easily describe and there will be no doubt about which disease, they are talking about, like Newcastle Disease or Fowl Pox. Other diseases will only be described like diarrhea or a cold. The final product is a list of diseases where some are listed by name, others by symptoms.

Practical group work (60 min)

Next step is to produce a seasonal disease calendar to get some knowledge about when the different diseases occur. This work can either be done by the participants together or the group can be split into 2-3 subgroups, which all make the same exercise. Farmers will draw a calendar on the ground showing each month or each season of the year. The group should choose months or seasons according to what is most suitable in their area.

The seasonal disease calendar should then show all the diseases or disease symptoms known and listed in the previous group work (see above). The farmers should indicate, after discussing it, when the diseases most often occur. Relative occurrence of the diseases can be shown by adding more or less stones or sticks at each month or season (Figure 53) can be used as inspiration for the facilitator. The calendar can also be made similar to the seasonal feed calendar made in chapter 4.



Figure 53: showing an example of a monthly disease calendar (source Riise et al 2004)

Farmers' presentation (15-30 min)

If the group has been split into subgroups for this exercise, they should now present their findings and any differences should be discussed thoroughly, as they may become important, when deciding on prevention strategies. The participants should finally have more or less the same picture and understanding about the variation of diseases throughout the year, and which diseases are most dangerous and important to control.

Discussion, disease prevention calendar (30 min)

The following points can be discussed:

- What are the effects of the disease symptoms, for example high mortality, unproductive birds?
- What are the causes for variations in disease outbreaks over the year (for example climate, nutrition, movement of chickens)?
- Think of strategies to overcome these diseases (for example management, behaviour, medicine)? To what extent are people using such strategies? If not, why not?

Finally, a disease prevention calendar can be discussed and elaborated in a collaborative way between the facilitators and the participants (Figure 54).

A disease prevention calendar helps the farmers to identify and remember when it is time to perform preventive measures such as vaccination and deworming. There is often a need for a communal strategy to prevent diseases. If many neighbours have badly managed chicken flocks, it is difficult to keep a healthy flock as mixing with those flocks might infect them. It is therefore important that a communal strategy to prevent diseases is developed and followed by all farmers. One example could be a calendar showing when to vaccinate and treat diseases at certain times during the year.

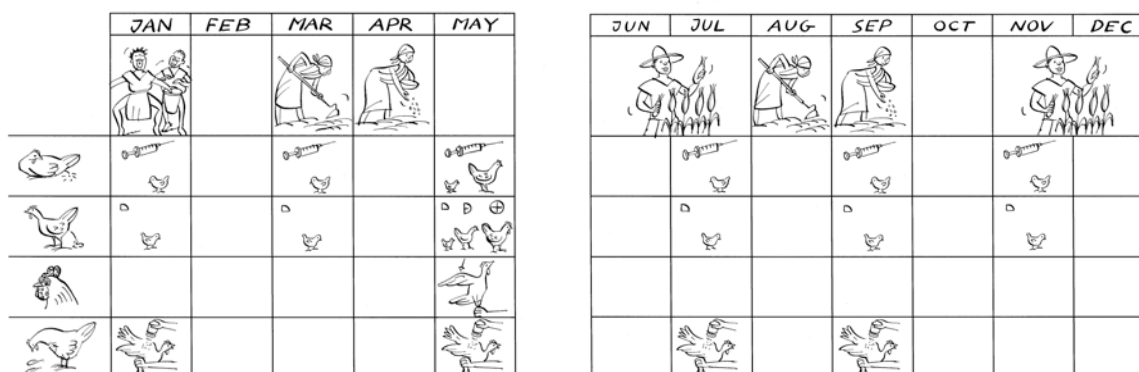


Figure 54: disease prevention calendar (source Riise et al 2004)

E. Content

No specific content for this part. If necessary, the facilitator may remind some aspects of the previous chapter. Vaccination and deworming will be addressed in parts 2 and 3.

Part 2: Fighting parasitic diseases

A. Learning objective

After this module, participants will be able:

- to recognize symptoms of parasitic infestation
- to know how to prevent or treat parasites

B. Learning aids

- If possible, ask a farmer to bring a local hen or cock with parasitic infections.
- Anthelmintic, insecticide, dust and material to demonstrate poultry and building treatments against parasites

C. Activities and exercises

Practical Group work exercise. Fighting parasitic infections (45 min)

The birds should be examined for external parasites, which specifically can be found on head parts, around the vent and on the legs. Identify the most important external parasites. What is the behaviour of the hens, cocks and small chicks, when they are infested? What are the local names? What do they look like and how are they treated locally?

Small practical exercise to treat scaly legs or perform other treatments:

Dip the legs daily in kerosene, oil or in an insecticide until the scales disappear. For all external parasites it is also important to treat the housing materials as many of the parasites will hide or breed in these places. Therefore, walls, roofs and perches should also be sprayed or dusted with pesticides or ashes.

D. Content

No specific content for this part. If necessary, the facilitator may remind some aspects presented in chapter 5.

Part 3: Vaccinations

A. Learning objectives

After learning this module, farmers will:

- Know what vaccination is
- Know when birds can be vaccinated safely
- Have practiced to handle vaccines in the form of eye drops (and the paravets will have practiced vaccination by injection)
- Know that vaccines can also be administered by injections (syringes)
- Know the costs of vaccination

B. Duration

2-3 hours

C. Learning aid

- Material and vaccine to demonstrate the vaccination against ND and fowl pox for example
- Cool box and ice packs
- Vaccination chart
- Vaccine carriers, vaccines, dilution reagents and administration tools (such as droppers, syringes and needles)

D. Activities and exercises

Practical group work. Vaccination (60 min)

The facilitator should bring an eyedropper and a syringe and some chickens and demonstrate the use of them for the farmers. The facilitator should always invite a local veterinarian to perform the first demonstrations of vaccination, and to take part in the further training of selected village vaccinators. Birds should be vaccinated in the early morning, out of the sun, for example in the shade of a tree.

All participants should try to practice use of the eyedropper to vaccinate birds. Initially, a veterinarian should always assist in this work. Make sure enough birds are available so that all farmers can try to vaccinate. Ideally, it could be arranged that all birds owned by participants be vaccinated against for example Newcastle Disease on this day. However, for the testing of a safe method, a few birds should be sufficient.

Discussion and selection of village vaccinator (60 min)

The participants should now discuss how vaccination could be carried out in the village. This can be done by the whole group or by splitting the group into subgroups. The facilitator should explain that vaccines are bought in bottles (vials) with many doses (usually 200 or more doses per vial) and that the vaccines have to be used within the same day of opening the bottle. Even if thermo-stable vaccines are used, they can only keep for a limited time in a warm environment. Therefore, many birds must be vaccinated once the bottle is opened or it will be too expensive if doses are wasted. The farmers should be given details on how to handle the vaccination type used locally. They must understand, that it is necessary to plan and organise the vaccination campaigns together with the paravets. During this group work the farmers should propose a person within the group whom they would like to have as village vaccinator – in addition to the paravets – to be further trained by the facilitator or the veterinarian in a separate training session.

Discussion on organisation and costs (30 min)

The participants group should now discuss the plan for vaccination in relation to the expected

output and in relation to the costs involved. The following questions should be answered during the discussion:

- How will they practically ensure that many birds are vaccinated on one day?
- Where can vaccine be bought?
- What is the cost of the vaccine?
- Who will buy and bring the vaccines? Will they pay in advance? How?
- What are the positive and negative things about vaccination?
- Do you think vaccination will protect chickens better than traditional methods?

E. Content

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.

NB: 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.
- All poultry 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.



6.3. Vaccination methods

There are four fundamental ways of vaccinating birds:

1. Eye drops	Most vaccines in Uganda are administered by this route (Figure 21). Sometimes by nose or mouth drops. Examples of vaccines given as eye drops include Newcastle disease, Gumboro disease and infectious bronchitis
2. Injections	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.
3. Skin piercing	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
4. Orally (in feed or water)	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.

- 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 55).
- 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.

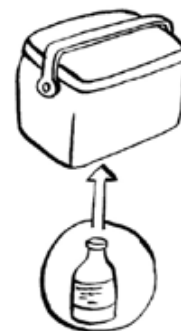


Figure 55: store vaccines in a cool box during vaccination campaigns (source Riise et al 2004)

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 (see part 1).

Table 15: 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 th week	Fowlpox	Wing web skin piercing	Scoop of vaccine in needle eye, one wing pierced once.	Very important
8 th week	Newcastle	Eye drop	One drop per eye	Important
5 th 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 administer 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 56: 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 a 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.
 - - 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 57).

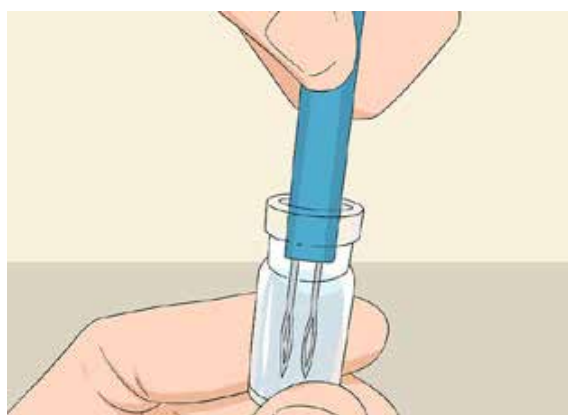


Figure 57: place of injection by piercing the skin of the wing. The wing web is located near the bone where the wing connects to the body. You may pluck a small patch of the feathers so that you can properly administer the vaccine (source Riise et al 2004 and wikihow)

- 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.

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

A. Learning objectives

After completing this module, participants will know:

- the benefits of programmed hatching
- how to apply programmed hatching
- how to identify and manage a broody hen
- how to rear chicken in order to reduce losses
- how to maintain and manage a broody hen

B. Duration

2-3 hours

C. Learning aids

- If possible, the training should take place in a farm where programmed hatching is already applied.
- Nest, material to install and clean and adequate brooder
- Egg trays, pencils and record sheets
- Material to produce charcoal briquettes
- Unfertilized and fertilized egg
- Candler

D. Activities and exercises

Brainstorming (10 min)

Ask the participants what they know and think about programmed hatching. Have they ever heard about it or seen it? What do you think about it? How can we increase the numbers of chicks hatched? What can be done to improve the survival of the chicks? What can be advantages and challenges?

Visit of a farm practicing programmed hatching (60 min)

In particular, participants should assess the place where the nests are installed for incubation and the brooding room and its equipment. They will find out strength and weaknesses, making the link with what they have already learned in the previous modules.

They can ask the farmers about the advantages and challenges he has faced since he applies programmed hatching.

Practical workshop

Different aspects can be exercised in the practical workshop:

- choice of eggs for incubation
- egg candling
- production of charcoal briquettes
- labeling purchased eggs with pencils and placing them in trays
- preparation of nests: participant subgroups should each prepare a nest following the three steps shown in Figure 16 (chapter 2). The groups could use the nests they made/brought/found during the session on equipment.

- demonstrate lighting a charcoal stove and regulating the heat
- Step by step explanation of the programmed hatching (30 min)
- The facilitator explains in details the different steps of the programmed hatching.

E. Content

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 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 at least tripling original stock numbers in less than 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 offsprings. 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 a 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 58 and Figure 59).

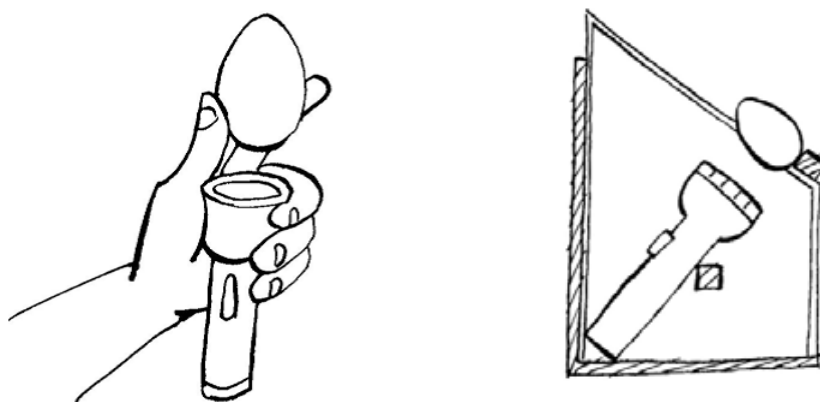


Figure 58: Home-made candlers using either your hand or a wooden box, and a torch

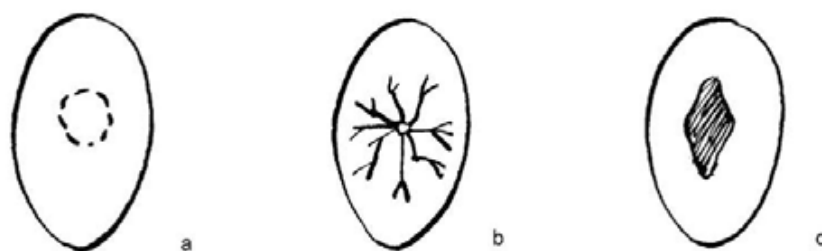


Figure 59: Identification of infertile eggs (a), fertile eggs (b) and eggs with dead (source Riise et al 2004)

- 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 candlers 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 60 and Figure 61). 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 decreases quickly over the 4-6 weeks of life.

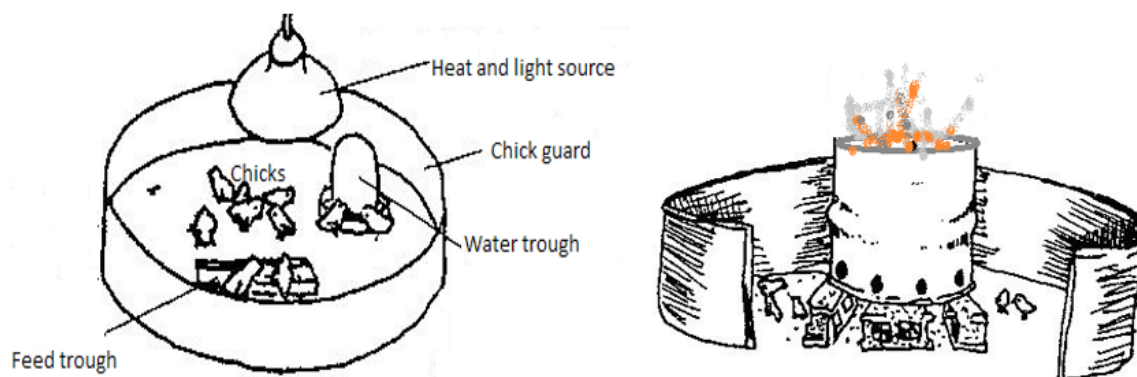


Figure 60: Chick guard or ring made of cardboard. This helps to keep chicks not to stray away.



Figure 61: 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

This chapter is divided into two parts. Part 1 deals with the marketing of chicken and its products and price fluctuations. Part 2 deals with the analysis of the profits of poultry production. Both parts can be covered in the same training sessions or in separate training sessions.

Part 1: Participatory Marketing

A. Learning objectives

After completing this module, participants will:

- understand the benefits of participatory marketing strategies;
- improve their skills on how to maintain their poultry according to the market and the.

B. Duration

2-3 hours

C. Learning aid

- The training should take place close to a market selling poultry (and on a day when poultry is sold).
- A ground where it is possible to draw a matrix.
- Large sheet of papers and cards, felt-tip pens.
- Stones or dry beans or small sticks in large quantities

D. Activities and exercises

Practical group work – Market visit (60 min)

Participant subgroups should describe or visit the nearest local market. The following questions may be investigated:

- What type of birds and eggs are sold? How old are they and what size are they?
- What are prices of feeds, hens, cocks, cockerels and eggs?
- What is the highest price? When is the highest price?
- Do women sell poultry at the market? Is there a difference between the prices received by a man and a woman selling at the market?

Based on the information collected at the market, a seasonal price calendar (Table 16) can be produced showing:

- the annual price fluctuations of feeds (and other inputs)
- the annual price fluctuations of animals and eggs (=main output)

(see chapter 3 on how to produce a seasonal calendar).

Table 16: An example of a seasonal price calendar for inputs. A similar calendar can be produced for prices on outputs (birds and eggs). In the table, each stick (I) stands for relative abundance of the feed in the season.

Feed	Dec –Feb dry season	March to May rain season	June to August dry season	Sept to Nov rain season
Maize				
Ground nuts				
Cow peas				
Broiler starter				
Total	 	 	 	

In addition to months and seasons the calendar should show festival periods, which often involve significant changes in prices. Each subgroup can make both calendars or one group could make the input price calendar and another group the output price calendar. Everyone should be involved in discussing and refining the calendar.

Participants' presentation (30 min)

After producing the calendars, selected participants should present the calendars to each other and describe the reasons for price changes during the year.

Discussions (60 min)

When to sell?

The groups will discuss their findings and the necessary implications. It is important that farmers compare the input and output calendars and consider the best time to produce and sell chickens. Knowing the production time for local birds to reach a marketable size, the farmers should discuss when to start producing small chicks and when to avoid producing small chicks, because of feed problems or low price seasons arriving.

How to sell?

Farmers should discuss selling their products together. Could they send their ready-to-market birds and eggs to the market for example once or twice a week? Could they thereby achieve a higher price? Where is the best market? How much extra can the farmers get for their products, if they avoid selling to the usual middlemen? Who can go to the market? Farmers should discuss the opportunity for contracting local individuals, for example young men from the community to go to the market. These people could make an income at the same time, as farmers would achieve a higher price for their products. What would be the advantages and disadvantages of buying and selling together? Possibilities to buy feedstuffs in the farmers' groups in large quantities and at a lower price should also be investigated. Can farmers agree on such arrangements and with whom?

E. Content

8.1. Marketing

At local markets cocks and hens are sold at highly variable 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 imported improved breeds, although

they are often smaller. 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 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 62: 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 fetch a good price, as one cock to 10-15 hens is sufficient to produce fertile eggs. Cocks may be sold any time when they attain market weights of 1.8 to 2kg.
- In some cases, you may also want to sell a cock, if it is not doing a good job in mating.
- 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.
- Alternatives for carcass preservation should be sought to prevent spoilage.
- Establish good communication with hotels, training institutions, and retail operators to provide a quick market for your products.

Part 2: Financial Performance Analysis

A. Learning objective

After this module, the farmers will:

- know how to follow the evolution of inputs and outputs in the production system
- make a simple cost benefit analysis
- understand the importance of keeping written records and be able to fill in keeping record forms
- be able to identify the major risks in production.

B. Duration

2-3 hours

C. Learning aid

- Large sheet of papers (flip chart), felt-tip pens.
- Simple formats to record data and perform simple cost benefit analysis to be distributed to the participants

D. Activity and exercises

Brainstorm (10 min)

The participants are asked to brainstorm in plenum about their main types of costs and income in relation to the small-scale poultry production.

Practical group work (60 min)

Participants subgroups are asked to list all the costs and income they can think of from their poultry production during the last month. The costs and income of one farmer of the group can be taken as an example. The simple format presented below can be used as model to conduct the exercise.

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
Total income – total cost = Profit			

- Try to note numbers and values of all the income from the last month. It is important that participants also set a value on birds and eggs consumed and incubated in the household, used as gifts or for barter as these also represent a value and sometimes more birds and eggs are used in this way than for marketing.
- Afterwards participants should list all the costs of their production for the last month.
- Once estimates on costs and income are made, a simple calculation on the profits or losses can be made by the subgroup.

Presentation and discussion (60 min)

A participant or the facilitator will give oral presentations of the results of the simple cost-benefit calculations. The implications will be discussed in plenum, and the possibilities of changing costs and revenue levels. The following questions can be discussed:

- Can the costs be reduced? Can profits be increased?
- What are the most important factors that determine the profit?
- What should we include in our calculations?

The facilitator distributes the record keeping chart to the participants and explains how the chart can be used. He may ask them to record data for the next session and explain he will then give a feedback to them.

E. Content

8.4. Principles of profit maximization in poultry enterprise

Any business person aims at making maximum profits within the limits of operation. 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 63), 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

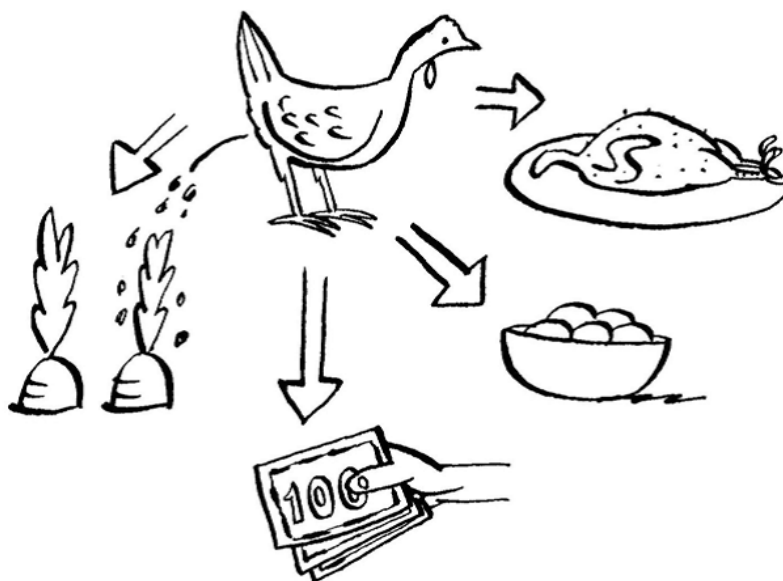


Figure 63: The revenue from poultry may be in terms of meat, eggs, money or manure (source Riise et al 2004)

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 18: 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
Total income – total cost = Profit			

Profit = income from sales – costs

Table 21 below gives an example of the costs and benefits from a flock of local village poultry, starting with an initial flock of 5 hens and one cock and having up to 24 chicks and growers to be sold every six months. Growth potential is 1 kg within 22-24 weeks, and the feed intake approximately 1 kg per 5 weeks per bird. In general always balance the gain and the risks involved in keeping birds for longer periods. If the risk is high and the gain minimal, sell the birds earlier, and vice versa. Values should be corrected to fit to the local conditions.

Table 19: Example of simple cost-benefit analysis (annual basis)

Cost-benefit analysis	Text	Cost/Unit	Cash flow
Costs per year		Ug.Shs	Ug.Shs
5 hens and 1 cock	5 x 12000 + 1 x 20000		80,000
Baskets, 3 night + 3 day baskets	6 baskets	10000	60,000
Low cost home-made feed	354 kg/year	600	212,400
Vaccine (ND) + Fowl pox	2x3 vials of 100 doses	3000	18,000
Medicine (coccidiostat, deworming and insecticide)	Assorted	16000	16,000
Miscellaneous			40,000
Cash out-flow			426,400
Income (Benefit) per year			
Sale of eggs	424-154 = 270	500	135,000
Sale of cockerels, 22 weeks	24	14000	336,000
Sale of pullets, 24 weeks	24	10000	240,000
Total cash in-flow			711,000
Net cash flow, annually			284,600

- It is advisable to keep proper records of expenses and returns (see next section on how to keep records) involved in the business. The farmer should plan right from the start of what expenses he is going to incur before starting to receive income from the poultry enterprise.
- Local birds may start laying around 7 months of age and a farmer should ensure that he/she has enough resources to take care of the costs of housing /equipment, feeds, vaccines/drugs, transport, labour, fuel, and others to the point of lay. Any change in maintenance in this period can lead to low productivity of the birds especially when they get stunted, sick or have an underdeveloped reproductive tract.
- Get ideas on the information for making business plans from veterinary extension workers or progressive farmers near you.

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.

- 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



Examples of record charts that can be used in poultry units are given in the following tables:

Table 20: 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					w		
Week 5							
Week 6							
Week 7							
Week 8							

Table 21: Production Records of the hens

Number of HensNumber of hens laying.....						
Number of CocksNumber 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 22: Vaccination record

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

Table 23: Flock Numbers (count weekly if possible, then monthly)

Date	Weeks	Hens (from laying onwards)	Pullets (8 weeks to laying 1 st 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 24: 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, quantity
Feed			Type, quantity
Feed stuffs			
Formulated feeds			
Vitamins, minerals			
Medicine			

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