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AGRICULTURE & FINANCE CONSULTANTS

POULTRY PRODUCTION & AGRIBUSINESS TRAINING MANUAL FOR SMALL AND MEDIUM SCALE PRODUCERS

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Area 43/498

Lilongwe 3

Malawi

Kristina.Spantig@giz.de

www.giz.de

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Authors:

Professor Timothy Gondwe

James Muhowa (AFC)

Key Contributors:

Dr. Ute Ochsenreither

Dr Jonathan Tanganyika

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FOREWORD

Poultry production is increasingly becoming an important Agri-business for smallholder, small and medium scale, and large-scale producers. The industry is largely chicken production, though other production of species like pigeons, ducks, Guinea fowls, quails, and geese are on the increase. In the smallholder sector, production uses mainly local breeds, though exotic dual-purpose breeds like the Black Australorp prevail. It is this smallholder sector that also raises these other species, and almost all of them are indigenous. Commercial sectors comprise small and medium scale producers, and large-scale producers, that mainly keep meat chickens (broilers) and egg producing chickens (layers) at varying sizes, usually from 50 – 2000 per batch (small and medium-scale) and over 20000 – 100000 per batch for large scale producers. Commercial production mainly takes place near consumer markets in urban and peri-urban areas of districts and cities. However, with growing rural urbanization, it is expected that commercial poultry production will spread to rural areas and integrate with smallholder poultry production.

There is an emerging urban agriculture that engages mostly small livestock production of poultry and pigs. In this farming, local chickens are produced alongside broiler and layer production. There is a proliferation of other dual-purpose chickens in addition to Black Australorp, the likes of Kuroiler, Sasso, Boschveld and other breeds. Quail farming has also been introduced into this sector, all aimed at production for business.

There are few large-scale producers, with infrastructure and technical capacity to produce enough chickens for meat and eggs for the country and for export. These include Central Poultry, Kelfoods (Proto, Donas Eggs), Thanzi Ltd, Kamponji Enterprises, Glenae/Komforzi. On the other side, there are many small and medium scale producers who keep broilers and layers for the local market. These producers are in all cities and districts in Malawi.

- Large -scale producers have technical capacity to produce broilers and eggs using local and imported human expertise and technologies
- Small and medium scale producers lack such capacity, they rely on supply of day-old chicks and feeds from these large-scale producers, and eventual compete for the same local markets

Other people think there is no need to worry about small and medium scale producers if large producers can suffice national and export needs. However, poultry production is a source of cheap animal protein, and provides supplementary income to majority in workforce. Poultry production is a source of livelihood to the non-employed and is compatible enterprise for the youth that have graduated from various vocational and university training institutions. Poultry production is therefore, beyond achieving food goals, hence the need to focus and enhance skills and competency of small and medium scale producers.

The 2021 National Livestock Development Policy and the National Agriculture Policy talk to Agenda 2063 that aim to promote productivity and commercialization of agriculture. In livestock, both smallholder and commercial poultry need to be promoted and commercialized.

This manual aims to develop materials that will harmonize training in the smallholder and commercial poultry production to develop skills, knowledge and competency of producers and other players.

Aim of the training manual

To enable producers of rural poultry, small and medium scale broilers, and layers to gain knowledge, skills, competency, confidence, and values leading to sustainable and profitable business and youth employment.

Objectives of the training manual

The training is intended to:

Acquired knowledge

- Equip producers with theories in poultry production for business

Acquired skills

- Enhance techniques that lead to:
  - Planning and establishing a poultry unit
  - Producing poultry
  - Low-cost production strategies, that include feed rations development and feed mixing
  - Marketing of poultry and poultry products

Acquired attitude

- Motivate the men, youth and women to venture into poultry business
- Develop agri-business minds in rural, small, and medium scale poultry producers

Outcomes of the training manual

It is expected that the following will be achieved following successful training:

1. Producers with adequate knowledge of poultry production and marketing.
2. Producers with technical skills to raise poultry structures, keep chickens and manage them for profitable outputs.
3. Producers with knowledge, skills and competency in ration formulations and feed making.
4. Producers with analytical knowledge and judgement on minimizing costs of production in their poultry enterprises.
5. Producers and services providers with competitive marketing skills.
6. All gender categories (men, women, youth) able to produce and sustainably market poultry.

THE APPROACH TO DEVELOPING THE TRAINING MANUAL

The materials in the manual are a blend of theory from expert knowledge, review of training manuals from other countries including Ethiopia, Uganda, India, Nigeria, review of manuals, and guides from trademarks of broilers, layers, and specially developed dual-purpose breeds of Sasso, Kuroiler and Boschverd. The Department of Animal Health and Livestock Development (DAHLD) developed livestock guides that include broiler and layer handbooks. The Ministry of Agriculture has a handbook titled *'Guide to agriculture production in Malawi'* and has poultry production under livestock section. Efforts were made to consolidate notes from all these, and from teaching materials in higher education institutions, to ensure there is one message to the target users of the training manual. A few small-scale producers and services providers such as hatching units and veterinary shops were visited in Northern, Central, and Southern Malawi. Conventional and experientially acquired knowledge and observations from production practices on these small and medium scale producers were integrated. Other information came from social groupings of poultry farmers on WhatsApp media, where farmers exchange information on production, challenges and sales of chickens, eggs, and other products.

How to use the manual

The training manual recognizes three key enterprises:

1. Broiler production
2. Layer production, and
3. Rural poultry with focus on local and dual-purpose chicken production

Majority small and medium scale farmers produce one of these, though a few would combine two (broiler and layer production). These are developed as key modules in the manual.

Considering that majority beginners may take one of the three enterprises, each is considered a complete and stand-alone module, from planning, to production to marketing, to minimize cross referencing.

Additionally, special sections have been developed as separate modules of:

1. Enterprise budgeting and business plans
2. Feed formulation and mixing
3. Parent stocking and hatchery management

These later modules target farmers who may need to enhance their special skills and integrate into their production. Trainers and extension agents from Government and NGOs can be trained to help beginners to roll out production. Enterprise budgeting Module can be taken by beginners to motivate them as they go into poultry production, hence combined with any of the three key modules. The same Module targets existing producers who may be trained only on this module to enhance their entrepreneurial skills in poultry production business.

Feed Production module targets producers who would enhance their skills in making rations, other than being provided with such to compound feeds on their farms. The module also targets the youth and other participants that would like to venture into local and small-scale feed production for business to poultry producers. We expect these participants to have acquired O-level education and have basic/elementary computing skills to use excel on computers and smart phones.

Where such basic qualification is missing, farmer groups should send extension agents who can be trained to help producers in local feed formulation.

Parent stocking and hatchery management is specialized module that targets participants as individuals or corporates, aiming at producing day-old chicks for their production and sell to small and medium poultry producers. Considering chick production as special, we do not expect this module to be delivered to all participants and may be through special arrangements.

The module includes production of day-old chicks for rural poultry value chain. This may target small-scale rural poultry producers, including youth groups. Other youths may be interested in producing day old chicks for supply to other farmers in rural and urban areas. Because of this, the materials are also included and to be discussed in the key module of rural poultry with focus on local and dual-purpose chicken production.

All sections are presented as modules, and within a module, there are units. The units have combined modes of delivery that include:

- Developing rapport by getting to know each other and basic knowledge of participants
- Lecture contents
- Demonstrations
- Practical sessions within class
- Practical sessions on farm
- Self-assessment
- Take home assignments

Additionally, each module is developed to guide a self-reader to implement each step into production.

MODULE 1: ENTERPRISE BUDGETING AND GROSS PROFIT ANALYSIS

Duration: 250 minutes

Module objectives

By the end of the module, participants and users should:

Acquired knowledge

- Attain knowledge and capacities to plan a profitable poultry enterprise
- Understand the challenges, risks and mitigation measures faced by the poultry industry

Acquired skills

- Develop simple budgets and gross profit analyses for rural and commercial poultry production
- Ability to start, manage and produce broilers and layers, and dual-purpose chickens
- Ability to develop strategies for mitigating challenges that faces the poultry industry in Malawi

Acquired attitude

- Get motivated to start poultry production and marketing business

Methodology

Plenary discussions, group discussions, exercises, lecturette, case study

Training schedule

TIME	ACTIVITY	AIM	DURATION (MINUTES)
08:00 – 08:30	Registration, introductions	Participants register and know each other	30
08:30 – 09:50	Introduction to poultry value chain	Understand structure of poultry industry and business opportunities	120
09:50 – 10:00	Break	Health break	10
10:00 – 11:30	Gross margin analysis	Understand the profitability analysis of a poultry business	130
11:30 – 12:00	Conclusion of day 1	Recap and closing	30

Instructions on training/facilitation

1. Participants to make self-introductions, including history of production and areas of interest
2. Let participants draw their expectations from the training
3. Recognize trainees with experience and be used to lead discussions and answering questions
4. Cross-check with the below material contents and add where needed

Materials required

1. Flip charts and markers
2. A ream of paper/brown papers
3. Gross margin poster sheet

Unit 1: Introduction to poultry value chain

Duration: 120 minutes

Main outcome

- Participants acquired or refreshed with different poultry enterprises comprising broilers, layers and rural poultry production and marketing

Materials required

- Flip charts and markers
- A ream of paper
- Printer for producing templates for budgeting

Methodology

- Plenary discussions
- Lecturette
- Brainstorming

Approach/steps

Overview of poultry industry in Malawi

Activity 1.1. Plenary discussions (10 minutes)

a. What do you know about the poultry industry in Malawi and the SADC region?

b. What are key components forming the poultry industry?

c. To what level are we involved here (let the participants share the role they play in the poultry industry)

Trainer records the outcome of the discussions on a flipchart, and complements the discussion with the following information:

- Commercial poultry production is categorized into three sub-sectors (trainer shows a poster with different poultry categories):

Broiler production

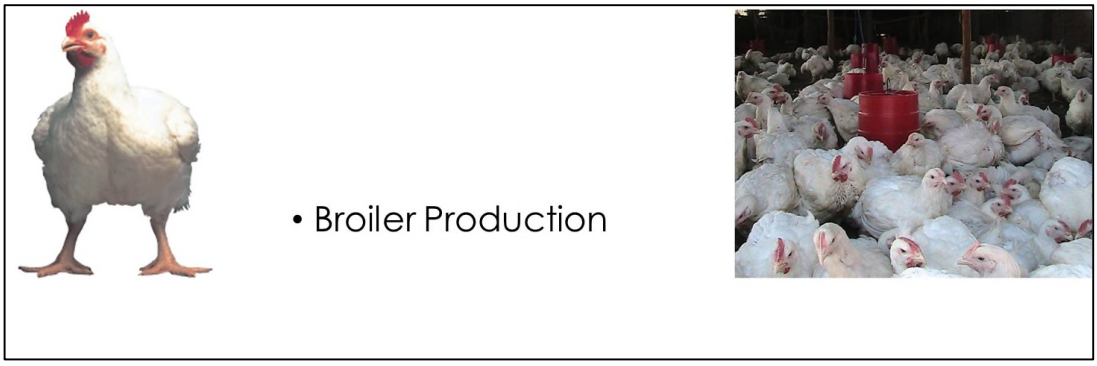


Figure 1. Broiler production

Layers production

Figure 2. Layers chickens

Duo-purpose (or local) production

Figure 3. Duo-purpose chickens

Within these categories, the poultry value chain is categorized further depending on the focus of the business as follows:

1. Hatchery
2. Brooding
3. Rearing/finishing
4. Slaughtering and processing (or egg production for layers)
5. Marketing

While sections two to five can be combined, the production of chicks (hatchery) (Section 1) is special-ised unit especially because it is:

- Done at a parent stock farm
- Usually combines parent stock farm and hatching units
- Its main role is to supply chicks to producers
- Located far from other sections of the poultry farm

In terms of scale of production, we have different categories in Malawi:

- Small-scale ~ most common
- Medium scale ~ common
- Large scale ~ few in Malawi

In the Figure below shows on large-scale producer, and one medium scale producer.

Figure 4. Large-scale producer (Central Poultry) on the left, and medium scale producer (Nyaluwanga Farm)

Starting your poultry business (30 minutes)

Activity 1.2. Group discussion:

- What considerations did you have to make before starting your poultry business?
- How did those factors influence your choice of business?

Trainer leads the participants into forming groups of four to five:

- Participants to discuss above questions. Let the participants list the key factors they had to consider when selecting their business
- Let those which are already in the poultry business share what was involved in choosing one poultry business over another
- For those new in poultry business, let them share their experiences in other types of businesses they have done before. Use the table below in responding to these questions.

NO	FACTOR OF CONSIDERATION	HOW DID IT AFFECT THE CHOICE OF BUSINESS?
1		
2		
3		
4		
5		
6		
7		

Towards the end of their discussions, let the participants rank the factors in their order of importance on a scale of one to five (where 1=not important and 5= extremely important). Use the table below in ranking the factors:

NO		FACTOR	RANK (1-5)
1			
2			
3			
4			
5			
6			
7			

Let the groups choose a representative to present the outcomes of their discussions.

Conclusion (40 minutes)

Trainer to summarize the discussion with the following additional points:

People starts businesses for so many different reasons, some out of passion or out of inspiration from someone doing the same business.

Ideally however, starting a business requires a thorough decision-making process to reduce the risk of failure.

In many cases, entrepreneurs have so many business options at their disposal but with limited resources to engage into all of them. The choice of which enterprise to invest the resources onto therefore becomes very critical.

Similarly, in poultry, one must consider which category of the sector to invest into, how big should my investment/production be, and where. This therefore requires conducting a thorough assessment of the business as well as your ability to manage the same.

Some of the considerations needs to be made around the following five key aspects (Figure 5):

Figure 5. Five key factors to consider before choosing a poultry business

NO		FACTOR	KEY QUESTIONS
1		Technical capacity	• Do I have the knowledge and skills which are required for this type of business? • Where and how do I get the required skills?
2		Financial capacity	• Do I have enough capital that would enable me to start the business? • How do I get extra financing to boost up my capital?
3		Managerial skills	• Do I have the skills to manage the business? • What systems do I need to put in place to help me manage it? • Where do I get extra support for managing the business?

NO		FACTOR	KEY QUESTIONS
4		Availability of key resources	• What resources are most required for the business? • What resources do I have already? • How do I get the remaining resources? What things do I need to dispose of to get the required resources?
5		Profitability of the enterprise	• How much revenue am I going to get from the business? • Is the business profitable? Is the profit big enough in comparison with other potential business • What are the chances that the profit will grow over time?

Trainer to emphasize that these factors might not always be the end in themselves, but nevertheless critical in helping the entrepreneur make informed decisions as well as identify strategies for filling the capacity gaps that may be found during the assessment.

Unit 2: Gross margin analysis (Assessing the profitability of a poultry business)

Duration: 130 minutes

Main outcome

- Participants to be able to calculate the profitability of their poultry business

Methodology

- Plenary discussions
- Group discussions

Required materials

- Flip charts and markers
- LCD projector
- Brown papers
- Rulers
- Calculators
- Gross margin calculation posters
- Laptops (optional for those into poultry business already, or for training of trainers)

Approach/steps

Why is it important to assess the profitability of a poultry business? (40 minutes)

Activity 2.1: Plenary discussions (10 minutes)

In plenary, trainer asks the participants the following questions:

- How profitable is your poultry business?
- How did you determine the profitability?
- Why is it important for you to determine the profitability of the business from the onset?

Trainer notes the responses on a flipchart before presenting the case study below:

Activity 2.2: Case study (30 minutes)

Chisomo ordered two crates of 30 eggs each at K 4000 per crate from Kalimbuka poultry farm. He spends K 4000 as transport to and from the poultry farm, and 1000 to the nearest market. At the market, he pays K 200 as a market fee and spends K 1000 on food while selling his eggs. Furthermore, Chisomo spent K 500 on plastic bags where he was putting eggs for customers. Chisomo sells all eggs in one day at K 200 per egg; however, two eggs broke when he was helping a customer.

Did Chisomo make a profit or a loss?

Let us calculate together (trainer takes the participants through the steps below):

Step 1: Know your quantity

How many eggs did Chisomo purchase?

Total eggs purchased = 2 X 30 eggs = 60 eggs

Step 2: Know your costs

A. Cost of purchasing the eggs:

- Unit of measure: number of crates
- Unit price: K 4000 per crate
- **Cost of purchase:** = quantity of units purchased X unit price
- = 2 X K 4000 = K 8000

B. Other costs:

- Transport cost: K 4000 + K 1000 = K 5000
- Calculate the marketing cost: K 200 + K 1000 = K 1200
- **Total cost =** Cost of purchase+ marketing costs + transport cost
- = K8000 + K5000 + K1200 = **K14,200**

C. Calculate the unit cost

- Unit cost = (total cost/quantity of goods sold)
- = K 14,200/58
- = K 244.83 per egg

Step 3: Know your income (money-in)

- Gross sales: Number of units sold X price per unit
- Unit of measure: Number of eggs
- Unit price: K200 per egg
- Gross revenue: = K 200 X 58 eggs = K 11,600

Step 4: Know your profit

- **Gross profit/loss**: money-in (revenue) – money-out (expenses/costs)
- **Therefore:** Chisomo's gross profit/loss = K11,600 – K14,200 = -K2600

Discussion questions

In the plenary, trainer discusses the following with the participants:

- Did Chisomo make a profit or a loss?
- What strategies can Chisomo use to make the business profitable?
- Why was the quantity of eggs used in the calculating the costs and revenue lower than what was originally purchased?

Trainer notes the responses on a flipchart and summarizes the discussion with the following:

- Profitability is the primary goal of any business ventures. Without profitability, the business will not survive in the long run. Assessing profitability is therefore very important particularly before the start of a poultry business to minimize the risk of failure
- The profitability of a business is measured with income and expenses. Income is money generated from the activities of the business (i.e. the money that comes into the business from selling chickens or eggs). However, money coming into the business from activities like borrowing money do not create income
- On the other hand, **expenses** are costs of resources used up or consumed by the activities of the business (i.e., buying vaccines, feed or paying labours working at a poultry farm)
- **Profit therefore** describes the financial benefit realized when **revenue/income** generated from a business activity **exceeds** the **expenses, costs, and taxes** involved in sustaining the activity in question
- **A Loss** is a situation where the **revenue/income** generated from a business activity is less than **the expenses, costs and taxes.** Persistent business loss may result in a failure of a business
- In Chisomo's case, a business **loss** has been established (the revenue is lower than the cost)
- Strategies to improve the profitability of her business would include the following:
  - Increasing the quantity of eggs per purchase
  - Increasing the unit price of the egg (to be more than the unit cost)
  - Reducing the transport and marketing costs

Gross margin analysis (85 Minutes)

Trainer to start the session by sharing the following:

- Income and expenses differ from one business to another in terms of their structure and amount hence the probability of businesses also differs
- Knowing which business is more profitable compared to another both in short and long term therefore is key in helping to make an informed decision on what business to invest more into
- In case of poultry, the comparison could be between the following business opportunities:
  - Specialising in parent stock and hatching
  - Broiler production
  - Layer production
  - Production of dual-purpose breeds
  - Production and marketing of the above
- As discussed earlier on above, except for the first one (specializing in parent stock and hatching), one can decide to combine the rest or focus on one business. Within these however, one needs to decide on the following key questions:
  - Which breed to raise?
  - How many birds to keep per batch?
  - How much feed to prepare?
  - What type of feed?
  - When to change feed?
  - What type of treatment to give to the chickens?
- Gross margin analysis therefore becomes so handy in helping an entrepreneur in making an informed decision of where to allocate the scarce resources is very critical
- To help us understand better, let's work on another example:

Activity 2.3: Case study 2: (60 minutes)

In the plenary, trainer to read the following case study to the participants:

Madziko Youth Cooperative is located at Manyamula Trading Centre in Mzimba district. The group has mobilized MK2,500,000 from share purchases and is planning to start a poultry production farming business. The group approached the local chief to ask permission if they can use an old building, which used to be a CSBC for their poultry production business and the permission was granted. However, the cooperative members are struggling to agree on which to engage in layers production or broilers. According to the chairperson of the group, engaging in layers' production could be more rewarding as he has seen the same happening to some farmers in Kasungu where he went for a learning visit. The group's executive could not take this information on face value as some members argues that broilers could make the group significant revenue if they make use of the increasing demand for broiler chickens which currently is on huge undersupply. The cooperative marketing committee was therefore tasked to conduct a market research of the two value chains and provide the group with recommendation. Their kraal can only accommodate 300 chickens of either layers or broilers per batch. As part of the research, the group was told to establish the capital requirements for both farming business and the following were the findings:

Information for calculation

Table 1. Information for calculation for broiler and layers production business

BROILERS			LAYERS		
COSTING MATERIALS	**QUANTITY**	**UNIT COST**	**COSTING MATERIALS**	**QUANTI-TIES**	**UNIT COST**
Day old chicks	300 chicks	MK 1000 per chick	Day old chicks	300 chicks	MK 15000/chick
Broiler starter	150 kg	MK 42,000 per 50 kg bag	Chick starter	330 kg	MK 33,000/50 kg bag
Broiler grower	300 kg	MK 42,000 per 50 kg bag	Pullet grower	2100 kg	MK 44,000/50 kg bag
Broiler fin-isher	630 kg	MK 38,000 per 50 kg bag	Layers mash	12,000 kg	MK 37,000/50 kg bag
Labour	2 months	MK 50,000 per month	Labour	72 weeks	MK 50,000/month
Vaccines	Lump sum	MK 10,000	Vaccines	Lump sum	MK 10,000
Drugs	Lump sum/month (for two months)	MK 12,000	Drugs	Lump sum/mon th (18 months)	MK 13400/month
Charcoal	4 bags	MK 16000	Charcoal	4 bags	MK 16,000/bag
Litter	20 bags	MK 600	Litter	100 bags	MK 600/bag

Notes

- Layers will start laying at 18 weeks of age, and will be sold as spent layers after 72 weeks. Eggs around Manyamula are selling at MK 130 per egg while spent layers are selling at K 4500 per chicken. On the other hand, broilers will be sold at 8 weeks of age and prices for a broiler chicken around Manyamula is at K 5500 per chicken.
- The veterinary officer for the area has advised the cooperative to include 5% mortality rate in their calculation as chicks tend to die especially in the first few weeks.

Trainer to prepare a gross margin calculation sheet and take the participants through the calculations to find the totals.

Table 2: Gross margin analysis for broilers and layers production

GROSS MARGIN ANALYSIS													
BROILERS							LAYERS						
STEPS	**NO**	**ITEM**	**UNIT**	**QUAN-TITY**	**UNIT COST (MK)**	**TOTAL COST (MK)**	**STEPS**	**NO**	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST (MK)**	**TOTAL COST (MK)**
Step1: Know your quanti-ties	1	Day old chicks	MK/chick	300	1000	MK300,000.00	**Step1: Know your quanti-ties**	1	Day old chicks	MK/chick	300	1,500.00	MK450,000.00
	2	**FEED**						2	**FEED**				
		Broiler star-ter	MK/bag of 50 kgs	3	42,000	MK 126,000.00			Chick starter	MK/bag of 50 kgs	7	33,000.00	MK231,000.00
		Broiler grower	MK/bag of 50 kgs	6	42,000	MK 252,000.00			Pullet grower	MK/bag of 50 kgs	42	44,000.00	MK1,848,000.00
		Broiler finis-her	MK/bag of 50 kgs	13	38000.00	MK 494,000.00			Layers mash	MK/bag of 50 kgs	240	37,000.00	MK8,880,000.00
	3	Labour	MK/month	2	50,000	MK 100,000.00		3	Labour	MK/month	18	50,000.00	MK900,000.00
	4	Drugs (need to mention the drugs)	MK/month	2	12,000	MK 24,000.00		4	Drugs (need to mention the drugs)	Lump sum	1	60,000.00	MK60,000.00
	5	Vaccines	Lump sum	1	10,000	MK 10,000.00		5	Vaccines	Lump sum/month	3	10,000.00	MK30,000.00
	6	Charcoal	MK/bag	4	16000	MK 64,000.00		6	Charcoal	MK/bag	4	16,000.00	MK64,000.00
	7	Litter	MK/bag	20	600	MK 12,000.00		7	Litter	MK/bag	100	600.00	MK60,000.00
	8	Mortality rate	Percentage	5%	15			8	Mortality rate	Percentage	5%	15	
Step 2: Know your costs		**Total cost of production**				**MK1,382,000.00**	**Step 2: Know your costs**		**Total cost of production**				**MK12,523,000.00**
		Unit cost (*total cost of production/quantity of product produced***)**				**MK4,606.67**	**Step 3: Know your revenue**		**REVENUE**				
Step 3: Know your revenue		**REVENUE**						**Sale of eggs**		MK/egg	76,650	130.00	**MK9,964,500.00**
		Unit price(*selling of chickens***)**				**MK5,500.00**		**Sale of spent layers**		MK/chicken	270	4,500.00	**1,215,000**
		Gross revenue (*Unit price x quantity produced***)**				**MK1,567,500.00**		**Gross revenue(***egg sales + sales of spent layers***)**					**MK11,179,500.00**
Step 4: Know your profit		**Gross profit (***Gross revenue-total cost of production***)**				**MK185,500.00**	**Step 4: Know your profit**	**Gross profit (***gross revenue-total cost of production***)**					**-MK1,343,500.00**
		Gross margin % (*Gross profittTotal cost of production) x 100%***)**				**13.42%**		**Gross margin % (***gross profit/Total cost of production) x 100%***)**					**-10.73%**

Discussion questions (10 minutes)

- Given the capital requirements and the capacity of Madziko Youth Cooperative, what business should they take?
- How can Madziko improve the profitability of the business (what strategies can they use to make that happen?

Trainer to write the responses on a flip chart before complementing with the following:

Strategies for improving profitability of the businesses

NO	STRATEGY	HOW
1	Reducing the production costs	• Making own feed • Identifying cheaper options to supply materials • Increasing the level of production
2	Increasing revenue	• Increasing the selling price • Selling by-productions (i.e. manure)

In the next modules, we are going to discuss how farmers can make their own feed as well as how management costs can be minimized.

Conclusion (5 minutes)

- Prudent planning is very key before starting any business including poultry business
- The level of production matters, some businesses will only make a profit at a large scale as the economies of scale increases
- Understanding your capacity against the requirements of the business is very critical before deciding on what business to take

MODULE 2: BROILER PRODUCTION AND MARKETING

Duration: 36 hours

Module objectives

The following objectives will be achieved:

Acquired knowledge

- Develop knowledge of broiler production from raising day old chicks to point of marketing the birds

Acquired skills

- Establish a broiler poultry unit
- Identify strains used in broiler production and their sources
- Raise and manage broiler chickens
- Feed broiler chickens cost-effectively
- Manage diseases and parasites in a broiler unit
- Market the chickens

Acquired attitude

- Describe factors that can lead to profitable broiler production
- Analyse and adjust production of broilers based on prevailing production costs and selling prices

Methodology

Mode of delivery of the training

- Group discussions
- Farm visits and practice
- Lecturette
- Plenary discussions

Instructions on training/facilitation

- Participants to make self-introductions, including history of production and areas of interest
- Let participants draw their expectations from the training
- Recognize trainees with experience and be used to lead discussions and answering questions
- Together with participants, draw a schedule during the day
- Cross-check with the material contents and add where needed

Materials needed during the training

- Flip charts
- Markers
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training
- Feed ingredients
- Feed making equipment (shovels, scales, floor or drum mixers)
- Drugs and vaccines
- Working coat

Unit 1: Background to broiler production

Duration: 1 hour

Main outcome

- A knowledge and understanding of what a broiler is, and its production system and management

Materials required

- Flip charts
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training
- Working coat

Methodology

- Presentations
- Demonstration of a broiler chicken
- Question and answers

Approach/steps

- What is a broiler chicken?

Activity 1.1. In plenary, let trainees describe in their own understanding, a broiler chicken (5 minutes)

Trainer to complement the responses with the following definition:

A broiler is an American term applied to chickens that are bred specifically for:

- Rapid growth to reaching average weight of 2 kg within five to six weeks
- With only 2 kg of feed consumed for each kg of live weight gain

A broiler is a hybrid, just like hybrid maize. It has been developed by special companies called breeders. These are only few in the world but distribute these broilers to all parts of the globe through other companies that keep parent stock and hatch fertile eggs.

Notes to trainees and users

At the end, a trainer should explain and illustrate this:

- Because a broiler is a hybrid, it has combined good features described above from crossing of more than two breeds
- It is not advisable to produce another broiler by breeding from the stock you have
- Rather, the practice is to source and buy broiler chicks, raise them under good management and feeding, and sale all when they reach mature weights
- A farmer always needs to go and buy new batch of day-old chicks from hatchery services providers, just like a maize farmer who goes to buy seed from a seed company

Sentence of motivation

Broiler production business can be started and run by any farmer regardless of gender and age, hence fit for the youth, active working, or businesspeople, the retired and the elderly.

Broiler strains available in Malawi

Common strains (types) of broilers available in Malawi include:

- Cobb
- Ross

Discuss with participants how the two strains look like and if there are differences in their growth performance. Should one worry of which strain to use?

Cobb is mostly supplied by Central Poultry (2000) Ltd. Ross is produced by other companies include Charles Stewarts, Kelfood (Proto), Thanzi, and a few that emerge into broiler hatching business.

Points for trainees to note

In Malawi, we have the required broiler chicken strains, and hence, their presence should encourage everyone intending to start business with ease.

Many farmers that have been visited explained that they started small according to capital one has and grow with the business. This is the best experience one need to acquire, and we encourage as many in work, youth, and other categories to start within affordable ranges and grow with the business.

Unit 2: Housing establishment

Main outcome

- A knowledge of broiler houses and ability to establish standard broiler houses suiting the production sizes

Materials required:

- Flip charts
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training
- Working coat

Methodology

- Presentations
- Demonstration of broiler houses
- Designing some housing
- Visits to a poultry unit
- Question and answers

A. Housing establishment

Housing broilers is one important area to consider for proper growth performance of the bird. Housing provides an environment that can make the birds grow uniformly, and be protected from adverse weather, predators, and security from thieves.

To begin with, one needs to plan to establish a poultry housing for broilers. There is a standard housing, locally called *kholas*, and will be described below. However, many small-scale producers use any structure that can keep a few to thousands of chickens within the homestead. These structures include a kitchen, a servant quarter or guestroom, a garage, rooms constructed along the fence walls, etc.

We encourage using standard and purpose built *kholas*. However, in situations economy cannot allow at start, one can use these non-conventional structures if certain standards are achieved.

In the Figure below shows broiler houses constructed along the wall fence in Mzuzu. Primary purpose is to construct a fence for security, secondary is create rooms for keeping broilers.

Figure 6. Broiler houses constructed along the wall fence. Courtesy of Modern Farm technologies, Mzuzu

Plenary discussion
Since this is a broiler-housing situation a farmer has, what would you do to ensure birds comfort is not compromised (spacing, aeration, placement in the compound etc.).

Siting of khola
Broilers are relatively sensitive to heat and cold stresses, and diseases. As such, it is advisable to identify a place that is some 50 m away from main dwelling unit.
It is advisable to build a *khola* on East – west position. This will prevent direct exposure of sunshine to the birds through the windows. Also, make sure the *khola* has access to aeration for good ventilation inside.

Points for trainees to note

Sometimes these conditions are difficult to follow because a farmer may not have such large space to accommodate 50 m specification. In some areas, theft of chickens may necessitate constructing a *khola* close to the main dwelling unit.

Such farmers are advised to do so and compensate the shortfalls with extra management of the birds.

Activity 2.1 Poultry house positioning (40 minutes)

In groups of four to five participants, draw a poultry house and show direction of sunrise, full sun and sunset positioning. If you are planning to start broiler production, draw poultry house on a draft sketch of your farm.

Sketches will be presented to the other participants.

Introduction of task: 5 min

Individual work/group work: 15 min

Presentation and discussion: 20 min

B. Types and specifications of kholas

Broilers are commonly raised on deep litter *kholas*. These are housing that accommodate birds on the floor that is supplied with litter, hence the name deep litter *kholas*. In the Figure below shows an outside of one structure of a deep litter *khola*. Details of the inside will be explained below.

Figure 7. A deep litter structure (courtesy of Nyaluwanga Farm, Mzuzu)

1. Space requirements in a deep litter khola

Sizes of a *khola* depend on number of birds to be raised, determined at adult size of the chickens. Broilers need small space to avoid excessive movement that may utilise energy required for growth. Many recommend a range of ten to twelve adult birds per m^2 of the floor.

So:

- If you have a khola of 10 m in length and 6 m in width, this will give 60 square m (60 m^2)
- At 12 birds per square gives me 720 birds at point of sale
- Therefore, a 60 m^2 khola would accommodate between 600 and 720 birds per batch:
  - A batch is a cycle of producing broilers from day old to sales

This space includes accommodating other equipment like feed troughs (also called feeders) and water troughs (also called waterers) as shown in Figure below. These will be described further under feeding management.

Figure 8. A broiler khola showing deep litter floor with feed troughs

Activity 2.2 Poultry house positioning (30 minutes)

In groups of four to five participants, draw a poultry house that can accommodate the size of broilers you will likely raise.

Draw a draft sketch of the floor.

Sketches will be presented to the other participants.

Introduction of task: 5 min

Individual work/group work: 15 min

Presentation and discussion: 10 min

2. Windows of a khola

A broiler *khola* is usually open sided on the length.

- With windows of between 0.75 and 1.0 m from the foundation
- Windows heights can be from 2.0 m to 2.25 m or higher depending on width size of the *khola*
- Windows are covered with chicken wire mesh, which is available from hardware shops in towns
- There should be no other covering to provide enough light inside the *khola*
- In cases of security against theft, steel bars can be installed on the windows

- Other farmers use cement blocks, but these block lighting and reduce air circulation

Windows facilitate ventilation and good air circulation inside the *khola*. Windows may be covered by plastic curtains, tapelines or plastics sheets during cold season and when it is cold and opened during hot periods.

Other *kholas* have opening at the top of the roof as shown in Figure below. These are ideal in hot areas to enhance air circulation.

Figure 9. Broiler khola with opening at top of roof courtesy of CAPS Poultry Farm, Chinakanaka, Mulanje

3. The wall

Bricks and cement blocks are used to build walls for the *khola*. It is also possible to use timber planks (*zigwagwa*), wooden blocks and any other materials that can be found locally and are affordable. Any local brick layer/builder can be used to construct the *khola*. In case wood or timber is used, a local carpenter can be used. These will need specifications as per your requirements and will provide estimates of the materials.

Figure 10. A poultry structure made of wooden timber, zigwagwa

The Figure above shows poultry structure made of *zigwagwa* that can also be used for broiler production.

Birds have pecking behaviour, so make the walls strong and plastered inside to minimize being gradually eaten up by the chickens.

4. The floor

Hard compact floor made from cement mix with river sand in rough concrete form is recommended. Builders know how to mix such concrete floors. This eases cleaning and disinfection, and holds the litter when birds are in. Floors of cement like that for dwelling units are not recommended.

In situations where costs do not accommodate, a farmer can start with hard compacted mud or brick floor that needs to be maintained after every batch. As the farmer progresses, the floor should be upgraded to the concrete one.

Figure 11. A poultry house showing the floor type

Activity 2.3 Visit to a broiler khola (30 minutes)

Participants visit an arranged broiler unit and appreciate the types of kholas.

In groups of four to five participants, draw a poultry house you have observed in terms of the floor, walls and roof.

Also, assess the khola and evaluate the standards if they are met.

Sketches will be presented to the other participants.

Introduction of task: 5 min

Individual work/group work: 10 min

Presentation and discussion: 5 min

5. Other forms of broiler houses (kholas)

Broilers can as well be raised in raised kholas with timber slats, and battery cages:

- Slatted khola are built on a platform of poles or concrete that may be up to one meter high. The floor is on the platform, usually with timber. It is also possible to make the floor concrete
- Such kholas are recommended in wetlands where basic floors may face problems of wet floors
- Recommended spaces for a deep litter khola should be applied for slatted kholas

Battery cage types of housing are usually reserved for layers. However, one can raise broilers after brooding phase (see Figure below):

Please note that battery cages should be avoided wherever possible, since this is against rules of animal welfare.

- Battery cages increase density of broilers from 10 – 12 per m2 to 20 to 25 m2
- Battery cages have advantages of no need for litter, hence saving on costs, and soil borne infections are minimized
- However, cages are expensive to install, and grown-up broilers have problems of standing and sitting on wire cages, and easily get breast blisters
- For small and medium scale producers, deep litter kholas and their modifications to suit convenience are recommended to start with

Figure 12. Broilers in a battery cage at Dr Munthali Farm, Salima

C. General tips on broiler housing

1. Ensure that the wall and roof are well constructed and regularly maintained to minimize entry of rats, predators and other pests, and water seepage from rains.
2. Have a storeroom, could be an extension to the *khola*, for storage of feeds and other equipment.
3. At the entrance, build a change room that has a shower room. Workers need to change clothes and take a bath before going into the *khola.*
4. In hot areas, it is possible to install electric fans in the *khola.*
5. While other modifications are accommodated, note that any departure from ideal will compromise with ventilation, aeration, lighting, humidity and gaseous orders and circulation.

- These make performance to depart from ideal as specified by the broiler breeders
- And this departure contributes to reduced revenue (illustrate on cases)

6. So, ensure your structures are upgraded with improving and continued productivity.
7. Remember to regularly disinfect the structures during breaks between batches.

D. Summary of materials need and costing the khola

Constructing a *khola* will require the following materials (check the Table below).

Table 3. Khola construction materials

MATERIALS	PURPOSE	WHERE FOUND AND COSTS
Bricks	Building the foundation and walls	Can be molded or bought locally
Sand	Building and plastering, and floor	Bought from local suppliers
Chicken wire mesh	Covering windows	Bought from hardware shops
Brick force wire	Wall reinforcing	Bought from hardware shops
Cement	Building, plastering and floor	Bought from hardware shops
Iron sheets	For roof	Bought from hardware shops
Timber or poles	For roofing and door frames	Bought locally
Doors and locks	For doors	Bought from hardware shops
Electric materials (for electricity from ESCOM or solar power)	For lighting	Bought from hardware shops

Note: Where there is no electricity and a farmer cannot afford solar, use of torches and lamps is ok.

Activity 2.4. Costing a broiler khola (30 minutes)

In groups of four to particpants participants, list materials required to construct a poultry house according to requirements of chickens you would like to keep per batch.

For each item, establish local costs and estimate total costs.

Materials and costing will be presented to the other participants

Introduction of task: 5 min

Individual work/group work: 10 min

Presentation and discussion: 15 min

Unit 3: Identifying strains to use in broiler production and their sources

Main outcome

- Trainees and users should be able to identify types of broiler chicks that are available within localities

Materials required

- Flip charts
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training
- Working coat

Methodology

- Presentations
- Identification of broiler strains
- Questions and answers

Instructions on training/facilitation

1. Let participants express knowledge of broilers, types of broilers and their sources
2. Participants to identify costs of chicks and other logistics to ensure chicks arrive at the *khola*
3. Cross-check with the below material contents and add where needed

A. Identifying types and source of broiler chicks

- Identification of broiler strain to raise is important, though at times we have limited choice due to limited sources
- A good healthy day-old chick is a good start for profitable broiler production
- Farmers have different experiences and can differentiate day old chicks by breed (Cobb or Ross), and source. In many cases, farmers often switch between breeds depending on which is available

Figure 13. Ross Day old chicks in a brooder

- Given an opportunity, choose broiler chicks that:
  - Look health at hatch or by day of supply
  - Weight over 40 g at day old (ideal range from 44 – 50 g at day old or the following day)
  - Are alert and active
  - Respond to water and feed provided to them

In the batch, some chicks may have wet feathers, showing signs of incomplete hatch. These chicks need to be rejected into the flock.

Please note

Despite differences in strains, the chicks have similar genetic potential of attaining market weights at between 35 and 42 days.

In Figure 14, day old chicks, showing some that did not hatch well (look closely and identify a few from the batch)

Figure 14. Day old chicks, showing some that did not hatch well

Activity 3.1. Farm visit: (Identification of quality of day-old chicks) (30 minutes)

Trainer to take the participants on a visit to any broiler unit that has received day old chicks within the previous five days.

In groups of four to five participants, let the participants observe the quality of day-old chicks and score them on scale of one to five (poor to excellent), using the criteria discussed during the training.

NO	CRITERIA	RATING (1-5 1 = POOR 5 = EXCELLENT)
1		
2		
3		
4		
5		
6		
7		

Let each group make presentation of their findings in the plenary.

Plenary discussion

After the group presentations, trainer to facilitate the discussions of the following:

- What do you take out from this exercise? What key lessons have been drawn from it?
- How can we ensure quality chicks are purchased? What strategies can we use?

Unit 4. Preparing for day-old chicks in broiler production

Duration: 3.0 hours

Unit outcomes

After going through the unit, trainees and users should be able to:

- Source inputs including feed, day old chicks, drugs, and vaccine
- Prepare a brooding unit and brood chicks with minimal losses
- Feed the birds according to requirements
- Raise broilers to recommended weights within prescribed time frame
- Market broilers as live birds or dressed products

Instructions on training/facilitation

- Let participants draw their expectations from the training
- Recognize trainees with experience and be used to lead discussions and answering questions
- Cross-check with the below material contents and add where needed

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training
- Working coat

Approach/steps

In the plenary, let the participants discuss the following:

- What set of activities do you do before receiving a new batch of day old chicks?
- How do you ensure the room meets the optimal requirements to raise them?
- How to you ensure security of the chicks and prevent them from being infected with diseases/pests?

Trainer to write the responses on a flipchart before complementing with the following steps:

Placing orders of day-old chicks

- A farmer must order the day-old chicks a week or so in advance from a hatchery or its agents that are located within the area of reach
- For beginners, they may ask from fellow farmers, extension agents, or other social media groups that host poultry farmers
- Many hatcheries or agents will ask to pay in advance, or a deposit and a farmer will be given a date of collection
- Some hatcheries arrange for delivery of chicks within a certain perimeter of their location

Preparing arrival of chicks

- Prior to arrival of chicks, make sure you prepare the brooding unit. This unit can be a separate structure, specially made brooding house, but many brood in the same rearing house
- In the rearing house, make demarcations for brooding by blocking part of the *khola* using block boards, iron sheets, cartons or any other material that may work.
    - It is recommended to make a round brooding unit
    - Many farmers demarcate/block one quarter of the khola, which should be enough to accommodate day old chicks to suit capacity of the khola
- The brooder looks rectangular, and in this case, there is need to block corners with cartons to prevent chicks from crowding around the corners and creating stampede and deaths (to see chicks in a brooder below)
    - Ensure windows are covered with sacks, plastic tents/tarpaulins and other materials that will block cold air entering the brooding house as shown in the Figures.

Figure 15. A brooding section of the khola prepared for arrival of chicks, courtesy of Mr Michael Phiri, Kamphata, Lilongwe

Figure 16. Brooding section windows covered by sacks

Figure 17. Brooding unit windows covered by plastic tents (tarpaulins)

- In terms of floor requirements:
  - Allow 20 – 30 chicks per m^2
  - Provide dry litter from materials that provide insulation, comfort bedding to chicks, and absorb moisture from droppings and water spillage
- Common litter materials are rice husks (locally called utuchi) that are bought or given free from rice mills
- Other litter include wood shavings from carpentry shops, groundnut hulls from mills, coffee husks, dry thatch grass that is chopped into small pieces
  - Litter should be placed to depths of 6 – 10 cm

Disinfecting the brooding unit

A day before arrival of the birds:

- Make sure the khola is fully disinfected using strong chemicals that can kill bacterial, viruses and other germs
- Strong disinfectants are available in veterinary shops
- A farm can also disinfect using herbicides that kill vegetable and crops pests including fall armyworm.
- Charcoal is crushed and mixed with lime powder and spread on the floors to prevent insects from entering, and then the house is closed

Activity 4.1 Practical exercise at the demonstration unit (30 minutes)

Let the participants visit the demo unit to conduct the following:

- Learn how to dilute a disinfectant
- Learn how to put on a sprayer
- Learn how to disinfect all parts of a khola

Introduction of task: 5 min

Individual work/group work: 10 min

Trainer to facilitate discussion and reflections at the end of the practical exercise

Pre-warming the brooding unit

- The brooding unit should be pre-heat around twelve hours before arrival of chicks
- Charcoal burner (locally called 'Mbaula') is common source of heating the brooder
- Depending on size of the brooder, one mbaula is centrally placed, covered by wire mesh to prevent chicks from entering underneath and get burnt
- Ideally, a hoover guard is placed on top of the mbaula, to prevent heat from going up and spread heat in the brooder unit
- Examples of mbaula include the normal metallic types used in the kitchen, and specially clay earth made brooding types that are sold in veterinary shops
    - In large brooding units, a few mbaula may be spread around to ensure even spread of heat. Figure 18 shows some types of mbaula and their placement in a brooder

Figure 18. Brooding unit with mbaula placed at strategic places (left) and centrally located (right)

- Other types of heaters include electric, kerosine heaters, steam pipes and gas heaters. Electric heaters include high watts infrared bulbs (around 200 watts) and heating elements. Gas from bi-ogas production can also be used to heat the brooding unit
- Electric bulbs are hung in the brooder unit. Three bulbs will suffice a 500-capacity brooder if just hang
- Efficiency is increased if a bulb is placed under a hoover guard as shown in Figure below

Figure 19. Electric infrared brooders

- Farmers can also instruct tinsmiths to construct a metal hover guard, and place heat elements underneath. When placed in the brooder, the elements will heat and spread the head to the chicks. In the Figure below shows such types of heat sources used at Mikolongwe government farms

Figure 20. Electric brooders using heat elements shown underneath on the right

Placing drinkers and feeders

- In the brooder, evenly place water and feed troughs. These are small containers, usually plastic drinkers
- During the first week, cartons that had brought the chicks and flat plastic trays are used as feed troughs
- Apart from feed troughs, plastic sheets and papers are laid where feed is spread for young chicks to pick (see Figure 21)
- If small plastic or metallic drinkers are not around, small plastic plates are used. However, put clean stones inside to prevent chicks from getting soaked and drowned
- Figure on the right shows a set up brooder ready to receive chicks, using drums as heat sources

Figure 21. A set up brooder, courtesy of Nyaluwanga Farm, Mzuzu

Activity 4.2. Brooding practice at a demo (30 minutes)

Trainer to lead the participants go at the broiler demo unit to practice and discuss the following:

- Calculate the space requirements
- Check distribution of the litter, feed and water troughs
- Practice of using a mbaula for brooding

Introduction of task: 5 min

Individual work/group work: 10 min

Unit 5: Stocking and brooding the chicks

Unit objectives

At the end of the lesson, participants will be able to:

- Understand the process of receiving day old chicks
- Differentiate healthy chicks to defected ones
- Assess the feeding and drinking behaviour of chicks and manage it
- Understand how to manage critical aspects of a brooding chamber (lighting, heating, feeding and ventilation

A. Introduction

In plenary, trainer asks participants what they understand by the term brooding? Trainer to record the responses on a flipchart before providing the following definition:

- Brooding is the management of chicks from day old, to ensure they survive and stay health by providing heat and all necessary care for them to easily adapt to their unfamiliar environment
- Brooding period is around two to three weeks in broilers depending on weather of the season
- This is the most critical stage of birds since it ensures the chicks survival rate in its later stages

When chicks arrive, brooding starts

Usually, chicks are packed in cartons of 100 chicks plus 2 % to cater for normal mortality. That is, for every 100 chicks bought, hatcheries supply 102.

- Count the chicks when placing in a pre-warmed brooder
- Record the number of chicks from each carton and total the number. This number is to be recorded on a record template, using a sample as shown in the following Table.

Figure 23. Carton boxes carrying 100-day old chicks

Table 4. Sample template for record keeping in a broiler unit

DATE	NUMBER	FEED CONSU-MED	COST (MK)	DEATHS	SOLD	EATEN OR GIVEN	BALANCE
26-Aug	497						497
27-Aug	497			3			494
28-Aug	494			5			489
29-Aug	489			2			487
30-Aug	487			1			486

- Reject the weak and dead chicks upon arrival if delivered by the hatchery, or upon collection at the hatchery or agent
- It is important to count at arrival, and be recording deaths on each day, to determine number of live chicks for the day (see the table above)
- Place the chicks evenly in a brooder unit and monitor their movement and sound behaviour. The chicks will show some signs of stress upon arrival or respond to the heat of the brooder
- Once finished placing the chicks, first give them water in small plastic drinkers
- In the water, add vitamin and mineral anti-stress factors, usually called stress pack bought from veterinary shops. This will help to energize the chicks and stimulate their appetite to feed
- Thereafter introduce the chicks to feed, placed on cartons that had carried the chicks

Use crop fill assessment to check if chicks have access to water and feed:

- Sample between 20 and 50 chicks at random from different places in a brooder and assess crop content at 2nd, 4th and 24th hour
- By 2nd hour following placement of chicks, 75 % of the chicks should have their crops filled with feed and water, an indicator that they have good appetite and have access to feed and water
- Crop fill should be full, soft, and rounded
- If crop is small, it means they have not accessed feed and need to check feed placement
- If crop is hard, feed grit felt, it means chicks have not accessed water and need to check water placement

Activity 5.1: Practical at the demonstration unit on crop and fill

Trainer to lead participants to a demonstration unit and practice crop fill assessment. This should be done along with placing of day-old chicks or within few days after. Key focus areas should be the following:

- Practicing how to touch the crop
- Practicing how to detect water and feed intake

Exchange same chick among participants to verify the findings.

B. Observing behaviour of chicks in the brooder

- Day old chicks will respond to heat or coldness, threats from human beings and animals including rats, and quality of litter and feed
- The optimal temperature is regulated by the thermometer and chick behaviour. You can place a thermometer by hanging at around 10 cm from the floor, or at the edge of a hover guard
- Regularly monitor activeness and behaviour of chicks as they respond to heat in the brooder. This will help to increase or reduce heat in the brooder
- Ensure that we maintain a temperature of 32oC to 34oC at day old, reducing to 28oC in a week. Make sure the birds are evenly scattered in the brooder unit, some are eating, others sleeping, others running around:
    - When the birds are clinging to the heat source it simply tells that the room is cold, and we need to increase the heat. Also, check if we have openings where a lot of cold air is coming in from so that we close them
    - When the birds are drifted to one side it shows us that the heat is not being distributed evenly, so we put the heat sources evenly in the house or we put an iron sheet (hover) on top of the charcoal burner and increase heat
    - When the birds are going far from the heat source, we know that there is too much heat and they are running from it, so we lower the temperatures till the birds are evenly distributed
    - Sometimes the birds can be evenly distributed but they seem to be sleepy and lazy. This can also show us that the temperatures are too high we need to reduce them. The birds need to be active most of the time
- Make sure the house does not always run out of water and feed. This reduces a stamped when you are adding water and feed at another time

Figure 24 below shows a picture of evenly distributed chicks. Figure 25 shows cases of high temperature and draughts or scare in the brooder.

Figure 24. Evenly distributed chicks in a brooder, showing normal temperature

Figure 25. Hot temperature (left) and draughts or scare (right) in the brooder

C. Removing heat during brooding

Heat is usually and gradually removed at around 2nd week of brooding. By this time, the birds would have grown feathers to insulate themselves against cold weather. From mid of 2nd week to 2nd week, heat can be removed during daytime and re-introduced during the evening.

In the event of weather changes and temperature drops, heat may be introduced.

At withdraw of heat, birds may be given stress pack to counter stress that may arise and sustain their normal growth.

Remember to be extending the guard as chicks grow to avoid overcrowding.

D. Lighting program

Broiler houses need sufficient lighting for the birds to see each other, feed, and water. Normal lighting program is:

- 24 hours during day one, and
- Reduce to 22 – 23 hours during the first week, then
- 18 hours afterwards

However, majority practice 24-hour lighting when there is access to electricity or solar, or as a security measure against theft and predation.

There is need to ensure light is evenly distributed in the *khola*.

Lighting source can be kerosene lamps, torch bulbs, electricity from grid or solar among others.

Extended lighting increases time for birds to eat and enhances growth.

For those without other sources of lighting, it is possible to keep birds in the dark during the night and they only feed during the day. Growth may be delayed, but birds will be able to attain market weights within optimal periods of six to seven weeks.

E. Ventilation

The *khola* should be well ventilated through proper air circulation through the windows. Even though the windows may be covered during brooding, there is need to ensure that there are spaces for good air circulation.

Good ventilation helps to:

- Remove excess ammonia, carbon monoxide and other gases build in the khola, and provides fresh air to birds
- Regulate temperatures and humidity in the khola
- Prolong dry condition of the litter

Activity 5.2: Plenary discussions on brooding (20 minutes)

Based on the practicals at the demo unit and the discussion above, let the participants discus share their experiences for brooding. Let the discussion/sharing focus on the following areas:

- Ventilation
- Lighting
- Feeding and growth targets

Introduction of the task : 2 minutes

Group discussions: 10 minutes

Summarising remarks by the trainer: 8 minutes

Unit 6: Raising birds to point of sale

Unit objectives:

By the end of the unit, participants should be able to:

- Develop an effective feed management regime
- Calculate estimated feed requirements for birds
- Cost their feed and make informed decision between commercial feed and home-made feed
- Broilers must be raised from day old during brooding to point of sale during rearing period

A. Feed broiler chickens cost-effectively

Broilers are fed using two or three feeding regimes (see the table above):

- Two feeding regimes comprise feeding broiler starter from day old to four weeks, and broiler finisher from 4th week to point of sale
- Three feeding regime comprises feeding broiler starter from day old to two weeks, then gradually fed broiler grower for next two weeks, and finally broiler finisher to point of sale

Table 5: Feeding regimes in broilers

TWO FEEDING REGIMES	ESTIMATED CONSUMPTION PER BIRD, KG	PERIOD (DAYS)	THREE FEEDING REGIMES	ESTIMATED CONSUMPTION PER BIRD, KG	PERIOD (DAYS)
Broiler starter	1.5	0 - 28	Broiler Starter	0.5	0 – 14
			Broiler Grower	1.0	15 – 28
Broiler finisher	2.1	28 – 42	Broiler Finisher	2.1	28 - 42
Expected total, kg	3.6 (3.5 – 4.0)			3.6 (3.5 – 4.0)	

Activity 6:1: Estimating the amount of feed required for broiler demo chickens: (35 minutes)

Based on the information provided in the table above, let the participants in groups of 4-5 calculate the estimated feed amount for the batch of chickens placed at the demo. In the calculations, the groups should:

- Estimate the amounts for each type of feed
- Estimate the total number of 50kgs bags of feed required

Introduction of taks: 5 minutes

Group discusion: 15 minutes

Presentation of groups in plenary: 15 minutes

Important note

- Regardless of feeding regime, chickens are supposed to reach saleable age of 35 – 42 days weighing at between 1.5 and 2.0 kgs live weights
- What may determine which regime to use is the cost of production?
- Three feeding regime produces a chick at lower cost than the two-feeding regime
- This cost reduction is true whether feed is bought or made on farm (see Figure below)

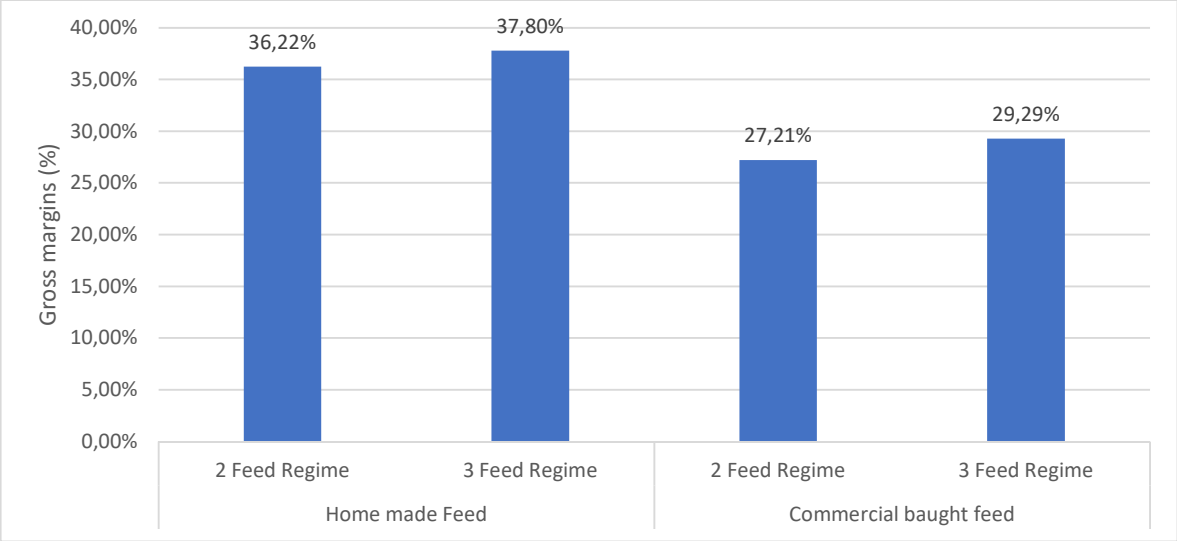


Figure 26. Gross margin for raising 500 broiler chickens using 2 or 3 feeding regimes of locally made and bought commercial feed

Activity 6.2: Feed costing and gross margin calculation: (25 minutes)

Reflection

Remember the gross margin analysis calculation in module 1, lets revist that based on our findings in the previous calculations.

- Using the same groups used in Activity 4.6 above, trainer to let participants calculate gross margin with the number of chickens at the demo and the feed estimates found
- Provide the participants with the gross margin calculation sheet (or template)
- Participants to calculate the total cost of production per chicken

B. Sources of feeds

Feed can be bought (commercial feed) or made on farm (home or on-farm made feed). If feed is bought, check:

- The label of name to make sure correct feed is bought, and
- Nutrient label to ascertain the nutritional values.

Currently major sources of feeds include:

- CP feeds and proto feeds

Medium level feed manufacturers include:

- Ndatani, Linzie Mill Feed, Charles Stewart, TYM, and Alfa Feeds. There are many small-scale feed producers within cities

In Figure below shows some examples of commercial broiler feed from Ndatani and Proto Feeds.

Figure 27. Examples of Commercial feeds for broilers

In plenary, trainer to share the following:

- Research show that making own on-farm feed reduces cost of feed by 20-40 %. This would vary depending on season and prices for major feed ingredients maize and soybeans
- When the prices for these two ingredients increase, they push the on-farm made feed closer to commercial feed
- However, there is need to ensure on-farm made feed is of good quality, hence need for capacity to formulate these rations
- We will learn about ration formulation in the subsequent sessions

Notes

- Feed costs account for between 60 and 70 % of total cost of producing broilers
- Managing the feed well will reduce costs towards 60 % and that will translate into more profit
- On the other hand, poor feeding management will push feed costs to over 70 % and that will eat into revenue leading to reduced profit
- Feed the birds ad-lib, meaning feed must be always available in feed troughs.
- Feed must be fresh and of superior quality and particle sizes to make the birds reach point of sale early enough and consume less feed, hence more profit at same selling prices
- There is need to periodically raise feed troughs to the back height of the birds, this will minimize feed wastage on the floor (see Figure 19)

Figure 28. Raised feed and water troughs to height. Note the even and alternate distribution of feeders and drinkers

- If a farmer is not sure of quality of on-farm made feed, he or she can opt to:
    - Start by buying commercial broiler starter and feed from day old to two weeks.
    - Make or buy grower ration and feed from two to four weeks
    - Make all broiler finisher for the birds from four to point of sale
- Critical stage of growth is the first two to four weeks and hence the need for superior quality starter. Birds will have carryover effect of broiler starter and continue to grow well during grower phase
- During finishing phase, quality of finisher may not offset previous good growth and still push the birds to finish
- It is the finishing feed that takes more costs, and by making own feed, that cost is reduced

C. Tested rations for use in on-farm feed making

Rations in table have been used and proven effective for use in formulating feed for broiler production on-farm. Farmers can therefore use them with assured levels of success.

Table 6: Sample working rations for on farm feed making for broiler chickens

BROILER STARTER				BROILER GROWER				BROILER FINISHER		
INGRE-DIENT	UNIT	QUAN-TITY		INGRE-DIENT	UNIT	QUAN-TITY		INGRE-DIENT	UNIT	QUAN-TITY
Maize	Kgs	481.0		Maize	Kgs	568.7		Maize	Kgs	554.2
Soybeans	Kgs	429.3		Soybeans	Kgs	345.7		Soybeans	Kgs	402.8
Fishmeal	Kgs	48.9		Fishmeal	Kgs	56.2		Fishmeal	Kgs	4.6
Premix	Kgs	3.0		Premix	Kgs	3.0		Premix	Kgs	3.0
Salt	Kgs	3.0		Salt	Kgs	2.5		Salt	Kgs	3.0
MCP	Kgs	13.8		MCP	Kgs	10.0		MCP	Kgs	13.9
Lime	Kgs	20.0		Lime	Kgs	12.8		Lime	Kgs	17.3
DL-Met	Kgs	1.1		DL-Met	Kgs	1.0		DL-Met	Kgs	1.3
L-lysine	Kgs	0.0		L-lysine	Kgs	0.0		L-lysine	Kgs	0.0
Total	Kgs	1000		Total	Kgs	1000		Total	Kgs	1000

Notes

- Soybean is full fat, heat treated; do not use solvent extracted soybean
- Vitamin - mineral premix of 3 kg pack
- Salt is iodized, do not use non-iodized salt
- Fishmeal is that which is well treated, above 60 % CP

- Lime is the one with 37 % Ca

Activity 6.3: Costing of on-farm made feed (60 minutes):

Based on the ration provided in Table 5 above, let participants estimate how much of each ingredient is required in order to make 100kgs of feed.

- Establish the cost for each feed ingredient
- Establish the cost of milling, processing and bags
- Calculate the cost of producing each type of feed
- Compare the cost found above with the cost of buying the same from commercial feed makers

D. Provide clean water always

Broilers drink a lot of water and need to always have water in drinking troughs (drinkers). Provide fresh clean water and clean the drinkers as often as possible.

Water is provided in drinkers which include:

- Bell plastic drinkers
- Tinsmithed drinkers
- Plates
- Any improvised using locally available materials
- Automatic nipples

Figure 29. Placement of drinkers in a broiler unit

- Check the drinkers for possible leakages and spillages
- Train and demonstrate workers on tilting drinkers when placing in the khola to prevent water pour on chickens and wetting the litter
- With advancing in production, farmers can install water nipples that are connected to a tank outside. Chickens drink from these and water flow is initiated by the beak. In the Figure below shows a khola installed with automatic drinkers

Figure 30. Water nipples installed in a khola, connected to a tank (right)

E. Litter management

- Litter gets wet often due to heavy defecation from broilers. In addition, this can be source of infections and discomfort to broilers if not well managed.
- Ensure litter of correct depth of 6 – 10 cm is maintained.
- Turn the litter almost every day to avoid moulding, and caking
- Change litter when it is no longer possible to turn, usually the case when birds are grown up
- You can dig a pit to damp litter or can pack in sacks and store for some time to turn into manure

Activity 6.4: Practicals on feeding and water provision (60 minutes)

- Trainer to devide the participants into groups of four to five and visit the demonstration unit.

Round 1:

- Let the groups assess food and water availability in the demo unit
- While at the demo unit, let the groups present the findings of their assessments
- Trainer to conclude the discussion before taking the groups intothe second round

Round 2:

- Let the participants practice feeding and provision of water to broiler chickens
- Observe how they are handling the drinkers and feeders
- Let the participants share their experiences and challenges of the exercise

Unit 7: Manage diseases and parasites in a broiler unit

Unit objectives

At the end of the unit, participants will learn how to:

- Identifying diseases and parasites in a broiler unit
- Understand the different courses of diseases and parasites
- Take appropriate preventive and treatment measures for disease and parasites in a broiler unit

A. Introduction

- Professionally managed chickens in a good, well-ventilated khola and with dry litter are key to make birds health
- Common diseases in broiler production are shown in Table 6 alongside causal factors and mode of prevention /treatment

Table 7: Common infections in broiler production

DISEASE	PRE-DISPOSING FACTORS	CAUSE	PREVENTION	TREATMENT
Coccidiosis	Wet, damp, caked litter	Protozoa	Management of litter – correct depth, turning and changing	Coccidiostats found in veterinary shops
Chronic respiratory disease (CRD)	Poorly ventilated *khol*a, ammonia gases from litter	Bacteria	Management of litter, proper ventilation, and humidity	Antibiotics found in veterinary shops
Gumboro (infectious bursitis)	Poor biosecurity	Virus	Vaccine, disinfection	Treat against secondary infections
Newcastle disease	Poor biosecurity	Virus	Vaccine, disinfections	Treat against secondary infections
Infectious coryza	Poor biosecurity	Bacteria	Management of litter, proper ventilation, and humidity	Antibiotics found in veterinary shops
Internal worms	Wet litter	Internal parasites	Management of litter	Dewormers from veterinary shops
External parasites	Other birds outside, holes in walls		Disinfection	Use dusting powders from veterinary shops

Veterinary drugs are available in veterinary shops in cities and districts, and trading centers.

B. Understanding common diseases in broiler production

- Usually, health chickens at any age show normal movement and feeding behaviour that you can observe, feel their feathers, and crop contents, and listen to their sound and breathing
- Assessment uses five senses of hearing (on birds), site (on birds and the environment), taste (on water, feed and *khola*), smell (on *khola*) and feeling (on bird) according to Ross broiler parent stock guide
- Departure from normal behaviour and uniformity of growth is indicative of health issues in a flock, which may be due to diseases, parasites, and nutrition

1. Gumboro and Newcastle Diseases

Gumboro and Newcastle are very serious disease that cause over 50 % mortality in a unit infected.

Good of the two infections is that vaccine management at appropriate time provides 100 % prevention. In the Table below shows routine vaccine programs for broilers.

Routine disease vaccine management of a broiler unit as provided by CP.

Table 8: Common infections in broiler production

BROILER VACCINATION AND MEDICATION GUIDE		
AGE IN DAYS	**TYPE OF VACCINE PLUS STRESS PACK**	**APPLICATION**
1 - 3	Vitamins as stress pack	1 teaspoon per liter of water
7	Newcastle, Hitchner (ND)	Water
14	Gumboro (ibd)	Water, can add skimmed milk
21	Gumboro (ibd)	Water, can add skimmed milk
28	Newcastle, Lasota (ND)	Water, can add skimmed milk
28	Dewormer	Water as per prescription
	5 grams = 1 tea-spoon	

2. *Coccidiosis*

- Coccidiosis is serious infection in that it takes time to detect, and by the time it is noted, some productivity damage has been caused
- Clinical signs of Coccidiosis include:
    - A bird eating well but does not grow, even become lighter in weight
    - Yellowish, blood related dropping on the litter
    - Fluffy feathers
- Coccidiosis, just like worms, make the bird look health outside but growth ceases, and become lighter and pale
- Early detection of Coccidiosis or suspect of it through observing droppings is helpful to arrest its spread in the *khola*
- Any spot should be taken as an infection and the need to treat the infection
- Treatment includes use of Coccidiostats such as Amidiostat, Amprolium, and use of sulphur-based antibiotics such as Triple Sulphur, ESB3 and several trademarks for them. These are also available at vet shops (see Figure on right). The Figure shows Amprolium pack
- All treatments are administered through water, following instructions provided on the sachet
- If not sure, it is advisable to consult an Assistant veterinary Officer (AVO) of the area who can help identify the disease and advise correct treatment and how to administer the drugs

Figure 31. Amprolium for treating Coccidiostat

- For prevention, it is also advisable to administer prophylaxis to birds. This is giving the birds treatment even when they are not sick. This includes oral administration through water or adding coccidiostat to feed. When adding to feed, make sure the rate is known and should be part of feed formulation

3. *Chronic Respiratory Diseases (CRD)*

- CRD is also common and makes birds produce a persistent cough sound. The birds may continue to look health and with good appetite, but loose conditions
- When serious, birds' feathers start looking fluffy
- Coughing is the main identifier of CRD in a khola
- CRD is treatable, using broad spectrum antibiotics that include Tetravit, Triple Sulphur and its versions, and other forms of oxytetracycline

Activity 7.1: Practical on vaccination and treatment of birds (30 minutes)

Let participants visit a demonstration unit and conduct the following:

- Vaccine administration (this can either be Gumboro or Newcastle or both)
- Adminster some treatment (in case of disease infection seen)
- Assess the bio-security of the unit
- Make recommendations for the unit

Trainer to conduct a demonstration prior to giving prarticipants to practice.

Unit 8. Marketing the chickens

Duration: 60 minutes

Unit learning outcomes

After going through the unit, trainees and users should be able to:

- Understand how markets for broilers are identified
- Market broilers as live birds or dressed products

Instructions on training/facilitation

- Let participants draw their expectations from the training
- Interactive discussion with participants on marketing of broilers once they are ready
- Cross-check with the below material contents and add where needed

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training
- Visit to local markets (optional)

A. Introduction

- Broilers should be ready to sell as live or slaughtered and dressed from 35 days. In many small and medium scale production, optimal is 42 days and may extend to 56 days
- Selling beyond 42 days and any day delay to sell afterwards, leads to reducing profits, since the birds are still consuming the feed. And when sells start, birds get stressed of being caught, and stop growing, unless a farmer separates the group to sell from those that are still growing
- At point of sale, birds should weigh at least 1.8 kg live weight, and achieve above 65 % dressing rate. Below these targets, a farmer may make losses from sales

Activity 8.1: Interactive group discussions on marketing of broilers

Trainer to form groups of five to seven participants. Let the groups visit a nearby trading center or market to interact with small and medium poultry farmers selling their broiler chickens. Provide the participants with the following guiding questions for interacting with the farmers:

- What is your experience in selling the chickens?
- How does the delay in finishing sale of a chicken batch affect you?
- What strategies do you use in case a sale of a batch takes more time than expected?

Let the groups choose a representative to present in the plenary after this exercise.

Trainer to summarize with the following:

- Marketing of broilers requires great planning as any delays will have a big effect on the cost of production. As such, it is important for would be or practicing farmers to develop strategies, which can help in increasing their sales
- Some of the strategies small and medium farmers are using include:
  - Live sales to individuals who come to the farm and buy
  - Live sales to middlemen who buy in small bucks and sell at urban and peri-urban, and trading centers markets
  - Taking live birds in a small van to the market and sell to consumers including restaurant owners
  - Some farmers own shops and sell dressed chickens kept in refrigerators
  - Sale of dressed chickens to retail shops, restaurants, and institutions
  - Sale of roast dressed chickens at trading centers
- Individual chicken sales take time to clear the khola and defeats all in and all out system of broiler production and marketing
- Sales at trading centers and markets ends small and medium scale producers competing with large-scale producers who bring live chickens in vans to same markets
- Middlemen buy from markets and sell to consumers or roast them as 'kenyenya' as in Figure shown below
- Usually young men (majority) and women (few) are engaged in broiler marketing as middlemen and roasters

B. Challenges of marketing of broilers

Some of the key challenges faced by small and medium poultry farmers in marketing of their broilers are as follows:

Figure 32. Examples of marketing strategies being employed by small and medium farmers & middlemen in marketing of broilers

- Delayed sales at farmstead leading to a farmer to lose revenue
- Competition with large-scale producers at urban and peri-urban markets, and at trading centers who bring large numbers of low cost produced broilers in vans (see figure below).

These challenges make the farmer fail to attain an all-out production and marketing.

Figure 33: Live chickens from a large producer at a trading center market

Activity 8:2: Case study (30 minutes)

Marketing of chickens especially broilers remains to be a biggest challenge for small and medium poultry famers as big commercial farmers continue to flood local markets with their vans which are mostly selling the chickens at a very lower price. Despite complaints to the Commission of Fair Trade Comission, Ministry of Trade and Industry and other government bodies, no permanent solution has been found, leading to many smallholder broiler farmers being pushed out of the market.

Group discussion

- What strategies can we use to manage the situation and make our chickens competitive on the market?

Let the groups present their outcomes of their discussions in the plenary.

Trainer to complement the group presentations with the following:

- Encourage more to enter production are needed as this will lead to multiplier effect of production
- Form cooperatives and increase the economies of scale
- Improving production standards
- Capacity building in feed making and management
- Aggregation of chickens produced by small scale farmers to sale as a group

Unit 9: Record keeping

Duration: 60 minutes

Unit outcomes

After going through the Unit, trainees and users should be able to:

- Incorporate record keeping as part of broiler production business
- Make informed decisions from records

Instructions on training/facilitation

- Let participants draw their expectations from the training
- Interactive discussion with participants on record keeping and analyses of broilers
- Cross-check with the below material contents and add where needed.

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some broiler units that can allow participants to visit during the training

A. Introduction

In plenary, trainer to ask participants the following:

- What they understand by record keeping?
- What types of records do you normally keep in your poultry business?
- Why keeping records is import in poultry production?

Trainer records the responses on a flipchart and complement with the following:

- Record keeping is very important is one is to succeed in business
- There are different types of records and these includes production records, sales records and financial records
- Simple records need to be developed and used on a farm

Tables 8 and 9 below show sample record that can capture data on inputs and their costs, inventory of chickens, deaths, feed consumed and costs, sales, and daily inventory.

Table 9: Records on broiler inventory and monitoring

DATE	NUM-BER	FEED CONSUMED, KG	UNIT COST, PER BAG	COST (MK)	DEATHS	SOLD	EATEN OR GIVEN	BA-LANCE	WEEK	MORTALITY			
				0.00				0		%			
12/08/2022	505			0.00	1			504		0.19802	Feed Broiler Starter	Weight	0.05
13/08/2022	504			0.00				504		0			
15/08/2022	504			0.00				504		0			
16/08/2022	504			0.00				504		0			
17/08/2022	504			0.00				504	1	0		Weight	
18/08/2022	504			0.00				504		0			
21/08/2022	504			0.00				504		0			
22/08/2022	504			0.00				504		0			
23/08/2022	504			0.00				504		0			
24/08/2022	504			0.00				504	2	0	Change to Broiler Grower	Weight	
25/08/2022	504			0.00				504		0			
29/08/2022	504			0.00				504		0			
30/08/2022	504			0.00				504		0			
31/08/2022	504			0.00				504	3	0		Weight	
01/09/2022	504			0.00				504		0			
05/09/2022	504			0.00				504		0			
06/09/2022	504			0.00				504		0			
07/09/2022	504			0.00				504	4	0	Change feed to Finisher	Weight	
08/09/2022	504			0.00				504		0			
11/09/2022	504			0.00				504		0			
12/09/2022	504			0.00				504		0			

DATE	NUM-BER	FEED CONSUMED, KG	UNIT COST, PER BAG	COST (MK)	DEATHS	SOLD	EATEN OR GIVEN	BA-LANCE	WEEK	MORTALITY			
13/09/2022	504			0.00				504		0			
14/09/2022	504			0.00				504	5	0		Weight	
15/09/2022	504			0.00				504		0			
18/09/2022	504			0.00				504		0			
19/09/2022	504			0.00				504		0			
20/09/2022	504			0.00				504		0			
21/09/2022	504			0.00				504	6	0	Start selling	Weight	
22/09/2022	504			0.00				504		0			
25/09/2022	504			0.00				504		0			
26/09/2022	504			0.00				504		0			
27/09/2022	504			0.00				504		0			
28/09/2022	504			0.00				504	7	0		Weight	
29/09/2022	504			0.00				504		0			
02/10/2022	504			0.00				504		0			
03/10/2022	504			0.00				504		0			
04/10/2022	504			0.00				504		0			
05/10/2022	504			0.00				504	8	0	End selling	Weight	
Total		0		0	1	0				0.25		0	FCR
	Bags	0											

Notes

- Date = date of actual production, starting from the day chicks arrived
- Number = actual number of chickens counted at day or arrival
- Feed consumed and costs per bag= record of feed supplied and costed, that has finished and the associated costs
- Deaths, sold and given as presents = record of deaths, and when sales start, number sold or given away at that day

- Balance = number remaining in a khola after taking out deaths, numbers sold and given away
- Week = week into production, and if there is any activity to follow, it is documented in subsequent columns

Table 10: Broiler records of income and expenditure

1	**INCOME**									
	DATE	**DETAILS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT (MK)**					
					0					
					0					
	Total		0		0					
2	**EXPENDITURE**									
	DATE	**DETAILS**	**QUANTITY**	**UNIT COST**	**AMOUNT (MK)**					
	12-Aug	Day old chicks	500	750	375000					
					0					
					0					
					0					
	Total						375000			
	Cost of feed						0			
	Cost of chicks						375000			
	Drugs and others						0			
	Cost per chick									742.574
	Percent feed cost						0			
	Percent chick cost						100			
	Percent drugs and others						0			
3	**Net**							-375000		

Notes for the table above

- Income = where sales records for the day are entered
- Expenditure = where itemized inputs are entered, example given of day-old chicks.

Activity 9.1: Developing farm records (60 minutes)

Using the templates provided in the tables above, let participants in groups of five seven develop records for the demo unit.

Group representatives should present the outcomes of their discussions in plenary. Trainer to observe the following during the presentation:

- Surviving chickens after deaths, sale or given out
- Mortality rate so far following the death of chickens
- Total amount of feed consumed during the production and associated costs
- Total number of deaths, sold and given out
- Approximate feed conversion rations

Unit 10: Starting a broiler production business

Duration: 60 minutes

Unit learning outcomes

After going through the Unit, trainees and users should be able to:

- Develop a concrete plan for their broiler production business
- Establish financial requirements for their broiler production business
- Make revenue projections for their business
- Make informed decisions on their broiler production business

Instructions on training/facilitation

- Let participants draw their expectations from the training
- Interactive discussion with participants on record keeping and analyses of broilers
- Cross-check with the below material contents and add where needed

Materials needed during the training

- Flip charts and markers
- LCD projector or plasma screen
- Laptops
- Gross margin calculation sheet

Recap

Recall what we covered in module 1, what were your key takeaways?

Trainer to let participants share their reflections of module one before introducing the day's lesson. Trainer to record all the responses on a flipchart before and start the following:

In this module, we are going to reflect back on module 1 to consolidate our learning on broiler production.

Activity 10.1: Individual exercise: (20 minutes)

Trainer to let the participants reflect the entire broiler production module and the enterprise selection and gross margine calculation discussed in module 1.

- Moving forward, how many chickens are you going to start with?
- Think of key activities that needs to be done to make that happen (or improve your business).
- What resources do they need to ensure that the listed activities have been done?
- By when are they going to have done the activities?

Let them come up with an estimated quantity and cost of those resource. (this could be khola, feed, drinkers, etc).

Trainer to provide them with the activity planning template below to record their reflections.

Table 11: Recourse calculation sheet

NO	ACTIVITY	RESOURCES NEEDED	TIMELINES							
			WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8
1										
2										
3										
4										
5										
6										
7										
8										

Activity 10.2: Gross margin calculation. (60 minutes)

Based on the planned size of a batch (number of chickens) mentioned above, let the participants calculate gross margin of their planned business. In their calculation, let them take into account of the following:

Estimated mortality rate.

Estimated feed amounts of each type.

Other associated costs (i.e. vaccines, charcoal, etc).

Estimated total cost of production.

Let them compare between making own feed and buying from commercial feed producers.

Trainer to provide the participants with the gross-margin calculation sheet below.

Table 12: Information for calculation sheet

SIZE OF BATCH PLANNED (NUMBER OF CHICKENS):							
ON-FARM FEED				**COMMERCIAL FEED**			
COSTING MA-TERIALS	**UNIT**	**QTY**	**UNIT COST**	**COSTING MATERIALS**	**UNIT**	**QTY**	**UNIT COST**

Table 13: Gross margin calculation sheet

GROSS MARGIN ANALYSIS													
OWN FEED							**COMMERCIAL FEED**						
STEPS	**NO**	**ITEM**	**UNIT**	**QUAN-TITY**	**UNIT COST (MK)**	**TOTAL COST (MK)**	**STEPS**	**NO**	**ITEM**	**UNIT**	**QUAN-TITY**	**UNIT COST (MK)**	**TOTAL COST (MK)**
Step1: Know your quantities	1						**Step1: Know your quantities**	1					
	2							2					
	3							3					
	4							4					
	5							5					
	6							6					
	7							7					
	8	Estimated Mortality rate						8	Estimated mortality rate				
Step 2: know your costs		**Total cost of production**					**Step 2: know your costs**		**Total cost of production**				
		Unit cost (t*otal cost of production/quantity of product produced***)**							**Unit cost** (*total cost of production/quantity of product produced***)**				
Step 3: Know your revenue		**REVENUE**					**Step 3: Know your revenue**		**REVENUE**				
		Unit price(*selling of chickens)*							**Unit price** (*selling of chickens**)***				
		Gross revenue (*unit price x quantity produced***)**							**Gross revenue** (*unit price x quantity produced)*				
Step 4: Know your profit		**Gross profit** (*gross revenue-total cost of production*)					**Step 4: Know your profit**		**Gross profit** (*gross revenue-total cost of production*)				
		Gross margin % (*gross profit/total cost of production) x 100%*)							**Gross margin %** (*gross profit/total cost of production) x 100%*)				

Strategies for financing the broiler business

Let the participants develop strategies for financing their planned broiler production business.

At random, trainer to select five participants to share their plans and financing strategies in plenary. Let the rest of the class help them in reviewing the proposed strategies.

A. Factors to consider in order making a profitable broiler production

In plenary, discuss key factors which needs to be considered in order to make a profitable broiler business.

Trainer writes the responses before sharing the following:

- Managing growth rates, weights, feed consumption, growth uniformity and mortality as some critical factors which can affect profit in broiler production business
- Broiler breed producers have different production and management guide, which guides farmers in monitoring if they are within an ideal production targets
- A farmer should strive to manage broiler to achieve the targets. To assess oneself, it is important to get records at different ages and compare against the targets
- Over 20 % departure from such an ideal situation will indicate problems in the production and management, and these calls for investigation

In the Figure below shows an ideal production curve for Ross broilers.

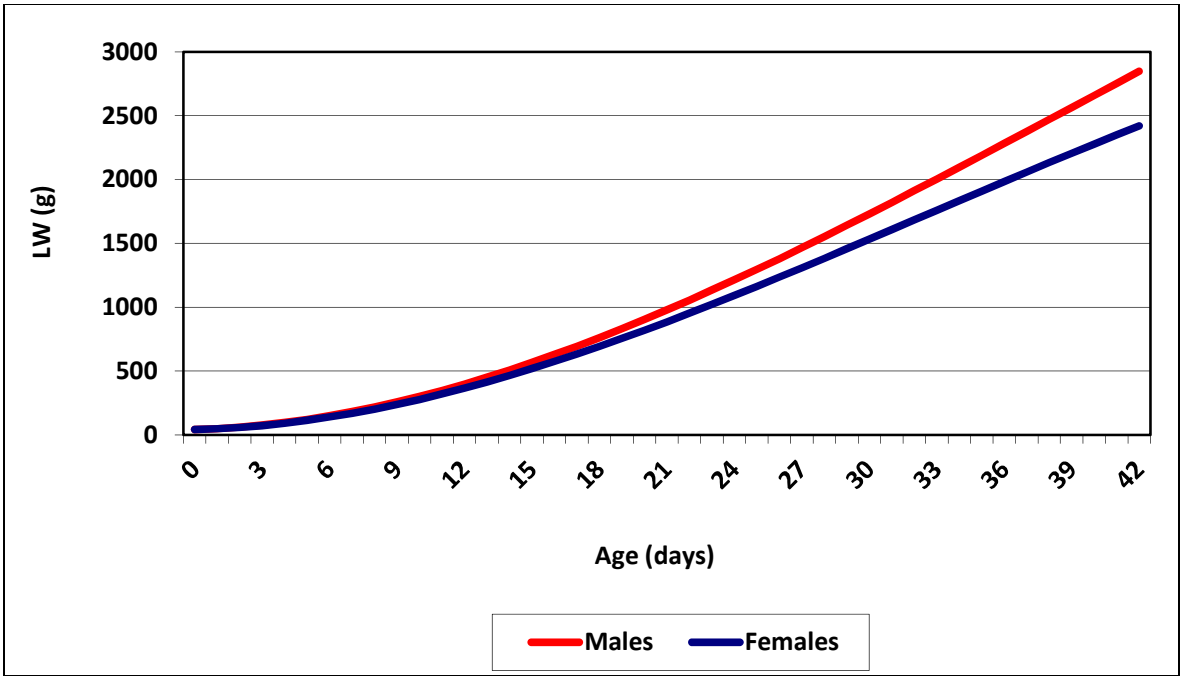


Figure 34: Ideal Production for Ross broiler (Source: Ross Production and Management Guide)

- An investigation on broiler production will require considering and checking all factors that can influence production
- Ross Manual provides nine factors that needs to be checked as in the figure below. There is a need to check this right from day of placing the chicks up to the point of sale

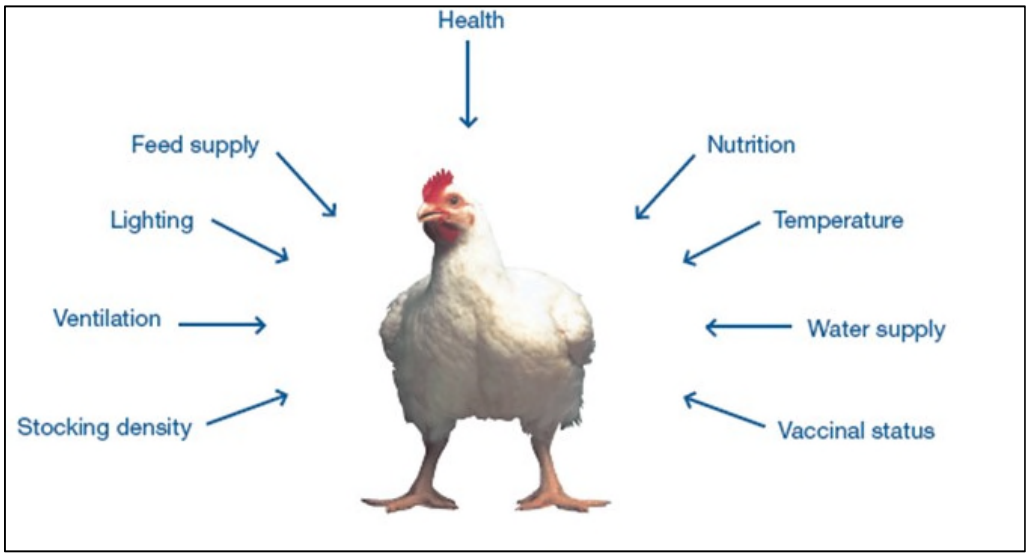


Figure 35: Factors to consider during production (Source: Ross Manual)

It is important that during the training, participants discuss these factors and strategize how best to enhance them on the farm.

B. Biosecurity consideration

- It is very important to consider biosecurity of the broiler unit. This is in addition to considerations made when citing a broiler unit
- It is recommended not to bring guests into a broiler unit
- The unit should be fenced to prevent entry and access of other animals including dogs and cats
- There is need for a shower and exchange room where workers will change clothes and take a shower
- Remember to disinfect the inside and outside of the broiler unit at regular intervals
- Customers should not access a broiler unit. Rather, take birds to a collection point
- Birds that have been taken out for sale should not be returned into the khola
- Ensure proper manure disposal into a pit or in sacks that can be taken to a garden or sold
- At entrance into the khola, put a footbath with disinfectant to always dip legs when entering the unit
- Make sure workers are provided with personal protective clothing

MODULE 3: LAYER PRODUCTION, MANAGEMENT AND EGG MARKETING

Module objectives

Acquired knowledge

- Understand the different llayers strains available in Malawi
- Know how to raise layers from brooding stage to production
- Understand different housing systems for layers production
- Understand different feeding regimes and feed management practices in layers production
- Understand the importance of recording keeping in layers production

Acquired skills

- Establish a layer poultry unit
- Identify strains used in layer production and their sources
- Raise and manage layer chickens
- Feed layer chickens cost-effectively
- Manage diseases and parasites in a layer unit
- Ability to market the eggs and spent layers
- Ability to keep records for their farming enterprise

Acquired attitude

- Layers production can be profitable if well planned and management
- Record keeping is important in layers business

Methodology

Group discussion, farm practical, individual work assignments, plenary discussions, lecturrate and presentations.

Materials needed during the training

- Flip charts
- Markers
- LCD projector or plasma screen
- Demonstratin unit
- Feed ingredients
- Feed making equipment (shovels, weighing scales, floor, or drum mixers)
- Drugs and vaccines
- Working coat

Unit 1: Establish a layer poultry unit

Duration: 30 minutes

Unit outcomes

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

- Plan to start up a layer production enterprise
- Construct recommended layer house (s)
- Source inputs including feed, day old chicks, drugs, and vaccine

Materials needed during the training

- Flip charts
- A farm keeping layers to allow learners appreciate the chickens
- Markers and masking tapes

Steps

Background to layer production

What is a layer chicken? Let the participants share their understanding of layers, trainer to record their responses on a flipchart before complementing with the following:

Layer is a term applied to chickens that are bred specifically for:

- Slow growth, light and hard, able to reach mature weights and point of laying eggs between 18 and 20 weeks
- Optimally lay eggs for 52 weeks or more from point of lay
- High egg production rate of more 300 table eggs per annum

A layer is a hybrid, developed by special companies called breeders. These are only few in the world but distribute these layers to all parts of the globe through other companies that keep parent stock and hatch fertile eggs.

- Because a layer is a hybrid, it has combined good features from crossing of more than two breeds. It is not advisable to produce another layer from the stock you have. Rather, the practice is source and buy fresh stock, raise them under good management and feeding, and they lay quality eggs
- A farmer always needs to go and buy new batch of day-old chicks from hatchery services providers, just like a maize farmer who goes to buy seed from a seed company
- Layer production business can be started and run by any farmer regardless of gender and age, hence fit for the youth, active working, or businesspeople, the retired and the elderly

Layer strains available in Malawi

What strains are common in Malawi?

- Hy-Line is the common strain (type) of layers available in Malawi. In the Figure on right shows a brown Hy-Line that lays brown eggs.
- Hy-Line is bred to achieve maximum eggs production of over 300 per bird per annum following inception of laying at between 18 and 20 weeks. The birds are light, weighing around 1.5 kg at point of lay.
- Central Poultry (2000) Ltd, Charles Stewarts, Kelfood (Proto), Thanzi Chicks Limited, and a few that emerge into layer hatching business.

Figure 36. A Hy-Line strain for egg production

The availability of layer chicken in Malawi assures easy accessibility of layers to farmers

Unlike broilers, layers can be stocked:

- At day old as chicks, or
- At week 18 – 20 as pullets that have started laying

Investments into layer enterprise are substantial before a farmer starts earning from it. Farmers are therefore encouraged to start within a reasonable and manageable range of birds and grow organizacally.

Unit 2: Housing establishment

Duration: 4 hours

Unit outcomes

A knowledge of layer houses and ability to establish standard layer houses suiting the production sizes.

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Layers demonstration units that can allow participants to visit during the training
- Working coat

Methodology

- Presentations
- Demonstration of layer houses
- Designing some housing
- Visits to a poultry unit
- Question and answers

A. Housing establishment

Activity 2.1: Identifying poultry houses for layers: 30 minutes

Let the participants in groups of five to seven discuss different poultry houses recommended for layers. Let them come with factors to consider before constructing a poultry house for layers production.

Participants to present the outcomes of their discussions in plenary.

Trainer to complement the outcomes of their discussions with the following:

- Housing layers is one important area to consider for proper growth of the bird and egg production afterwards. Housing provides an environment that can make the birds grow uniformly, and be protected from adverse weather, predators, and security from thieves.
- Similar housing structures for broilers could be used for layers (see a layer unit in Figure 3.2).
- Two standard types of housing are used in layer chicken production:
  - Deep litter types (just like for broilers)
  - Battery cages
- For either type, housing can be
  - Flat floor types as in broiler production
  - Floors on raised platforms

Figure 37. Layer house. Courtesy of Zenizeni Poultry Farm, Ntaja, Machinga

1. A.Deep litter/floor type housing

- These are most common for layers, where birds are raised on floors with litter supplied to the depth of 8 – 10 cm
- A khola should provide enough space to accommodate six to eight birds per m2 at hen/laying stage
- There should be drinkers and feeders placed evenly in the house. The following recommendations must be followed for feeders and drinkers
    - For chicks and pullets:
        - Zero to six weeks: 2.5 cm; six to eighteen weeks 5.0 cm for feed troughs
        - Zero to six weeks: 1 cm; six to eighteen weeks 2 cm for water troughs
    - During laying:
        - 8 – 11 cm per hen for feed troughs
        - 12 hens per tube feeder of 30 cm diameter
        - 20 hens per bell shaped drinker of 25 cm diameter

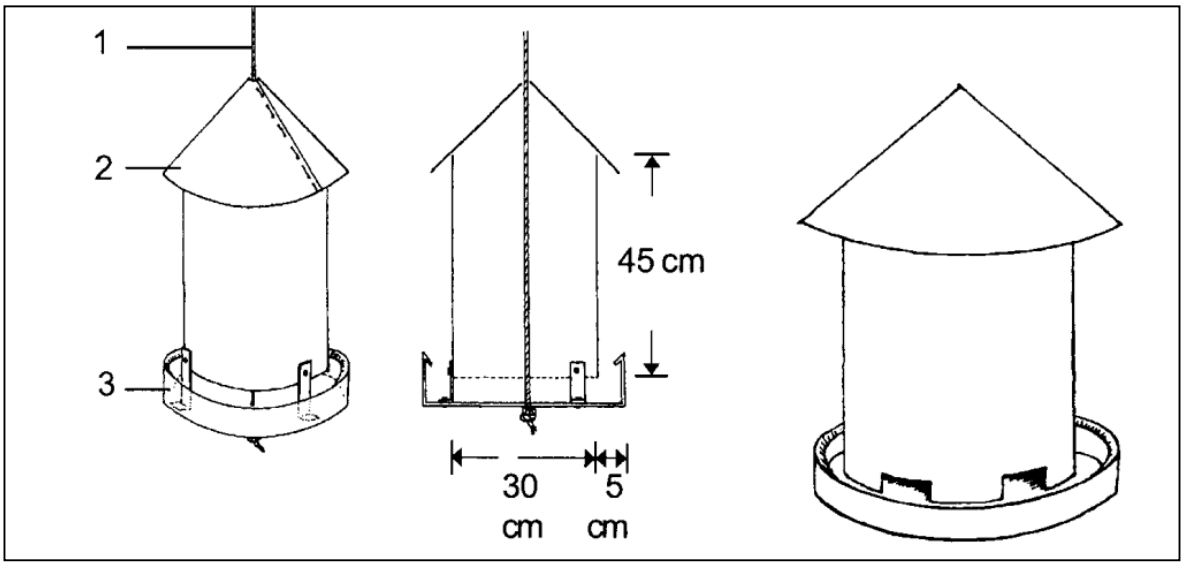


Figure 38. Feed and water troughs for layers (Source: Agromisa Foundation, 2004)

Notes

- Hanging wire, 2. Cover: sheet metal cone, 3. Tray: sheet metal
- In many cases, the same house is used to brood chicks and later keep hens for laying.
- There are also cases where a separate house for brooding is constructed:
  - Where separate houses are used, layers should be transferred to the laying house at 18 weeks of age
  - In some instances, birds can be reared in the same house from day old to laying period

Placing nesting boxes

- When birds are nearing laying, adequate number of nests must be provided (20 for 100 pullets)
- Nesting boxes are where birds go and lay eggs
  - To allow birds walk in headfirst, turn around and sit facing out, the nest must be at least 30 cm wide, 30 cm long and 40 cm height
  - And to enable the birds to inspect the nests before they select one, there must be an area in front of the nest where two hens can pass each other freely
  - Usually nesting boxes are placed on the walls, but can be placed centrally in the *khola*
  - The top should be slopy to prevent hens from sitting on the top

Figure 39. A deep litter house with Hylines showing nesting boxes

Figure 40. Wooden nesting boxes placed on the walls of the kholas

Notes

- Place enough nests for the unit, can estimate one nest for five hens is required
- Place nests two to four weeks before pullets start laying
- Place litter in the nests
- Collect eggs as often as possible to avoid breakages

Activity 2.2: Visit to a demonstration farm unit: 30 minutes

Trainer to organize participants in groups of four to five for a farm visit at a demonstratio unit. At the demo unit, let the participants appreciate the layers demonstration unit as they observe how the drinkers and feeders have been placed.

Let them develop a drawing from it indicating the recommended direction of a layers unit.

Participants to present the outcomes of their discussions in plenary.

2. *Battery cage housing*

- These are similar structures but fitted with cages that can accommodate between 1 and 3 hens per cage. These cages are usually made of galvanized iron, and fitted with drinkers, feeders and laying crate.
- **Note: this is not the preferred type of chicken housing, since it is against rules of animal welfare and should be avoided wherever possible.**
- Chicks are brood on the floor and transferred to cages at point of lay (around 18 weeks).
- A cage is basically like a laying nest with fittings for water and feed troughs, and egg collection tray (see Figure 41 & 42).
- These are stack in tiers forming a pyramid like structure.

Figure 41:Battery cages inside the laying house, courtesy of Dr Munthali Farm, Salima

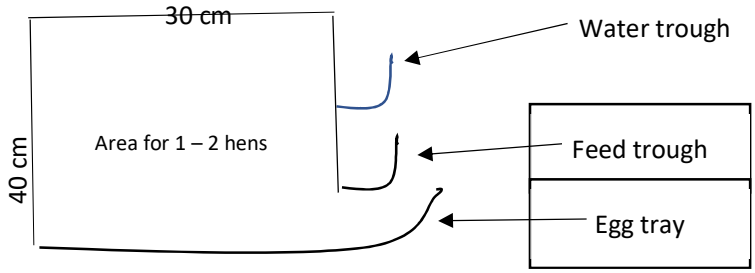


Figure 42: Illustration of a battery cage with specifications for 1 – 2 hens

Activity 2.3: Planning a layer production unit. 40 minutes

In groups of four to five, let the participants reflect on the following:

- What type of housing do you plan to build?
- How many chickens do you want to start with?

Participants to prepare a design and list all materials required to construct it. Let them calculate the cost of materials. The chicken design should correspond to the number of chickens decided above.

Groups to select a reprsentative to present in plenary.

Unit 3. Layer production, feeding and management

Main outcome

By the end, participants should be able to:

- Source day old chicks or pullets at point of lay
- Brood chicks
- Feed the birds according to their requirements
- Raise disease free birds till point of lay and afterwards

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- A demonstration unit
- Working coat

Delivery methodology

- Farm practical sessions, plenary discussions, group discussions, presentations, questions and answers

A. Stages of layer production

Layer production has the following sections on the farm:

- Sourcing and brooding of day-old chicks (from day old to six weeks)
- Rearing of pullets (from six to eighteen weeks)
- Rearing of laying hens (from 18/20 weeks to 72 weeks or end of laying)

Producers have an option to start from keeping day old chicks or buying pullets at 18 weeks, usually referred to as point of lay (POL).

Activity 3.1: Group discussions: 30 minutes

Let the participants in groups of four to five discuss the following:

- What is your preferred option for rasing chickens (starting from day old chicks or buying POL)?
- What are the advantages and disadvantages of each of the above options? (this should be but not limited to initial cost of investments, time of productiom before egg production, risks involved)

After the discussions, let the groups present their outcomes in plenary.

1. Sourcing day old chicks

- Layer production can start at day old or at point of lay, around 18 weeks. The module will cover a process of production from day old.
  - A farmer must order the day-old chicks a week or so in advance from a hatchery or its agents that are located within the area of reach
  - For beginners, they may ask from fellow farmers, extension agents, or other social media groups that host poultry farmers
  - Many hatcheries or agents will ask to pay in advance, or a deposit and a farmer will be given a date of collection
  - Some hatcheries are kind enough to arrange for delivery of chicks within a certain perimeter of their location

2. Preparing arrival of chicks

- Prior to arrival of chicks, make sure you prepare the brooding unit. This unit can be a separate specially made brooding house, but many brood in the same rearing house.
- In the rearing house, make demarcations for brooding by blocking part of the khola using block boards, iron sheets, cartons or any other material that may work.
- It is recommended to make a round brooding unit (see an ideal in Figure 43 above for broilers).
- Many farmers demarcate/block one quarter of the khola, which should be enough to accommodate day old chicks to suit capacity of the khola.
- Ensure windows are covered with sacks, plastic tents/tarpaulins and other materials that will block cold air entering the brooding house.
- In terms of floor requirements:
  - Allow up to 40 chicks per m^2 during brooding
  - 2.5 cm per feed trough for birds between zero to six weeks
  - Provide dry litter from materials that provide insulation and comfort bedding to chicks and absorb moisture from droppings and water spillage:
    - Common litter materials are rice husks that are bought or given free from rice mills
    - Other litter include wood shavings from carpentry shops, groundnut hulls from mills, coffee husks, dry thatch grass that is chopped into small pieces
    - Litter should be placed to depths of 6 – 10 cm

Figure 43. Brooding of day-old layer chicks

3. Disinfecting the brooding unit

- A day before arrival of the birds we make sure the khola is fully disinfected using strong chemicals that can kill bacterial, viruses and other germs
- Strong disinfectants are available in veterinary shops. A farm can also disinfect using herbicides that kill vegetable and crops pests including Fall Armyworm
- Charcoal is crushed and mixed with lime powder and spread on the floors to prevent insects from entering, then the house is closed

4. Pre-warming the brooding unit

- The brooding unit should be pre-heat around twelve hours before arrival of chicks
- Charcoal burner (locally called 'mbaula') is common source of heating the brooder
- Depending on size of the brooder, one mbaula is centrally placed, covered by wire mesh to prevent chicks from entering underneath and get burnt
- Ideally, a hoover guard is placed on top of the mbaula, to prevent heat from going up and spread heat in the brooder unit
- Examples of mbaula include the normal metallic types used in the kitchen, and specially clay earth made brooding types that are sold in veterinary shops
- In large brooding units, a few mbaula may be spread around to ensure even spread of heat
- Other types of heaters include electric, kerosine heaters, steam pipes and gas heaters. Electric heaters include high watts infrared bulbs (around 200 watts) and heating elements. Gas from biogas production can also be used to heat the brooding unit.

Figure 44. Raised type of mbaula for brooding

- Electric bulbs are hung in the brooder unit. Three bulbs will suffice a 500-capacity brooder if just hang.
- Efficiency is increased if a bulb is placed under a hoover guard as shown in the Figure below in broiler module.
- Farmers can also instruct tinsmiths to construct a metal hover guard, and place heat elements underneath. When placed in the brooder, the elements will heat and spread the head to the chicks.

Figure 45. Brooding unit with a metal hover guard

5. Placing drinkers and feeders

- In the brooder, evenly place water and feed troughs. These are small containers, usually plastic drinkers. Feed troughs could during the first week, be cartons that had brought the chicks.
- Apart from feed troughs, plastic sheets and papers are laid where feed is spread for young chicks to pick.
- If small plastic or metallic drinkers are not around, small plastic plates are used. However, put clean stones inside to prevent chicks from getting soaked and drowned.

Activity 3.2: Feeders and drinker placement in a demo unit-practical session: 40 minutes

Let the participants visit a demonstration farm unit and practice the placement of drinkers and feeders in the brooding chamber. Let them calculate the number of drinkers and feeders required in the unit.

Participants to present their justifications for the number of drinkers/feeders calculation.

Facilitate a reflection session at the end for the participants to share their experiences.

B. Stocking and brooding the chicks

- Brooding is the management of chicks from day old, to ensure for their survival and health by providing heat and all necessary care for them to easily adapt to their new environment
- Brooding period is around two to three weeks in layers depending on weather of the season. This is the most critical stage of birds since it ensures the chicks survival rate in its later stages
- Birds will stay in brooding until six weeks old

1. When chicks arrive, brooding starts

- In layer production, only female chicks are supplied to farmers. These are distinguished by feather colour; the males are white and are easily isolated out at the hatchery
- Usually, chicks are packed in cartons of 100 chicks plus 2 % to cater for normal mortality. That is, for every 100 chicks bought, hatcheries supply 102
- There is need to count the chicks when placing in a pre-warmed brooder
- Record the number of chicks from each carton and total the number. This number is to be recorded on a record template
- Reject the weak and dead chicks upon arrival if delivered by the hatchery, or upon collection at the hatchery or agent
- It is important to count at arrival, and be recording deaths on each day, to determine number of live chicks for the day
- Place the chicks evenly in a brooder unit and monitor their movement and sound behaviour. The chicks will show some signs of stress upon arrival or respond to the heat of the brooder
- Once finished placing the chicks, first give them water in small plastic drinkers
- In the water, add vitamin and mineral anti-stress factors, usually called stress pack bought from veterinary shops. This will help to energize the chicks and stimulate their appetite to feed

- Thereafter introduce the chicks to feed, placed on cartons that had carried the chicks

2. Observe behaviour of chicks in the brooder

- Day old chicks will respond to heat or coldness, threats from human beings and animals including rats, and quality of litter and feed
- The optimal temperature is regulated by the thermometer and chick behaviour. You can place a thermometer by hanging at around 10 cm from the floor, or at the edge of a hover guard
- Regularly monitor activeness and behaviour of chicks as they respond to heat in the brooder. This will help to increase or reduce heat in the brooder
- Ensure that we maintain a temperature reducing as per below:
  - Day old to one week old:
    - Temperature under hover 35°C
    - Within building temperature 15°C
  - One tot wo weeks:
    - Temperature under hover 30 °C
    - Within building temperature 15 °C
  - Three to four weeks:
    - Temperature under hover 26 °C
    - Within building temperature 15 °C
  - Four to six weeks:
    - Temperature under hover 23 °C
    - Within building temperature 15 °C
- Make sure the birds are evenly scattered in the brooder unit, some are eating, others sleeping, others running around:
  - When the birds are clinging to the heat source it simply tells that the room is cold, and we need to increase the heat. Also check if we have openings where a lot of cold air is coming in from so that we close them
  - When the birds are drifted to one side it shows us that the heat is not being distributed evenly, so we put the heat sources evenly in the house or we put an iron sheet (hover) on top of the charcoal burner and increase heat
  - When the birds are going far from the heat source, there is too much heat and they are running from it, lower the temperature until the birds are evenly distributed
  - Sometimes the birds can be evenly distributed but they seem to be sleepy and lazy. This shows the temperature is too high and needs to be reduced. The birds need to be active most of the time
- Make sure the house does not always run out of water and feed. This reduces a stamped when you are adding water and feed at another time.
  - Removing heat during brooding
- Heat is usually and gradually removed at around 2nd week of brooding

- Note that layer chicks are relatively more adapted to environment than broiler chicks
- By this time, the birds would have grown feathers to insulate themselves against cold weather.
- In the event of weather changes and temperature drops, heat may be introduced
- At withdraw of heat, birds may be given stress pack to counter stress that may arise and sustain their normal growth
- Remember to be extending the guard as chicks grow to avoid overcrowding

3. Lighting program

- Ample light is required for feeding and watering of birds
- Increased lighting in the houses of Layers has been reported to have increased egg production by 20%
- Artificial day should be 16 – 18 hours of light

4. Ventilation

- The khola should be well ventilated through proper air circulation through the windows. Even though the windows may be covered during brooding, there is need to ensure that there are spaces for good air circulation.
- Good ventilation helps to:
  - Remove excess ammonia, carbon monoxide and other gases build in the khola, and provides fresh air to birds
  - Regulate temperatures and humidity in the khola
  - Prolong dry condition of the litter

5. Raise the birds through all stages

- Layers must be raised from:
  - Day old during brooding to pullets (zero to six weeks)
  - To Point of Lay (POL) at 18 weeks, and
  - During laying period
- In the past, laying period was one year (up to 72 weeks of age). However, it is possible to extend production before selling the hens (as spent layers)
    - Critical during the period is feeding and disease management. These will be discussed in the subsequest lessons

C. Feed laying chickens cost-effectively

In plenary, trainer to discuss with the participants the following:

- What types of layers feed do you know?

- At what stage is each type of the feed given to the chickens?
- How do you source the feed for layers?

Trainer to complement the discussions with the following:

- Laying chickens are fed using three feeding regimes (see Table 14).

Table 14. Feeding regimes in layers and estimated quantities per bird

TWO FEEDING REGIMES	ESTIMATED CONSUMPTION PER BIRD, KG	PERIOD (WEEKS)
Chick starter	1.1	0 - 6
Pullet grower	7.0	6 – 18
Layers ration	40.0	18 - 72
Expected total, kg	48.1 (48.0 – 51.0)	

- Feed can be bought (commercial feed) or made on farm (home or on-farm made feed). If bought, check the label of name to make sure correct feed is bought, and nutrient label to ascertain the nutritional values
- Locally on-farm made feed reduces cost of feed by between 20 and 40 %, depending on season and prices for major feed ingredients maize and soybeans. When the prices for these two ingredients increase, they push the on-farm made feed closer to commercial feed
- However, there is need to ensure on-farm made feed is of good quality, hence need for capacity to formulate these rations. Ration formulation will be detailed in a separate module of the training manual
- Currently major sources of feeds include central poultry and proto. Medium level feed manufacturers include Ndatani and Alfa feeds. There are many small-scale feed producers within cities

Activity 3.3: Estimating the quanities of feed required: 30 minutes

Using the information provided above, let the participants go intro groups of 4-5 and estimate the quantities of feed required for the demo:

- Let the calculations provide the quantities per type of feed
- Participants should calculate the number of 50kg bags required for each type of feed and estimated cost
- Participants to present the outcomes of their discussions in plenary

D. Feeding during chick period

- Chick starter is provided from day old up to six to eight weeks (see Figure on right)
- The ration has:
  - 20 % CP
  - 2000 kcal/kg ME
  - <5 % CF
  - <5 % Fat
- Start by providing feed on chick cartons or trays
- Then provide in troughs as chicks grow
- Small round drinkers are used during first week

Figure 46. Layer chicks in growing stage of zero to six weeks

1. Feeding pullets/growers

- Pullets are those from six weeks to sixteen to eighteen weeks (see Figure on right)
- This is critical growing period that require good management
- To realize a uniform, health laying bird
- Pullets are fed pullet growers ~ commonly called growers

Figure 47. Twelve weeks old pullets

- The ration has:
  - 16 % CP
  - 2700 kcal/kg ME
  - <5 % CF
  - <5 % Fat
- During 6th week, gradually introduce grower ration by mixing with starter
- Until you completely provide growers by 7th to 8th week

Table 15 below shows floor and trough spaces for pullets.

Table 15. Floor and trough space requirements for pullets per 100 birds

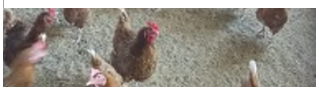
AGE (WEEKS)	FLOOR SPACE (M^2)	THROUGH SPACE (M)
0 - 4	4	1.5
5 – 8	9	3.0
9 – 20	12	6.0

Source: Smith AJ (2001). Poultry, Revised Edition. CTA

2. Feeding layers

- Layers are those in laying stage from 18 – 20 weeks up to end of lay (72 weeks) (see Figure on right)
- Effective laying period is 52 weeks
- With peak laying at 35 – 40 weeks of age
- Two layer feed types exist:
- The ration has:
  - 16 % CP
  - 2700 kcal/kg ME
  - <5 % CF
  - <5 % Fat
  - 2.0 – 3.5 % Ca
- High energy layers ration has:
  - 17 % CP
  - 2800 kcal/kg ME
  - <5 % CF
  - <5 % Fat
  - 2.0 – 3.5 % Ca

Figure 48. Layers



- Gradually introduce layer ration from 18 weeks, until 20 weeks when they are completely on layers ration
- Where possible, layers should be provided with grit in the feeders
- At the time of moving to laying house, the diet of birds should contain a higher level of Calcium (2 – 3.5 %)
- During laying period, each hen is consuming about 110 – 130 g of feed per day

3. Option of making feed on the farm

On-farm feed making are based on nutrient requirements for poultry (expressed per kg diet) (

- Table 16)

Table 16. Nutrient requirements for poultry (expressed per kg diet)

CATEGORY	ME (KCAL)	CP %	CF %	LYS %	METH %	CA %	P (TOT) %
	OPT	MIN	MAX	MIN	MIN	MIN	MIN
Chicks	2000	20	5	1.0	0.45	1.0	0.7
Growers	2700	16	5	0.8	0.32	1.0	0.6
Layers	2700	16	5	0.7	0.2	2– 3.5	0.8
Layers (HE)	2800	17	5	0.75	0.3	2-3.5	0.8

- The following (Table 17) are sample rations that can be used to mix feeds on farm (amounts in kg per ton).

Table 17. Sample working rations for layer chickens

CHICK STARTER			PULLET GROWER			LAYERS RATION	
INGREDIENT	AMOUNT,		INGREDIENT	AMOUNT		INGREDIENT	AMOUNT
Maize	433.9		Maize	548.5		Maize	443.4
Maize bran	150.0		Maize bran	150.0		Maize bran	150.0
Soybeans	317.9		Soybeans	191.7		Soybeans	259.8
Fishmeal	25.0		Fishmeal	3.5		Fishmeal	15.0
Sunflower	39.9		Sunflower	73.5		Sunflower	28.5
Premix	3.0		Premix	2.0		Premix	2.0
Salt	3.0		Salt	3.0		Salt	3.0
MCP	9.8		MCP	7.4		MCP	17.2
Lime	16.4		Lime	20.0		Lime	80.6
DL-Met	1.0		DL-Met	0.5		DL-Met	0.5
L-lysine			L-lysine			L-lysine	
Total	1000		Total	1000		Total	1000

The following notes should accompany the rations as for the above

Notes

- Soybean is full fat, heat treated; do not use solvent extracted soybean
- Vitamin - mineral premix of 3 kg pack
- Salt is iodised, do not use non-iodised salt
- Fishmeal is that which is well treated, above 60 % CP
- Lime is the one with 37 % Ca

4. Achieving feed efficiency

- Defined as the number of kilograms of feed required to produce a unit of eggs
- Records must be kept of the amount of feed used and egg production to calculate feed efficiency
- Divide the total kg of feed fed by the number of units of eggs produced to calculate how many kgs of feed it took to produce one-unit eggs
- Feed efficiency should be about 1.95 kg of feed per unit eggs
- Wasted feed, low rate of lay, health problems or other management problems lower feed efficiency

Activity 3.4: Feed mixing practicals

Based on the ration provided in Table 17 above, let participants estimate how much of each ingredient is required in order to make 100 kgs of feed

- Establish the cost for each feed ingredient
- Establish the cost of milling, processing and bags
- Calculate the cost of producing each type of feed
- Compare the cost found above with the cost of buying the same from commercial feed makers

5. Provide clean water always

- Layers need water and there is need to always have water in drinking troughs (drinkers). Provide fresh clean water and clean the drinkers as often as possible
- Water is provided in drinkers which include:
  - Bell plastic drinkers
  - Tinsmithed drinkers
  - Plates
  - Any improvised using locally available materials
  - Automatic nipples

- Place drinkers evenly and in alternate to feeders
- Check the drinkers for possible leakages and spillages
- With advancing in production, farmers can install water nipples that are connected to a tank outside. Chickens drink from these and water flow is initiated by the beak

6. Litter management

- Litter gets wet though not as often as in broilers. And this can be source of infections and discomfort to layers if not well managed
- Ensure litter of correct depth is maintained

- Turn the litter almost every day to avoid moulding, and caking
- Change litter when it is no longer possible to turn, usually the case when birds are grown up
- You can dig a pit to damp litter or can pack in sacks and store for some time to turn into manure

7. Placing nesting boxes

- For floor raised layers, nesting boxes need to be provided
- This is where birds go and lay eggs
- For cages, laying takes place in the cages
- Nesting boxes can be wooden, made of bricks, or using any other locally available materials. What is important is there should be enough space for the hen to get in, turn and relax to sit and lay
- The placement, usually along the walls, should provide light for the hen to see, but not too much for other birds to note a laying hen, as this can lead to cannibalism

Figure 49. A nesting box with hens laying, courtesy of Mr Ezala Magombo Poultry, Mkwinda, Lilongwe

Placing perches for roosting materials

- Laying birds stay long in the rearing unit and their natural behaviour is to roost. It is advisable and recommended to constructs perches, made from timber or poles, and place them in the khola.
- These are placed 60 cm from the floor.
- Hens will climb the roosts and sleep there, and only come down when they need feed or water.
- Providing roosting materials also help to reduce congestion on the floors, and this also helps to minimize cases of infections related to congestion or wet floors.

Figure 50. A perch in a laying unit

Activity 3.8. Visit to a farmer with laying hens (30 minutes)

Let layer farmers demonstrate the roosting materials and participants practice developing some perches.

Present the drawings in five minutes per group of four to five participants.

Unit 4. Manage diseases and parasites in a layer unit

Duration: 1.0 hour

Unit outcomes

After going through the module, trainees and users should be able to:

- Produce health chickens by quickly identifying diseases and parasites, their causes, and take appropriate preventive and treatment measures

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Demonstration unit
- Drugs and vaccines
- Working coat

Activity 4.1. Group discussion: 30 minutes

In groups of four to five, let the participants discuss:

- Common diseases and parasites of poultry that affect layers
- Discuss their control measures

Participants to present the outcome of their discussions in plenary

Trainer to complement with the following:

- Well-managed chickens in a good well ventilated khola and dry litter are key to make birds health
- Common diseases in layer production are shown in

- Table 18 alongside causal factors and mode of prevention/treatment (trainer to prepare before-hand the table below on a flipachart)

Table 18. Common infections in layer production

DISEASE	PRE-DISPOSING FACTORS	CAUSE	PREVENTION	TREATMENT
Coccidiosis	Wet, damp, caked litter	Protozoa	Management of litter	Coccidiostats found in veterinary shops
Chronic Respiratory Disease (CRD)	Poorly ventilated khola, ammonia gases from litter	Bacteria	Management of litter, proper ventilation, and humidity	Antibiotics found in Veterinary shops
Gumboro (infectious bursitis)	Poor biosecurity	Virus	Vaccine	Treat against secondary infections
Newcastle disease	Poor biosecurity	Virus	Vaccine	Treat against secondary infections
Infectious coryza	Poor biosecurity	Bacteria	Vaccination at 5 – 6 weeks, management of litter, proper ventilation, and humidity	Antibiotics found in Veterinary shops
Fowl pox	Poor biosecurity	Virus	Vaccination at 5 – 6 weeks	None
Internal worms	Wet litter	Internal parasites	Management of litter	Dewormers from veterinary shops
Fleas	Unclean khola	External parasites	Dusting the khola, strong disinfectants	Dusting the khola and the chickens

Knowledge of a disease in a *khola* is important

- Usually, health chickens at any age show normal movement and feeding behaviour that you can observe, feel their feathers, and crop contents, and listen to their sound and breathing
- Assessment uses five senses of hearing (on birds), site (on birds and the environment), taste (one water, feed and khola), smell (on khola) and feeling (on bird) according to Ross broiler parent stock guide
- Departure from normal behaviour and uniformity of growth is indicative of health issues in a flock, which may be due to diseases, parasites, and nutrition

Activity 4.2: Identification of disease and parasites in a layer unit (30 minutes)

Participants to visit a laying unit and practice to investigate health status of birds using the five senses described above.

Let participants discuss in groups (of four to five) their observations as per each sense.

Present the drawings in five minutes per group of four to five participants.

A. Gumboro and Newcastle Diseases

- Gumboro and Newcastle are very serious disease that cause over 50 % mortality in a unit infected.
- Good of the two infections is that vaccine management at appropriate time provides 100 % prevention. Table 19 shows routine vaccine programs for layers.

Table 19. Routine disease vaccine including flock management for layers

LAYER VACCINATION AND MEDICATION GUIDE		
AGE	**TYPE OF VACCINE PLUS STRESS PACK**	**APPLICATION**
Day 1 – 3	Vitamins as stress pack	1 teaspoon per liter of water
Day 7	Newcastle, Hitchner (ND)	Water
Day 14	Gumboro (ibd)	Water, can add skimmed milk
Day 15 - 16	De-beak	
Day 21	Gumboro (ibd)	Water, can add skimmed milk
Day 28	Newcastle, Lasota (ND)	Water, can add skimmed milk
Day 28	Dewormer	Water as per prescription
Week 5	Fowl Pox	Wing web
Week 6	Infectious Coryza	Wing web
Week 10	Newcastle, Lasota (ND)	Water
Every 3 months	Newcastle, Lasota (ND)	Water
Week 12	Infectious Coryza	Wing web
Week 13	Fowl Pox	Wing web
Week 16	Dewormer	Water as per prescription
	5 grams = 1 tea-spoon	

1. Coccidiosis

- Coccidiosis is serious in that it takes time to detect, and by the time it is noted, some productivity damage has been caused
- Clinical signs of Coccidiosis include:
  - A bird eating well but does not grow, even become lighter in weight
  - Yellowish, blood related dropping on the litter
  - Fluffy feathers
- Coccidiosis, just like worms, make the bird look health outside but growth ceases, and become lighter and pale
- Early detection of Coccidiosis or suspect of it through observing droppings is helpful to arrest its spread in the khola
- Any spot should be taken as an infection and the need to treat the infection
- Treatment includes use of Coccidiostats such as Amidiostat, Amprolium, and use of sulphur-based antibiotics such as Triple Sulphur, ESB3 and several trademarks for them
- All treatments are administered through water, following instructions provided on the sachet
- If not sure, it is advisable to consult an Assistant veterinary Officer (AVO) of the area who can help identify the disease and advise correct treatment and how to administer the drugs
- For prevention, it is also advisable to administer prophylaxis to birds. This is giving the birds treatment even when they are not sick. This includes oral administration through water or adding coccidiostat to feed. When adding to feed, make sure the rate is known and should be part of feed formulation.

2. Chronic Respiratory Diseases (CRD)

- CRD is also common and makes birds produce a persistent cough sound. The birds may continue to look health and with good appetite, but loose conditions
- When serious, birds' feathers start looking fluffy
- Coughing is the main identifier of CRD in a khola
- CRD is treatable, using broad-spectrum antibiotics that include Tetravit, Triple Sulphur and its versions, and other of oxytetracycline
- In any medication, it is advisable to follow prescription and duration of treatment

3. Beak trimming

- Beak trimming, also called debeaking, is an operation that cuts upper beak to prevent the birds from pecking and cannibalism in layers
- Pecking is very common in laying chickens
- 1/3 of the upper beak is cut by an experienced person using special blades called trimmers
- Other people use a sharp knife, hot metal in absence of specialized equipment

- Beak trimming is stressful, done first between six and ten days, then at five to six weeks, and thereafter regularly depending on challenges of pecking, cannibalism, and egg drinking
- At each trimming, ensure stress is managed by providing the birds with mineral and vitamin supplements

Activity 4.3. Practical on disease management (30 minutes)

At the demonstration unit, let participants in their groups of 4-5 vacination and oral administration of treatment and beak trimming.

Trainer to demonstrate before all participants follow.

Trainer to facilitate a reflection session towards the end to share experiences.

Unit 5. Egg production, egg quality, grading and handling

Duration: 1.0 hour

Unit outcomes

After going through the module, trainees and users should be able to:

- Market their eggs at a profitable margin
- Understand egg handling and grading

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Working coat (optional)

A. Introduction

Egg production starts at around 18 weeks in hens:

- By this time, a hen is weighing around 1.5 kg
- When the hens need to be transferred to a laying house, it is recommended to transfer them when they are 16 weeks old
- During this phase, pullets are becoming hens, and need to gradually introduce layer ration and phase out pullet grower ration
- By 20th week, all birds should be on layer ration
- Effectively a hen is supposed to lay eggs for one year (52 weeks). This means by week 52 of age, the hens need to be disposed of as spent layers

Figure 51. Trays of eggs collected from a laying unit at Mkwinda, Magombo poultry

B. Egg grading

There are four grades of eggs, based on sizes and egg weights, using European standards:

1. Small eggs 43 – 53 g
2. Medium eggs 53 – 63 g
3. Large eggs 63 – 73 g
4. Very large over 73 g

Plenary discussions

What determines the size of an egg?

Trainer records the responses on a flipchart and complements with the following:

Egg sizes produced by a layer chicken is determined by:

- **Age –** small eggs are laid during the first period of between 20 and 25 weeks. As laying peaks at around 35 to 40 weeks, egg sizes increase towards large size
- **Body weight at maturity** – large body weights lead to large egg sizes. Hens should be between 1.5 and 1.6 kg at onset of egg production
- **Nutrition** – hens fed well balanced quality ration tend to lay more eggs of large sizes. This emphasizes the importance of sourcing or making own feed

Activity 5.1. Practical on egg collection, grading and handling (30 minutes)

Participants to visit a nearest laying unit and practice on egg collection, grading and handling

- Let participants practice in groups of four to five practice on egg grading and storage
- Present the outcomes in five minutes per group of four to five participants

Unit 6. Marketing of eggs

Duration: 1.0 hour

Unit learning outcomes

After going through the module, trainees and users should be able to:

- Market table eggs profitably with minimal delays

Materials needed during the training

- Flip charts
- Markers and pens
- Eggs trays with eggs
- Working coat (optional)

A. Introduction

Plenary discussion:

- How do we understand by the term marketing?
- How is marketing important in layers production?

Trainer records the responses on a flipchart and shares the following:

Many people think that marketing is about introducing products or services to customers and offering them attractive promotions in order to increase sales. While this is correct, marketing is more than that.

Marketing means identifying customer needs, and satisfying them better than your competitors in order to make a profit. On the other hand, a market is a place where buyers and sellers can meet to exchange goods and services***.***

In layers production, marketing involves the following products:

- Eggs from point of lay to end of lay
- Manure from the poultry units
- Culled and spent layers

However, selling of eggs is the main business in layer production

B. Strategies of marketing

- Common strategies used by farmers to market their eggs include:
  - Sales to individuals who come to the farm and buy
  - Sales to middlemen who buy in small number of trays and sell at urban and peri-urban, and trading centers markets
  - Taking eggs in a small van to the market and sell to consumers including restaurant owners
  - Some farmers own or rent shops and sell eggs

Activity 6.1. Group discussion-30 minutes

Let the participants in groups of four to five discuss the pros and cons of the above marketing strategies. Let them come up with further strategies which are common in their area.

In the same groups, let the participants identify key marketing challenges faced in layers production and come up with strategies for mitigating those challenges.

Group representative should present the outcome of their discussion in plenary.

Some of the marketing challenges would include:

- Delayed sales at farmstead leading to a farmer to lose revenue
- Competition with large-scale producers at urban and peri-urban markets, and at trading centers who bring large numbers of low cost produced eggs in vans

Some of the strategies would include the following:

- Form cooperatives and increase the economies of scale
- Improving production standards
- Capacity building in feed making and management (improve efficiency)
- Aggregation of eggs produced by small scale farmers to sale as a group

C. Identifying none-laying hens

During production, some hens do not lay and these need to be identified and culled from the flock. Table 20 provides some parameters that can be used to indicate a non-laying hen.

Table 20. Detecting non-laying or poor producing hens

CHARACTER	LAYER	NON-LAYER
Comb & wattles	Large, bright red glossy	Small, dull, shriveled, scaly
Head	Neat, refined	Beefy, weak
Eye	Bright, prominent	Dull, sunken
Eye ring & beak	Bleached	Yellow tinted
Vent	Large, moist, wide	Small, dry, puckered, yellow
Abdomen	Deep, soft, pliable	Shallow, tough, tight
Pubic bones	Flexible, wide apart	Stiff, close together

Activity 6.2. Practical-Identifying non-laying hens in a demonstration unit-30 minutes

Let the participants visit the demonstration unit and practice the identification on non-laying hens using the criteria given above.

Notes

- When these non-laying hens are taken out of the *khola*, they can be sold following marketing systems for broilers
- Another group sold include hens that have reached end of laying period (usually called spent layers)
- Spent layers are preferred by some consumers and are sold using the marketing value for broilers

Unit 7: Record keeping

Duration: 1.0 hour

Unit learning outcomes

After going through the module, trainees and users should be able to:

- Keep records of production
- Utilize records to monitor and evaluate the layer unit

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Visit to a layer farm and study the records kept and utilized
- Laptops
- Working coat (optional)

Activity 7.1: Paired discussion-20 minutes

In pairs, let the participants brainstorm about the following:

- What are records?
- Why is it important to keep records in layers production business
- What type of records does a farmer needs to keep?

Trainer to select at least four pairs at random to share the outcomes of their discussion.

The trainer complements with the following:

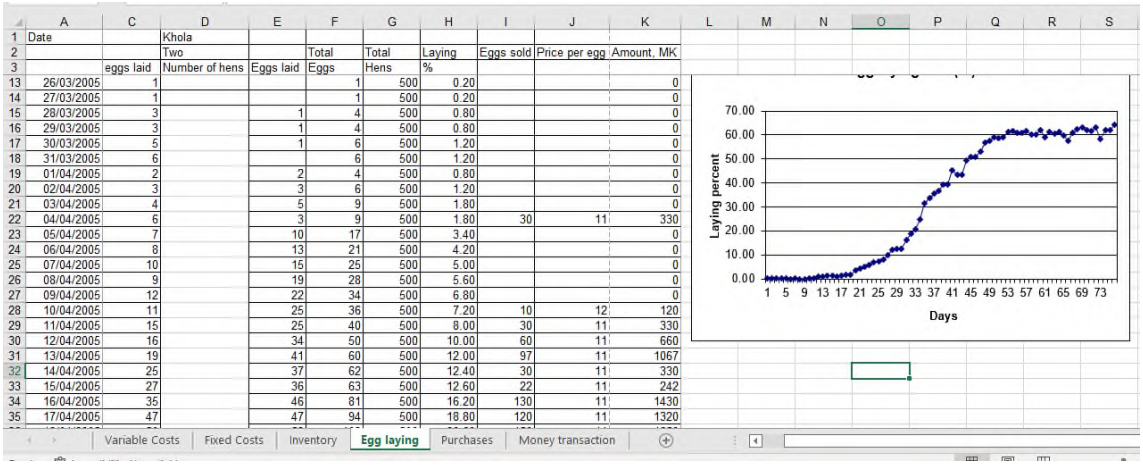
- It is important to take records of production, costs of inputs and services, and income from sales of eggs, culled and spent layers, and manure.
- In this unit, we will discuss some of the critical records a recommended for a farmer doing layers production
- Simple records need to be developed and used on a farm and these includes production records, financial records and sales records.
-

- Table 21 shows a sample record which combines production and sales record, capturing data on inputs and their costs, inventory of chickens, deaths, feed consumed and costs, sales, and daily inventory.

Table 21. Sample records for layers

DATE	NUMBER	FEED CONSUMED	COST, MK	DEATHS	SOLD	BALANCE	
25-Aug-05	500					500	
26-Aug-05	500					500	
27-Aug-05	500					500	
28-Aug-05	500					500	
29-Aug-05	500					500	
30-Aug-05	500					500	
25-Oct-05	500					500	
26-Oct-05	500					500	
27-Oct-05	500					500	9th week
28-Oct-05	500					500	
13-Nov-05	500					500	
14-Nov-05	500					500	
15-Nov-05	500					500	
16-Nov-05	500					500	
17-Nov-05	500					500	12th week
18-Nov-05	500					500	
19-Nov-05	500					500	
20-Nov-05	500					500	
21-Nov-05	500					500	
11-Dec-05	500					500	
12-Dec-05	500					500	
13-Dec-05	500					500	
14-Dec-05	500					500	
15-Dec-05	500					500	16th week
16-Dec-05	500					500	
17-Dec-05	500					500	
18-Dec-05	500					500	
19-Dec-05	500					500	
20-Dec-05	500					500	
21-Dec-05	500					500	
22-Dec-05	500					500	17th week
23-Dec-05	500					500	
24-Dec-05	500					500	
25-Dec-05	500					500	
26-Dec-05	500					500	
27-Dec-05	500					500	
28-Dec-05	500					500	
29-Dec-05	500					500	18th week

In the Figure below shows aggregated data sheet of egg production record with a summary graph that is automatically plotted in Excel



	A	C	D	E	F	G	H	I	J	K
1	Date		Khola							
2			Two		Total	Total	Laying	Eggs sold	Price per egg	Amount, MK
3		eggs laid	Number of hens	Eggs laid	Eggs	Hens	%			
13	26/03/2005	1			1	500	0.20			0
14	27/03/2005	1			1	500	0.20			0
15	28/03/2005	3		1	4	500	0.80			0
16	29/03/2005	3		1	4	500	0.80			0
17	30/03/2005	5		1	6	500	1.20			0
18	31/03/2005	6			6	500	1.20			0
19	01/04/2005	2		2	4	500	0.80			0
20	02/04/2005	3		3	6	500	1.20			0
21	03/04/2005	4		5	9	500	1.80			0
22	04/04/2005	6		3	9	500	1.80	30	11	330
23	05/04/2005	7		10	17	500	3.40			0
24	06/04/2005	8		13	21	500	4.20			0
25	07/04/2005	10		15	25	500	5.00			0
26	08/04/2005	9		19	28	500	5.60			0
27	09/04/2005	12		22	34	500	6.80			0
28	10/04/2005	11		25	36	500	7.20	10	12	120
29	11/04/2005	15		25	40	500	8.00	30	11	330
30	12/04/2005	16		34	50	500	10.00	60	11	660
31	13/04/2005	19		41	60	500	12.00	97	11	1067
32	14/04/2005	25		37	62	500	12.40	30	11	330
33	15/04/2005	27		36	63	500	12.60	22	11	242
34	16/04/2005	35		46	81	500	16.20	130	11	1430
35	17/04/2005	47		47	94	500	18.80	120	11	1320

Figure 52. Records on layer inventory and monitoring

Activity 7:2: Developing farm records (60 minutes)

Using the templates provided in the tables above, let participants in groups of five seven develop records for the demo unit.

Group representatives should present the outcomes of their discussions in plenary. Trainer to observe the following during the presentation:

- Surviving chickens after deaths, sale or given out
- Mortality rate so far following the death of chickens
- Total amount of feed consumed during the production, associated feed costs and number of eggs produced and sold
- Total number of deaths, spent layers sold and given out

Some parameters to calculate to monitor egg production efficiency

- A farmer should be able to calculate egg laying rate as number of eggs laid per day divide by number of hens in a khola times 100 %
- This parameter is checked against recommended standards which peaks to 75 – 80 at around 35 weeks of age
- If there are problems to reach the target, it means there are some problems in the flock that need to be identified and rectified

Other parameters to be assessed include

- Hen-day egg production:
  - ~ Number of eggs produced by the flock divided by the product of number of days and the number of birds alive on each of these days

- % Hen-day egg production:
  - ~ Number of eggs produced per day over total number of hens present that daytime 100
- Hen-household production:
  - ~ Number of eggs produced divided by number of birds housed multiplied by the number of days the birds were in lay
- % Hen-housed egg production:
  - ~ Number of eggs produced per day divided by total number of hens housed times 100
- Survivor egg production:
  - ~ Number of eggs produced by birds that survive for 500 days
- % Lay:
  - ~ Total eggs produced over total number of days of laying times 100

$$\%Lay = \frac{Totaleggs}{Totallayingdays} * 100$$

A. Management problems in layer production

Major challanges associated with layers production includes the following:

1. Broodiness

- Under normal conditions, hens will lay a clutch of eggs and then go broody so that these eggs can be incubated
- This condition is associated with increased production of hormone Prolactin and prevented by the secretion of oestrogen
- Under intensive layer production broodiness is disadvantageous because hens stop laying eggs
- It is a common problem under deep litter system of layer production where communal Nest boxes are used
- Broodiness can lead to an outbreak of egg eating vice because broody hens in the process of making nest break eggs
- It is desirable to remove broody hens from the colony as soon as possible and put in a Brooder coop (wire floored pens with free ventilation) so that they lose broodiness and return into production
- You can also control broodiness by adequate feeding and provision of long day length
- Luckily enough broodiness is an inherited characteristic and breeders have bred the trait out of modern hybrid layers

2. Moulting

- Laying birds usually moult at the end of the laying year and in the process lose and regain a new set of feathers
- Egg production declines once a moult has begun and ceases completely after ten days
- Feather loss start fifteen days after the beginning of a moult
- The process is initiated by an increased production of thyroxin hormone
- It can be experimentally prevented by injecting anterior pituitary extracts
- Uncontrolled moulting is undesirable process that is associated with cessation of egg production
- It is initiated by a decrease in day length or stress caused by lack of water or feed
- In hot season of the year the lack of water is the cause of accidental moulting by birds and a complete cessation of egg production
- Birds kept for a second layer year are sometimes force moulted to ensure they resume laying at the same time

3. Canibalism

- This the vice that develops in a flock characterized by birds pecking each other to death
- Cannibalism is caused by:
  - Overcrowding
  - Feed which is not balanced
  - High temperature and lack of ventilation
  - High light intensity
  - Starvation
- Insufficient salt and other essential minerals in the feed
- Provide the right floor space per bird for the system
- Provide enough feed and water through space
- Provide the right feed to the birds
- Dim the lights until cannibalism stops
- Provide green feeds (hung up at bird's head level) divert birds attention from pecking others to pecking these green materials
- House should be well ventilated and avoid overheating
- De-beak or beak trim the birds at five to ten days redo at ten to twelve weeks if not properly done at first
- Wound spray with antibiotics or any wound drug when birds are badly pecked and start bleeding

Unit 8: Starting a Layers Production Business

Duration: 60 minutes

Unit learning outcomes

After going through the Unit, trainees and users should be able to:

- Develop a concrete plan for their layers production business
- Establish financial requirements for their layers production business
- Make revenue projections for their business
- Make informed decisions on their layers production business

Instructions on training/facilitation

- Let participants draw their expectations from the training
- Interactive discussion with participants on record keeping and analyses of layers
- Cross-check with the below material contents and add where needed

Materials needed during the training

- Flip charts and markers
- LCD projector or plasma screen
- Laptops
- Gross margin calculation sheet

Recap

Recall what we covered in module 1, what were your key takeaways?

Trainer to let participants share their reflections of module one before introducing the day's lesson. Trainer to record all the responses on a flipchart before and start the following:

In this module, we are going to reflect back on module 1 to consolidate our learning on layers production.

Activity 8.1: Individual exercise: (20 minutes)

Trainer to let the participants reflect the entire layers production module and the enterprise selection & gross margine calculation discussed in module 1.

- Moving forward, how many chickens are you going to start with?
- Think of key activities that needs to be done to make that happen (or improve your business)
- What resources do they need to ensure that the listed activities have been done?
- By when are they going to have done the activities?

Let them come up with an estimated quantity and cost of those resource. (this could be khola, feed, drinkers, etc).

Trainer to provide them with the activity planning template below to record their reflections.

Table 22: Recourse calculation sheet

NO	ACTIVITY	RESOURCES NEEDED	TIMELINES							
			WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8
1										
2										
3										
4										
5										
6										
7										
8										

Activity 8.2: Gross margin calculation. (60 minutes)

Based on the planned size of a batch (number of chickens) mentioned above, let the participants calculate gross margin of their planned business. In their calculation, let them take into account of the following:

- Estimated mortality rate
- Estimated feed amounts of each type
- Other associated costs (i.e. vaccines, charcoal, etc)
- Estimated total cost of production

Let them compare between making own feed and buying from commercial feed producers

Trainer to provide the participants with the gross-margin calculation sheet below

Table 23: Information for calculation sheet

SIZE OF BATCH PLANNED (NUMBER OF CHICKENS):							
ON-FARM FEED				COMMERCIAL FEED			
COSTING MA-TERIALS	UNIT	QTY	UNIT COST	COSTING MATERIALS	UNIT	QTY	UNIT COST

Table 24: Gross margin calculation sheet

GROSS MARGIN ANALYSIS													
OWN FEED							COMMERCIAL FEED						
STEPS	**NO**	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST (MK)**	**TOTAL COST (MK)**	**STEPS**	**NO**	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST (MK)**	**TOTAL COST (MK)**
Step1: Know your quantities	1						**Step1: Know your quantities**	1					
	2							2					
	3							3					
	4							4					
	5							5					
	6							6					
	7							7					
	8 Estimated mortality rate							8 Estimated mortality rate					
Step 2: know your costs	**Total cost of production**						**Step 2: know your costs**	**Total cost of production**					
	Unit cost (t*otal cost of production/quantity of product produced***)**							**Unit cost (***total cost of production/quantity of product produced***)**					
Step 3: Know your revenue	**REVENUE**						**Step 3: Know your revenue**	**REVENUE**					
	Unit price (*selling of eggs**)***							**Unit price**(*selling of eggs**)***					
	Total revenue from eggs sales (*Unit price x quantity)*							**Total revenue from egge sales** (*Unit price x quantity)*					
	Unit price (*Selling of spent layers*)**							**Unit price** (*selling of spent layers*)**					
	Total revenue from sales of spent layers (*Unit price x quantity*)**							**Total revenue from sales of spent layers** (*Unit price x quantity*)**					
	Gross revenue (*Eggs sales + chicken sales)*							**Gross revenue** (*Eggs sales + chicken sales)*					
Step 4: Know your profit	**Gross profit** (*gross revenue-total cost of production*)**						**Step 4: Know your profit**	**Gross profit** (*gross revenue-total cost of production*)**					
	Gross margin % ((*Gross profit/total cost of production) x 100%***)**							**Gross margin %** (*Gross profit/total cost of production) x 100%*)**					

Strategies for financing layers production business

Let the participants develop strategies for financing their planned broiler production business.

At random, trainer to select five participants to share their plans and financing strategies in plenary. Let the rest of the class help them in reviewing the proposed strategies.

Biosecurity consideration

- It is very important to consider biosecurity of the layers unit. This is in addition to considerations made when citing a broiler unit
- It is recommended not to bring guests into a broiler unit
- The unit should be fenced to prevent entry and access of other animals including dogs and cats
- There is need for a shower and exchange room where workers will change clothes and take a shower
- Remember to disinfect the inside and outside of the layers unit at regular intervals
- Customers should not access a broiler unit. Rather, take birds to a collection point
- Birds that have been taken out for sale should not be returned into the *khola*
- Ensure proper manure disposal into a pit or in sacks that can be taken to a garden or sold
- At entrance into the *khola*, put a footbath with disinfectant to always dip legs when entering the unit
- Make sure workers are provided with personal protective clothing

MODULE 4: DUAL – PURPOSE CHICKEN PRODUCTION

Module objectives

Acquired knowledge

- Understand the background and strains of duo-purpose chickens
- Know different management/production systems suitable for duo-purpose chickens
- Understand strategies for improving duo-purpose chicken

Acquired skills

- Develop and implement strategies for improving dual-purpose chickens:
  - Intensification through semi-scavenging system
  - Breeding strategies
  - Health management
- Develop a disease control program for village poultry
- Manage village poultry profitably under scavenging production systems

Acquired attitude

- Appreciate roles village poultry plays
- Compare village and commercial poultry production systems
- Village chickens requires equal management as with other breeds of chickens

Methodology

Farm practical sessions, group discussions, brainstorming, presentations

Materials needed during the training

- Flip charts
- Markers
- LCD projector or plasma screen
- A demonstration unit
- Feed ingredients
- Feed making equipment (shovels, scales, floor, or drum mixers)
- Drugs and vaccines
- Working coat

Unit 1: Introduction to Dual – purpose chickens and its production system

Duration: 2.0 hours

Unit outcomes

After going through the module, trainees and users should be able to:

- Describe a dual-purpose chicken and its production system
- appreciate roles village poultry plays
- Compare village and commercial poultry production systems

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some dual-purpose chicken units that can allow participants to visit during the training
- Working coat (optional)

Steps:

Understanding local and dual-purpose chickens

In plenary, discuss the following with participants:

- What is your understanding of a local chicken?
- How do they differ to broilers/layers?
- What role do local chickens play in our society?

Trainer to complement responses from participants with the following:

- Dual – purpose chickens is an umbrella term used to describe local and other improved breeds such as Black Australorp (locally called Mikolongwe), Kuroiler, Sasso and Boschverld
- In this module, we will discuss each of these breeds and how they came about
- Local chickens are dominating in the villages, hence also called rural chickens
- These are indigenous and locally adapted to their agro-ecological zones
- Their main production system is free-range, scavenging where chickens in mixed flocks in a community, and of mixed ages (sizes), move along the homesteads searching for feedstuffs
- Sometimes households provide supplement from household food leftover

A. Local chicken

- Local chickens are more marketable among urban communities, and this has triggered some back-yard production
- Also known as runners, local chickens are scavengers with low output on both meat and eggs
- In most Malawian households, local chickens are kept as a tradition but also immediate asset in terms of financial needs
- Due to their taste and organic nature of production, huge interest has developed over local chicken increasing their demand and market value

Figure 53: Rural poultry production in urban areas

B. Presence of Black Australorp (BA) chickens in rural chickens

Before or around independence (1964), Government identified a BA chicken, locally called *Miko-longwe* to be used to improve local chicken production of meat and eggs.

- BA (Mikolongwe) chicken is an improved exotic black feathered chicken breed that can grow up to 3 kgs for males and 2.5 kg for females in five to six months and can lay around 250 eggs per year from 5 months, hence a dual-purpose breed
- Because of its dual-purpose nature, it was recommended that male BAs cross with local hens, to produce a crossbred chicken. This chicken will take good meat and egg characteristics from Miko-longwe and adaptation to rural environment from local chickens
- The crossbred was aimed to give more meat and lay more eggs under scavenging village systems, hence be of more output to the household
- Government hatched and raised BA chicks at its three farms (Mikolongwe, Bwemba and Choma) to six weeks old, and distribute grower pullets and cockerels to farmers through district and EPA agriculture offices

Figure 55. A free-range system of producing local chickens

Figure 54: Black Austrop chickens

C. Presence of other dual-purpose breeds in urban rural poultry

Urban communities have introduced other dual-purpose breeds into rural poultry. These include:

- Kuroiler
- Sasso
- Boschverd:
  - Kuroiler is a dual-purpose hybrid developed in India by Keggfarms, while Sasso is a hybrid from France. Boschverd is a composite breed developed in South Africa
  - Kuroiler and Sasso are bred to be raised under intensive, semi-intensive and scavenging systems, able to reach 2.5 to 5 kg live weights, and lay continuously up to 300 eggs per annum, under relatively low inputs Kuroiler and Sasso being hybrids are not supposed to be rebred, but rather have continuous supply of fresh chicks from the hatchery
  - The two breeds are multi-coloured and phenotypically look like local chickens

Figure 56. Kuroiler chicken

Dual-purpose chicken has gained preference in urban and peri-urban communities. This is due to preference of local and traditionally managed products to exotic genetically modified products, which include broilers.

D. Importance of rural chicken (duo-purpose)

Chickens play a crititical roles both at household and community level. The roles are both cultural, spiritual as well as economical in nature. Majority of rural communities can afford to raise rural poultry due to their low input requirements. At the same time, rural poultry can be raised by all gender groups of communities, including the youth, women, and elderly

Some of the benefits/multiple roles village chickens play are as follows:

- Good and readily available source of animal protein
- Easily managed (low input low output system)
- Children and aged can take care of, hence benefit everybody
- Quick impact
- Occupies less space
- Cultural attributes (ceremonies, healing, fines)
- Income
- Integrate well within other farming activities
- More convenient for communities

The figure below summarizes the multiple role of a local chicken in our society:

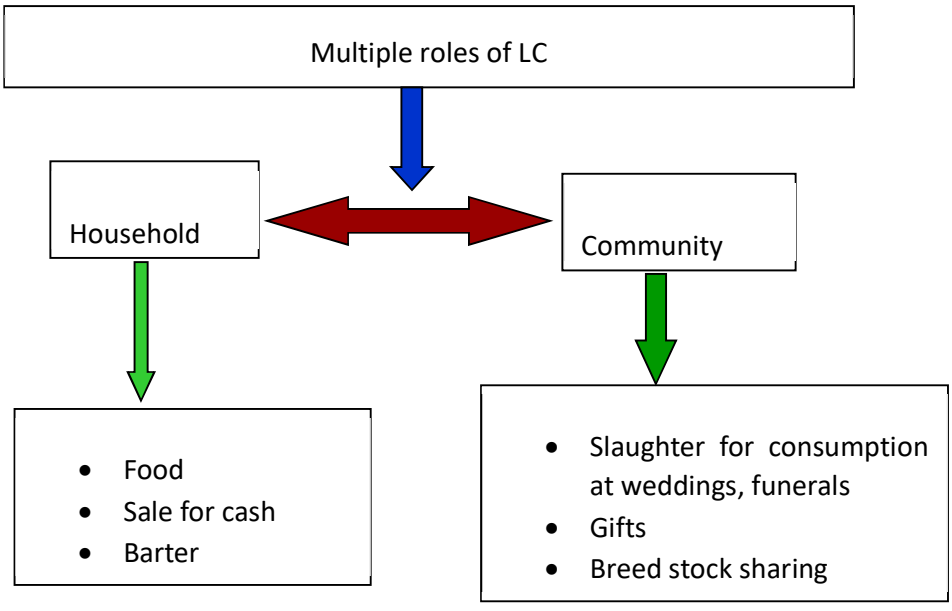


Figure 57. Multiples roles of rural poultry

Unit 2: Production systems for dual purpose chickens

Unit outcomes

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

- Understand different production systems available for duo-purpose chickens
- Develop strategies for improving duo-purpose chicken production

A. Introduction

Activity 2.1. Group discussions: production systems of duo-purpose chickens-30 minutes

- In groups of four to five, let participants discuss production systems of local/duo-purpose chickens available in their area.
- Let them come up with prons and cons of each production system they come up with.
- Let a representative of each group present in the plenary.

After the discussions, trainer to summarize with the following:

Three main systems exist for rural poultry. These include:

- Traditional, scavenging system which is most common
- Semi-intensive or semi-scavenging system
- Intensive system just like in broilers and layers production, common for exotic dual-purpose breeds in urban and semi-urban areas

However, rural poultry are mostly scavengers.

- Raised on free-range systems, also called traditional scavenging systems
- They are usually given supplement feeds in terms of left over from human food
- Their productivity in terms of meat output, egg production is low.
- They reproduce chicks that over 50 % die, leading to low output
- The system needs to be improved
- On other hand:
    - Intensively feeding them is expensive and not cost effective
    - Therefore, level of intensification is only by promoting semi-scavenging:
        - Let them scavenge
        - Introduce regular supplement feed
        - Maintain low-cost system

The need to develop rural dual-purpose chickens

- As noted already above, majority of rural communities can afford to raise rural poultry in small flock sizes and following scavenging low input systems. Scavenging system makes raising of rural chickens affordable for all gender and age groups including youths and elderly. However, we need to develop strategies for improving production, numbers, and outputs from rural poultry, and commercialize the system
- This requires moving from complete scavenging to semi-scavenging system

Desired targeted output under semi-scavenging includes

- Increased flock size but maintain sizes to be supported by scavenging feed resource base (SFRB)
- From increased flock sizes, increase off-take to sustain production
- Increased meat output (carcass yields) to around 60 % ~ hence become more economical
- Improved flock health

Currently

- Rural poultry production includes small flock sizes of mixed age groups, limited number of grown chickens to sale, consume or provide as gift, high losses of offspring that could grow and lead to productive off-take, and poor marketing that is limited to informal system
- Carcass yields for local chickens are currently below 60 %, leading to meat being of more bones. And this low carcass yields make local chickens unable to fetch better prices to producers in the formal market, compared to broiler chickens

Trainer to add that low carcass yields make local chickens less attractive on formal markets. Improving production system therefore would help improve the carcass yied and acceptance on the formal chicken market.

Unit 3: Feeding strategies under semi-scavenging systems

Duration: 5.0 hours

Unit outcomes

By the end, participants will have achieved the following:

- Appropriate feeding strategies to develop dual purpose chickens

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some dual-purpose chicken units that can allow participants to visit during the training
- Working coat (optional)

A. Feeding strategies under sem-scavanging system

Feeding strategies on dual-purpose chickens will depend on season.

During rainy season ~ :

- Protein sources are available
- Energy sources are deficient ~ hens stop laying during hunger periods
- Targeted supplement feeding of energy supplement

During dry season:

- Energy supplements available from crop harvests and food available on households
- Protein sources available but may need supplement

Furthermore, feeding strategies will be influenced by flock health for each season. This relationship is described below.

Feeding availability versus flock health by season

During rainy season:

- Birds lack energy
- They compromise reproduction
- Usually prone to worm infestation
- Productivity is low

During dry season:

- Birds produce and reproduce normally
- But prone to infections of NCD, coryza, fowl pox and fleas
- They reproduce but chicks suffer high mortality

B. Possible feeding rations

Against the above analyses, possible feeding strategies will depend on season. The following are recommended:

During rainy season:

- Regular supplement of maize bran is required to scavenging chickens
- Let households keep dry and clean bran for birds during dry season
- For mid-able households:
  - Simple low-cost balanced rations can be formulated and will enhance production and reproduction

During dry season:

- Regular supplement of maize brain is advisable
- Households have grain and should ensure maize bran is fed to poultry
- Simple low-cost rations to those that are able

C. Layers feed recommended for scavenging systems

In absence of proper diets and requirements for local and dual-purpose chickens:

- Rations for commercial laying birds are used
- Hence the need to make rations for laying birds

The question is which layer ration should be used as supplement feed to semi-scavenging chickens.

- Feeding chick starter is costly and will only benefit chicks that will respond to fast growth. It is not of use to adults
- Feeding layers ration is suitable for laying hens and cocks, has more calcium that may give problems to chicks and growing birds. After all, local hens will not respond to layers by increased egg production

However, the recommended practice is:

- Chick starter – from day old to six weeks ~ only when you basket raise chicks from two weeks old
- Grower ration – from six to eighteent weeks ~ recommended under mixed flocks
- Laying/breeder ration – during laying periods ~ only under confined situations

The following rations can be used to make feeds for supplement feeding scavenging chickens:

Table 25: Recommended Rations for making feed for Local Chickens under Sem-Scavenging System

	CHICK STARTER MARSH 20% CP			PULLET GROWERS MARSH 16% CP			BREEDER RATION 16% CP 2700 KCAL/KG M		
INGRE-DIENTS	**QTY**	**UNIT COST**	**TOTAL (MK)**	**QTY**	**UNIT COST**	**TOTAL (MK)**	**QTY**	**UNIT COST**	**TOTAL (MK)**
Maize	52.59	200	10,517.60	64.7333	200	12,946.66	56.67	200	11,334.00
Maize bran	5.84	60	350.58	7.19259	60	431.56	6.30	60	378.00
Soybeans	33.81	600	20,287.20	21.8827	600	13,129.62	23.72	600	14,232.00
Fishmeal	3.76	1200	4,508.27	2.43141	1200	2,917.69	2.64	1200	3,168.00
Sunflower	-	200	0.00	0	200	0.00	-	200	0.00
Premix	0.30	6667	2,000.10	0.3	6667	2,000.10	0.25	6667	1,666.75
Salt	0.30	350	105.00	0.3	350	105.00	0.30	350	105.00
MCP	1.20	1500	1,800.00	1	1500	1,500.00	1.50	1500	2,250.00
Lime	2.00	100	200.00	2	100	200.00	8.60	100	860.00
DL-Met	0.15	5500	825.00	0.1	5500	550.00	0.03	5500	165.00
L lysine	0.05	500	25.00	0.06	3500	210.00	-	3500	0.00
Total	**100.00**		**40,618.75**	**100**		**33,780.63**	**100.01**		**34,158.75**
Cost per 50kg bag, MK			**20,309.38**			**16,890.32**			**17,079.38**

Activity 3.1. Individual assignment: Costing feed rations for dual-purpose chickens (20 min)

Trainer to provide the participants with a ration table provided above without the costs. Let the participants determine the unit price (using prevailing prices) and total prices of each ingredient

- Let the participants compute the total cost of produsing a bag of 50kg feed
- Trainer to move around to monitor and support the participants
- Select three to four participants at random to present their results

D. Options to supplement scavenging chickens at low cost

These feeds are expensive for scavenging chickens. So:

- Grower ration can be fed as whole for those who are able or are keeping improved dual-purpose breeds
- The same can be fed after diluting with between 20 – 40 % maize bran
- The following ration is optional for those that can barely afford a feed, having maize bran already in large quantities

Table 26: Alternative Low-cost suppliment option for scavenging chickens

RATION NAME: PULLET GROWER	
INGREDIENT	**QUANTITY (KGS)**
Maize	8.11
Maize bran	72.95
Soybeans roast/full fat	15.41
Salt	0.30
Premix	0.20
MCP	0.70
Lime	2.20
DL - Methionine	0.14
Cost per bag, MK	**10613.35**

Unit 4: Housing management for dual-purpose chickens

Duration: 1.0 hour

Unit outcomes

After going through the module, trainees and users should be able to:

- Develop standard housing structures for dual-purpose chickens
- Improve existing structures, be it traditional or use of household dwelling houses for chickens

Materials needed during the training

- Flip charts and markers
- Demonstration unit

A. Housing systems and types for dual-purpose chickens

- Majorly, local/duo-purpose are raised on a free-range system and only housed at night. However, there are different housing systems and these include:
  - Traditional pigeon type
  - Deep litter type
- Currently majority keep their chickens in dwelling houses for fear of theft
- Housing is, therefore, locality specific, and adaptations needs to be made. However, there is need to check the dwelling houses to see where chickens stay, to ensure they co-exist with human beings
- The Figure below shows examples of a deep litter and traditional pigeon houses side by side

Figure 58. Deep litter (left) and traditional raised (right) chicken houses

- There are no standard sizes for local chickens. A farmer usually constructs a size that can fit a household flock of between 20 and 30 adult chickens
- Based on traditional types, the following modern types are recommended

Figure 59. Left and right Elevated houses with slat floors and metal guards

Figure 60: Elevetated house with slat floor and deep litter base

- Mostly traditional houses are made from poles and grass thatch
- The same can be made from bricks and iron sheet roofs, depending on affordability of a farmer. These types are common in urban areas

Plenary discussions: 10 minutes

In plenary, let the participants brainstorm about how different traditional kholas discussed above can be taken care of in terms of:

- Routine cleaning
- Disinfection
- Provision of nesting boxes

Let the participnts also brainstom about how to improve the housing of chickens living in dwelling houses.

Unit 5. Breeding and reproduction for rural poultry

Duration: 2.0 hours

Unit outcomes

After going through the module, trainees and users should be able to:

- Develop strategies for breeding improvement in dual-purpose chickens

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some dual-purpose chicken units that can allow participants to visit during the training
- Working coat

A. Breeding strategies to improve dual-purpose chickens

In this session, we will discuss breeding systems for rural poultry and strategies to improve productivity.

In the communities:

- Chickens mate between cocks and hens at random
- Chickens of mixed flocks from different households in a community feed in the same area, and mating takes place during free ranging
- In rural poultry, we can, therefore, not talk of breeding in a household flock, but in a community of flocks that feed together during free ranging
- Therefore, it is advisable to estimate cock to hen ration of a community and not of a household

Brainstoming-15 minutes

In plenary, let the participants brainstom steps for identifying community breeding stock for rural chickens. The discussion should include how to enstablish cock to hen ration in the community.

Trainer to summarize the discussion with the following step for identifying community breeding stock:

Discuss with participants how to identify a community of breeding chickens, and hence be able to manage breeding and mating ratios communally.

- Interact with households to establish flocks that feed together
- Count number of hens in those flocks
- Count number of cocks in those flocks
- Establish a breeding population for the village
- Establish and assess cock: hen ratio
- Make improvement where the ratios are outside the recommended

1. Reproduction coefficients

Reproduction in local hens is very good under scavenging conditions.

The following Table shows the production parameters, let participants discuss areas to improve in plenary.

Table 27. Reproduction parameters in local chickens

PARAMETER	UNDER SCAVENGING CONDITIONS
Age at first hatch (weeks)	29.8
Hatchling interval (days)	107.5
Number of hatches per year	3.7
RI (chicks hatched per hen per annum)	30.4
Hatching rate (% of eggs incubated)	88.9

- Local chickens lay between ten to fifteent eggs and sit on them to hatch
- Generally hatching rate is very good at over 80 %

However, the hens keep chicks for too long before next hatch. This makes the birds to produce few batches per year.

In addition, age when a hen starts laying is long (26 – 30 weeks ~ six to seven months).

2. Strategies to improve reproduction in local chickens

- Increase number of hatches per year by reducing hatchling intervals from 108 days (three months) to 1.5 to two months:
  - This is a management strategy of early weaning chicks from a hen and the hen goes to mating cycle as quickly
  - Chicks can be separated from a hen at three weeks by confining them to a basket and feed them inside
  - After a week, the hen forgets the chicks, and these can now be released but given supplement feeds
  - A hen broods the chicks, hence ensure during the night and cold season, warm and clean environment is provided to chicks
- Reduce age at first hatch from six to seven months to five to six months:

- This is a breeding and management where early maturing hens and cocks are selected and used for breeding
- Regular supplement feeding will reduce mobility of chickens and grow fast and start reproducing early

- Increase egg laying per batch by selecting hens with good laying ability. This though, may take time

Notes

In local chickens, chick survival is a problem:

- Much as hens naturally hatch chicks, their survival is a challenge, as many die within the first coming two to three weeks
- Over 50 % of the chicks hatched die before reaching 20 weeks. This is a loss that can be managed and turn losses to valuable output
- Low chick survival suggests that there are flock health constraints that need to be addressed

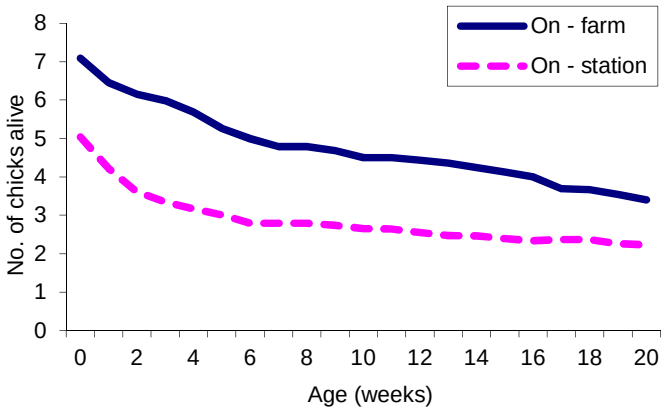


Figure 61. Survival of chicks at a household as compared to a well-managed farm

By reducing hatchling interval, age at first hatch, and increasing survival of chicks, a local chicken can double the offtake, and this will translate to more meat, eggs and sales from the household.

Activity 5.1. Simulate the numbers during training together with the participants to show how much is increased offtake

Produce a table with columns to fill in as below:

INTERVEN-TION	CURRENT VALUE	VALUE WHEN IMPROVED	FLOCK SIZE	TOTAL OUT-PUT
Hatchling in-terval	108 days	45 days		
Age at first hatch	27 weeks	20 weeks		
Survival of chicks	50 %	70 %		
....				
....				

Participants to present to the plenary.

Possible strategies to improve local chicken production include:

- Breeding (to be done as a community - community approach):
  - There is need to prevent inbreeding,
  - By promoting:
    - Intercommunity stock exchange
    - Phenotypic selection of cocks for the community
  - The non-selected cockerels should be targeted to be sold or eaten at around four months before they start mating
- Health (some need community and others need household approach):
  - Household flock hygiene
  - Preferential treatment for chicks
  - Community vaccination and treatment
  - Selecting for helminth resistance
- Feeding (this can be household approach):
  - Regularly supplement scavenging chickens by placing troughs at strategic places
  - Keep clean maize bran during season of plenty to feed during season of hunger
  - For those able, make a simple ration to supplement feed chickens
- Reproduction (this is at household level - household approach):
  - Through preferential treatment of chicks, early weaning will reduce hatchling interval

- Use of hens that reach reproductive maturity early

Notes

- As you can note, there is need to holistically improve production and productivity of local chickens
- As numbers increase, there will be a burden of maintaining large flock sizes. This creates competition for scavenging feed, and flock level diseases emerge
- To prevent these problems, there is need to increase flock offtake by:
  - Consuming grown up cockerels and non-selected pullets at around four to five months
  - Selling cockerels and non-selected pullets for income
  - Passing on some birds to other would-be farmers
- This makes local chicken a viable business, hence commercializing the production system

Unit 6. Rural Poultry health and management

Duration: 3.0 hours

Unit learning outcomes

After going through the module, trainees and users should be able to:

- Develop health strategies for preventing and managing disease and parasites in rural chickens

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some dual-purpose chicken units that can allow participants to visit during the training
- Working coat

A. Poultry health for dual-purpose chickens

- Rural poultry health has been adequately covered by training modules for Community Animal Health Workers (CAHW) developed by SSLPP. These are also available on Rural Poultry Center (RPC) website (RPC - Home (www.ruralpoultrymalawi.org)
- This module will refer to these modules and only highlight important diseases and strategies necessary to manage such

Brainstoming

What are the common causes of losses in village chickens?

Some of the responses would include the following:

- Diseases
- Parasites
- Predation
- Theft

Group discussions-common chicken diseases in our area

In groups of four to five, let the participant identify common diseases which affect chickens in their local community. For each of the disease identified, let them indicate the age in which the chickens are normally affected by the disease, the season the outbreak for that particular disease, type of losses caused and treatment/control methods.

Trainer to provide the participants a flipchart poster with the table below to use in recording the outcomes of their discussions:

Table 28: Common Diseases which affects rural chicken in our area

DISEASE/PARASITE	CHICKEN AGE AFFECTED	SEASON OF OUTBREAK	LOSSES CAUSED	CONTROL MEASURES
e.g. Newcastle				

Other courses of losses in rural chickens includes the following:

- Coryza
- CRD
- Worms
- Fleas
- Red Ants
- Weaknesses
- Cocicidosis

The figure 62 below shows the prevelance of such causes of losses in rural chickens

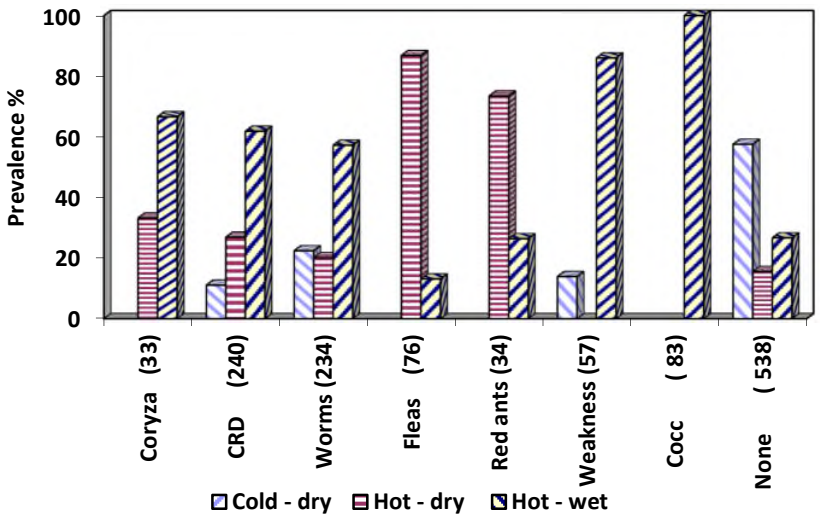


Figure 62. Prevalence common causes of losses in rural chickens by season

Figure 63 below shows the rate of flock infection over a the year/seasons

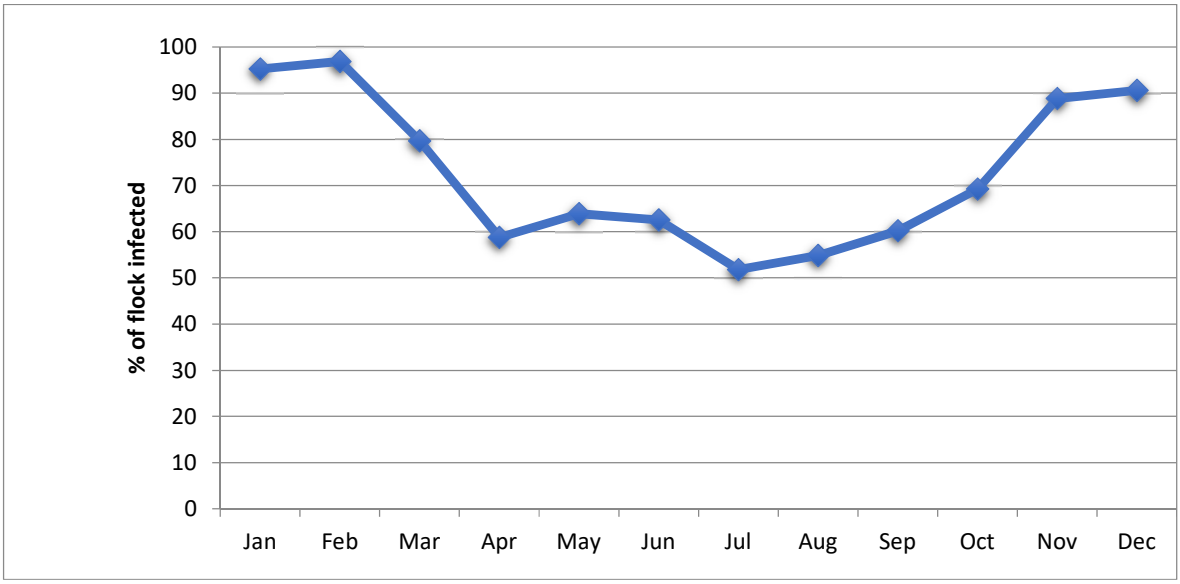


Figure 63. High rate of flock infection between October and February

Brainstoming

- Why is the rate of flock infection high from September into February?

Some of the reaons could be the following:

- **During dry season,** chickens have enough feed from scavenging and household supplement from crops and food leftover:
  - This feed situation makes hens to lay eggs and hatch many chicks leading to increased flock sizes
  - However, this is the same seasonal period rate of infections is high, leading to increased chick losses
- **During rainy season,** disease infection rates are high until February and drop thereafter:
  - Majority infections in February are nutritional related because this is a season of food shortage in homesteads, and less feed supplement for chickens
  - Due to feed shortage, hens cease laying, and hence few hatches and no growth of flocks
- **Multiple infections** are also frequently observed in rural chickens
- **Management of rural poultry** is, therefore, complex and needs to combine nutrition, health, and breeding

B. Management of Newcastle Disease

- NCD is viral disease and kills almost all chickens in a flock
- The virus spreads from infected birds through nasal discharges and faecal matter
- The incubation period ranges from two to fifteen days
- Observed clinical signs that are also documented in many books include:
  - Body incoordination due to affected nervous system, and this leads to twisting of the neck
  - Feathers fluffs and shows a coat dropping to the ground, with head pointing downwards
  - Green diarrhea
  - Head inserted into its wings (Torticollis) when the disease has advanced
  - Convulsions and paralysis of legs and wings
  - Deaths of chickens with mortality between 50 % and 100 %

1. Seasonality of Newcastle Disease

- Mainly a disease of dry season
- Not only due to weather
- But socio-economic factors such as:
  - Sales and marketing activities that peak during the dry season
  - Relatives visiting each other and carrying infected birds as gifts
- However, these days infections have occurred during rainy season.
- Farmers are aware of periods of ND outbreaks and need to be consulted in each location, hence the need for farmer participation

2. Control of NCD

- Prevent spread of the virus through:
  - Bird to bird
  - Man to bird
  - Wild animals to birds
  - Preventing purchase of infected chickens from markets
- But main route is through vaccination against NCD

Main types of NCD vaccine in Malawi

- Hitchner B1 Live vaccine, thermolabile
- Lasota Live vaccine, thermolabile
- I-2 Live vaccine, thermostable

All vaccines are effective at preventing NCD. What matters is administration and convenience.

For rural chickens, I-2 (Figure 64) is recommended because of its thermostability and can stay out of cold chain for a long time of the day.

Unlike La-Sota, I-2 is most conveniently administered through eye drops, hence easier to handle in village chickens. And can be administered by children, women and men as shown in the pictures below:

Figure 64: Aministration of 1-2 vial vaccine

3. The I-2 Vaccine

- Is a version of NDV4-HR developed by ACIAR for distribution at no cost to developing countries
- Malawi is a beneficiary
- With a Lab for local manufacturing at CVL
- With vaccination campaigns, monitoring and evaluation supported by KYEEMA Foundation, based in Mozambique
- NGOs such as Rural Poultry Center (RPC), SSLLP and Inter Aid have supported I-2 promotion and vaccinations
- Community Animal Health Workers (CAHWs) are usually trained to administer I-2 vaccine in rural poultry

Let training participants deliberate on NCD, vaccination programs and use of CAHWs.

Period between vaccinations.

One to two is recommended to be vaccinated once every four months.

Lasota is recommended once every three months.

Because of yearly nature of outbreak, it is recommended to schedule vaccinations a month before anticipated outbreak.

RPC has a calendar that has schedules for campaigning for vaccinations, and actual vaccinations.

Importance of recognizing other infections apart from Newcastle disease in dual-purpose chickens

- Despite NCD vaccination other infections and predation are observed as major animal health problems
  - Infectous coryza, fowl pox, CRD, coccidiosis, internal and external parasites
  - Multiple infections are observed within flocks

In fact:

- It is relatively easier and cost effective to prevent NCD through vaccination
- Management of other infections is complicated by their nature of causal factors, need for expensive antibiotics, and communal spread that require communal treatment

C. Treating other infections

1. Infectious coryza

- Is bacterial and is treatable by broad-spectrum antibiotics
- There is a vaccine available and is administered using injections at around five to weeks old
- Usually, its fatality is due to closing of eyes and the bird fails to eat and drink, hence starves (see the Figure below)

Figure 65. A chicken with Infectious Coryza closing the eyes

- However, the disease is becoming serious in rural poultry in villages and more especially in confined urban production
- Most antibiotics are not working to treat the infection
- Inter-flock infection is common in villages, meaning its management should not be at flock level but a community of flocks

Figure 66. Two flocks with similar infection

- It is suspected that marketing of broilers by large companies into trading centers facilitated transfer of the infection from commercial to rural flocks
- Management in commercial flocks is able through vaccine administration. This vaccine is expensive for a small flock, and administration through injection requires qualified veterinarian or paravets
- Because of the above, the infection is more complicated to prevent or treat than NCD

2. Fowl pox

- The disease is viral and without treatment
- It is not deadly but causes wounds around the heads, and reduces productivity of the birds
- Majority are affected between six to ten weeks, and this delays their growth and age to mature for meat and egg production
- Inter-flock infection is common
- The vaccine is available, using wing web injections
- Because of communal infection in nature, let the discussion on infectious coryza be applicable here

3. Fleas and mites

- These are external parasites, usually common during dry season
- They affect heads and body of a chicken of any age
- Habits on roosting areas and nesting places

Figure 67. Rural chickens with fleas

- Fleas are dangerous to chicks and causes deaths during the dry season, a period when hen reproduction is at peak
- Some hens when attacked, abandon eggs

Treatment against fleas

- Treatment includes treating the birds and the roosting and laying nests
- Dusting powders like Akheri powder is effective
- Traditional methods used include applying paraffin, vaseline, and tick grease of affected parts of the body (see Figure 68)
- Roosting kholas and laying places need to be dusted with Akheri Powder. If not available, can use any strong disinfectant

Figure 68. Treating against fleas using tick grease

D. Problems with treatment in rural poultry

There are lots of challenges which affects treatment of diseases in rural poultry. Some of them include the following:

- Drug resistance:
  - Partly due to poor administration of drugs
    - Treating one bird
    - And not completing the dose
  - And within flock treatment procedure
- Drugs are expensive and or unavailable or inappropriate for village chickens
- Some diseases are nutritional related or fail to respond due to nutritional deficiency

A holistic approach is needed when dealing with village chickens.

Activity 6.1. Managing rural poultry diseases at community level

- In groups of four to five, let the participants discuss strategies for managing diseases at for rural chickens community level (20 minutes)
- Some of the strategies should include:
- Organize farmers into communities and manage such infections communally and not individually
- With this, can buy one vaccine and vaccinate the community
- And minimize inter-flock infections

Notes

Roles of CAHWs need to extend from mainly focusing on NCD vaccination to these other diseases.

Ethno veterinary methods exist

- Based on indigenous knowledge
- Ethno veterinary medicines, also called veterinary anthropology have been explored and utilized
- For treating various infections including predation
- These are country or location specific

Ethno veterinary knowledge includes

- Knowledge, prevalence and virulence of infection:
  - Local names established
- Distribution in terms of time and space:
  - Timing of outbreaks
- Local remedies developed and tested, and shared among individuals
- To some extent, their effectiveness

Activity 6.2 Practical on disease management (60 minutes)

- Establish local names for infections in chickens
  - By disease
  - By agro-ecological zone, and
  - Traditional remedies
- Practice on chicken ND vaccination
- Practice on vaccination against infectious coryza and fowl pox
- Practice on treating fleas

Unit 7. Urban and peri-urban rural poultry production

Duration: 2.0 hours

Unit outcomes

After going through the module, trainees and users should be able to:

- Develop an efficiently operated urban production of dual-purpose chickens

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some dual-purpose chicken units that can allow participants to visit during the training
- Working coat

A. Urban production of dual-purpose chickens

This unit introduces urban production of dual-purpose chickens in cities and districts.

As mentioned earlier on, production of dual-purpose local and introduced breeds takes place and is on the rise in cities, districts, and municipalities.

Unlike in rural communities, all production systems take place in urban production (see the Figures below).

Figure 69. Free range Vs semi-confined production systems

Figure 70. Confined Black Australorp and Kuroiler breed, courtesy of Mr Happy Mkandawire, Mzimba

B. Production and feeding systems in urban rural poultry

Since all production systems are practiced in urban production, the focus is on feeding.

- For chickens on free range, they are usually given supplement feed, mainly maize bran:
  - What needs to be checked is if the birds are really on free range. Some are within backyards, but floor is concrete, without much left-over feed, and access to vegetation
  - In this case, supplement feeding with maize bran needs to be discussed as birds may suffer from nutritional deficiency
  - Since urban production is by financially able households, it is recommended to formulate simple rations and supply to birds even on free-range
- For chickens with a house and fenced perimeter:
  - The scavenging feed resource base depletes with increasing in flock sizes and time spent in the area
  - Just like the free-range described above, these birds are confined but with space to roam around, not with scavenging feed resource
  - As such, there is need to make simple rations to feed and maintain their productivity
- For production in intensive:
  - Complete feeding is recommended
  - Farmers can buy feed or make their own

Local and dual-purpose Black Australorp chickens do not have prescribed feeding regime.

Kuroiler, Sasso and Boschverd are introduced with recommended feed types.

Regardless, dual-purpose chickens follow a feeding regime for layer production:

- Chick starter From day old to six weeks old
- Pullet grower From six to eighteen weeks
- Layers From point of lay onwards

Unlike in village production, it is possible to group birds into age classes:

- So, it is possible to feed all three regimes to different classes
- Chicks are usually hatched from incubators and raised together during brooding
- Hence, it is easy to provide chick starter
- This is true for pullet grower

At a sex ratio of one cock to five to ten hens, additional cockerels are removed at point of table meat, these are sold or consumed on homes.

The remaining constitute parent stock, used to produce fertile eggs for hatching.

If a household keeps dual-purpose birds for breeding, layer breeder feed needs to be procured or formulated to feed the parent stock, instead of layers ration.

C. Recommended breeds for parent stock

Black Australorp (shown in the Figure on the right side):

- These are pure breeds
- Can rebreed at farm level
- Hence production can keep hens and cocks for production of fertile eggs

Boschvered (see Figure on the right side):

- This is a pure breed, and can be used to produce fertile eggs

Figure 71. Black Australorp cocks and a Boschverd hen

Kuroiler and Sasso:

Figure 72. A Kuroiler flock at Bunda farm

- These are hybrid from production of two parent lines
- The male and female lines produce a fertile egg that hatches a Kuroiler or a Sasso

- This is like a hybrid maize which is not recommended to be recycled
- Many farmers recycle Kuroiler by using the F1s as parent stock (as in Figure on the right)
- This is not recommended because the subsequent production leads to offspring that disintegrates
- The Figure here on the right shows disintegrated Kuroiler by showing some phenotypes with a non-uniform flock. Similarly, productivity goes down

Activity 6.3: Group discussions- disadvantages of recycling Kuroiler and Sasso chickens

- In groups of four to five, let participants discuss the distadvantages of recycling kuroiler and sasso chickens. Let them come up with strategies for ensuring high productivity.

Group representatives to present outcomes of their discussions in plenary.

Figure 73. A disintegrated Kuroiler flock following re-use of the hybrids

D. Ideal model to operate urban poultry business

Just like in broiler or layer production, kuroiler needs to operate with a:

- Hatching unit ~ that keeps parent stock and hatches day old chicks
  - These need to be brood before distributing to small-scale farmers
  - Urban producers have brooding capacity and can buy day old chicks and brood them before releasing to semi-scavenging system
- For rural farmers, there should be brooding households that are called mother units
  - These brood chicks to three to four weeks and from here, the chicks can be released to start fending on their own
  - Brooding units sell to ordinary farmers who are rearers
- Rearers will raise pullets to four months and from there:
  - All cockerels are selected and sold for meat
  - All hens are left on flock to lay eggs
- So, we have:
  - Hatching units ~ that hatch and sell day old chicks

- Brooding units/mother units ~ that buy day old chicks and brood them to sell to producers/rearers
- Producers ~ buy from mother units and raise birds for meat (males) and egg production (hens)

- At each stage, there is business that spends (costs) and get income from sales
- There is need to develop simple business plans to assess profitability at:
  - Hatching unit
  - Brooding unit
  - Rearing unit

Unit 8. Rural poultry marketing

Duration: 1.0 hour

Unit outcomes

After going through the module, trainees and users should be able to:

- Develop a better market strategy for dual-purpose chickens

Materials needed during the training

- Flip charts
- LCD projector or plasma screen
- Identification of some dual-purpose chicken marketing units that can allow participants to visit during the training
- Working coat

A. Marketing systems for dual-purpose chickens

Activity 8.1. Identification of markets for dual-purpose chickens (30 minutes)

In groups of four to five, let participants identify different markets for local and improved dual-purpose chickens.

- Source of the chickens
- Who are the players
- How is pricing like
- Challenges for each marketing

Present during plenary.

This unit discusses with participants, marketing systems for local and dual-purpose chickens.

Local chicken marketing is:

- Dominated by informal sector marketing
- Characterized by middlemen (Figure 74)
- That link producers to consumers through commodity markets (Figure 75)

Figure 74. Middlemen on bicycles selling local chickens to consumers

Figure 75. Local chickens sold at Nanjiri Market, Lilongwe

Activity 8.2: Let participants discuss how they sell local chickens and trace all marketing chains from producer to consumer (30 minutes)

- Discussions to include challenges farmers face to directly sell their chickens to consumers:
  - Distances to the market
  - Market restrictions to individual farmers
  - High transaction costs
- Also discuss who benefits more in the poultry value chain:
  - Producers
  - Middlemen
  - Consumers
- Discuss strategies to ensure more benefits flows to the farmer

Please note that in terms of demand, majority in urban communities prefer local chickens and hence more demanded.

Formal local chicken marketing

- Is upcoming by not well formalized
- Farmers find it not motivating to sell through formal market
- There is better premium value when a chicken is sold alive than when sold on carcass basis

Activity 8.3. Discuss reasons why farmers shy away from formal market systems (30 minutes)

These should include:

- Low meat content of local and dual-purpose chickens, making carcass yields to be below 60 %
- And in chickens, lower yields mean low market price per kg, leading to lower selling value compared to when sold alive
- When local chickens are sold live, the value is high such that when converted to per kg live weights, prices are higher than for broilers. It is this price that is described as a premium
- Many dual-purpose chickens sell with premium prices, and this does not fit well in formal marketing sector
- There is need to improve meat yields of dual-purpose breeds to attain carcass yields of above 60 % for them to sale favorably in the formal marketing structures

Discuss the need for holistic strategies to improve carcass yields, to include:

- Breeding (community approach)
  - Contain inbreeding, promote intercommunity stock exchange
  - Phenotypic selection of cocks
- Health (community and household approach)
  - Household flock hygiene
  - Preferential treatment for chicks
  - Community vaccination and treatment
  - Selecting for helminth resistance
- Feeding (household approach)
  - Increase availability of supplement by making households food secure
  - Reproduction (household approach)
  - Through preferential treatment of chicks, early weaning will reduce hatchling interval

Marketing or urban rural poultry.

Discuss with participants how urban rural poultry marketing takes place.

Majority integrate marketing of:

- Fertile eggs
- Consumer eggs
- Live chickens
- Breeding chickens
- Day old, six weeks old and adults

Discuss if this system is profitable.

Unit 9: Starting a Business in Duo-purpose chicken production

Duration: 60 minutes

Unit outcomes

After going through the Unit, trainees and users should be able to:

- Develop a concrete plan for their layers production business
- Establish financial requirements for their layers production business
- Make revenue projections for their business
- Make informed decisions on their layers production business

Instructions on training/facilitation

- Let participants draw their expectations from the training
- Interactive discussion with participants on record keeping and analyses of layers
- Cross-check with the below material contents and add where needed

Materials needed during the training

- Flip charts and markers
- LCD projector or plasma screen
- Laptops
- Gross margin calculation sheet

Recap

Recall what we covered in module 1, what were your key takeaways?

Trainer to let participants share their reflections of module one before introducing the day's lesson. Trainer to record all the responses on a flipchart before and start the following:

In this module, we are going to reflect back on module 1 to consolidate our learning on layers production.

Activity 9.1: Individual exercise: (20 minutes)

Trainer to let the participants reflect the entire layers production module and the enterprise selection & gross margine calculation discussed in module 1.

- Moving forward, how many chickens are you going to start with?
- Think of key activities that needs to be done to make that happen (or improve your business).
- What resources do they need to ensure that the listed activities have been done?
- By when are they going to have done the activities?

Let them come up with an estimated quantity and cost of those resource. (this could be khola, feed, drinkers, etc).

Trainer to provide them with the activity planning template below to record their reflections.

Table 29: Recourse calculation sheet

NO	ACTIVITY	RESOURCES NEEDED	TIMELINES							
			WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8
1										
2										
3										
4										
5										
6										
7										
8										

Activity 9.2: Gross margin calculation. (60 minutes)

Based on the planned batch side (number of chickens) mentioned above, and the discussions in the module, let the participants calculate gross margins of their planned business for duo-purpose chickens. In their calculation, let them take into account of the following:

- Hatching rate of major duo-purpose breeds
- Estimated mortality rate
- Estimated feed amounts of each type
- Other associated costs (i.e. vaccines, charcoal, etc)
- Estimated total cost of production

Let the comparison be between local chickens, black austrope (mikolongwe), and Kroiler/sasso chickens.

Trainer to provide the participants with the gross-margin calculation sheet below.

Activity 9.3: Gross margin calculation. (60 minutes)

Based on the planned batch side (number of chickens) mentioned above, and the discussions in the module, let the participants calculate gross margins of their planned business for duo-purpose chickens. In their calculation, let them take into account of the following:

- Hatching rate of major duo-purpose breeds
- Estimated mortality rate
- Estimated feed amounts of each type
- Other associated costs (i.e. vaccines, charcoal, etc)
- Estimated total cost of production

Let the comparison be between local chickens, black austrope (mikolongwe), and Kroiler/sasso chickens.

Trainer to provide the participants with the gross-margin calculation sheet below.

Table 30: Information for calculation sheet

LOCAL CHICKEN				BLACK AUSTROPE CHICKEN			KROILER/SASSO CHICKEN		
COSTING MATERIALS	UNIT	QTY	UNIT COST	UNIT	QTY	UNIT COST	UNIT	QTY	UNIT COST

Table 31: Gross margin analysis sheet for duo-purpose chickens

GROSS MARGIN ANALYSIS FOR DUO-PURPOSE CHICKENS																
		LOCAL CHICKENS					BLACK AUSTROPE					KROILER/SASSO CHICKENS				
Steps	**No**	**Item**	**Unit**	**Qty**	**Unit cost (MK)**	**Total cost (MK)**	**Item**	**Unit**	**Qty**	**Unit cost (MK)**	**Total cost (MK)**	**Item**	**Unit**	**Qty**	**Unit cost (MK)**	**Total cost (MK)**
Step1: Know your quantities	1															
	2	**Feed**					**Feed**					**Feed**				
	3															
	4															
	5															
	6															
	7															
	8	Hatching rate	Percentage													
	9	Mortality rate	Percentage				Mortality rate	Percentage	5%	15		Mortality rate	Percentage			
Step 2: know your costs		**Total cost of production**					**Total cost of production**					**Total cost of production**				
		Unit cost (*Total cost of production/quantity of product produced*)					**Unit cost** (*Total cost of production/quantity of product produced*)					**Unit cost** (*Total cost of production/quantity of product produced*)				
Step 3: Know your revenue		**Revenue**					**Revenue**					**Revenue**				
		Unit price(*Selling of chickens)*					**Unit price**(selling of chickens)					**Unit price**(Selling of chickens)				
		Gross Revenue (*Unit price x quantity produced*)					**Gross revenue** *(Unit price x quantity produced)*					**Gross revenue** *(Unit price x quantity produced)*				
Step 4: Know your profit		**Gross profit** (*Gross revenue-total cost of production*)					**Gross profit** *(Gross revenue-total cost of production)*					**Gross profit** *(Gross revenue-total cost of production)*				
		Gross margin % (*Gross profit/total cost of production) x 100%***)**					**Gross margin %** *(Gross profit/total cost of production) x 100%)*					**Gross margin %** *(Gross profit/total cost of production) x 100%)*				

Strategies for financing layers production business

Let the participants develop strategies for financing their planned broiler production business.

At random, trainer to select five participants to share their plans and financing strategies in plenary. Let the rest of the class help them in reviewing the proposed strategies.

MODULE 5: PRACTICAL FEED FORMULATION AND MIXING

Module objectives

Acquired knowledge

- Understand basic principles of feed formulation and mixing
- Understand steps to be followed when making feed
- Understand the differences between different feed ingridients
- Understand different methods for making feed

Acquired skills

- Able to develop feed rations
- Able to mix and package feed ingredients
- Able to cost feed and feed materials

Acquired attitude

- Its possible to make own feed for poultry production

Materials needed during the training

- Feed ingredients
- Pearson square excel cheet
- Markers and flipcharts
- Maize mill
- Transport for raw materials
- Firewood
- PPE
- Computer
- LCD Projector/TV

Feed training outline

TIME	ACTIVITY	AIM
Day 1 09:00 – 16:00	Registration, introductions	Participants register and know each other
	Requirements in feed formulation	Understand steps and what is needed to make a feed formula
Day 1 09:00 – 16:00	Feed formula making on table	Learning mathematics and techniques of making feed using Pearson Square
	Developing rations in Excel	Practicing using Pearson Square to develop rations in Excel
Day 2 09:00 – 16:00	Feed processing and mixing	Participants practice to process feed ingredients and mix their own feed
	End of program	

Unit 1: Overview of feed formulation and mixing

A. Introduction

- Feed formulation involves developing rations, and practicing mixing the feeds to the satisfaction of an animal, either for egg production or for meat in the case of poultry
- Feed is expensive and contributes between 60 and 80 % of total cost of production. The higher the contribution, the lower the profit
- Commercial feed is available, but usually and extraordinarily expensive and quality is at times compromised
- Encouraging producers to compound their own feed has proven to reduce feed costs and subsequently cost of production by 30 – 40 %
- Majority poultry producers seek rations from experts, some work, others fail to work for various reasons
- In event an ingredient changes, a farmer finds problems to replace an ingredient for another, due to lack of knowledge
- Majority emerging farmers are literate, comprising 50 % youth who have attained at least O level, and are computer literate
- Instead of providing rations to such, they better be trained on how to develop those rations and proceed to make feed for their livestock
- Use of computer, excel has managed to reduce period of training on feed formulation to a day or two, and with online platforms (including WhatsApp), follow-ups and backstopping is possible

B. Steps in feed formulation

Review of what is required in feed formulation

Together with participants, identify local ingredients available in your area, and their quantities and costs.

These should include:

- Maize
- Maize bran
- Rice bran
- Cassava
- Soybeans
- Ground nuts
- Cakes from legume bye-products
- Etc.

Exercise: List or tick ingredients available and their costs

Under the following Table, the list of ingredients and their costing per kg is shown.

Table 32. List of ingredients as identified by participants and their costing per kg

INGREDIENT	AVAILABILITY	SOURCE	UNIT OF MEASURE	COST PER UNIT, MK	COST PER KG, MK
Maize		Farmers	Bag, 50 kg	15000.00	300.00
Soybean		Farmers	Bag, 50 kg		700.00
Rice bran		Mills	Bag		70.00
Maize bran		Maize mills	Bag		75.00
Groundnut cake		Oil processors			450.00
Sunflower cake		Oil processors			450.00
Cotton cake		Oil processors			300.00

Classifying ingredients

Help the participants to classify the ingredients into feed groups based on main nutrition the ingredient aims to contribute.

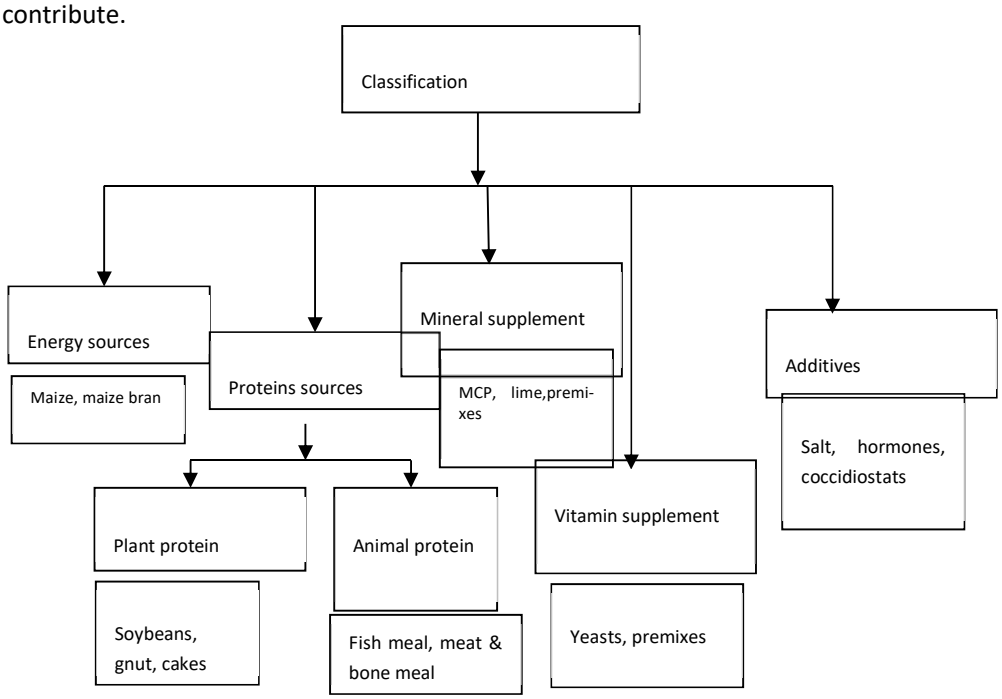


Figure 76. Classification of feed ingredients into feed groups

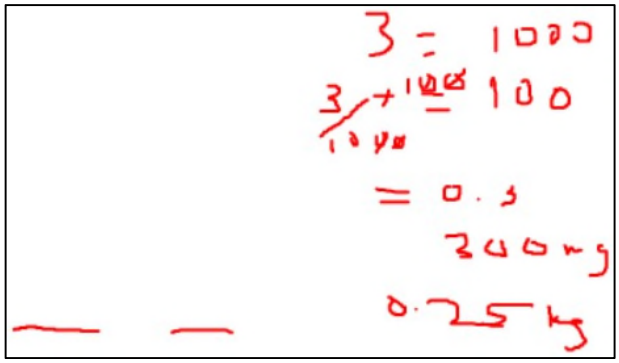
There is need to determine their restrictions/constraints and processing needs before adding to the feed to mix

- Soybeans need processing to remove anti-nutritional factors:
  - Trypsin inhibitors (inhibits growth)
  - How to remove them?
    - Roasting is cheapest – overheating denatures proteins
- Maize bran and rice bran:
  - Too much fibre, never go beyond 5 – 10 %
  - Not recommended in broiler rations
- Fishmeal:
  - Expensive, too much lead to fish taint in meat and eggs
  - Never go beyond 10 % in ration, better 5 % in broilers. Not needed in pigs

Determine other ingredients needed to be included in the formulation

- Essential amino acids include:
  - Lysine
  - Methionine
  - These are limited in most feed ingredients
  - So, there is need to add some synthetic amino acids:
    - L-Lysine (99 %), can be left out when seen adequate from ingredients
    - DL – Methionine (99 % Methionine)

Some ingredients are and should be added to the feed as prescribed



- Vitamin/mineral premixes:
  - Exist in 2 or 3 kg packets
  - To add to a tone of feed
- Salt:
  - Add between 0.25 – 0.5 %
  - Use iodised salt
- DL – Methionine:
  - Add between <=0.1 – 0.15 %
- L-Lysine:
  - ~ Add around 0.05 – 0.10 %
- There is need to source ingredients not locally found:
  - Some through group approach
  - Fish from local markets

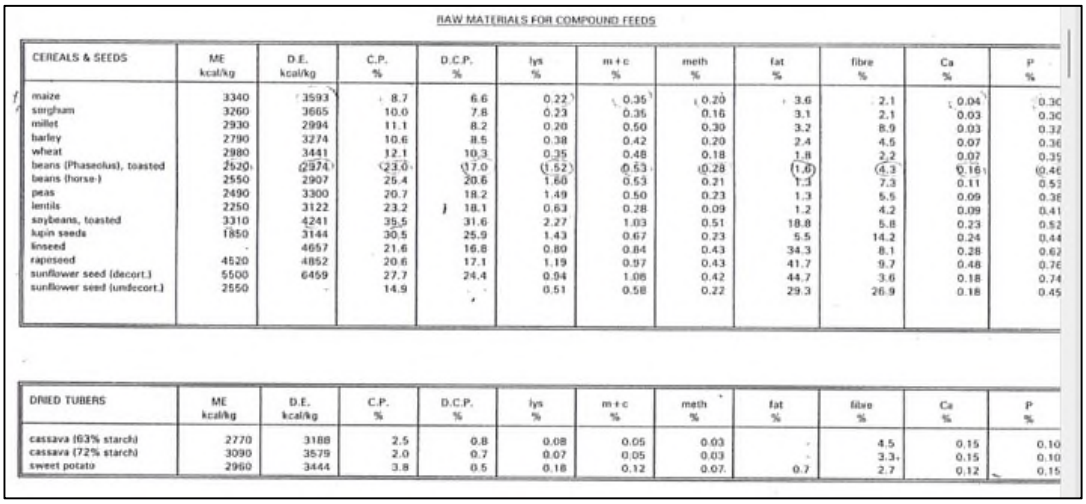
Identifying nutrient composition of feed ingredients

When ingredients to add to feed are identified, next step is to know their nutritive value for different nutrients of importance to livestock.

- These are usually determined by:
  - Referring each ingredient to feed composition tables
    - NRC Books commonly used
    - IPC Barneveld also applicable to Malawi, or
- Taking samples to the lab for analyses:
  - Bunda, Chitedze, CVL and MBS have such labs

Let the facilitator show participants feed composition tables:

- IPC Benerverd (Figure below)
- NRC



RAW MATERIALS FOR COMPOUND FEEDS

CEREALS & SEEDS	ME kcal/kg	D.E. kcal/kg	C.P. %	D.C.P. %	lys %	m+c %	meth %	fat %	fibre %	Ca %	P %
maize	3340	3593	8.7	6.6	0.22	0.35	0.20	3.6	2.1	0.04	0.3
sorghum	3260	3665	10.0	7.8	0.23	0.36	0.16	3.1	2.1	0.03	0.3
millet	2930	2994	11.1	8.2	0.28	0.50	0.30	3.2	8.9	0.03	0.3
barley	2790	3274	10.6	8.5	0.38	0.42	0.20	2.4	4.5	0.07	0.3
wheat	2980	3441	12.1	10.3	0.35	0.48	0.18	1.8	2.2	0.07	0.3
beans (Phaseolus), toasted	2520	2974	23.0	17.0	1.52	0.53	0.28	1.6	4.3	0.16	0.4
beans (horse-)	2550	2907	25.4	20.6	1.60	0.53	0.21	1.1	7.3	0.11	0.5
peas	2490	3300	20.7	18.2	1.49	0.50	0.23	1.3	5.5	0.09	0.3
lentils	2250	3122	23.2	18.1	0.63	0.28	0.09	1.2	4.2	0.09	0.4
soybeans, toasted	3310	4241	35.5	31.6	2.27	1.03	0.51	18.8	5.8	0.23	0.5
lupin seeds	1850	3144	30.5	25.9	1.43	0.67	0.23	5.5	14.2	0.24	0.4
linseed	-	4657	21.6	16.8	0.80	0.84	0.43	34.3	8.1	0.28	0.6
rapeseed	4520	4852	20.6	17.1	1.19	0.97	0.43	41.7	9.7	0.48	0.7
sunflower seed (decort.)	5500	6459	27.7	24.4	0.94	1.08	0.42	44.7	3.6	0.18	0.7
sunflower seed (undecort.)	2550	-	14.9	-	0.51	0.58	0.22	29.3	26.9	0.18	0.4

DRIED TUBERS	ME kcal/kg	D.E. kcal/kg	C.P. %	D.C.P. %	lys %	m+c %	meth %	fat %	fibre %	Ca %	P %
cassava (63% starch)	2770	3188	2.5	0.8	0.08	0.05	0.03	-	4.5	0.15	0.1
cassava (72% starch)	3090	3579	2.0	0.7	0.07	0.05	0.03	-	3.3	0.15	0.1
sweet potato	2960	3444	3.8	0.5	0.18	0.12	0.07	0.7	2.7	0.12	0.1

Figure 77. Sample of nutrient tables for feed ingredients

Determining nutrient requirements for your livestock

This units helps participants understand the need to establish what an animal needs in terms of nutrients. These nutrients differ depending on breed, class, age and physiological status of an animal.

Consider the following nutrients:

- Energy (ME or DE) in kcal
- Proteins (CP) in %
- Calcium (Ca) in %
- Phosphorus (P) in %
- Crude Fibre (CF) in %
- Methionine (Met) in %
- Lysine (Lys) in %
- Methionine and Cysteine (M+C) in %
- M+C in %
- Fats (EE) in %

Requirements are found in same books of feed compositions:

- NRC
- IPC Benerverd ~ shown as in the following Table for poultry

Table 33. Nutrient requirements for poultry (expressed per kg diet)

CATEGORY	ME – METABOLIZABLE ENERGY (KCAL)	CP % - CRUDE PROTEIN	CF % - CRUDE FIBRE	LYS % - LYSINE	METH - METHIONINE %	CA % - CALCIUM	P (TOT) % - PHOSPHOROUS
	OPT	MIN	MAX	MIN	MIN	MIN	MIN
Chicks	2800	20	5	1.0	0.45	1.0	0.7
Growers	2700	16	5	0.8	0.32	1.0	0.6
Layers	2700	16	5	0.7	0.2	2– 3.5	0.8
Layers (HE)	2800	17	5	0.75	0.3	2-3.5	0.8
Broiler starter	3100	22	3.5	1.2	0.5	1.0	0.8
Broiler grower	3175	21	3.5	1.25	0.45	0.9	0.45
Broiler finisher	3200	20	3.5	1.0	0.45	1.0	0.7

C. Develop formulas (rations)

Feed formulation starts on table, the lesson takes participants to developing rations for use to mix feeds for livestock.

- The idea is to match nutrients in feed ingredients to nutrients requirements in livestock
- Can use:
  - Simultaneous equation method
  - Pearson Square (to be done here)
  - Least cost computer method ~ complicated

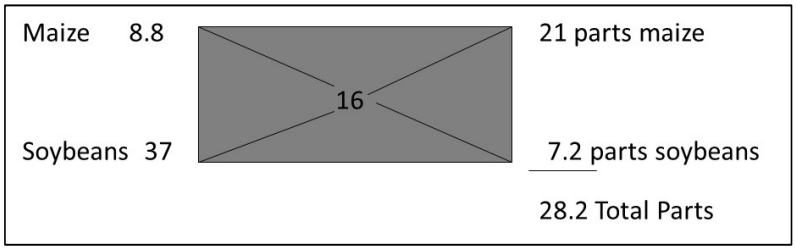
Figure 78. A feed training session in Mzuzu

Pearson Square technique

Pearson Square is used to achieve a set percentage of nutrient in a final mix

Illustrate using two ingredients to achieve 16 % protein required:

- For example, maize (8.8 % CP)
- Soybeans (37 % CP)



The following steps are used to determine ratios of maize and soybeans to combine to achieve 16 % CP:

- Required level of nutrient, usually CP is put at middle of the square
- Energy ingredients and their nutritive value, CP in this case is put on upper left corner
- Protein ingredients and their nutritive value, CP in the case is put on lower left corner
- Energy nutrient is subtracted from required to give parts of protein ingredients
- Protein nutrient is subtracting required nutrient to give parts of energy ingredients
- These are placed on respective right corners as shown above
- Sum of energy and protein parts give total parts of the ration to make as explained below

Ratio is 21 parts of maize to 7.2 parts of soybean required to achieve 16 % ration:

- In percentage or per 100 kg feed = 21/28.2 * 100 = 74.468 % maize
- = 7.2/28.2 * 100 = 25.532 % soybean
- If want to make 100 kg ration:
  - Maize will be 74.5 kg
  - Soybeans will be 25.5 kg

This is the same procedure used even if you have two or more ingredients that are included to provide energy or protein to the feed.

The facilitator will take you through step-by-step of the ration development until a full ration is achieved.

Pearson Square - assignment

- Formulate a broiler starter ration using maize and soybean only

Hint:

- Find nutritive composition of maize and soybeans from nutrient composition tables
- Find crude protein (CP) required for broiler starter from the nutrient requirement table
- Work on the ration and compare the results with your colleagues

Using Pearson Square by Excel

It is laborious and time consuming to use manual to develop rations using Pearson Square.

An Excel Template for Pearson Square was developed and is available to be used during and after the training.

There is no need for knowledge of Excel, rather knowledge of opening a computer and programs/apps.

This requires a laptop or a smart phone, which majority O-level holders and youth possess and use.

We shall demonstrate use of Excel to develop rations and use the same to practically make our own rations.

- Facilitator should go to Excel and open the Pearson Square
- Let each participants access own copy of Pearson Square and notes to use
- Take participants through different sheets under Pearson Square (Figure below)

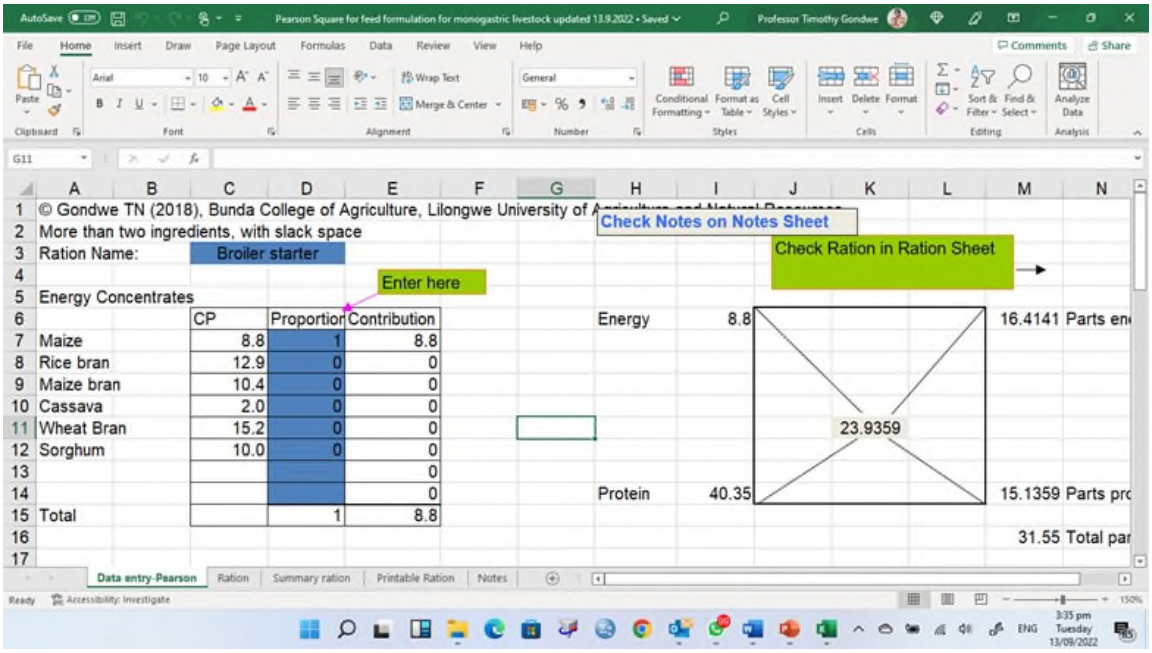


Figure 79. Pearson Square by Excel template

- Demonstrate the above example of making a broiler starter ration using maize and soybeans
- Check that same answer obtained manually is from Excel

Notes

Save the working excel in a different file name to keep the original intact e.g. save as layer feed if you are making layers ration

Making feed using more than two ingredients for energy or protein source or both

Assume have two energy feeds and two protein feeds

e.g. Cereals	= Maize	8.8 % CP
	= Maize bran	10.4 % CP
Proteins	= Soybeans	37 % CP
	= Fishmeal	60 % CP

First, group these into two before putting in Pearson Square.

Determine the amounts of each ingredient available or to be used.

Get contribution of each ingredient to the group (weighted average).

You get the CP to use in the Pearson Square, a composite of two ingredients.

The same is done for protein source ingredients as shown below.

	CP	Proportion	Contribution	Total
Maize	8.8	9	9x8.8/10	7.92
Maize bran	10.4	1	1x10.4/10	1.04
		10		8.96

CP to use

Protein

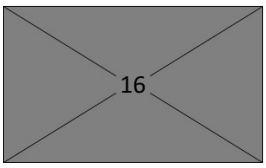
	CP	Proportion	Contribution	Total
Soybeans	37	5	5x37/6	30.8
Fish meal	60	1	1x60/6	10.0
		6		40.83

CP to use

Then use these mixes in final mix of Pearson Square

Energy 8.96

Protein 40.83



24.83 parts energy

7.04 parts protein

30.873 total parts

Assume want to make 100 kg ration

Energy => 24.83/31.873*100 = 77.913

Protein => 7.04/31.873*100 = 22.087

To get what was in energy, you use the proportions set above.

The same is used to find quantities for protein ingredients.

Final mix/ration

Maize	70.121 kg
Maize bran	7.791
Soybeans	18.406
Fish meal	3.681

As you can note, the ration is starting to build up.

Notes

- The above theory is included to illustrate what is happening behind computing the rations
- All these procedures are done in Excel and in a click of a button, the ration is developed
- Facilitator to take participants through to Excel on the above procedure (see next Figure)

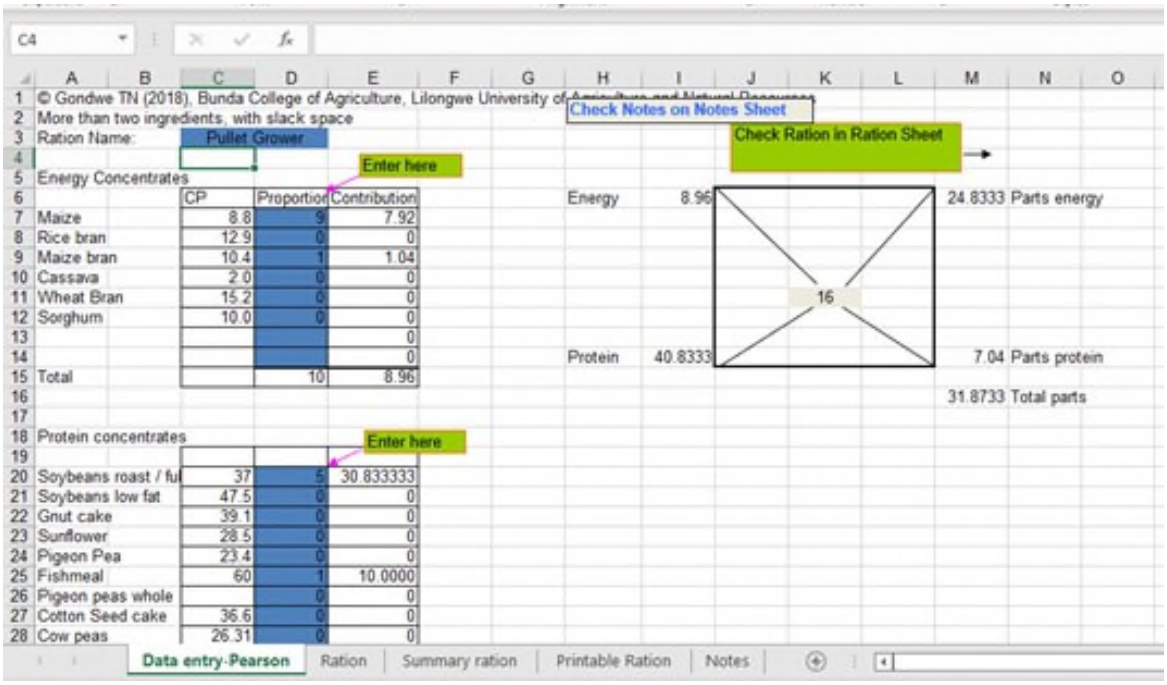


Figure 80. Pearson Square using two energy and two protein ingredient

Take participants to check ration in the Ration Sheet of Excel, as shown in the Figure shown here:

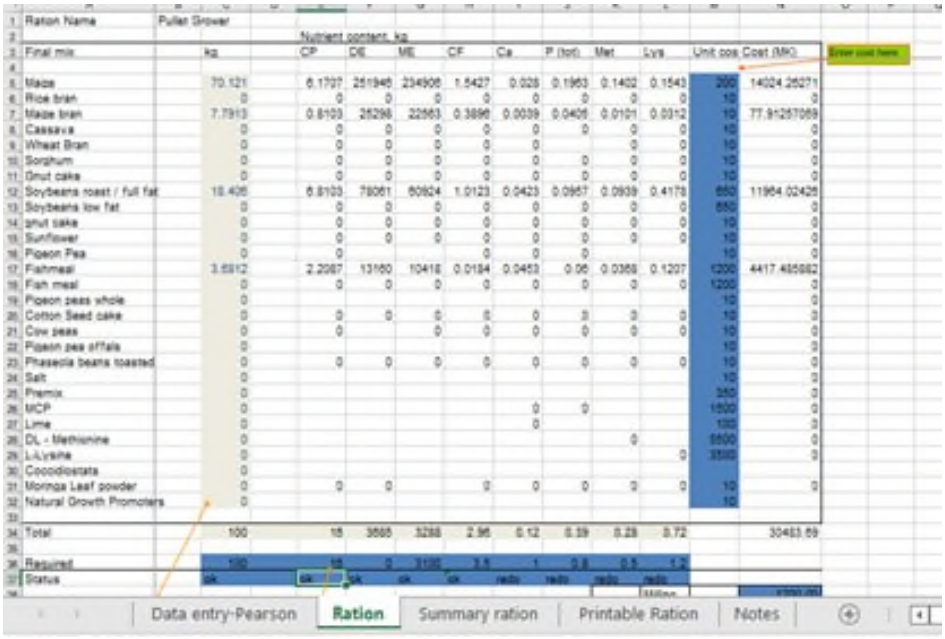


Figure 81. Ration template in the ration sheet

Assignment on formulating/making a ration using more than two ingredients

- Formulate layers mash from maize, maize bran, fish meal and soybean
  - Hint: Identify energy and protein sources
  - Try several proportions
  - Do it on Excel

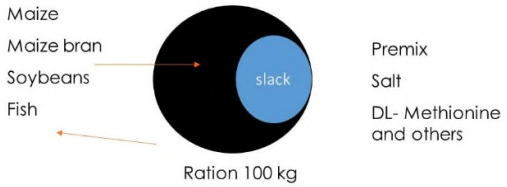
Be interactive and exchange findings with colleagues in a training class.

Adding other additives to the ration

There is need to add other ingredients that do not contribute to major nutrients such as protein but are required for certain micronutrients. Such ingredients are required in small prescribed levels, include:

- Salt => Assume add 0.3 %
- Premix => Assume add 0.3 % i.e., we use premix that is in a pack of 3 kg to add to a ton of feed. For whatever premix is available, check prescription and use that in the ration development.
- MCP => Assume add 2.0%
- Lime => Assume add 1.5 %
- DL – Methionine => Add 0.1 %
- May also add growth promoters and coccidiostats

- Most of these have manufacturer's prescription and withdrawal instructions
- These are essential but do not contain CP



These ingredients are usually added as slack space.

Ingredients plus those in slack space should contain required % CP.

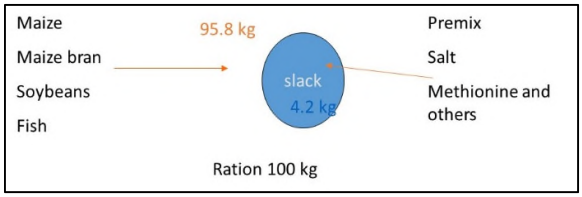
But all this 16 % comes from those not in slack.

Assume want to make 100 kg ration

First, take off slack quantity

- Salt = 0.3 kg
- Premix = 0.3 kg
- - MCP = 2.0 kg
- - Lime = 1.5 kg
- - DL – Methionine = 0.1 kg

Total = 4.2 kg



Rest of ration => 100 – 4.2 kg = 95.8 kg

All proteins (16%) are in 95.8 kg

i.e., 16 kg of CP is in 95.8 kg

% CP in 95.8 kg is => 16 kg CP/95.8 kg ration x 100

= 16.7 % The one to put in Pearson Square

Then work out the proportion for the energy and protein ingredients.

These procedures are already programmed in Excel. Illustrations above are for understanding only.

Facilitator to take through Excel and illustrate where to put added components as in the next Figure.

COMPONENTS							
			Enter here				
QUANTITY, KG				100	CP %	CP, kg	CP, kg
							16.00
Slack	Salt			0.3		0	0
	Premix			0.3		0	0
	Fish meal			0	60	0.6	0
	MCP			2		0	0
	Lime			1.5		0	0
	DL - Methionine			0.1		0	0
	L-Lysine			0		0	0
	Coccidiostats			0		0	0
	Moringa leaf powder			0	27.1	0.271	0
	Natural growth promoters			0		0	0
	Gnut cake			0	39.1	0.391	0
Total slack				4.2			0
The rest				95.8			16
% CP in the rest							16.70146

Figure 82. Slack for adding other ingredients

Making whole ration

From the above, a complete ration is developed as shown in the next Table.

Table 34. Ration made based on 16 % CP requirement

INGREDIENT	QUANTITY (KG)
Maize	64.471
Maize bran	7.163
Soybeans	20.138
Fish meal	4.028
Salt	0.3
Premix	0.3
MCP	2.0
Lime	1.5
DL - Methionine	0.1

Checking the rations

- You need to check the ration
  - To make sure nutrient content is correct
  - To find nutritive value for other nutrients
  - To determine cost
- Checking can also be done on computer using Excel as in table of ingredients and their quantities in ration sheet
- Much as ration is developed based on CP, Excel calculates other nutrients in the ration
- For any feed you make, there is need to enter corresponding nutrient requirements
- If the nutrient has met requirements, an 'ok' comes, otherwise you get a redo
- The moment there is one 'redo', there is need to rework on the ration by going back to sheet on data entry Pearson

Let the facilitator demonstrate ration sheet as a guide to whether the ration is balanced or not. The following Table is an Excel template in ration sheet.

Table 35. Excel template that shows quantities of feed, and ration check

Ration Name	Pullet Grower								
Final mix		kg	CP	ME	CF	Ca	P (tot)	Met	Lys
Maize		65.279	5.7445	218684	1.4361	0.0261	0.1828	0.1306	0.1436
Maize bran		7.2532	0.7543	21005	0.3627	0.0036	0.0377	0.0094	0.029
Soybeans roast/full fat		19.39	7.1743	64181	1.0665	0.0446	0.1008	0.0989	0.4402
Fishmeal		3.878	2.3268	10975	0.0194	0.0477	0.0632	0.0388	0.1272
Salt		0.3							
Premix		0.3							
MCP		2				0.32	0.48		
Lime		1.5				0.555			
DL - Methionine		0.1						0.099	
L-Lysine		0							0
Coccidiostats		0							
Total		100	16	3148	2.88	1.00	0.86	0.38	0.74
Required		100	16	2700	5	1	0.6	0.32	0.8
Status		ok	ok	ok	ok	redo	ok	ok	redo

This ration has redo on Calcium (Ca) and Lysine. This means those nutrients are not met by the feed specified. There is need to re-work until they also say ok.

Facilitator to guide participants how to ensure all nutrients have balanced.

Practical and assignment

- Make your own rations
- Broiler starter
- Broiler finisher
- Layers mash
- Pullet growers mash

D. Feed processing

Once rations have been developed, they can be used to prepare feed which includes:

- Processing some ingredients:
  - Soybeans need roasting or boiling of solvent extraction
  - This removes anti nutritional factors (trypsin inhibitors)
- Milling of ingredients with large particles:
  - Maize
  - Maize bran
  - Soybeans
  - Fish meal (can be pounded)
  - Salt, and
- Actual mixing the ingredients to make feed

1. Roasting soybeans

- Legumes contain ant-nutritional factors that need to be removed before mixing to feed
- Roasting is most convenient for small and medium scale producers
- Use locally made roasters
- Ensure roasting as is traditionally done for roasted maize or soybeans to prepare Likuni phala

Figure 83. Soybean roasting showing firewood, roasting pan and roasted soybeans

Figure 84. Actual roasting of soybeans

2. Milling ingredients

Large particle ingredients need to be crushed into smaller sizes depending on age of chickens.

An ordinary hammer mill for pounding maize flour can be used. There is need to remove a flour sieve to avoid making flour.

The following Figures show different types of mills.

Figure 85. An ordinary maize mill

Figure 86: A specific feed mill

Figure 87. A purpose made feed mill with mixers, courtesy of Ndatani Premier Feeds, Lilongwe

3. Scale for weighing feed and ingredients

There is need to keep weighing scales of different capacities (Figure 87)

Large scales for ingredients needed in large quantities.

Small kitchen-based scales for small quantity ingredients.

Digital scales are preferred as they accurately read the weights.

Figure 88. Different types of scales needed for feed making

4. Unit Feed mixing

This is a process of combining feed ingredients according to quantities in the ration/formula that has been developed. Product of feed mixing is a feed that is ready to give to livestock.

5. Feed mixing

- Follows after making a formula, processing ingredients
- Mix according to specified quantities
- Can be:
  - Through shovel on floor (Figure 87)
  - In a mixer (manual and electric)
    - Make sure mixing is thorough and without causing dusting to loose small ingredients
    - Mix small ingredients separately then add to the mix of large ingredients.

6. Floor mixing

This is most common for small-scale producers.

Ensure the flow has smooth cement floor and curved, with covering to contain wind blows.

Mix using a shovel, keep turning until no color of each ingredient is observed. And the feed flavour is smelled.

Figure 89. An ideal floor mixing feed unit

Figure 90. Floor mixing of feed by a group of farmers at a training at Bunda

7. Drum mixing

Local drum mixers are fabricated by welders in cities and urban.

These use drums and can mix 100 kg of feed per turn.

The drum loaded with feed ingredients is turned for a few minutes until the feed is done.

Examples of drum mixers are as in the following Figure.

Figure 91. Drum mixers locally fabricated at a welding shop

8. Costing the feed

This includes adding costs of:

- Ingredients
- Processing
- Transport
- Any other transaction costs
- Will be best demonstrated using Excel

Facilitator to take the participants through costing of each ingredient to establish total cost per bad of feed, as shown for broiler starter in the next table.

Note that feed costs comprise:

- Cost of ingredients
- Transaction costs of milling, roasting, bagging, and labelling among others

When costing is finalized, participants need to compare price per bag with that of commercial feed on the market.

Let participants understand important ingredients, maize, or soybeans, that influence costs, and how to manage such ingredients.

Table 36. Ration for broiler starter with costs

Broiler starter, 23 % CP, premix of 2.5 kg packet				
INGREDIENT	**AMOUNT**	**COST**	**MK**	**PER 500 KG**
Maize	48.40	300	14,521.35	242.02
Maize bran	-	75	0.00	-
Soybeans roast/full fat	42.92	700	30,041.87	214.58
Soybeans low fat	-	700	0.00	-
Fishmeal	4.77	1950	9,298.67	23.84
Salt	0.30	450	135.00	1.50
Premix	0.25	10000	2,500.00	1.25
MCP	1.60	3000	4,800.00	8.00
Lime	1.60	200	320.00	8.00
DL – Methionine	0.15	5500	825.00	0.75
L-Lysine	0.01	3500	35.00	0.05
Total	100.00		62,476.89	500.00
Per bag			31,238.45	
Milling charge, per bag			900.00	
Processing charge, per bag			150.00	
Labelling per bag			150.00	
Others, per bag			250.00	
Overall		MK	32,688.45	

Notes

When package and rate of inclusion of premixes change, there is need to develop another ration that can accommodate the new premix.

It is not automatic to change one ingredient with another. Rather make a fresh ration with the new ingredient included.

A ration can be good, but performance poor. This is due to quality of ingredients that have been used.