Family Poultry Training Course

Trainer's Manual

Table of Contents

PREAMBLE

Poultry production can be divided into four sectors: 1. industrial and integrated, 2. commercial high biosecurity, 3. commercial low bioseurity, 4. village, and family or backyard poultry. The focus here is largely on sectors 3 and 4 but there may be some overlap.

'Family poultry' as defined by the International Network for Family Poultry Development, covers sectors 3 and 4 which encompass small - scale poultry production.

There are numerous poultry handbooks which cover sectors 2 and 3, but this hand book has attempted, in two manuals, to cover mainly sector 3 while not ignoring the great importance of biosecurity particularly in the face of highly pathogenic avian influenza (H5N1). It is envisaged that, given time, some producers, now in sector 3 may move into sector 2. The two manuals are pitched at two different levels. The Trainer's (instructor) manual assumes that the trainer has qualifications and/or experience in a branch of agricultural science but not necessarily in poultry production. Some of the material included is beyond that necessary to give an initial course in poultry production but may be useful as the farmer progresses from sector 3 to sector 2. The trainee's manual has numerous illustrations and is aimed at a lower level than for the trainer. The farmer may be interested in starting a poultry enterprise or is already producing poultry in a small - scale commercial or semi-commercial (opportunistic) situation but would like to make poultry farming more permanent. The course will allow the farmer to increase his/her knowledge and skills and to become aware of a number of important issues (e.g. managing the environment, disease surveillance) of his/her enterprise.

In order to minimise repetition, there is some material in the trainee's manual that is not in the trainer's manual. Trainers should familiarise themselves thoroughly with both manuals.

The third manual is for the millions of families, worldwide, in low – income, developing countries who keep backyard poultry, mainly unmanaged, with few inputs, but nevertheless are of great importance by providing, some security, income and high – quality protein. It is hoped that this manual will make families aware of the possibility of improving output with a minimum of input.

Much of the information has been taken from a range of sources as well as the author's own experience of working in several developing countries over 25 years.

Ideally, there should be a small-scale demonstration unit or a poultry farm available so that the trainees can see, first hand, and better understand the main points in these manuals and observe how commercial poultry production should be practiced.

The importance of community poultry farming is seen as a critical step in alleviating poverty of household poultry keepers, empowering women, increasing income, and moving from a scavenging system to one that is likely to be sustainable.

Although these manuals are designed for poultry farmers they may prove to be invaluable for school teachers. Poultry can be of great interest to school children who may be required to undertake small projects as part of their curriculum or for members of poultry clubs or other organisations. Pupils will take back information to their

parents and this may well stimulate the family to start taking an interest in producing poultry, albeit, initially, in a modest way.

High school children in South Africa with their broiler house in the background

It is recognised that the production of these manuals is only the start of a training program in poultry keeping. There is need for infrastructure so that there is a place for these courses to be held and provision made, particularly for women, so that they can attend the course with or without their children. Demonstrations of housing and equipment should be available and visits to progressive poultry farmers arranged.

Competent local trainers must be found and some kind of incentive provided. In order to commence production there will probably be requirement for access to credit or to borrowing money. Care has been taken to assist potential family poultry producers to research, thoroughly, all aspects of an enterprise before embarking on such a venture.

Finally, family or village poultry covers not only chickens but other species such as geese, Muscovy ducks, domestic ducks, guinea fowl, Japanese quail etc. These are not covered here.

Muscovy ducks

Geese

Domestic ducks

These manuals were written and produced by David Farrell with the technical assistance of Rider Perez-Maldonado and Bronwyn Powell, and illustrated by Shona Reed

ACKNOWLEDGMENT
We thank the ATSE Crawford Fund for providing financial assistance to improve and upgrade the three manuals... We are grateful to UniQuest (University of Queensland) who provided financial support in the early stages of preparing these manuals. I have been given permission to use these manuals to benefit the poultry industry and most particularly the small-scale village poultry farmer

FAMILY POULTRY TRAINING COURSE

TRAINER'S MANUAL

Purpose: to give the opportunity for trainees to learn about raising chickens for their meat and eggs in order to manage a small-scale, commercial poultry enterprise that will be profitable. Small – scale is about 1000 birds (broilers or layers) or less.

Objectives: to undertake feasibility study and market survey to investigate opportunities in your district or country before establishing a poultry enterprise and to prepare a business plan. Trainees will be exposed to all aspects of poultry keeping on a commercial and semi-commercial scale. There will be practical activities, and discussion with trainees should be encouraged.

Manual: is to assist trainers (instructors) to conduct the poultry course, to provide technical information and to make suggestions that will backstop the course offered to trainees at a different level. An important aspect of the course is to demonstrate the different production systems and test their suitability. In this manual, guidelines and suggestions are made to assist the trainers in conducting the course. Visual presentations in the form of illustrations and diagrams will appear in the trainee's manual only but these are also relevant to this manual. Trainers should refer constantly to the trainees' manual throughout the training course. They will find there additional information.

Trainees: these will be men and women who may be already raising poultry or have shown interest in poultry production but who require further knowledge in the area. It will be important for the trainer to maintain their interest throughout the course by mixing its content with demonstrations, illustrations and spiced with humour wherever possible.

UNIT I

There are two essential general guidelines:

1. That the poultry system is sustainable (it can continue indefinitely and has the infrastructure to do so); and
2. That it does not harm the environment (e.g. irresponsible disposal of animals, their waste and rubbish; careful use of chemicals at their recommended concentration, soil degradation)

Within the overall module, there are two *separate* components. There is (a) commercial poultry production, and (b) backyard or scavenging poultry production. Towards the end of the module, commercial poultry production will be *divided* into i) broiler (meat) and ii) egg production. Only *commercial poultry production* will be dealt with here; backyard will be presented in a later course using a separate manual.

Unit I. Trainer will:

a. introduce him/herself and ask the trainees to introduce themselves, describe their background and explain why they are here i.e. their poultry interests
b. explain to the trainees the purpose of the course and outline its contents
c. explain the *three* production systems in general terms (even though the *scavenging chicken* will not be dealt with here but later)
d. explain why poultry keeping and the different poultry produce are so important

1. INTRODUCTION

In almost all countries in the world, poultry are kept for:

- Eggs and meat – are very valuable foods especially for young children to grow strong and healthy. They are rich in protein, vitamins and minerals (essential nutrients)
- Meat – is lean and healthy and eaten widely. It is particularly important during pregnancy and infant growth. There are no major taboos (prohibition) against eating poultry products
- Feathers – are good for stuffing pillows, mattresses and quilts to keep warm
- Manure – is an excellent fertiliser for gardens especially for growing vegetables
- Recreation – are great as pets, in poultry competitions and shows, are kept for their crowing ability and in some countries for their fighting ability (but not to be encouraged)
- Special festivals, traditional ceremonies, gifts, traditional human medicine, religious and sacrificial ceremonies

They contribute to food security, provide cash and are used for barter. People living in *urban* areas often consume more eggs and chicken meat than those people living in *remote* areas, but these rural people often need these foods most. This is why it is so important to *expand* the poultry industry into the more *remote* areas of the country. As

countries get more prosperous, there is increasing *demand* for eggs and meat, some of which may now have to be *brought* into a province or region from outside. There may be therefore *opportunity* to establish commercial and semi-commercial poultry production locally.

Trainer will explain the current poultry industry in your country

2. BACKGROUND INFORMATION

Before a potential producer commences poultry farming, there is the need to find out as much *information* as possible. This will then be used to determine if the enterprise will make a *profit*; will fit into the existing farming system, and will be *sustainable*. The current situation in which to produce poultry in some countries is not easy. If you do decide to become a poultry farmer, the advice is: *to start small, and learn by experience.*

A list of questions that should be addressed before a potential producer launches into an enterprise is given in Section 12. From this information, a profit and loss *margin* can be calculated and a *business plan* prepared. This exercise will be done at the end of the course. But trainees should be encouraged to refer to it from time to time to allow them to gather the required information. This will take time.

Trainer will later assist trainees to complete the questions and encourage discussion.

[END of UNIT I]

UNIT II

3. POULTRY BREEDS

For commercial poultry production, there are today three breeds of birds that may be suitable.

3.1 Dual purpose breeds

These are generally heavy *pure* breeds and were used in the past for both egg production and their meat. In the ***today's*** poultry industry, Rhode Island Reds and Plymouth Rocks, for example, do not *produce* eggs and meat at a high enough rate, and are not sufficiently *efficient*, but they may have an important role to play in developing countries where *constraints* occur (no access to hybrids, high temperature, housing, feed supply and feed quality, disease and hygiene). They will go broody and hatch their own eggs. When the eggs hatch half will be males and these can be raised and sold for meat. In modern, industrialised (commercial) egg production, the males are usually of no value for meat and may have to be destroyed. This makes the female chicks expensive.

Rhode Island Red

Plymouth Rocks

3.2 Special breeds

These were used for egg production. The popular White Leghorn is a small - bodied, flighty hen (1.5 kg) and lays white-shelled eggs weighing about 55-60 g. It eats only a small amount of feed (90 g/day). The Black Australorp is a heavy hen (2.2 kg) and lays light-brown (tinted) shelled eggs. It is docile but eats a lot of feed (120 g/day); but their meat may be important. If these breeds are found in your country, they could be valuable and used to produce table eggs on a commercial layer farm.

Black Australorp

3.3 Hybrid meat and laying stock.

These have been specially selected for either meat or egg production, but *not* for both. Several different *breeds* have been used to produce a '*hybrid'* chicken which can *grow* to 2.5 kg in 39 days while utilising only 4.5 kg of *feed.* A 'hybrid' hen will lay *90 eggs* every 100 days until almost a year old and will not go broody. Conditions and management for this high level of performance, whether for meat or eggs, must be *ideal*. These hybrids, because of the selection process, will *produce* better than their parents due to *'hybrid vigour'*. This lasts for only *one* generation. Because poultry farmers do not have access to *parent* stock, they should not *breed* using these hybrids but should purchase chicks from a commercial hatchery each time they want new birds.

There are general management principles which apply to all forms of poultry production. These will be dealt with first. Then we will examine *broiler* production and *egg* production separately.

[Unit II. Trainer will discuss the breed options and explain why *hybrids* are generally preferred but must be purchased from specialist breeders. Are they now the most *suitable* stock for your conditions or are there pure breeds available?]

4. HOUSING

The purpose is to *protect* the birds from dogs, cats, snakes, rats and other pests and thieves and to keep out mice, rats and birds from *eating* valuable poultry feed and transmitting *disease*.

Basic requirements for the building are:

- it is *rain* proof
- it protects poultry from direct *sunlight*
- it is not subject to *flooding*

- it is *wild bird* proof (difficult to do)
- it has enough *space*
- it is easy to *clean* out
- it has a solid door with a *lock*

The house should be *low-cost* and constructed from as much *local* materials (bamboo, thatched roof, woven palm leaves etc.) as possible. A disadvantage is that the house may *last* only 4-5 years unless refurbished when wear and tear occurs.

Weaving panels suitable for poultry houses using local materials

More expensive material can be used for a more *permanent* house constructed from sawn timber, poles, cement, wire-mesh, galvanised iron etc.

Positioning of the house is an important consideration in order

- to *protect* poultry from wind and rain storms
- to prevent *direct* sunlight from entering the house and stressing the birds
- to have good drainage around the house to protect it from *flooding*
- to avail of the prevailing wind to cool the house in a warm climate

The house should have a roof with a steep slope to allow rainwater to run off, and have a good overhang. The house should be at least 1.8 –2.0 m high so that a person can stand upright.

[Unit II. The trainer will explain the principles of poultry housing and why they are important. Trainees will be shown demonstration poultry houses]

4.1 Floor

The floor must be *flat* with no protruding rocks or other objects.

It should be covered with suitable *litter* (sawdust, wood shavings, dried leaves, dried grass, chopped straw, rice hulls, and coffee hulls, peanut hulls) to absorb moisture from birds' droppings and to reduce *odour*. Wet litter releases *ammonia* which can affect the bird's eyes and respiratory system. Breast blisters and *down-grading* of the carcass will result.

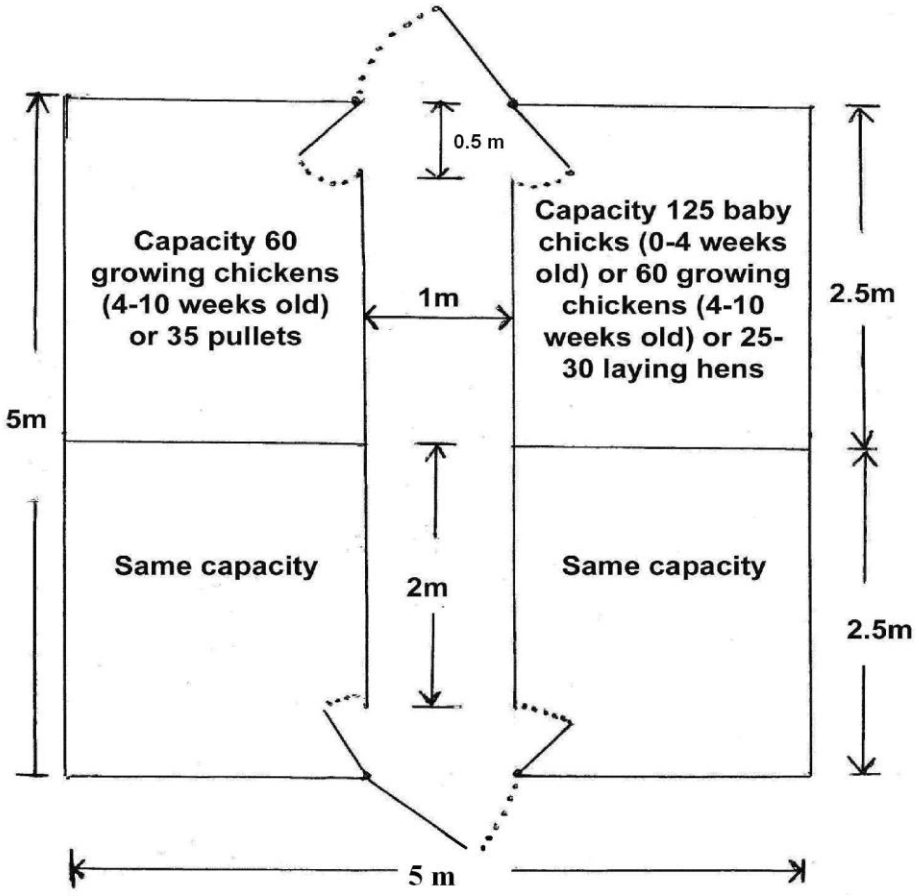
The litter should be *raked* weekly and *changed* after about every two batches of broilers, or each time the layer shed is emptied.

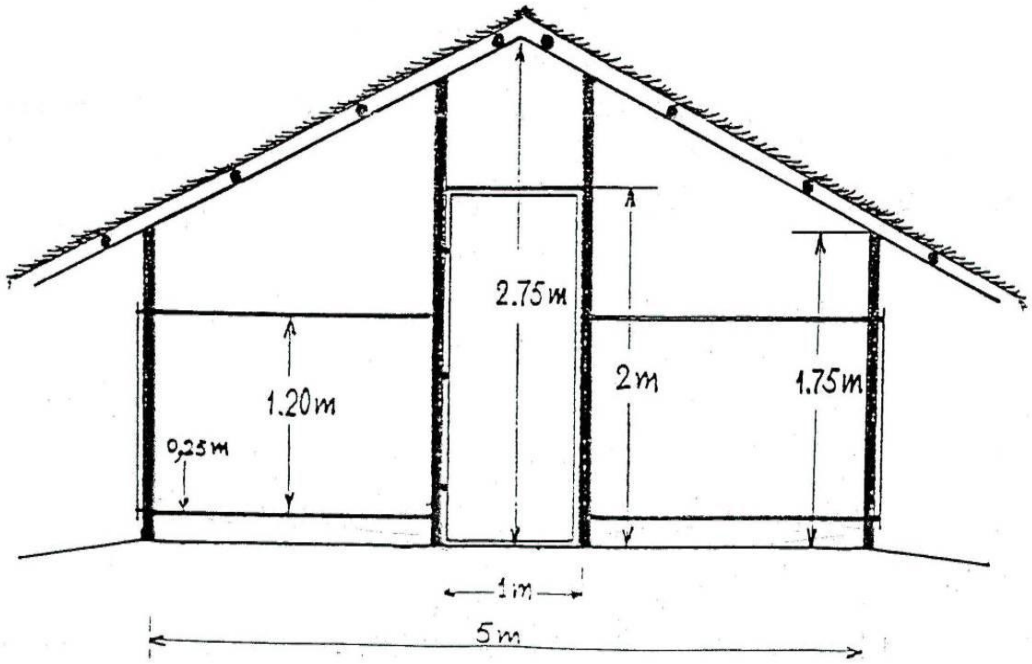
Fresh chicken manure is an excellent *fertiliser* for gardens but needs to be aged (a few months) before application otherwise it may *burn* the plants But it can be put in a compost with other material. Chicken litter from broiler houses can be used almost immediately on the garden.

For a small holder with only a few birds, a raised split bamboo *floor* eliminates the need for *litter.* The housing must allow the fresh excreta to be *removed* from underneath. Spaces between the bamboo strips need to be such that the excreta *fall* through but the bird doesn't catch its *foot* between the strips (about 2-2.5 cm wide for an adult bird).

Do not overcrowd the chickens and floor *space* should be as follows:

- Chickens 0-6 weeks old: 10-12 birds/m^2. Floor size 5m x 2m /100 birds
- Pullets to 16 weeks old: 5-7 birds/m^2 Floor size 2m x 2m / 25 birds
- Laying hens: 5 birds/m^2. Floor size 5m x 2m / 25 hens
- Hens in layer cages, floor space may be 12-15 birds/ m^2
- Cage size for 3 hens: 40 cm long x 30 cm wide x 45 cm high, for 5 hens: 50 cm long x 30 cm wide x 45 cm high


0.5 m
Capacity 60 growing chickens (4-10 weeks old) or 35 pullets
1m
Capacity 125 baby chicks (0-4 weeks old) or 60 growing chickens (4-10 weeks old) or 25-30 laying hens
2.5m
5m
Same capacity
2m
Same capacity
2.5m
5 m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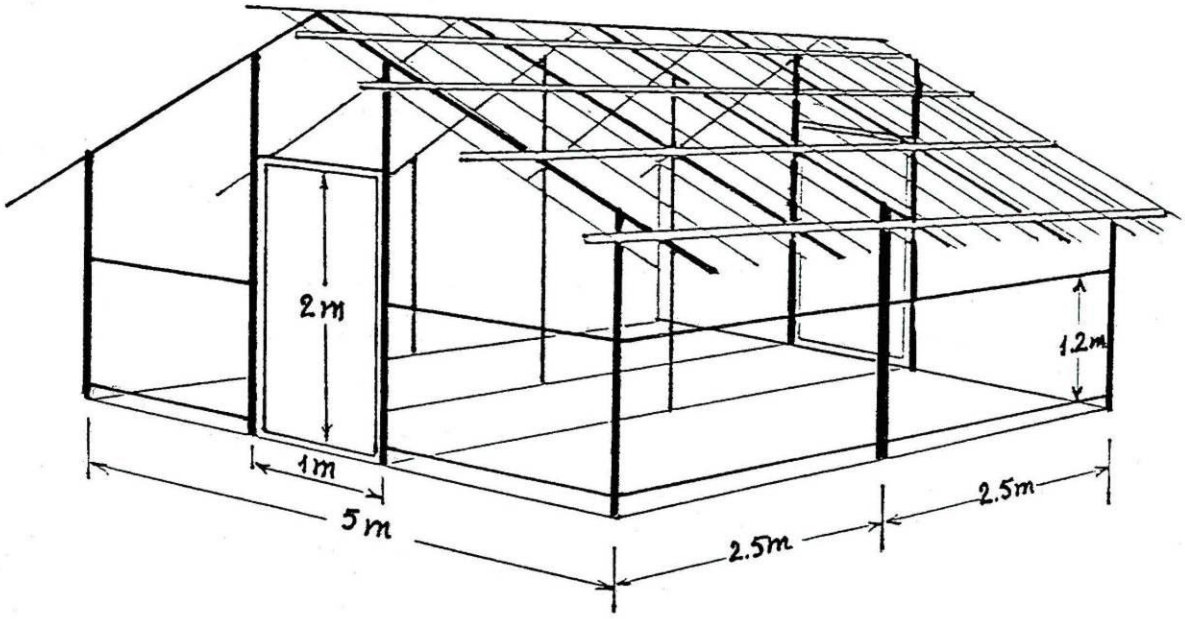
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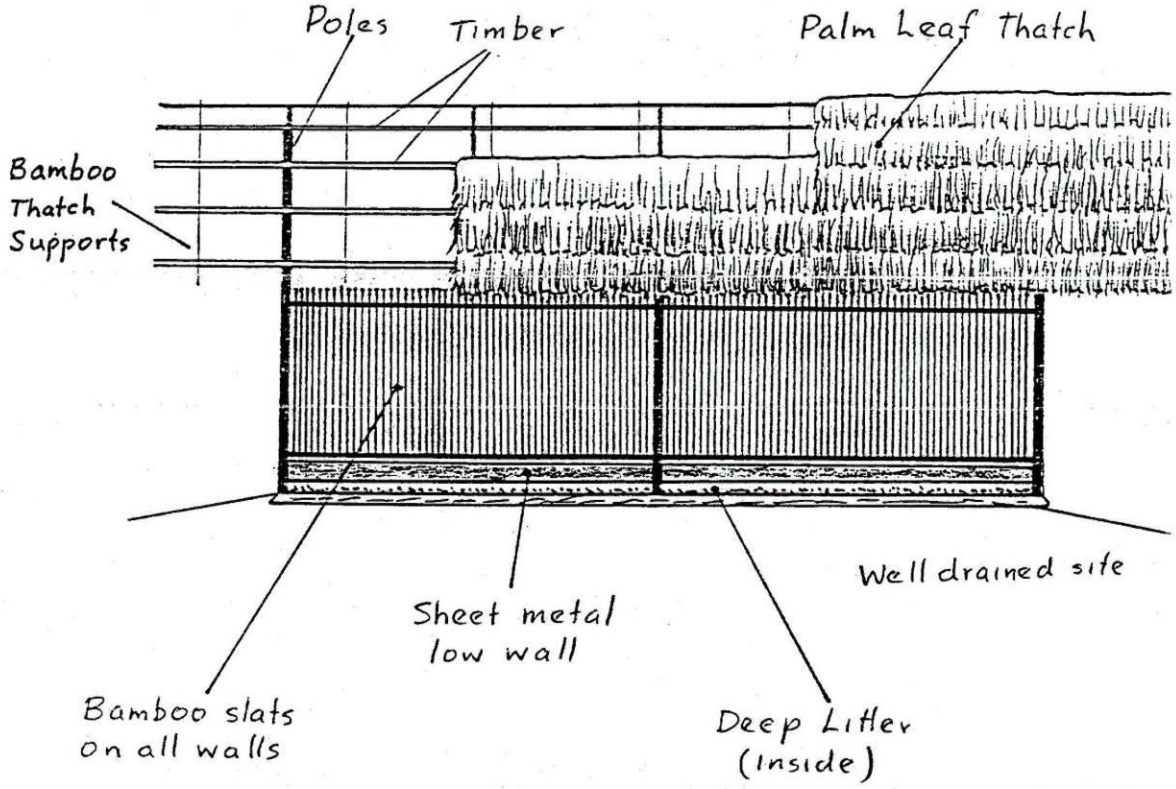
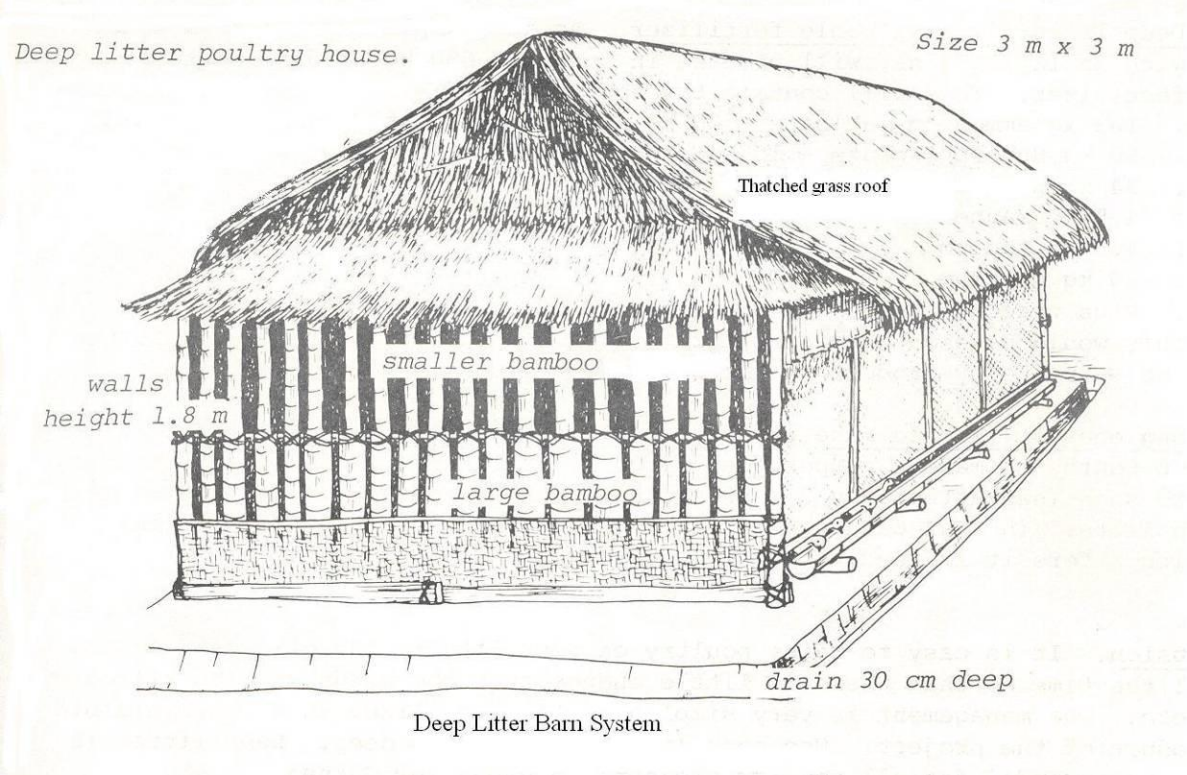

Poles
Timber
Palm Leaf Thatch
Bamboo
Thatch
Supports
Well drained site
Sheet metal
low wall
Bamboo slats
on all walls
Deep Litter
(Inside)



Deep Litter Barn System

[Unit II. The trainer will explain the importance of the floor type; the options for litter, and the various space allocations for the different classes of stock and why overstocking is bad. The trainer will now go through a detailed sketch of a poultry house suitable for meat birds and layers. If possible, this will be followed by a visit to a poultry farm to inspect a demonstration poultry house]

5. EQUIPMENT

5.1 Drinkers

It is essential that birds always have access to *clean*, fresh water. A simple floor drinker can be *made* out of a can or drum inverted in a dish or tray with a hole punched about 2.5 cm above the end of the can. Other kinds of plastic drinkers can be *purchased* that can either be suspended from the ceiling, and height above the floor adjusted, or sitting on the floor [these are shown in section 4.1 the trainees' manual].

Bamboo can be used to make drinkers but you must provide a regular, ample supply of *clean* water. In larger chicken houses, a 44 gallon (200 litres) drum can be used with a ballcock in a cistern to provide a *constant* supply of water with a hose connected to the drinkers. Floor drinkers should be moved regularly as the litter gets wet around the drinkers. Ideally they should sit on a raised bamboo or timber *platform*.

Drinkers get dirty very quickly particularly in a warm climate. They must be cleaned thoroughly and regularly to prevent disease. This may mean scrubbing them.

Water allocation should meet these requirements:

100 chicks	0-3 weeks	10 litres/day
100 chicks	3-7 weeks	25 litres/day
30 layers	Adult	15 litres/day

[Unit II. Trainer will demonstrate different drinking systems both home-made and purchased, and how to correctly adjust drinker height]

5.2 Feeders

Laying hens and meat chickens should have a *continuous* supply of feed. Any attempt to restrict their feed will give *reduced* production and a smaller *profit*. Feed troughs can be made from *local* material (bamboo) or made from old 20 litre *drums* (tube feeder). The feed drops into a feeding tray just below the drum, as the birds consume their diet. Feeders are either on the *floor* or suspended from the ceiling and *adjusted* according to bird age. Feed troughs can be *purchased* but they should always have a *lid* to prevent birds from entering the bin.

Floor feeders need to be *filled* regularly but should not be *over-filled* resulting in feed wastage. Adequate trough *space* should be provided:

Chicks	0-8 weeks	2.5 cm/bird
Birds	9-16 weeks	7.5 cm/bird
Layers (floor)		4.0 cm/hen
Layers (cages)		7.5 cm/hen
For broilers		3 feeders/100 birds
For layers		4 feeders/100 hens

[Unit II. Trainer will demonstrate the different feeders both purchased and made from local material, and explain how they need to be adjusted, and number of birds per trough.

[END of UNIT II]

UNIT III

6. BROODING

In commercial and semi-commercial production, the *young* chick needs to be kept *warm* (brooded) as there is normally no mother hen to brood them. In countries where the days are *hot* the chicks need very little (if any) additional heat except possibly when the temperature *drops* at night. If there is a supply of *electricity* a 60 or 100 watt bulb can be suspended above the chicks or placed in a can on the floor. There are also special heat lamps. Alternatively, a small *kerosene* lamp within a surround (small can) can be put in the brooder. The chicks are confined in the brooder by placing a chick guard (a ring of cardboard or woven grass, palm or bamboo strips) around the chicks with a diameter of about 90 cm and 40-48 cm high. The cardboard ring can be *adjusted* according to the number and age of the chicks.

If the chicks are for *egg* production, they will remain in the brooder for 3 to 5 weeks. If they are for *meat* production, they will be brooded for only 10 days. A '*cold brooder'* is probably more appropriate in hot countries which needs no *heating* but relies entirely on the heat produced by the *chicks*. Up to *50 chicks* are placed in a box with two *compartments*. Polystyrene or other *insulating* material is attached to the lid and walls of the compartment which houses an insulated (dried grass) cardboard ring (60 cm and 45 cm high). The chicks have access to a second compartment covered with wire mesh where there is feed and water. (see section 5 Trainee's Manual for more detail)

Chick behaviour indicates their comfort:

Huddled up and chirping	⇨	too cold
crowding around the edges	⇨	too warm
Dispersed evenly within the circle	⇨	just right

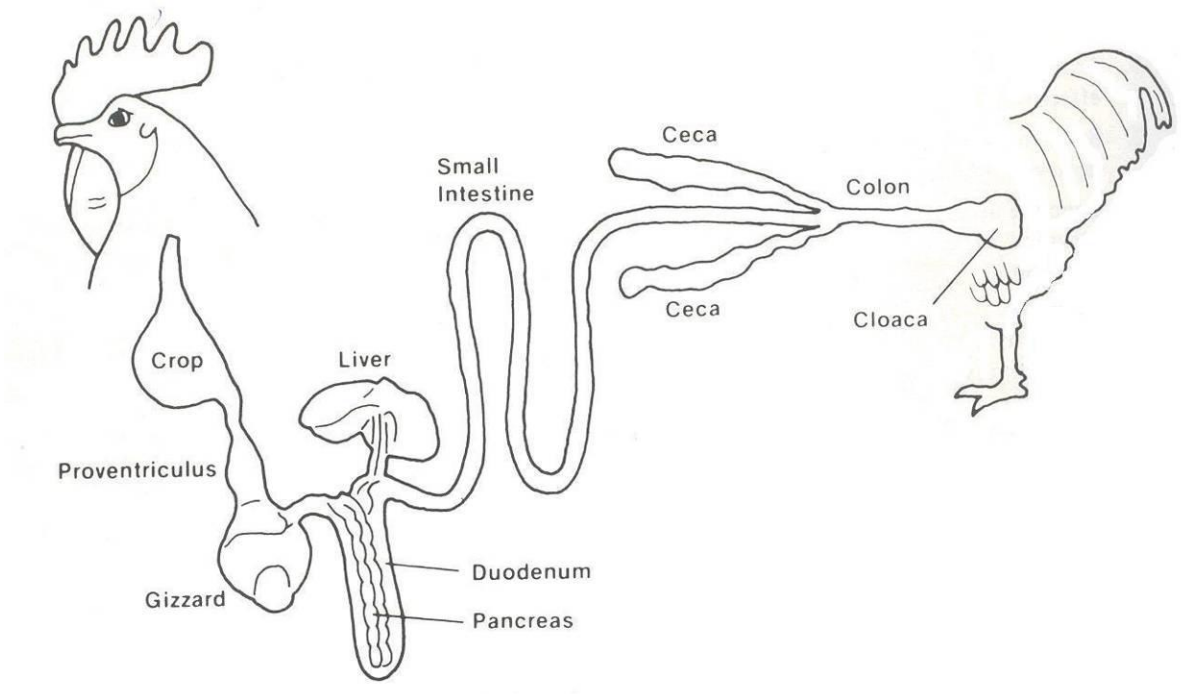
Mortality is normally *highest* during the first few days so the chicks need *special* care. Very s*mall* chicks are particularly vulnerable and dead chicks should be removed immediately and *buried.*

[Unit III. Trainer will set up a brooder with drinkers and feeders; show the different methods of heating birds even if there is no electricity. A cold box brooder should be constructed. A sketch of a brooder will show chicks in various positions depending on brooder temperature]

7. FEEDING

The major *constraint* to raising meat birds and laying hens in developing countries is often the *feed* supply. Manufactured or compound feed is usually not available on site and must be brought in. It is extremely *expensive* and may make commercial poultry keeping uncertain since feed is about *60-70%* of the total cost of producing commercial poultry. A disadvantage of modern poultry breeds (hybrids) is that they need a *high-quality* diet if they are to produce to their genetic *potential.* Under certain circumstances, there is therefore a case for using dual - purpose breeds who do not need such a high - quality feed and importantly it does not need to be pelleted but can be fed as a mash.

A simple diagram of an adult bird's digestive system illustrates just how *short* it is. Digestion time is very *rapid* and the food passes from the mouth to anus in about three hours. Having no teeth, birds rely on the gizzard to *grind* the feed to small particles before passing into the very short intestinal tract. *Grain* is traditionally the major ingredient in poultry diets. Little grain is often produced in many developing countries and it has to be *imported.* Some farmers may find it possible to grow corn (maize) and sorghum to feed to their chickens. But the grain must be *balanced* with other feed ingredients if birds are to produce close to their genetic potential. Although chickens have caeca they are small and unable to digest fibrous feeds well especially when young.



The digestive tract of a chicken.

7.1 Nutritional principles

7.1.1 Protein

Poultry need a source of high-quality *protein* to allow them to grow and produce meat and eggs. Protein sources *differ* greatly in that the number and type of amino acids (building blocks) determine *quality*. The closer the protein building blocks *match* those in the proteins in meat and eggs, the better is the quality of the protein. Fish meal, meat & bone meal and soybean meal are the most *common* providers of these amino acids. Some amino acids can also be mixed into the diet in *pure* form (e.g. methionine, lysine, threonine and tryptophan) to make up a shortfall.

7.1.2 Energy

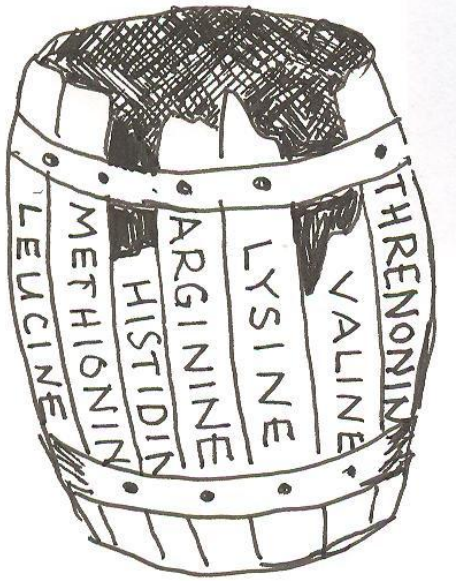
The requirement for *energy* (body fuel) is met by feeds that provide carbohydrates, usually starch. Although grains traditionally supply starch, and other carbohydrates, local roots and tubers are also rich in starch but very *low* in protein. Grains contain 8-15% protein, but the quality is *not* good.

7.1.3 Minerals and vitamins

There are 13 vitamins that are *essential* and if deficient in the diet, it will result in a specific *disease* and/or reduced production. There are at least 9 essential minerals. Calcium and phosphorus are deposited in bones and egg shell, and salt is often *deficient* in poultry diets. Keeping poultry out-of-doors on *green* pasture allows them to forage for protein, minerals and vitamins and birds are less likely to become *deficient* compared to birds kept indoors all of the time. Normally a mineral and vitamin supplement is added to the feed but these are not always available in developing countries.

7.1.4 The concept of limiting nutrients (stays in a barrel)

The shortest stay in the barrel determines how much water the barrel will hold. Replacing the shortest stay will allow the water to rise to the next shortest stay. When all short stays are replaced then the barrel will hold water to its capacity. The illustration here applies to amino acids but it applies equally well to any essential nutrient (minerals, vitamins, fats). Here the first limiting amino acid (shortest stay) is valine by adding an ingredient with this amino acid in the necessary amount will allow the bird to grow better or lay more eggs but only up to the level of the next shortest stay, histidine. When all limiting amino acids are added, the birds will perform to their maximum potential unless there are other limiting factors (disease, management, temperature).



7.2 Common ingredients

A list of the common feed ingredients that may be found in some developing countries is given below

Ingredient	Comment
Sorghum	An excellent source of *energy* but contains only about 9 % protein
Wheat bran	Contains about 15% protein; high in fibre and low in energy. More suitable in *layer* diets and broiler *grower* diets
Rice bran	Is also high in *fibre* but high in energy; it may contain 12% oil and 13% protein. Used in layer and broiler grower diets
Broken rice	High in energy but low in protein
Maize (corn)	Most common grain used in poultry feeding
Millet	This grain grows well in arid areas
Fish meal	This is made from fish waste. Protein is only 45% but is of good quality. It also provides valuable oil, minerals and vitamins
Copra meal	Widely available in tropical countries. Contains 20-22% protein of moderate quality. It has 7% oil and is high in fibre but has no starch. It contains no starch but contains *mannans* which can cause high viscosity in the gut of chickens and can reduce the digestibility of some dietary nutrients
Copra meat	This is the whole coca nut. It very high in oil (65%) and therefore in energy but low in protein (7-9%)
Palm kernel cake	Also widely available in tropical countries. Protein is 16% and of inferior quality and similar to copra meal in feeding value
Peanuts	These contain about 28% protein of medium quality. They are high in oil but may contain *aflatoxins* which are highly toxic
Green feed	Succulent green feed, particularly legumes, provide important vitamins and xanthophylls which give the skins of meat chickens and egg yolk an *orange - yellow* colour. Also dried tops of cassava, sweet potatoes etc. contain high amounts of protein
Starchy root and tubers	Sweet potato, yams, taro, cassava etc. are good sources of *energy* but are very low in poor quality protein (5-6%). They must be first cooked before feeding to chickens
Shell grit, coral grit, limestone	Very important sources of calcium (40%) for bone growth and egg shell formation
Grain balancer	This is a *commercial* product providing high-quality protein to balance deficiencies in local ingredients. Minerals, vitamins and other nutrients may be included
Free amino acids	Some of these 'building blocks' are now manufactured and can be added to the diet in small amounts to make up deficiencies e.g. lysine, methionine, threonine

7.3 Diet formulation

The object is to include a *combination* of ingredients in the diet that meets all of the nutrient *requirements* of layers and meat chickens at least cost. This requires detailed information of the nutrient *composition* of each ingredient and the *requirements* of

poultry for essential nutrients. Recent information on requirements is shown in Tables 1, 2 & 3 for *broilers, layers and breeders* at the back of this manual. If a diet is *deficient* in a particular essential nutrient the bird will attempt to seek it out, often causing feed *spillage.*

7.4 Choice feeding

This may be practised where there is *uncertainty* about the composition of feedstuffs and the bird is allowed to *select* from several different ingredients placed in *separate* feed troughs. In this way the bird can balance its diet. This may be suitable for small flocks that are kept on the floor or have access to out - of - doors.

The bird's nutrient requirements *change* for meat and eggs as it goes through the production *cycle;* choice feeding allows the bird to select the most *appropriate* mix of feed ingredients which may alter even from day to day (especially for layers) and often with savings in feed costs. During the latter part of production, the nutrient requirements of broiler chickens decline markedly. This allows feedstuffs of low nutritional value to be used in their diet. It is therefore best to keep the high - quality feedstuffs to feed the young chicks and the poorer quality feed ingredients for the older bird. Also hens can digest poor - quality feeds better than young broilers because their digestive system is more developed.

7.5 Home mixing

There may be opportunity for the poultry keeper to mix his/her own diet from a combination of local and purchased ingredients. Once the diet formulation has been calculated, the next step is to combine the ingredients in exact amounts into a *single* mixture. A spring balance or pre-weighed containers (of different sizes) are *required* to include exact amounts of each ingredient in the final diet. There are *different* ways of mixing the ingredients. This can be done with a *shovel* on a clean dry cement or wooden floor or on a plastic sheet. Alternatively, small amounts of feed can be mixed in a plastic or *paper bag* and shaken vigorously. It is possible to make a *hand mixer* from a drum (200 litres) with a turning handle inserted through it (See illustration section 6 Trainee's Manual). Feed must be mixed for at least *5 minutes* to get even distribution of the ingredients.

7.6 Feed storage

Feed ingredients and mixed diets must be *stored* in a clean, dry space about 5 cm above the floor (on bamboo slats) in a *vermin-proof* area. The feed should be *labelled* and old feed used *first* before opening new feed ingredients. In warm countries especially, feed should be kept for *4-6 weeks* maximum otherwise it will deteriorate.

[Unit III. This is a large and important topic and the trainees must be led through the various components slowly and carefully step by step with the help of the trainees' manual. There are illustrations and demonstrations in this manual.
[END of UNIT III]

UNIT IV

8. HEALTH AND DISEASE PREVENTION

Modern poultry production is constantly under *threat* from disease particularly if birds are under stress (crowded, high temperature, predators) and out - of - doors**.** Medication is *expensive.* In most commercial hatcheries, chicks are *vaccinated* at day old. Farmers who hatch their own chicks, or buy from a local hatchery will need to be very *cautious*, and may have to vaccinate the chicks themselves. This topic will not be covered here in detail as it is *specialised.* Advice should be sought from a poultry adviser. Newcastle disease and highly pathogenic avian influenza (H5N1) are discussed briefly in the Trainee's Manual (section 7.1 and 7.2).

Cleanliness is top priority. This means leaving sufficient time between batches (2-4 weeks) of chicks to thoroughly clean out and *disinfect* the poultry house and allow time for measures to work. (Jaye's Fluid is widely available and a good, cheap general purpose disinfectant for equipment and houses).

Birds kept on the *floor* are particularly prone to some diseases because they come in *contact* with their excreta. There are some elementary rules that should be followed:

- never allow *other* poultry on your farm
- never allow other poultry *farmers* near your chickens
- farmer should keep *special* boots/shoes for working in the poultry house and keep them there
- remove old litter, dirty bags, and *contaminated* rubbish and bury them or dump them far away in an eco - friendly manner
- wash thoroughly with *detergent* feeders and waterers (always keep them clean -discard *mouldy*, damp feed, it may contain toxins that make your birds *sick* or *die*)
- very *sick* birds should be removed, killed and buried or burnt
- all in - all out systems are preferred (same age). Do not *mix* birds of different ages
- a *foot bath* containing disinfectant or lime should be placed at the entrance to the poultry house and soles of boots dipped into it
- observe your chickens at least *three* times a day especially when they are very young

8.1 Diseases

Nutritional *deficiencies* result in *metabolic* diseases and these have to be distinguished from diseases spread by different classes of *organisms*. Also poor nutrition not only reduces bird performance, but makes birds more *susceptible* to disease organisms.

Riboflavin deficiency

Biotin deficiency shown here in ducks.

There are several classes of diseases which relate to the organism that causes it:

Disease type	Cause
Bacterial	fowl cholera, coryza, chronic respiratory disease, *Mycoplasma pullorum*
Viral	fowl pox, Newcastle disease, infectious bronchitis, egg drop syndrome, Marek's disease
External parasites	lice, mites, ticks, fleas
Internal parasites	tapeworms, round worms
Protozoa	coccidia, blackhead

Viral and bacterial diseases are *difficult* to diagnose. There is need for a specialist with laboratory backup to *identify* diseases. Once the birds have contracted a disease, it may be *too late* to treat it effectively although for some bacterial diseases *antibiotics* in the drinking water may be successful.

Respiratory diseases can be identified when the birds *cough* and *wheeze*. Only a few may die from *infectious bronchitis* if they are put on a mineral supplement (electrolyte replacer) to make up for mineral losses that occur in the watery excreta.

External parasites can be *treated* with chemical sprays, and for *internal* parasites the chemical is put in their drinking water. A dust (sand) bath helps to control some *external* parasites.

Blood in excreta may be a sign of *coccidiosis* - common in meat chickens. *Mortality* can be high in infected birds and any treatment is often too late. Birds on a *slatted* floor or in cages are less likely to become infected than those on solid floors. In commercial practice, a *coccidiostat* is usually added to broiler diets.

Chickens can be vaccinated using four methods (1) by placing a drop in the eye (2) put vaccine in the birds' drinking water (3) spray the birds with the vaccine (3) inject with a needle usually into the wing.

[Unit IV. Trainer should focus on disease prevention and how to clean out, disinfect and rest a poultry house. Classification of organisms can be shown by way of diagrams].
[END of UNIT IV]

UNIT V

9. COMMERCIAL BROILER PRODUCTION

Intensive poultry farming is usually divided into *specialised* operations, although some farmers may be interested in keeping poultry for *both* meat and eggs. For meat production, the chicks have been selected for *rapid* growth, breast meat and usually lean meat (low fat). They will not lay many eggs. An important rule - of - thumb is that the farmer is *kind* to his/her birds and looks after them like part of the family. They will then *respond* and serve the farmer well.

Broiler chicken.

Happy chickens will produce well.

The approximate composition of a 1.8 kg broiler chicken is:

water	64%	1152g
fat	14%	252 g
protein	18%	324 g
bone ash	4%	72 g

The very high amount of *water* is associated with the lean meat (no fat) of which water is about 80% and protein 20%. The birds are brooded on a *starter* diet for about 2-3 weeks. They are then given a *grower* diet and sometimes a *finisher* diet for the final 7-10 days. As mentioned, as they age, their nutrient *needs* decline. This means that *older* chickens can handle *poorer* quality feeds better than *younger* birds. Mortality is normally 3-5% and most of this occurs during week 1. Poultry production targets in most developing countries will be lower than in temperate climates. Typical figures for growth and feed conversion ratio (FCR, kg feed per kg gain) in good commercial production are:

Days	Weight	Feed Conversion Ratio (FCR)
0-21	900 g	1.42
21-43	2.3 kg	1.85

The implications are that there is a requirement for a very *high-quality* feed if maximum growth rate is to be achieved (this may not be possible or *desirable* in some countries due to high temperature or feed ingredients are very costly).

You will see that there is very high feed intake during the *last* 2-3 weeks of production and growth then slows. The message is that keeping birds beyond normal *slaughter age* (7-8 weeks) is expensive and often the difference between a *profit* and a *loss*.

Chickens in a broiler house

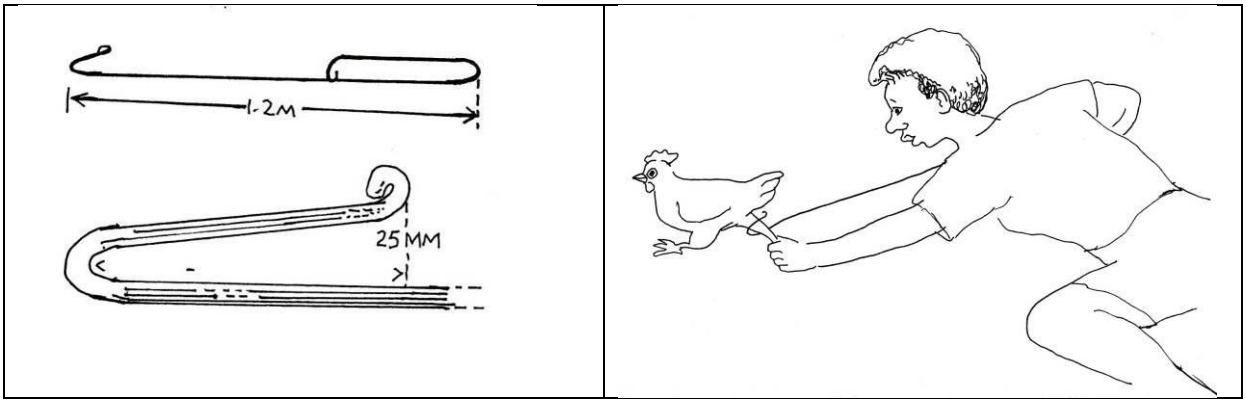
In a survey of 37 small batches (50 – 200) of broilers grown around Lae in Papua New Guinea, birds reached 1.85 kg (range 1.68-2.18) in 53 days (range 44-67). Feed intake was 4.73 kg (range 3.5-6.7). Feed conversion ratio was 2.56 (range 1.91-3.49). Mortality was 7.1% (range 2.9-17.3). The wide variation is due to different levels of *management, feeding* and *conditions*. Good *results* will only come from well cared for flocks. *("The eye of the farmer fattens his stock")*

Chicks must get off to a good start and good management is very important especially during the first week of life.

Before the chicks *arrive*, their house must be clean and ready to *receive* them. Shavings (5 cm thick), or other litter should be in place and *old litter* removed every second batch of chicks.

- The brooder heat lamp or kerosene lamp must be *checked*, adjusted and switched on
- The circular (1.2 m diameter/100 chicks) brooder guard that surrounds the heating unit must be in *place*
- Within the brooder there should be two drinkers and two feeders adjusted to chick *height* and adjusted again each week
- A commercial *starter* diet should be fed at least for the first *two* weeks
- For the first few days, the feed should be placed on *paper* spread on the ground, or in scratch trays as well as in the feeders within the brooding area so that they can peck at the feed
- Chicks should be encouraged to *drink.* If reluctant place the beak in the water trough/tray
- Check chicks *several* times during the day and again at night
- On day 4, make the brooding circle a little *larger* as chicks are growing fast
- Chicks should be using the *feeders* although a few may be still eating off the paper

- Brooder temperature should be *reduced* but chicks will indicate this by their *behaviour*
- At 7-10 days *remove* brooder guard and remove heating unit at the same time
- At least 10 chickens/batch of 50 should be *weighed* (spring balance) at 4 weeks of age (700 g/bird) and again at 7 weeks (1600-1880 g) to gauge performance
- Catch birds using a 1.2 m wire with a *hook* on the end [see diagram]
- Start *selling* off the heaviest broilers at about 7 weeks of age



[Unit V. Trainer will demonstrate brooding, catching and weighing birds.]

9.1 Marketing

There will be much information from the feasibility study on how broilers are *sold*. A small commercial broiler producer may have *four* options

1. Sell them *alive* on a bird or weight basis to a consumer- usually best option
2. Sell them to a *trader*
3. Sell them oven ready - *plucked* and eviscerated (without feathers, guts and organs) - labour intensive but usually the highest price
4. Sell them live to an *abattoir* for processing

It is possible to alter the colour of the skin of broiler chickens by adding a colouring agent to the feed or the feed ingredients (corn) may contain xanthophylls, natural colouring agents. Consumers may be used to buying broilers with white or yellow skins others don't care.

9.2 Manure

A single batch of 100 broilers will produce in 10 weeks about 100 kg of deep *litter* especially rich in *nitrogen.* It should not be wasted and can be used as a *fertiliser* or to make compost when mixed with other *organic* matter (inedible kitchen waste, tops of vegetables, leaves etc.) for your garden. The composition of the poultry litter varies but is about: 3% nitrogen, 2% phosphorus and 1% potassium. It has a commercial *value* and can be sold to vegetable growers.
[Families should be encouraged to have a garden and add litter to grow fruit and vegetables]

9.3 Record keeping

It is important to keep good *records* of broiler performance. A *sample* of a record sheet covering a single batch of broilers is given for the full period (batch) at the end of this manual

- record when you *open* a new batch of feed of known weight
- mark when a bird *dies* or is removed from the pen
- record *weight* of birds when weighed at 4 and 7 weeks
- At 4 weeks take a sample of say 10 birds in a batch of 50 and weight them
- *divide* total bird weight by *number* of birds weighed to get average broiler weight
- add up all feed used (weight of bag x number of bags) then *divide* by total weight of birds, then by the number of birds
- Feed conversion ratio is feed *consumed* divided by the total *weight* of birds
- calculate *mortality* (%) by dividing the number of birds at the end by the number placed in the pen at the start x 100

(*A worked example is given at the end of the manual)*

Mention has been made of *vaccination* of birds at day old. Commercial broilers will arrive *already* vaccinated but a vaccination program appropriate to a particular location will have to be worked out at a *later* date and if necessary a supply of the vaccines sourced.

Trainer will describe the current marketing of meat birds in his/her region or village and will go through a worked example of all calculations for weight gain and feed efficiency.
[END UNIT V]

UNIT VI.

10. COMMERCIAL EGG PRODUCTION

There are several *choices* that can be made about management and housing of laying hens.

Hybrid layer of large brown-shelled eggs.

They can be kept in group (3-5) *battery* cages; this has a high capital *cost* unless the cages are constructed from *local* material. They can be kept indoors on the floor (*barn hens*) or they can be kept out - of - doors (*free range*).

There is another system where they are kept in large groups in colony cages, and allowed *more space* than in battery cages (see later). Hybrids give more *eggs* when in cages and *dual purpose* birds perform well under free-range conditions. Black Australorps are *ideal* for free range as they have a good temperament.

There are two *options*, 1. The farmer can *purchase* hybrid day old female chicks. These are currently *expensive*, or 2. The farmer can *hatch* his or her own with a broody hen or in a small *incubator if she/he has suitable heating.* In this case she/he will have *equal* numbers of male and female chicks. Later she/he may then be able to separate them by *feather* growth but not until 6-8 weeks of age. If they are dual purpose, the males can be grown for *meat* production, or sold. They grow quite slowly.

(For incubators and incubating eggs see Section 9.2 Trainee's Manual)

10.1 Hatching chickens

If the farmer has a laying flock, she/he will need one *rooster* for about 8 hens. The hens' eggs will be fertile after the cock runs with them for 7 days. The *fertile* eggs should be kept in a cool, dry place for no more than 8 *days* before incubating. This may be in a small incubator or in nest boxes, in a secure house. These boxes should be located in a *quiet* space. The broody hens will need *special* litter, and a layer of sand to keep the eggs moist, is placed below the litter. Water and feed should be placed close to the *broody* hen.

10.2 Pullets

These are immature hens and usually raised *indoors* on litter in the same way as broiler chicks except that they grow much more *slowly*. They stay in the brooder for up to 4 - 6 weeks on a *starter* diet that is of high quality. Floor *space* is 25 pullets up to 20

weeks of age per 6-7 m^2. The *grower* diet is of lower nutrient specifications until about 17 weeks when they are then given a *layer* diet. This is high (3%) in *calcium*. The pullets are then *transferred* into the layer house and should be at a *predetermined* or *target* body weight at point of lay. If too light (thin) and immature, they will start to lay *later* than normal and produce *fewer* eggs. If too *heavy*, egg production will suffer and they will have over-consumed *costly* feed during the rearing period.

Rearing pullets indoors on litter

10.3 Battery cages

In *intensive* layer systems, 2 to 5 hens are normally kept in battery *cages* in various configurations (i.e. flat deck or in tiers) but there is increasing criticism of these cages on welfare grounds. Floor space is 400cm^2/hen or 2000m^2 for five hens (50 x 40 cm). Expensive, 'furnished' cages are being introduced in some European countries. Although *maximum* egg production occurs from hens in cages, the hens should have their beaks trimmed as *pecking* one another particularly around the vent can result in high *mortality*.

Battery cages constructed out of local material

Mortality is normally 1%/month although it can be much *highe*r and depends on the breed and numbers per cage. Sharp *claws* can damage the backs of hens in cages and at the end of lay they have few *feathers* left around the neck and breast. An *advantage* of cages is that individual hens can be *observed*. Those not in *lay* have flat, pale, scaly combs instead of large, shiny, waxy, red combs. Also the vent is dry instead of being moist and enlarged. These hens still *eat* feed and if they continue to be out of lay they should be *culled* (removed).

10.3.1 Small-scale cage system

A *sustainable*, household cage system has been designed in South Africa which is a single cage (120 cm long x 50 cm wide x 45 cm high) and divided into *three* compartments holding 12 hens (total). It can be constructed from *bamboo* with a thatched or other type of roof and is on poles or a stand about 1 m above the ground. Each compartment holds 4 layers. The cage is portable and can be *moved* out of the sun and rain and to a *secure* place at night if necessary.

Twelve hen cage system

A bamboo or metal feeder is located on the *outside* of the cage and various kinds of drinkers can be used; some made from large, soft-drink *bottles*. Hens must be given a *good-quality* layer diet but household food scraps can be added. The system should be *self-sustaining* in that 12 hens should lay 9 - 10 eggs/day from about 23 weeks of age. The farmer *sells* 5 eggs to neighbours to buy more feed, and keeps 4 - 5 eggs for his/her *family* to eat. At the end of 12 months the 8-9 surviving hens are *sold* and some of the income saved from the sale of 5 eggs/day is used to *replace* the 12 hens (either raised or purchased as point-of-lay pullets). The manure from under the cage is a valuable *fertiliser* for the household garden.

10.3.2 Colony cages

An interesting modification of the cage system has been developed in Vietnam. These are *large* colony cages on stilts/legs and made from bamboo with external feeders and drinkers. They hold about 12 or more layers. The eggs *roll out* of the cages as in battery cages as the floor is on a slope of about 1 cm in 8 cm. The manure can be collected underneath the raised split-bamboo floor. The large cages are in a barn or house. Such a system may be successful in other countries and is a good *compromise* between the barn and the battery cage system.

Colony cages

10.4 Barn hens

These are kept indoors and run on *litter* at 50 hens /10m^2 . There is a need to provide *nest* boxes at about 18 nests /100 layers. Clean *litter* should be placed in the nest box (35 cm x 35 cm x 35 cm) and *replaced* every month. The boxes can be on a stand or on the floor. Eggs should be collected *twice* each day. Feeders and drinkers are similar to those for broilers except that the height is *fixed* at about 30 cm above the floor. A free-choice system of feeding can be introduced, and a source of *calcium* in a *separate* feeder. Ideally there should be *perches* (25 cm/hen) on which the hens will roost and this concentrates the *manure* below. The advantage of this system is that it has lower capital *costs* than cages but feed consumption will be a bit *higher*, and egg production *lower* than for the same hens in cages. Some eggs will be laid on the floor so there will be some *dirty* eggs. However there is likely to be lower *mortality* with reduced vent pecking. There is also the need for floor *litter* which may have to be added to during the laying cycle to keep it. Green *feed* should be given to keep the birds occupied and provide them with essential nutrients especially *vitamins.*

Barn systems for layers

10.5 Free range

Hens are allowed access to *pasture* during the day time. The area needs to be *enclosed* (hen proof) and good *green feed* should be available. The hens should be given adequate *space* to range (5-6 m^2/hen). Ideally there should be *two* fenced areas to free-range so that one may be *rested* to prevent disease build up and the pasture or other green feed to re-establish. The hens will *return* to the deep-litter house (similar to barn hens) in the evening where they should be safe from *theft* and predators. This may be an ongoing problem.

Free range hens on good pasture.

Floor space in the deep-litter house can be less than the barn system by about 20%.The great advantage of free range poultry is that they are less likely to get a nutrient *deficiency* than if indoors all the time. The *disadvantage* is that they are more likely to pick up *disease* especially internal parasites. *Medication* can be added to the water. Again egg production will be *lower* and feed intake *higher* than in caged birds. The system is more appropriate to *docile* breeds such as the Black Australorp and dual purpose breeds than often flighty hybrids. They are likely to be able to give reasonable *production* on diets of only moderate quality.

[Trainer should have access to these systems for demonstration purposes. These, together with photographs and illustrations, will be important in discussing advantages of the different housing systems giving details of cost of materials and other costs]

10.5 Force moulting

Replacement pullets can be *expensive* so that it may be worthwhile putting hens through a *second* laying cycle. Production normally starts to *drop*, and shell quality *declines* at 40 - 50 weeks of lay (60 - 70 weeks old). Before this happens, hens are given a *low - quality* feed (just grain) for about 3 - 4 weeks which will put them out of production within 7 - 10 days and will slowly lose all their feathers. They are then gradually introduced to the *layer diet* and will start to *lay* again after a total elapsed time of 5 - *6 weeks*. Egg production will go much *higher* than that at 40 - 50 weeks of lay and egg shell quality will greatly *improve*. Although unlikely to reach the previous *peak* production, they will lay a large egg and at an acceptable rate until about 90 - 100 weeks old. The *decision* to moult will depend on (a) pullet replacement *costs* and (b) the *price* of eggs of different weights. Eggs are sold either graded (*weight*) or *mixed* grades and usually by the dozen or half dozen.

[Unit VI. Trainer will go through the pros and cons, and the steps in force moulting hens and illustrations will be shown in the Trainee's Manual]

10.6 Internal egg quality

Not everyone is *aware* of egg quality. It is related to both the *outside* (shell) and *inside* (contents) of the egg. This *relates* to the appearance, the cooking quality and the eating quality of the egg, some of which can be *controlled* by management.

10.6.1 Yolk colour

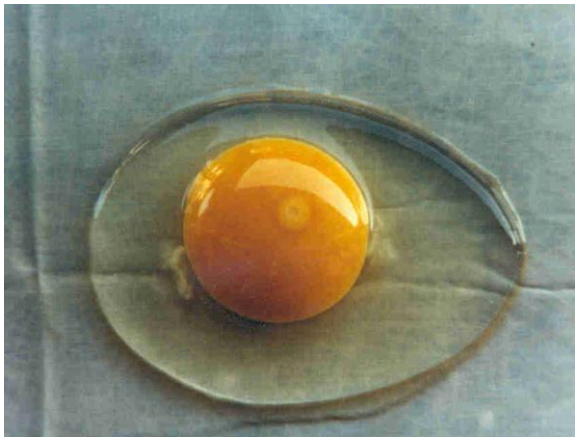
In some countries an egg with a pale, yellow yolk is *preferred* to a deep yellow-orange yolk. Natural yolk colour depends on the feed. Maize (corn) contains a pigment which gives the yolk a rich orange colour but wheat does not. Green feed *darkens* the yolk so that free-range hens on good *pasture* will lay eggs that have yellow yolks. In some countries consumers think that eggs with *pale* yellow yolks are not up to standard or are from hens that are *sick.* This is not correct.

A pigment or colouring agent can be *added* to the feed. Marigold petals, capsicum and chilli are an excellent source of natural pigments; others are synthetic (manufactured). Yolk colour does not alter the taste of the egg.

The colour of the yolk can be *measured* using the Roche Yolk Colour Fan Score which gives the yolk colour a *number* between 1 and 15 depending on intensity.

10.6.2 Staleness

As an egg *ages* in storage, it starts to lose weight. It will eventually float in water when very stale. In warm weather, this happens very quickly due mainly to loss of moisture, but other changes also occur. The result is that as the egg ages the yolk becomes *watery* when you break it out. The height of the white layer surrounding the yolk can be *measured* using a micrometer. This, and the *weight* of the egg, can be used to calculate *Haugh Units* (110 to 0). A new laid egg has a Haugh Unit of about 90 but *declines* quickly so that it reaches below 60 in less than 4 days at room temperature of >25^{o} C but only 80 at a cool 10^{o} C. When eggs reach a Haugh Unit of < 60, they are becoming *stale*; the white then spreads out and the yolk *mixes* with the white in a frying pan. A stale egg may taste no different from a fresh egg but looks to be inferior.



A fresh yolk with compact white and yolk colour score 12-13.

Other *factors* that affect Haugh Units are, breed of hen, age of bird (Haugh Units decline with age), and some diseases. Eggs should always be stored in a cool place and in a refrigerator if there is one. *Oiling* eggs by spraying them with an approved, light mineral oil seals the shell pores and reduces *moisture* loss. This is sometimes practised in warm climates to stop deterioration. Blood *spots* may occasionally appear in eggs; the exact cause is *not known* although it may be related to *breed.*

10.6.3 Shell quality

This is a *serious* problem in the egg industry and at least 10 -15% of all eggs are *rejected* (seconds). Breakages are *high* due to thin shells. As mentioned, shell quality *deteriorates* as a flock ages. Shell is thin and the eggs *cracks* easily. Blemishes, rough surfaces and misshapen eggs can be *caused* by poor diet (low calcium and phosphorus), high salt water, and some diseases. Dirt marks due to *fly* droppings, fungus, blood stains and cage wire marks are all causes of *down-grading* of eggs. Some aspects of shell quality can therefore be improved by *management*. Nutrition is sometimes a factor, especially *insufficient* calcium and available phosphorus in the feed (plant phosphorus is poorly available). Some diseases can affect shell quality.

A

B

C

A. Shell has rough textured areas, may be due to double ovulation with one egg without a shell (no photo) followed by one with a ‘sand paper shell’ (no photo)
B. Shell is partly flattened and wrinkled seen during early lay
C. Shell becomes stained with blood (usually in pullets) or faeces (laid on ground)

[Unit VI. Trainer will have visual material available and eggs with defects will be collected at the university farm and demonstrated. Eggs will be kept for several weeks and when stale will be broken out on a frying pan and compared with a fresh egg].

11. CONCLUSION

Poultry production is a *slow* process based on both knowledge and experience. Poultry keeping is not *attractive* to everyone, nor does everyone have the natural *skills* to manage poultry. It requires dedication and kindness to the flock if the birds are to *respond*. There is a need to *examine* all aspects of the production system before a farmer decides to set up a poultry enterprise. Recently, some farmers in some low - income countries have seen broiler production as *opportunistic* but this short-term approach does not form a solid or sustainable foundation for a broiler business. The producer not only needs to be *dedicated* but must be able to survive the good and the inevitable bad times associated with any livestock industry.

[END of UNIT VI]

12. FEASIBILITY STUDY

Before you decide to raise commercial poultry, it is essential to examine closely the possibilities of making a *profit*, otherwise the venture is a waste of time. You must gather as much information as possible. The information will also will form the basis of a *business plan* which is most important if you want to borrow money. From this information, you can carry out calculations which will show you where the weaknesses and strengths are in a poultry enterprise. First, do I have a reliable market or buyer? Some of the questions that need to be answers are:

Chick costs

How much are day-old?

Layer chicks?

Broiler chicks?

Where can you buy them from?

How far away is the supplier from you?

Does the supplier deliver?

If the chicks are delivered, how much does it cost?

If no delivery, how will you collect them and what is the cost of this?

Broiler costs

It may be possible to buy brooded chicks from a farmer who broods chicks for sale

Can you buy 3-week-old or 5-week old broilers? If so where?

How much do 3-week-old or 5-week old broilers cost?

Do they deliver and charge. Is there a minimum batch size?

How much will it cost me to deliver if they don't?

Are the chicks vaccinated and against what diseases?

Layer costs

What is the cost of point-of-lay (16-18 weeks) pullets?

Do they deliver free or charge?

How much do they charge?

If no delivery, how much will it cost to pick them up?

Feed costs

Where is there a supplier close to me?

How much per bag and size (kg) for broiler starter?

How much per bag and size (kg) for broiler finisher?

How much per bag (kg) and size for pullet finisher?

How much per bag and size (kg) for layer feed?

Does the supplier deliver, if so is there a charge?

If not, how will I transport the feed and the cost?

Equipment and water
Where can I get medical supplies and vaccines?
Where can I get medical advice?
Where can I get floor litter?
How much will it cost?
Where will I get water from?
Do I have sufficient for drinking water and cleaning equipment and the house?

Market survey questions
Where will I sell my broilers?
Who will I sell them to? (neighbours, schools, local market, shop)
Who else is selling chickens in your area?
How much are they charging per bird or per kg?
What age are they?
Why will people buy from you?
What will you charge per bird/kg?
How many birds can you sell per week or month?
How do you know that you can sell that many?

Egg sales
Where will you sell your eggs?
Who will you sell them to? (neighbours, schools, local market, shop)
How much will transport be?
How much will you charge for 12 eggs mixed grade?
Who else is selling eggs and as mixed or graded?
How much for 12?
How many can you sell per week?
How do you know that you can sell that many?

13. BUDGET

A statement of expected expenses, income and profit or loss is then calculated.

Expenses and Direct Costs		
Chickens (____ Birds x $____ per bird)	$	
Feed (____ bags of each kind x $____ per bag)	$	
Heating (cost of fuel/electricity)	$	
Medicine, vaccines, disinfectants	$	
Transport for everything	$	
Litter	$	
Other costs (5%)	$	
A. TOTAL DIRECT COSTS	**$**	
Indirect costs		
Water	$	
Electricity/heating	$	
Telephone	$	
Rent	$	
Bank loan interest	$	
B. TOTAL INDIRECT COSTS	**$**	
Monthly income		
____ broilers sold at $_____ per bird	$	
or		
____ dozen eggs sold at ____ $	$	
C. TOTAL INCOME	**$**	
PROFIT (C-A+B)	**$**	

13. CO-OPERATIVES

A cooperative is a group of *like-minded* producers who combine to form a farmer group to speak with a single voice and allow the *purchase* of feed, equipment, chicks, building material etc. more cheaply. Eventually storage facilities can be established and a supply shop set up. The group can also have a strategic plan to reduce competition between individuals, set prices for poultry products and generally work to help one another to establish an industry on a firm footing. Trainers should provide as much assistance to the farmers in forming a working group that will spearhead the formation of a cooperative. The co-operative may eventually expand into other areas of commerce where the farmers can trade other farm produce in addition to poultry.

14. COMMUNITY OWNERSHIP

This is similar to, but less *rigid* than a cooperative and is run by a *committee* representing a district or village community. For example the committee may be responsible for raising point - of - lay pullets. These they sell at 17-18 weeks to *individual* egg producers and the profits are distributed amongst the community. The egg producers may be individual farmers or a small group of men and women who share the responsibility similar to that in a cooperative. Sometimes it is a group of women who share responsibilities of raising poultry for meat or eggs and share their time and resources.

In all cases there is opportunity to buy large numbers of chicks and bags of feed. This is usually attractive to the supplier and cheaper for the community.

Broiler record sheet

(PHOTOCOPY THIS PAGE FOR RECORD KEEPING.)

Batch No.: Shed No.: Breed:

Hatch date: Starting No.:

Feed given (bags)								
Day	1	2	3	4	5	6	7	Total
Week 1								
Week 2								
Week 3								
Week 4								
Week 5								
Week 6					-			
Week 7								
Week 8								
Total								

Live body weight at 42 days: FCR:

No. of birds weighed: Mortality: %

Total weight of birds: kg Total feed intake: kg/bird

Average weight of one bird: kg

Remarks:

Layer record sheet PHOTOCOPY THIS PAGE FOR RECORD KEEPING

Batch: _____ No: _____
Hatch: Date:
No. at begging of period: Age at beginning of period:

Feed given (bags)								
Day	1	2	3	4	5	6	7	Total
Week 1								
Week 2								
Week 3								
Week 4								
Total								

Death and culls								
Day	1	2	3	4	5	6	7	Total
Week 1								
Week 2								
Week 3								
Week 4								
Total								

Eggs laid (Saleable = G **and Non Saleable = B)**															
Day	1		2		3		4		5		6		7		Total
	G	B	G	B	G	B	G	B	G	B	G	B	G	B	
Week 1															
Week 2															
Week 3															
Week 4															
Total															

Mortality %_____ Feed intake_____ g/hen/day Rol_____%
Remarks_____

TABLE 1. Nutrient Requirements of Broilers as Percentages or Units per Kilogram of Diet (90 percent dry matter)

Nutrient	Unit	0 to 3 Weeks[a]; 3,200[b]	3 to 6 Weeks[a]; 3,200[b]	6 to 8 Weeks[a]; 3,200[b]
Protein and amino acids				
Crude *protein*[c]	%	23.00	20.00	18.00
Arginine	%	1.25	1.10	1.00
Glycine + serine	%	1.25	***1.14***	***0.97***
Histidine	%	0.35	***0.32***	***0.27***
Isoleucine	%	0.80	***0.73***	***0.62***
Leucine	%	1.20	***1.09***	***0.93***
Lysine	%	1.10	1.00	0.85
Methionine	%	0.50	0.38	0.32
Methionine + cystine	%	0.90	0.72	0.60
Phenylalanine	%	0.72	***0.65***	***0.56***
Phenylalanine + tyrosine	%	1.34	***1.22***	***1.04***
Proline	%	0.60	***0.55***	***0.46***
Threonine	%	0.80	0.74	0.68
Tryptophan	%	0.20	0.18	0.16
Valine	%	0.90	***0.82***	0.70
Fat				
Linoleic acid	%	1.00	1.00	1.00
Macro minerals				
Calcium[d]	%	1.00	0.90	0.80
Chlorine	%	0.20	0.15	0.12
Magnesium	mg	600	***600***	***600***
Nonphytate phosphorus	%	0.45	0.35	0.30
Potassium	%	0.30	0.30	0.30
Sodium	%	0.20	0.15	0.12
Trace minerals				
Cooper	mg	8	***8***	***8***
Iodine	mg	***0.35***	0.35	0.35
Iron	mg	80	***80***	***80***
Manganese	mg	***60***	***60***	***60***
Selenium	mg	0.15	0.15	0.15
Zinc	mg	40	***40***	***40***
Fat soluble vitamins				
A	IU	***1,500***	***1,500***	***1,500***
D_3	ICU	200	200	200
E	IU	***10***	***10***	***10***
K	mg	0.50	0.50	0.50
Water soluble vitamins				
B_{12}	mg	0.01	***0.01***	***0.007***
Biotin	mg	0.15	0.15	0.12
Choline	mg	1,300	***1,000***	***750***
Folacin	mg	0.55	0.55	***0.50***
Niacin	mg	35	30	25
Pantothenic acid	mg	***10***	***10***	***10***
Pyridoxine	mg	3.5	3.5	***3.0***
Riboflavin	mg	3.6	3.6	3
Thiamin	mg	***1.80***	***1.80***	***1.80***

NOTE Where experimental data are lacking, values typeset in bold italics represent an estimate based on values obtained for other ages or related species.

[a] The 0- to 3-, 3- to 6-, and 6- to 8-week intervals for nutrient requirements are based on chronology for which research data were available; however, these nutrient requirements are often implemented at younger age intervals or on a weight-of-feed consumed basis.

[b] These are typical dietary energy concentrations, expressed in kcal AME/kg diet. Different energy values may be appropriate depending on local ingredient prices and availability.

[c] Broiler chickens do not have a requirement for crude protein per se. There, however, should be sufficient crude protein to ensure an adequate nitrogen supply for synthesis of nonessential amino acids. Suggested requirements for crude protein are typical of those derived with corn-soybean meal diets, and levels can be reduced when synthetic amino acids are used.

[d] The calcium requirement may be increased when diets contain high levels of phytate phosphorus (Nelson, 1984).

TABLE 2. Nutrient Requirements of Leghorn-Type Laying Hens as Percentages or Units per Kilogram of Diet (90 percent dry matter)

		Dietary Concentrations Required by White-Egg Layers at Difference Feed Intakes			Amounts Required per Hen Daily (mg or IU)		
Nutrient	Unit	80[a,b]	100[a,b]	120[a,b]	White-Egg Breeders at 100 g of Feed per Hen Daily[b]	White-Egg Layers at 100 g of Feed per Hen Daily	Brown-Egg Layers at 110 g Feed per Hen Daily[c]
Protein and amino acids							
Crude protein[d]	%	18.8	15.0	12.5	15,000	15,000	16,500
Arginine[e]	%	***0.88***	***0.70***	***0.58***	***700***	***700***	***770***
Histidine	%	***0.21***	***0.17***	***0.14***	***170***	***170***	***190***
Isoleucine	%	0.81	0.65	0.54	650	650	715
Leucine	%	***1.03***	***0.82***	***0.68***	***820***	***820***	***900***
Lysine	%	0.86	0.69	0.58	690	690	760
Methionine	%	0.38	0.30	0.25	300	300	330
Methionine + cystine	%	0.73	0.58	0.48	580	580	***645***
Phenylalanine	%	***0.59***	***0.47***	***0.39***	***470***	***470***	***520***
Phenylalanine + tyrosine	%	***1.04***	***0.83***	***0.69***	***830***	***830***	***910***
Threonine	%	***0.59***	***0.47***	***0.39***	***470***	***470***	***520***
Tryptophan	%	0.20	0.16	0.13	160	160	***175***
Valine	%	***0.88***	***0.70***	***0.58***	***700***	***700***	***770***
Fat							
Linoleic acid	%	1.25	1.0	0.83	1,000	1,000	***1,100***
Macrominerals							
Calcium[f]	%	4.06	3.25	2.71	3,250	3,250	3,600
Chloride	%	0.16	0.13	0.11	130	130	***145***
Magnesium	mg	625	500	420	50	50	***55***
Nonphytate phosphorus[g]	%	0.31	0.25	0.21	250	250	***275***
Potassium	%	0.19	0.15	0.13	150	150	***165***
Sodium	%	0.19	0.15	0.13	150	150	***165***
Trace minerals							
Copper	mg	?	?	?	?	?	?
Iodine	mg	0.044	0.035	0.029	0.010	0.004	***0.004***
Iron	mg	25	20	17	6.0	4.5	***5.0***
Manganese	mg	25	20	17	2.0	2.0	***2.2***
Selenium	mg	0.08	0.06	0.05	0.006	0.006	***0.006***
Zinc	mg	44	35	29	4.5	3.5	***3.9***
Fat soluble vitamins							
A	IU	3,750	3,000	2,500	300	300	***330***
D_3	IU	375	300	250	30	30	***33***
E	IU	***6***	***5***	***4***	***1.0***	0.5	***0.55***
K	Mg	0.6	0.5	0.4	0.1	***0.05***	***0.055***
Water soluble vitamins							
B_{12}	Mg	0.004	***0.004***	***0.004***	0.008	***0.0004***	***0.0004***
Biotin	Mg	***0.13***	***0.10***	***0.08***	***0.01***	***0.01***	***0.011***
Choline	Mg	1,310	1,050	875	105	105	***115***
Folacin	Mg	0.31	0.25	0.21	0.035	0.025	***0.028***
Niacin	Mg	12.5	10.0	8.3	1.0	1.0	***1.1***
Panthothenic acid	Mg	2.5	2.0	1.7	0.7	0.20	***0.22***
Pyridoxine	Mg	3.1	2.5	2.1	0.45	0.25	***0.28***
Riboflavin	Mg	3.1	2.5	2.1	0.36	0.25	0.28
Thiamin	Mg	0.88	0.70	0.60	0.07	***0.07***	***0.08***

NOTE: Where experimental data are lacking, values typeset in bold italics represent an estimate based on values obtained for other ages or related species.

[a] Grams feed intake per hen daily.

[b] Based on dietary Men concentrations of approximately 2,900 kcal/kg and an assumed rate of egg production of 90 percent (90 eggs per 100 hens daily).

[c] Italicized values are based on those from white-egg layers but were increased 10 percent because of larger body weight and possibly more egg mass per day.

[d] Laying hens do not have a requirement for crude protein per se. However, there should be sufficient crude protein to ensure an adequate supply of nonessential amino acids. Suggested requirements for crude protein are typical of those derived with corn-soybean meal diets, and levels can be reduced somewhat when synthetic amino acids are used.

[e] Italicized amino acid values for white-egg-laying chickens were estimated by using Model B (Hurwitz and Bornstein, 1973), assuming a body weight of 1,800 g and 47 g of egg mass per day.

[f] The requirement may be higher for maximum eggshell thickness.

[g] The requirement may be higher in very hot temperatures.

TABLE 3. Nutrient Requirements of Meat-Type Hens for Breeding Purposes as Units per Hen per Day (90 percent dry matter)

Nutrient	Unit	Requirements
Protein and amino acids		
Protein[a]	g	***19.5***
Arginine	mg	***1,110***
Histidine	mg	205
Isoleucine	mg	850
Leucine	mg	1,250
Lysine	mg	765
Methionine	mg	***450***
Methionine + cystine	mg	***700***
Phenylalanine	mg	610
Phenylalanine + tyrosine	mg	***1,112***
Threonine	mg	720
Tryptophan	mg	190
Valine	mg	750
Minerals		
Calcium	g	***4.0***
Chloride	mg	***185***
Nonphytate phosphorus	mg	***350***
Sodium	mg	150
Vitamin		
Biotin	μg	16

NOTE: These are requirements for hens at peak production. Broiler breeder hens are usually fed on a controlled basis to maintain body weight within breeder guidelines. Daily energy consumption varies with age, stage of production, and environmental temperature but usually ranges between 400 and 450 AME kcal per hen at peak production. For nutrients not listed, see requirements for egg-type breeders (Table 2-3) as a guide. Where experimental data are lacking, values typeset in bold italics represent an estimate based on values obtained for other ages or related species.

[a] Broilers do not have a requirement for crude protein *per se*. There, however, should be sufficient crude protein to ensure an adequate nitrogen supply for synthesis of nonessential amino acids. Suggested requirements for crude protein are typical of those derived with corn-soybean meal diets, and levels can be reduced somewhat when synthetic amino acids are used.

Example of calculation for 100 broiler chickens to determine performance

Starter period

Weight at 1day old	4.5 kg
Weight at 3 weeks old	62.0 kg
Weight gain (21 days)	**57.5 kg**
Feed at start	100 kg
Feed at finish	13.75 kg
Feed eaten (0-21 days)	**86.25 kg**
Feed conversion ratio (0-21 days)	$\frac{86.25}{57.50} = \mathbf{1.50}$
Finisher period (21-49 days)	
Weight at 21 days	62.0 kg
Weight at 49 days	180.0 kg
Weight gain	**118.0 kg**
Feed at 21 days	300.0 kg
Feed at 49 days	5.0 kg
Feed eaten (21-49 days)	**295.0 kg**
Feed conversion ratio (21-49days)	$\frac{295}{118} = \mathbf{2.50}$
Whole period (1-49 days)	
Weight gain	175.5 kg
Feed eaten	381.25 kg
Feed conversion ratio (1-49 days)	
Feed eaten	$\frac{381.25}{175.5} = \mathbf{2.17}$
Weight gain	

GLOSSARY OF TERMS USED IN POULTRY PRODUCTION

ABBATOIR	Place to kill and process chickens normally under government supervision
AFLATOXINS	Produced by micro-organisms in feedstuffs that can make chickens ill or die
AMINO ACIDS	The 21 building blocks that make up protein. Nine are essential in the feed the rest the chicken can produce itself
ANTIBIOTIC	Used to treat chickens that are sick from a bacterial Infection
BACTERIA	Single cell plant organisms. Some are harmful others are beneficial
BATTERY CAGE	Laying cages that holds 1 to 4 laying hens in a confined space. Cages will soon be banned in some countries
BROILER	A meat chicken usually killed at 6 to 8 weeks
BROODING	Caring for very young chicks often with a heat source
COMMERCIAL ENTERPRISE	A poultry farm that produces poultry in large numbers using modern methods
COMPOST	Vegetable and organic waste that is broken down and makes vegetables and plants grow and produce well
CULL	To remove birds from a flock
DIGNOSE	Usually to identify and diagnose a problem or disease
DIGESTION	The gradual process of breaking down food particles so that they can enter the blood stream
DUAL PURPOSE	Breeds of poultry that produce both eggs and meat
EVISCERATE	Removal of the digestive tract and some organs (lungs, heart, liver)
FARMING SYSTEM	All of the activities on the farm – both crops and animals
FEASABILITY STUDY	Undertaken to see if poultry framing is profitable
FIBRE	An indigestible part of the diet and of little nutritional benefit to the bird
FINISHER DIET	A lower quality feed sometimes given 7 to 10 days before slaughter
FOOD SECURITY	Supply of food for families in times of need
FORMULATED FEED	A diet that meets the nutrient needs for eggs or meat production
GROWER DIET	Fed to meat chickens between 21 and 39 days or longer
HAUGH UNIT	A measure of the height of the albumin (white) of the egg that indicates freshness
HYBRID CHICKEN	Chickens from parents of two different breeds
HYGIENE	Cleanliness
INSECTICIDE	Chemicals that kill insect pets – should be used with Caution and following instructions
INVESTMENT	Putting money into an enterprise or venture

LITTER	Material placed on the floor to soak up excreta from chickens and to keep the ground dry
MEDICTION	Medicine
MINERALS	Inorganic elements which are essential in the diet of
MORTALITY	Poultry Death
MOULDY	Contaminated with mould from micro-organisms
MOULTING	Shedding of feathers usually in layers
ORGANISM	Any kind of a living creature
PARASITE	Organisms that live and feed on or in chickens and causing them discomfort
PIGMENTOR	A colouring agent that makes egg yolk or skin yellow - orange
PREDATOR	A person or animal who takes your chickens or eggs
PROTOZOA	Minute internal parasite in chickens causing coccidosis
PULLET	A young hen coming into lay or often in early lay
SCAVENGING	Looking for food
STARTER DIET	Formulated feed given from day 1 to 21
SUSTAINABLE	Lasting indefinitely or for a very long time
VACCINE	Dead or alive micro - organisms given to chickens to help them fight disease
VIRUS	Minute organisms that can infect chickens and make them sick or die
VITAMINS	Essential organic elements in poultry diets for egg production and chick growth
XANTHOPHYLL	Colouring agent found especially in green feeds that makes the egg yolk yellow

END OF THIS POULTRY TRAINING MODULE